IDENTIFICATION

Product Code:	DEC-08-AFC3-LA
Product Name:	Fortran Operating System
Date Created:	August 15, 1967
Maintainer:	Software Services Group
Author:	John Wyatt

DEC-08-AFC3-LA

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/FIVETRAN OPERATING SYSTEM SEMI-INTERPRETIVE LANGUAGE

/SHEET 2
/PAGE 00

```
                        /SHEET 3
                        /INTERRUPT AND ZERO TRAP
      0001              *1
0001  7000                      NOP
0002  4502                      JMS I 7 GOOF
0003  6164                      6164
0004  5002                      JMP .-2
```

```
                        /SHEET 4
                        /IMPORTANT REGISTERS

      0010              *10
0010  0025    STK,      25              /OPERAND STACK POINTER
0011  0026    ISTK,     26              /INDEX STACK POINTER
0012  0027    CSTK,     27              /COUNTER STACK POINTER
0013  0030    DSTK,     30              /DO TERMINATION STACK POINTER
0014  0031    ILC,      31              /INSTRUCTION LOCATION COUNTER
0015  0000    TEMA,     0
0016  0000    TEMB,     0
0017  0000    TEMC,     0

      0020              *20
                        /LOWEST (INITIAL) STACKS
0020  3277    FSTK,     STAK-1
0021  0750    FIST,     ISTA-1
0022  1756    FCST,     CSTA-1
0023  1164    FDST,     DSTA-1
0024  3775    FILC,     PSTART-1
0025  0000    X,        0         /VARIABLE STORAGE FOR FUNCTIONS
0026  0000              0
0027  0000              0

      0030              *30
                        /HIGHEST STAKS
0030  3375    LSTK,     STAKL-3
0031  0777              ISTAL-1
0032  1777              CSTAL-1
0033  1177              DSTAL-1
0034  7576    LILC,     7577-1
0035  0000    MET1,     0         /TEMPORARY STORAGE FOR FUNCTIONS
0036  0000              0
0037  0000              0
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```
                        /SHEET 5
                        /MANY PAGE CONSTANTS

        0040            *40
0040    0000            X1,     0
0041    0000            H1,     0
0042    0000            L1,     0
0043    0000            X2,     0
0044    0000            H2,     0
0045    0000            L2,     0
0046    0000            IOAD,   0
0047    0000            BUFPNT, 0
0050    0000            WDCNT,  0
0051    0000            HILOP,  0       /-1 IMPLIES HISPEED PUNCH, 0 IMPLIES 33
0052    0000            HILOR,  0       /-1 IMPLIES HISPEED READ, 0 IMPLIES 33
0053    0000            MODE,   0       /-1 IMPLIES READ, 0 IMPLIES WRITE
0054    0000            XTRN,   0       /-1 IMPLIES INTEGER, 0 IMPLIES FLOAT
0055    0000            STAG,   0       /-1 IMPLIES FINAL LOOK, 0 IMPLIES NORMAL
0056    0000            INTR,   0       /-1 IMPLIES INTEGER, 0 IMPLIES FLOAT
0057    0000            MMFF,   0       /-1 IMPLIES DECTAPE, 0 IMPLIES PAPER TAPES
0060    0215            CRZ,    215
0061    0003            PTH,    3
0062    0002            PTW,    2
0063    7775            MTH,    0-3
0064    7776            MTW,    0-2
0065    7762            M16,    0-16
0066    7522            MPER,   0-256
0067    1777            R10,    1777
0070    0600            MODT,   0-7200
0071    7700            LT6,    7700
0072    7600            LT5,    7600
0073    6000            LT2,    6000
0074    0053            C53Z,   53
0075    0212            CHLF,   212     /CHARACTER LF
0076    7566            CMLF,   0-212   /MINUS CHARACTER LF
0077    7402            F00,    HLT
                        L00,
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                    /SHEET 6
                    /INDIRECT REFERENCE TABLE

      0100          *100

0100  0401          INTI,   INT
0101  3107          OVLI,   OVL
0102  3132          GOOF,   ERRR
0103  2247          ALN,    ALGN
0104  1153          BEXI,   BEXP
0105  5171          BREADI, BREAD
0106  3271          BTYPEI, BTYPE
0107  2717          CHEK,   CHK
0110  1532          ICHR,   CHR
0111  2476          DDII,   DD1
0112  2400          DVD,    DDVD
0113  2600          MPY,    DMUL
0114  1033          DPS,    DPCS
0115  1000          DPV,    DPCV
0116  1157          DPNI,   DPN
0117  5311          DTJI,   DTJ
0120  0636          ETTI,   ETT
0121  1600          FNKI,   FINK
0122  5366          FIXOKI, FIXOK
0123  3640          FOMI,   FOMT
0124  1200          FONI,   FONK
0125  1400          FXPI,   FXP
0126  0564          GRINDI, GRIND
0127  1154          HICI,   HIC
0130  3744          IOBI,   IOB
0131  2517          IOII,   IOI
0132  0403          IMPI,   IMP
0133  1050          INSI,   INS
0134  1500          IXCI,   IXCH
0135  1155          LWCI,   LWC
0136  0733          NEG1,   MIN1
0137  0720          NEG,    MINS
0140  1105          MIRI,   MTRL
0141  2707          MP2I,   MP2
0142  2660          MP4I,   MP4
0143  1135          MSN,    MSGN
0144  1065          MI10,   MT10
0145  1161          MTDI,   MIDG
0146  2037          MULT,   MUS
0147  2207          NOR,    NORM
0150  1727          OTCI,   OTCH
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                        /SHEET 7
                        /MORE INDIRECT REFERENCES

0151  1723               OTDI,    OTDG
0152  1720               OTEI,    OTEN
0153  1517               OUTI,    OUT
0154  3777               BEGI,    PSTART+1
0155  2372               QREADI,  QREAD
0156  3264               QTYPEI,  QTYPE
0157  2350               SND,     SCND
0160  1156               SGNI,    SGN
0161  0666               SWP,     SWAP
0162  0707               SWP1,    SWA1
0163  3200               IDT,     TABL
0164  1715               TENI,    TEN
0165  4102               TITI,    TIT
0166  0621               TVAI,    TVA
0167  2332               UNO,     UNOR
0170  5303               WMMFI,   WMMF
0171  5270               WMMXI,   WMMX
0172  2000               FAD,     XADD
0173  0612               XET,     XETT
0174  0645               XPN,     XPND
0175  0600               XTV,     XTVA
0176  3600               XXCI,    XXC
0177  2763               XXJI,    XXJ

                        L01,
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```
                    /SHEET 8
                    /PAGE 02

0200                *200
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```
                        /SHEET 9
                        /FOSSIL LOADER
0200  7610      BEG,    CLA SKP         /START OF LOADER
0201  5336              JMP RTRY                /START OF EXECUTION
0202  3330              DCA CKSM                /CHECKSUM=0
0203  4355              JMS IOBEG       /SELECT I/O DEVICE BY SWITCHES
0204  4314      LOOP,   JMS LEAD                /READ FIRST 8 BIT LINE
0205  7430              SZL             /BIT 1 (LEFT MOST)
0206  5221              JMP PSEU                /...
0207  7510              SPA             /BIT 2
0210  5214              JMP ORG         /...
0211  4322              JMS MAKE                /MUST BE DATA, ASSEMBLE IT
0212  3417              DCA I Z TEMC    /STORE IT
0213  5204              JMP LOOP                /TRY AGAIN
0214  4322      ORG,    JMS MAKE                /NEW ORIGIN, ASSEMBLE IT
0215  7041              CMA IAC         /SUBTRACT ONE
0216  7040              CMA             /...
0217  3017              DCA Z TEMC      /RESET STORAGE POINTER
0220  5204              JMP LOOP                /BACK FOR MORE
0221  7500      PSEU,   SMA             /BIT 2
0222  5272              JMP I TS        /200-277, IGNORE IT

0223  7006              RTL             /LOOK AT NEXT TWO BITS
0224  7430              SZL             /BIT 3
0225  5246              JMP PHOS
0226  4314      FWD,    JMS LEAD                /FORWARD REFERENCE TABLE
0227  7430              SZL             /BIT 1
0230  5205              JMP LOOP+1      /END OF TABLE
0231  4322              JMS MAKE                /ASSEMBLE WORD ...
0232  3334              DCA REAL                /AS TRUE ADDRESS
0233  4314              JMS LEAD                /ASSEMBLE WORD...
0234  4322              JMS MAKE                /AS START OF CHAIN
0235  3332      LUPY,   DCA TEM1                /TEM1=CURRENT CHAIN ADDR,
0236  1732              TAD I TEM1      /CONTENTS OF CHAIN...
0237  3331              DCA TEMØ                /SAVED,..
0240  1334              TAD REAL                /AND REPLACED BY ...
0241  3732              DCA I TEM1      /REAL ADDRESS
0242  1331              TAD TEMØ                /MORE WORDS TO CHAIN?
0243  7450              SNA
0244  5226              JMP FWD         /NO, GO READ TAPE
0245  5235              JMP LUPY                /YES, KEEP CHAINING

0246  7510      PHOS,   SPA             /BIT 4
0247  5263              JMP IGN         /360-377, START OF LINE DEBUG
0250  4300              JMS RED         /CHECKSUM, READ FIRST HALF...
0251  7106              CLL RTL         /AND ROTATE IT LEFT 6 BITS
0252  7006              RTL             /...
0253  7006              RTL             /...
0254  3332              DCA TEM1                /...
0255  4300              JMS RED         /READ SECOND HALF
0256  1332              TAD TEM1                /COMBINE WITH FIRST HALF
0257  7041              CMA IAC         /COMPARE IT WITH CALCULATED CHECKSUM
0260  1333              TAD CKSM
0261  7402              HLT             /CORRECT READ GIVES ZERO IN AC
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0262  5336          JMP RTRY                /GO START EXECUTION
```

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                        /SHEET 10
                        /MORE LOADER

0263  7200       IGN,   CLA             /ON-LINE DEBUG
0264  1065              TAD 7 M16       /IGNORE NEXT 14 LINES...
0265  3331              DCA TEM0                /BUT INCLUDE THEM IN CHECKSUM
0266  4304              JMS READ                /...
0267  2331              ISZ TEM0                /...
0270  5266              JMP .-2         /...
0271  5204              JMP LOOP                /RETURN FOR MORE

0272  7200       LTS,   CLA             /LEADER-TRAILER IGNORED
0273  1333              TAD TEM2                /SUBTRACT IT FROM CHECKSUM
0274  7041              CMA IAC         /...
0275  1330              TAD CKSM                /...
0276  3330              DCA CKSM                /...
0277  5204              JMP LOOP                /RETURN FOR MORE

0300  0000       RED,   0
0301  1333              TAD TEM2                /PUT SOMETHING IN AC...
0302  4735              JMS I RPGI      /AND GO READ A LINE
0303  5700              JMP I RED       /RETURN

0304  0000       READ,  0
0305  4300              JMS RED         /READ A LINE
0306  3333              DCA TEM2                /SAVE IT
0307  1333              TAD TEM2                /...
0310  1330              TAD CKSM                /ADD IT TO CHECKSUM
0311  3330              DCA CKSM                /...
0312  1333              TAD TEM2                /PLACE IT IN AC
0313  5704              JMP I READ      /RETURN

0314  0000       LEAD,  0
0315  4304              JMS READ                /READ A LINE
0316  7106              CLL RTL         /ROTATE 5 BITS LEFT
0317  7006              RTL             /LEAVING BIT 1 IN LINK
0320  7004              RAL             /...
0321  5714              JMP I LEAD      /RETURN

0322  0000       MAKE,  0
0323  7104              CLL RAL         /ASSEMBLE A 12 BIT WORD...
0324  3332              DCA TEM1                /USING SIX BITS FROM LEAD...
0325  4304              JMS READ                /AS LEFT MOST SIX AND NEXT...
0326  1332              TAD TEM1                /LINE AS RIGHTMOST
0327  5722              JMP I MAKE      /RETURN

0330  0000       CKSM,  0               /CALCULATED CHECKSUM
0331  0000       TEM0,  0               /TEMPORARY
0332  0000       TEM1,  0               /TEMPORARY
0333  0000       TEM2,  0               /LAST CHARACTER READ
0334  0000       REAL,  0               /TRUE ADDR FOR FWD. REF.
0335  1556       RPGI,  RPGIN           /ADDR OF READ ROUTINE
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                        /SHEET 11
                        /INITIALIZATION

0336  7201               RTRY,   CLA IAC         /STORE ONE IN HIGHEST LOC.
0337  3754                      DCA I LOCONE    /...
0340  4355                      JMS IOBEG       /SELECT I/O GEAR FROM SWITCHES
0341  1020                      TAD Z FSTK      /SET STACKS TO INITIAL...
0342  3010                      DCA Z STK       /VALUES
0343  1021                      TAD Z FIST
0344  3011                      DCA Z ISTK
0345  1023                      TAD Z FDST
0346  3013                      DCA Z DSTK
0347  1022                      TAD Z FCST
0350  3012                      DCA Z CSTK
0351  1024                      TAD Z FILC
0352  3014                      DCA Z ILC
0353  5500                      JMP I Z INTI    /BEGIN EXECUTION
0354  7577              LOCONE, 7577
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                        /SHEET 12
                        /IO SELECTION

0355  0000       IOBEG,  0
0356  6032               KCC             /33 READER (AND CLEAR AC)
0357  6046               TLS             /33 PRINTER-PUNCH
0360  6026               PLS             /HISPEED PUNCH
0361  7604               CLA OSR         /LOOK AT SWITCHES
0362  7700               SMA CLA         /BIT 0
0363  1263               TAD IGN         /OFF=5200
0364  1073               TAD 7 LT2       /ON=6000
0365  3554               DCA I 7 BEGI    /STARTING ADDR OF USER PGM
0366  7604               CLA OSR         /LOOK AT SWITCHES
0367  7006               RTL             /...
0370  7710               SPA CLA         /BIT 2=PUNCH
0371  7040               CMA             /ON=HISPEED
0372  3051               DCA 7 HILOP     /...
0373  7630               SZL CLA         /BIT 1=READER
0374  7040               CMA             /ON=HISPEED
0375  3052               DCA 7 HILOR     /...
0376  5755               JMP I IOBEG
0377  7402       F02,    HLT
                 L02,
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                    /SHEET 13
                    /PAGE 04

0400                *400
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```
                        /SHEET 14
                        /FOSSIL STACK MANIPULATION

0400  7402            PAWS,   HLT             /PAUSE COMMAND
                      NOOP,
0401  7200            INT,    CLA             /LOOK AT NEXT COMMAND
0402  1414                    TAD I Z ILC     /...
0403  3360            IMP,    DCA INST                /SAVE IT
0404  4507                    JMS I Z CHEK    /CHECK STACK LIMITS
0405  1360                    TAD INST                /WHAT KIND OF INST?
0406  7500                    SMA             /MEMORY REFERENCE
0407  5274                    JMP NREF                /NON-MEMORY REFERENCE
0410  7006                    RTL             /LOOK AT BITS 0 AND 1
0411  7430                    SZL             /BIT 0
0412  5254                    JMP IND         /GO GET INDEX
0413  7200                    CLA             /NON-INDEXED INSTRUCTION
0414  3357            IRET,   DCA INC         /STORE VALUE OF INCREMENT
0415  1360                    TAD INST                /LOOK AT BITS 10 AND 11
0416  7012                    RTR
0417  7710                    SPA CLA         /NORMAL STORE
0420  5331                    JMP DEX         /INDEX STACK
0421  1414                    TAD I Z ILC     /GET MEMORY LOC
0422  7420                    SNL             /BIT 10-SKIP RELOCATION
0423  0067                    AND Z R10       /RELOCATION PART 1
0424  7420                    SNL             /SKIP PART 2
0425  1073                    TAD Z LT2       /RELOCATION PART 2
0426  1357                    TAD INC         /ADD INCREMENT
0427  3361                    DCA ADDR                /COMPLETED MEMORY ADDRESS
0430  1360                    TAD INST                /LOOK AT BITS 2 AND 3
0431  7104                    CLL RAL         /...
0432  7006                    RTL             /...
0433  7700                    SMA CLA         /BIT 3
0434  5316                    JMP LOAD
0435  1010                    TAD Z STK       /STORE
0436  7420                    SNL             /BIT 2
0437  5306                    JMP SFIX
0440  1063                    TAD Z MTH       /FLOATING STORE
0441  3010                    DCA Z STK       /STACK LEVEL DECREASED BY 3
0442  1063                    TAD Z MTH       /SET CNT FOR 3 WORDS
0443  3356                    DCA CNT
0444  1010                    TAD Z STK       /USE AUTO-INDEX TEMA
0445  3015                    DCA Z TEMA      /TO PICK UP FROM STACK
0446  1415            LUP,    TAD I Z TEMA    /TRANSFER FROM STACK
0447  3761                    DCA I ADDR      /TO ADDR
0450  2361                    ISZ ADDR                /INCREMENT ADDR
0451  2356                    ISZ CNT         /CHECK LOOP COUNTER
0452  5246                    JMP LUP         /MORE
0453  5201                    JMP INT         /DONE, GO DO NEXT INST.
```

```
                        /SHEET 15
                        /INDEX CALCULATION

0454  7510              IND,    SPA             /FIXED OR FLOATING
0455  7100                      CLL             /LINK WAS ON
0456  7240                      CLA CMA         /-1 TO AC
0457  1011                      TAD Z ISTK      /DECREASE POINTER
0460  3011                      DCA Z ISTK
0461  1011                      TAD Z ISTK      /MOVE POINTER TO ...
0462  3015                      DCA Z TEMA      /AUTO-INDEX
0463  7240                      CLA CMA         /-1 TO AC...
0464  1415                      TAD I Z TEMA    /GIVING INDEX -1
0465  7430                      SZL             /IF FIXED, RETURN
0466  5214                      JMP IRET                /IF FLOAT, MULTIPLY BY 3
0467  3015                      DCA Z TEMA      /...
0470  1015                      TAD Z TEMA      /...
0471  7004                      RAL             /...
0472  1015                      TAD Z TEMA      /...
0473  5214                      JMP IRET                /AND RETURN
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                        /SHEET 16
                        /NON DATA REFERENCE

0474  1363      NREF,   TAD HIGH            /NON-DATA REFERENCE, IS...
0475  7500              SMA               /IT WITHIN TABLE?
0476  5705              JMP I TURG        /NO, TOO HIGH
0477  1362              TAD HIE           /ADD TABLE BASE ADDRESS
0500  1163              TAD Z IDT         /...
0501  3361              DCA ADDR                  /GET POINTER FROM TABLE
0502  1761              TAD I ADDR        /...
0503  3361              DCA ADDR                  /AND GO THERE
0504  5761              JMP I ADDR        /...

0505  0746      TU8G,   UNDF              /INSTRUCTION CODE TOO LARGE

0506  7041      SFIX,   CMA IAC           /SUBTRACT ONE
0507  7040              CMA               /...
0510  3010              DCA Z STK         /AND RESET STACK
0511  1010              TAD Z STK         /MOVE POINTER TO AUTO INDEX
0512  3015              DCA Z TEMA        /...
0513  1415              TAD I Z TEMA      /GET TOP ITEM
0514  3761              DCA I ADDR        /AND STORE IT
0515  5201              JMP INT           /GO GET NEXT INST

0516  1761      LOAD,   TAD I ADDR        /LOAD
0517  3410              DCA I Z STK       /FIRST WORD
0520  7420              SNL               /BIT 2
0521  5201              JMP INT           /FIXED, GO GET NEXT INST
0522  2361              ISZ ADDR                  /FLOATING LOAD
0523  1761              TAD I ADDR        /SECOND WORD
0524  3410              DCA I Z STK       /...
0525  2361              ISZ ADDR                  /THIRD WORD
0526  1761              TAD I ADDR        /...
0527  3410              DCA I Z STK       /...
0530  5201              JMP INT           /GET NEXT INSTRUCTION
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                        /SHEET 17
                        /INDEX STACK REFERENCE

0531  1360    DEX,    TAD INST                /STORE OR LOAD?
0532  7004            RAL
0533  7006            RTL
0534  7700            SMA CLA
0535  5346            JMP DEXL
0536  1010            TAD Z STK       /STORE ONTO INDEX STACK
0537  3361            DCA ADDR                /KEEP STACK LOCATION
0540  7240            CLA CMA         /SUBTRACT ONE FROM STACK POINTER
0541  1010            TAD Z STK       /...
0542  3010            DCA Z STK       /...
0543  1761            TAD I ADDR      /MOVE WORD FROM STACK...
0544  3411            DCA I Z ISTK    /TO INDEX STACK
0545  5201            JMP INT         /GO BACK FOR MORE

0546  1011    DEXL,   TAD Z ISTK      /LOAD FROM INDEX STACK
0547  3361            DCA ADDR                /ADDRESS OF INDEX DATA
0550  7240            CLA CMA         /RESET ISTACK POINTER
0551  1011            TAD Z ISTK      /TO VALUE-1
0552  3011            DCA Z ISTK      /...
0553  1761            TAD I ADDR      /TRANSFER FROM ISTAK...
0554  3410            DCA I Z STK     /TO STACK
0555  5201            JMP INT         /GO BACK FOR MORE

0556  0000    CNT,    0               /COUNTER FOR FLOATING STORE
0557  0020    INC,    0               /VALUE OF INDEX
0560  0000    INST,   0               /INSTRUCTION BEING EXECUTED
0561  0000    ADDR,   0               /ADDR OF DATA REFERENCE
0562  0063    HIE,    63              /LIMIT OF OP TABLE
0563  7715    HIGH,   0-63            /-LIMIT OF OP TABLE

                        /ALL HALTS
0564  0000    GRIND,  0
0565  3377            DCA HANGON      /SAVE AC
0566  1060            TAD Z CRZ       /OUTPUT A CR-LF
0567  4553            JMS I Z OUTI    /...
0570  7404            OSR             /SWITCHES=7200 MEANS ODT...
0571  1070            TAD Z MODT      /IN CORE
0572  7610            SKP CLA         /...
0573  5601            JMP I INT       /IF SO, JMP 7200
0574  1377            TAD HANGON      /IF NOT, RELOAD AC...
0575  7402            HLT             /AND HALT

0576  5764            JMP I GRIND     /RETURN TO JMS
0577  0000    HANGON, 0               /TEMP FOR AC
                L04,
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                        /SHEET 18
                        /PAGE 06

        0600            *600

                        /ARGUMENT SET-UP
0600    0000    XTVA,   0               /FLOATING DOUBLE ARGUMENT
0601    7340            CLA CLL CMA     /-3 TO AC
0602    7006            RTL             /...
0603    1010            TAD ≠ STK       /DECREASE STACK POINTER
0604    3010            DCA ≠ STK       /...
0605    1010            TAD ≠ STK       /POINTER TO FIRST OF 3,..
0606    7001            IAC             /WORDS OF FLOATING NUMBER...
0607    3040            DCA ≠ X1                /TO ARG1
0610    4212            JMS XETT                /GET OTHER ARGUMENT
0611    5600            JMP I XTVA      /RETURN

0612    0000    XETT,   0               /FLOATING SINGLE ARGUMENT
0613    7340            CLA CLL CMA     /-2 TO AC
0614    7004            RAL             /...
0615    1010            TAD ≠ STK       /STACK POINTER -2=FIRST OF
0616    3043            DCA ≠ X2                /3 WORD OF FLOATING NUMBER
0617    4245            JMS XPND                /SET SECOND AND THIRD POINTERS
0620    5612            JMP I XETT      /RETURN

0621    0000    TVA,    0               /FIXED DOUBLE ARGUMENT
0622    7300            CLA CLL
0623    1010            TAD ≠ STK       /POINTER TO FIRST ARGUMENT
0624    3041            DCA ≠ H1                /...
0625    1441            TAD I ≠ H1      /GET FIRST ARGUMENT
0626    2041            ISZ ≠ H1                /MOVE IT ONE UP ON STACK
0627    3441            DCA I ≠ H1      /...
0630    7240            CLA CMA         /SUBTRACT ONE FROM STACK POINTER
0631    1010            TAD ≠ STK       /...
0632    3010            DCA ≠ STK       /...
0633    4236            JMS ETT         /GET OTHER ARGUMENT
0634    3442            DCA I ≠ L1      /ZERO NEXT WORD
0635    5621            JMP I TVA       /RETURN

0636    0000    ETT,    0               /FIXED SINGLE ARGUMENT
0637    7200            CLA
0640    1010            TAD ≠ STK       /STACK POINTS TO ONE WORD
0641    3044            DCA ≠ H2                /...
0642    4256            JMS XPN1                /MAKE L1,L2 POINT TO...
0643    3445            DCA I ≠ L2      /WORDS OF ZERO
0644    5636            JMP I ETT       /RETURN
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                        /SHEET 19
                        /MORE ARGUMENT DIDDLING

0645  0000    XPND,   0               /MAKE ONE ADDR INTO THREE
0646  7201            CLA IAC         /H1=X1+1
0647  1040            TAD Z X1                /...
0650  3041            DCA Z H1                /...
0651  1043            TAD Z X2                /H2=X2+1
0652  7001            IAC             /...
0653  3044            DCA Z H2                /...
0654  4256            JMS XPN1                /SEE BELOW
0655  5645            JMP I XPND      /RETURN

0656  0000    XPN1,   0               /MAKE ONE ARGUMENT INTO TWO
0657  7201            CLA IAC         /L1=H1+1
0660  1041            TAD Z H1                /...
0661  3042            DCA Z L1                /...
0662  1044            TAD Z H2                /L2=H2+1
0663  7001            IAC             /...
0664  3045            DCA Z L2                /...
0665  5656            JMP I XPN1      /RETURN

0666  0000    SWAP,   0               /REVERSE ARGUMENTS
0667  7200            CLA             /X1=X2
0670  1440            TAD I Z X1      /X2=X1
0671  3306            DCA SWPT                /...
0672  1443            TAD I Z X2      /...
0673  3440            DCA I Z X1      /...
0674  1306            TAD SWPT                /...
0675  3443            DCA I Z X2      /...
0676  1442            TAD I Z L1      /L1=L2
0677  3306            DCA SWPT                /L2=L1
0700  1445            TAD I Z L2      /...
0701  3442            DCA I Z L1      /...
0702  1306            TAD SWPT                /...
0703  3445            DCA I Z L2      /...
0704  4307            JMS SWA1                /SEE BELOW
0705  5666            JMP I SWAP      /RETURN
0706  0000    SWPT,   0

0707  0000    SWA1,   0               /REVERSE HIGH ORDER MAGNITUDES
0710  7200            CLA             /H1=H2
0711  1441            TAD I Z H1      /H2=H1
0712  3306            DCA SWPT                /...

0713  1444            TAD I Z H2      /...
0714  3441            DCA I Z H1      /...
0715  1306            TAD SWPT                /...
0716  3444            DCA I Z H2      /...
0717  5707            JMP I SWA1      /RETURN
```

```
                        /SHEET 20
                        /NEGATION FOR FOSSIL

0720  0000    MINS,     0                 /NEGATE THE SECOND ARGUMENT
0721  7300              CLA CLL           /NEGATE L2 FIRST
0722  1445              TAD I Z L2        /...
0723  7041              CMA IAC           /...
0724  3445              DCA I Z L2        /...
0725  1444              TAD I Z H2        /NEGATE H2
0726  7040              CMA               /...
0727  7430              SZL               /ADD L2 CARRY IF IT OCCURRED
0730  7001              IAC               /...
0731  3444              DCA I Z H2        /...
0732  5720              JMP I MINS        /RETURN

0733  0000    MIN1,     0                 /NEGATE THE FIRST ARGUMENT
0734  7300              CLA CLL           /NEGATE L1 FIRST
0735  1442              TAD I Z L1        /...
0736  7041              CMA IAC           /...
0737  3442              DCA I Z L1        /...
0740  1441              TAD I Z H1        /NEGATE H1
0741  7040              CMA               /...
0742  7430              SZL               /ADD L1 CARRY IF IT OCCURRED
0743  7001              IAC               /...
0744  3441              DCA I Z H1        /...
0745  5733              JMP I MIN1        /RETURN
                        /UNDEFINED OP CODE
0746  4502    UNDF,     JMS I Z GOOF      /CALL ERROR ROUTINE
0747  6163              6163              /TILT NUMBER 13
0750  5500              JMP I Z INTI      /DO NEXT INSTRUCTION
```

```
                        /SHEET 21
                        /INDEX STACK
                        /25(OCTAL) LOCATIONS

0751  0005              ISTA,   5
0752  0005                      5
0753  0005                      5
0754  0005                      5
0755  0005                      5
0756  0005                      5
0757  0005                      5
0760  0005                      5
0761  0005                      5
0762  0005                      5
0763  0005                      5
0764  0005                      5
0765  0005                      5
0766  0005                      5
0767  0005                      5
0770  0005                      5
0771  0005                      5
0772  0005                      5
0773  0005                      5
0774  0005                      5
0775  0005                      5
0776  0005                      5
0777  0005                      5
                        ISTAL,
                        L06,
```

```
                    /SHEET 22
                    /PAGE 10

1000                *1000
```

```
                        /SHEET 23
                        /FLOATING POINT I-O

1000  0000  DPCV,   0               /DECIMAL INPUT CONVERSION
1001  7240          CLA CMA         /NO PERIODS SEEN YET
1002  3664          DCA I PRSWI     /...
1003  3354          DCA HIC         /ZERO EVERYTHING
1004  3355          DCA LWC         /...
1005  3356          DCA SGN         /...
1006  3357          DCA DPN         /...
1007  3362          DCA NUMI                /...
1010  4534  AGAN,   JMS I Z IXCI    /GET A CHARACTER
1011  1066          TAD Z MPER      /IS IT A PERIOD?
1012  7450          SNA             /...
1013  5600          JMP I DPCV      /YES RETURN
1014  7001          IAC             /IS IT A MINUS SIGN?
1015  7450          SNA             /...
1016  5231          JMP FMINUS      /YES, PROCESS IT
1017  1062          TAD Z PTW       /IS IT A PLUS SIGN?
1020  7450          SNA             /...
1021  5233          JMP DPCS                /YES, READ MORE
1022  1260          TAD MNINE       /IS IT GREATER THAN NINE?
1023  7500          SMA             /...
1024  5210          JMP AGAN                /YES, TRY AGAIN (I.E.,IGNORE IT)
1025  1263          TAD MNPO                /IS IT LESS THAN ZERO?
1026  7510          SPA             /...
1027  5210          JMP AGAN                /YES, TRY AGAIN
1030  5234          JMP DPCS+1      /NO,MUST BE A DIGIT
1031  7240  FMINUS, CLA CMA         /SET SIGN INDICATOR ...
1032  3356          DCA SGN         /TO MINUS

1033  4534  DPCS,   JMS I Z IXCI    /SIGNLE DIGIT INPUT CONVERSION
1034  7200          CLA             /GET CHARACTER READ
1035  1510          TAD I Z ICHR    /...
1036  1262          TAD MRUB                /IS IT A RUBOUT?
1037  7450          SNA             /...
1040  5201          JMP DPCV+1      /YES, TRY CURRENT NUMBER AGAIN
1041  1261          TAD MNIN                /IS IT A DIGIT?
1042  7500          SMA             /...
1043  5600          JMP I DPCV      /NO, END OF CONVERSION
1044  1263          TAD MNPO                /MAYBE, KEEP CHECKING
1045  7510          SPA             /...
1046  5600          JMP I DPCV      /NO, END OF CONVERSION

1047  3361          DCA MIDG                /KEEP DIGIT
1050  5250  INS,    JMP .           /TAD HIC OR SKP
1051  0072          AND Z LT5       /CHECK IF MORE SPACE
1052  7440          SZA             /...
1053  5233          JMP DPCS                /NO, IGNORE DIGIT
1054  2362          ISZ NUMI                /YES, INCREASE DIGIT COUNTS
1055  2357          ISZ DPN         /...
1056  4265          JMS MT10                /ADD IN DIGIT
1057  5233          JMP DPCS                /TRY FOR MORE
```

```
1060  7761          MNINE,  253-272
1061  0105          MNIN,   377-272
1062  7401          MRUB,   0-377
1063  0012          MNPO,   272-260
1064  1713          PRSWI,  PRSW
```

```
                        /SHEET 24
                        /MULTIPLY BY TEN

1065  0000  MT10,   0               /MULTIPLICATION CONTROL
1066  1355          TAD LWC         /SETUP X
1067  3364          DCA TWC         /...
1070  1354          TAD HIC         /...
1071  3363          DCA TIC         /...
1072  3360          DCA REM         /...
1073  4305          JMS MTRL                /FORM 2X
1074  4305          JMS MTRL                /4X
1075  4320          JMS MTAD                /4X+X=5X
1076  4305          JMS MTRL                /10X
1077  1361          TAD MIDG                /LAST DIGIT READ...
1100  3364          DCA TWC         /...
1101  3363          DCA TIC         /WITH HIGH ORDER 0
1102  4320          JMS MTAD                /COMBINE WITH SHIFTED RESULT
1103  1360          TAD REM         /OVERFLOW IN AC
1104  5665          JMP I MT10      /RETURN

1105  0000  MTRL,   0               /MULTIPLY ROTATE LEFT
1106  1355          TAD LWC         /LOW ORDER ROTATE
1107  7104          CLL RAL         /...
1110  3355          DCA LWC         /...
1111  1354          TAD HIC         /HIGH ORDER ROTATE
1112  7004          RAL             /...
1113  3354          DCA HIC         /...
1114  1360          TAD REM         /POSSIBLE REMAINDER
1115  7004          RAL             /...
1116  3360          DCA REM         /...
1117  5705          JMP I MTRL      /RETURN

1120  0000  MTAD,   0               /MULTIPLY ADD
1121  7300          CLA CLL         /LOW ORDER ADD
1122  1355          TAD LWC         /...
1123  1364          TAD TWC         /...
1124  3355          DCA LWC         /...
1125  7004          RAL             /HIGH ORDER ADD
1126  1354          TAD HIC         /...
1127  1363          TAD TIC         /...
1130  3354          DCA HIC         /...
1131  7004          RAL             /REMAINDER ADD
1132  1360          TAD REM         /...
1133  3360          DCA REM         /...
1134  5720          JMP I MTAD      /RETURN
```

```
                        /SHEET 25
                        /SIGN CHECK AND INVERSION

1135  0000  MSGN,  0                 /CHECK SIGN
1136  7300        CLA CLL           /COMPLEMENT IF MINUS
1137  1356        TAD SGN           /...
1140  7700        SMA CLA           /...
1141  5735        JMP I MSGN        /NO COMPLEMENT
1142  1355        TAD LWC           /LOW ORDER COMPLEMENT
1143  7041        CMA IAC           /...
1144  3355        DCA LWC           /...
1145  1354        TAD HIC           /HIGH ORDER COMPLEMENT
1146  7040        CMA               /...
1147  7430        SZL               /ADD CARRY, IF ANY
1150  7001        IAC               /...
1151  3354        DCA HIC           /...
1152  5735        JMP I MSGN        /RETURN

1153  0000  BEXP,  0                 /BINARY EXPONENT
1154  0000  HIC,   0                 /HIGH ORDER FRACTION
1155  0000  LWC,   0                 /LOW ORDER FRACTION
1156  0000  SGN,   0                 /SIGN SWITCH
1157  0000  DPN,   0                 /NUMBER OF DIGITS SINCE LAST JMP/JMS
1160  0000  REM,   0                 /HIGHEST ORDER TEMPORARY
1161  0000  MIDG,  0                 /DIGIT JUST READ
1162  0000  NUMI,  0                 /NUMBER OF DIGITS SINCE LAST JMS
1163  0000  TIC,   0                 /HIGH ORDER TEMPORARY
1164  0000  TWC,   0                 /LOW ORDER TEMPORARY
```

```
                        /SHEET 26
                        /DO STACK
                        /13(OCTAL) LOCATIONS

1165  0004              DSTA,   4
1166  0004                      4
1167  0004                      4
1170  0004                      4
1171  0004                      4
1172  0004                      4
1173  0004                      4
1174  0004                      4
1175  0004                      4
1176  0004                      4
1177  0004                      4

                        DSTAL,
                        L10,
```

```
                    /SHEET 27
                    /PAGE 12

1200                *1200
```

```
                        /SHEET 28
                        /FLOATING OUTPUT FOR FOSSIL

1200  0000      FONK,   0         /OUTPUT SIGN
1201  7200              CLA
1202  1444              TAD I Z H2
1203  7710              SPA CLA
1204  1062              TAD Z PTW
1205  1074              TAD Z C53Z
1206  4550              JMS I Z OTCI
1207  4551              JMS I Z OTDI      /OUTPUT ZERO
1210  1345              TAD CPER                  /OUTPUT DECIMAL POINT
1211  4550              JMS I Z OTCI
1212  1444              TAD I Z H2        /ASSURE POSITIVE NUMBER
1213  7710              SPA CLA
1214  4537              JMS I Z NEG
1215  7240              CLA CMA           /MINUS ONE
1216  1443              TAD I Z X2        /ADJUST TO MAKE RANGE CHECKING EASIER
1217  3443              DCA I Z X2
1220  3504              DCA I Z BEXI

1221  1444              TAD I Z H2
1222  7440              SZA               /NON-ZERO OUTPUT
1223  5231              JMP NZFO
1224  3527              DCA I Z HICI
1225  3535              DCA I Z LWCI
1226  3545              DCA I Z MTDI
1227  7240              CLA CMA
1230  5311              JMP FN7

1231  7300      NZFO,   CLA CLL /ADD FUDGE
1232  1445              TAD I Z L2
1233  1343              TAD FUDG
1234  3445              DCA I Z L2
1235  1444              TAD I Z H2
1236  7430              SZL
1237  7101              CLL IAC
1240  7510              SPA
1241  2443              ISZ I Z X2
1242  7510              SPA
1243  7010              RAR
1244  3444              DCA I Z H2
```

```
                        /SHEET 29
                        /MORE FLOATING OUTPUT

1245  1443              FN1,    TAD I Z X2
1246  7500                      SMA
1247  5263                      JMP FN2 /EXPONENT TOO POSITIVE
1250  1344                      TAD FOUR
1251  7700                      SMA CLA
1252  5272                      JMP FN3 /EXPONENT WITHIN RANGE
1253  1164                      TAD Z TENI
1254  3040                      DCA Z X1
1255  4574                      JMS I Z XPN
1256  4546                      JMS I Z MULT
1257  7240                      CLA CMA
1260  1504                      TAD I Z BEXI
1261  3504                      DCA I Z BEXI
1262  5245                      JMP FN1

1263  7200              FN2,    CLA
1264  1152                      TAD Z OTEI
1265  3040                      DCA Z X1
1266  4574                      JMS I Z XPN
1267  4546                      JMS I Z MULT
1270  2504                      ISZ I Z BEXI
1271  5245                      JMP FN1

1272  1444              FN3,    TAD I Z H2
1273  3527                      DCA I Z HICI
1274  1445                      TAD I Z L2
1275  3535                      DCA I Z LWCI
1276  3545                      DCA I Z MTDI
1277  4540                      JMS I Z MIRI
```

```
                        /SHEET 30
                        /EVEN MORE FLOATING OUTPUT

1300  7200              FN4,    CLA
1301  4544                      JMS I Z MI10
1302  7410                      SKP
1303  4327              FN4A,   JMS RR
1304  2443                      ISZ I Z X2
1305  5303                      JMP FN4A
1306  7450                      SNA
1307  5320                      JMP FN6
1310  4551              FN5,    JMS I Z OTDI
1311  1342              FN7,    TAD M6
1312  3346                      DCA RRT
1313  4544              FN5A,   JMS I Z MI10
1314  4551                      JMS I Z OTDI
1315  2346                      ISZ RRT
1316  5313                      JMP FN5A
1317  5600                      JMP I FONK

1320  7240              FN6,    CLA CMA
1321  3443                      DCA I Z X2
1322  7240                      CLA CMA
1323  1504                      TAD I Z BEXI
1324  3504                      DCA I Z BEXI
1325  7240                      CLA CMA
1326  5311                      JMP FN7

1327  0000              RR,     0
1330  7110                      CLL RAR
1331  3346                      DCA RRT
1332  1527                      TAD I Z HICI
1333  7010                      RAR
1334  3527                      DCA I Z HICI
1335  1535                      TAD I Z LWCI
1336  7010                      RAR
1337  3535                      DCA I Z LWCI
1340  1346                      TAD RRT
1341  5727                      JMP I RR

1342  7773              M6,     0-5
1343  0005              FUDG,   5
1344  0004              FOUR,   4
1345  0056              CPER,   56
1346  0002              RRT,    0
```

```
                        /SHEET 31
                        /COMPUTED GO TO

1347  0000      GAR,    0
1350  3015      CGT,    DCA Z TEMA      /0 TO AUTO INDEX
1351  1414              TAD I Z ILC     /COUNT NUMBER OF POSSIBLE...
1352  2015              ISZ Z TEMA      /GO TOS
1353  7640              SZA CLA         /...
1354  5351              JMP .-3         /...
1355  1414              TAD I Z ILC     /SAVE ADDRESS OF VARIABLES
1356  3347              DCA GAR         /...
1357  1747              TAD I GAR       /GET VARIABLE ITSELF
1360  7540              SMA SZA         /MINUS OR ZERO, GO TO NEXT INST.
1361  7610              SKP CLA         /...
1362  5503              JMP I Z INTI    /...
1363  1415              TAD Z TEMA      /NUMBER OF ADDRESSES
1364  7041              CMA IAC         /-NUMBER OF ADDRESSES
1365  1747              TAD I GAR       /+VARIABLE VALUE
1366  7500              SMA             /IS VARIABLE TOO LARGE
1367  5500              JMP I Z INTI    /YES, GO TO NEXT VARIABLE
1370  1014              TAD Z ILC       /NO, ADD ILC
1371  7041              CMA IAC         /SUBTRACT ONE MORE...
1372  7040              CMA             /TO COMPENSATE FOR VARIABLE ADDR
1373  3347              DCA GAR         /...
1374  7240              CLA CMA         /-1 TO AC
1375  1747              TAD I GAR       /+ ADDR OF GO TO
1376  3014              DCA Z ILC       /PLACE IN ILC(AUTO-INDEX)
1377  5500              JMP I Z INTI    /GO DO INSTRUCTION THERE

                        L12,
```

```
                    /SHEET 32
                    /PAGE 14

1400                *1400
```

```
                        /SHEET 33
                        /FIXED OUTPUT

1400  0000      FXP,    0               /ENTER WITH NUMBER IN AC
1401  7100              CLL             /CHECK SIGN
1402  7510              SPA             /POSITIVE, DONT COMPLEMENT
1403  7061              CML CMA IAC     /MINUS, COMPLEMENT NUMBER
1404  3274              DCA HDP         /AND STORE
1405  1074              TAD Z C53Z      /OUTPUT PLUS SIGN IF POSITIVE
1406  7430              SZL             /BUT MINUS SIGN IF NEGATIVE
1407  1062              TAD Z PTW       /...
1410  4550              JMS I Z OTCI    /...
1411  1063              TAD Z MTH       /SET NUMBER OF SUBTRACTIONS
1412  3271              DCA PLUP                /...
1413  1273              TAD STDP                /SET POINTER TO BEGINNING...
1414  3223              DCA JMPT                /OF MAGIC TABLE
1415  3270              DCA SPCNT       /ZERO EVERYTHING
1416  3266              DCA PZH         /...
1417  3272              DCA DGT         /ZERO DIGIT COUNTER
1420  7410              SKP             /DONT...
1421  3274      LUPP,   DCA HDP         /SAVE DIDDLED VALUE
1422  1274              TAD HDP         /LOOK AT REMAINING NUMBER
1423  5223      JMPT,   JMP .           /ADD MAGIC NUMBER
1424  2272              ISZ DGT         /INCREMENT DIGIT COUNTER
1425  7500              SMA             /OVER?
1426  5221              JMP LUPP                /NO, HIT ME AGAIN
1427  7240              CLA CMA         /YES, SUBTRACT ONE AND...
1430  1272              TAD DGT         /CHECK FOR ZERO
1431  7640              SZA CLA         /...
1432  5241              JMP NZFXP       /NON-ZERO, GO OUTPUT
1433  1266              TAD PZH         /ZERO, IS IT A LEADING ZERO
1434  7450              SNA             /...
1435  2270              ISZ SPCNT       /YES, INCREMENT SPACE COUNTER
1436  7640              SZA CLA         /IF NON-LEADING, DONT OUTPUT
1437  4551              JMS I Z OTDI    /OTHERWISE, DO OUTPUT
1440  5251              JMP PPLU                /GO CHECK IF MORE WORK
```

```
                        /SHEET 34
                        /ŻERO TO SPACE CONVERSION
1441  1266      NŻFXP,  TAD PŻH          /IS PREVIOUS DIGIT NON-ŻERO?
1442  7440              SŻA              /...
1443  5246              JMP NŻDIG        /NO, GO PRINT
1444  1272              TAD DGT          /YES, NON-ŻERO IT
1445  3266              DCA PŻH          /...
1446  7240      NŻDIG,  CLA CMA          /PRINT DIGIT
1447  1272              TAD DGT          /...
1450  4551              JMS I Ż OTDI     /...
1451  2223      PPLU,   ISŻ JMPT                 /INCREMENT MAGIC TABLE POINTER
1452  2271              ISŻ PLUP                 /MORE TO CONVERT?
1453  5217              JMP LUPP-2       /YES, GO TO IT
1454  1274              TAD HDP          /NO, OUTPUT LAST DIGIT
1455  4551              JMS I Ż OTDI     /...
1456  1270              TAD SPCNT        /OUTPUT SPACES,...
1457  7040              CMA              /(MINIMUM OF ONE SPACE)
1460  3270              DCA SPCNT        /...
1461  1267              TAD CHSP                 /...
1462  4553              JMS I Ż OUTI     /...
1463  2270              ISŻ SPCNT        /MORE TO OUTPUT?
1464  5261              JMP .-3          /YES
1465  5600              JMP I FXP        /NO, RETURN


1466  0000      PŻH,    0                /LEADING/NON-LEADING
1467  0240      CHSP,   240              /CHARACTER SPACE
1470  0000      SPCNT,  0                /NO. OF SPACES TO OUTPUT
1471  0000      PLUP,   0                /NO. OF DIGITS REMAINING
1472  0000      DGT,    0                /CURRENT DIGIT
1473  1275      STDP,   TAD NCN          /STARTING VALUE OF TABLE PICKUP
1474  0000      HDP,    0                /NUMBER BEING OUTPUT
1475  6030      NCN,    0-1750           /MAGIC TABLE...1000
1476  7634              0-144            /100
1477  7766              0-12             /10
```

```
                        /SHEET 35
                        /CARRIAGE RETURN LINE FEED OPERATIONS

1500  0000              IXCH,   0
1501  4356                      JMS RPGIN         /GET A CHARACTER
1502  3332                      DCA CHR           /...
1503  1052                      TAD Z HILOR
1504  7640                      SZA CLA
1505  5310                      JMP DTFMR
1506  1332                      TAD CHR           /ECHO IT...
1507  4317                      JMS OUT           /BUT NOT ON DT
1510  1332              DTFMR,  TAD CHR           /(DT RETURNS)
1511  7440                      SZA               /BLANK TAPE
1512  1076                      TAD Z CMLF        /LINE FEED
1513  7650                      SNA CLA           /...
1514  5301                      JMP IXCH+1        /YES, IGNORE IT
1515  1332                      TAD CHR           /CHARACTER TO AC
1516  5700                      JMP I IXCH

1517  0000              OUT,    0       /OUTPUT THE AC
1520  1076                      TAD Z CMLF              /LINE FEED
1521  7450                      SNA               /...
1522  5717                      JMP I OUT         /YES, IGNORE IT
1523  1075              OUTL,   TAD Z CHLF              /NO OUTPUT CHARACTER
1524  4333                      JMS RPGOUT        /...
1525  1331                      TAD CMCR                /WAS IT CR?
1526  7650                      SNA CLA           /...
1527  5323                      JMP OUTL                /YES, OUTPUT LF
1530  5717                      JMP I OUT         /NO, RETURN

1531  7563              CMCR,   0-215             /MINUS CHARACTER CR
1532  0000              CHR,    0                 /LAST CHARACTER READ
```

```
                        /SHEET 36
                        /I/O DECISION AND BRANCH
1533  0000              RPGOUT, 0
1534  3355                      DCA RPGTEM        /SAVE OUTPUT CHARACTER
1535  1057                      TAD # MMFF        /ARE WE OUTPUTTING TO DECTAPE
1536  7640                      SZA CLA           /...
1537  5350                      JMP RPGMO         /YES, DO SO
1540  1051                      TAD # HILOP       /OUTPUT ON HISPEED PUNCH?
1541  7640                      SZA CLA           /...
1542  5346                      JMP RPGHO         /YES, DO SO
1543  1355                      TAD RPGTEM        /NO, USE THE (UGM) 33
1544  4556                      JMS I # QTYPEI    /...
1545  5733                      JMP I RPGOUT      /RETURN

1546  4506              RPGHO,  JMS I # BTYPEI    /HISPEED PUNCH ROUTINE
1547  5733                      JMP I RPGOUT      /RETURN
1550  4522              RPGMO,  JMS I # FIXOKI    /MAKE SPACE FOR DT CHAR.
1551  2047                      ISZ # BUFPNT      /...
1552  1355                      TAD RPGTEM        /PUT IT INTO BUFFER
1553  3447                      DCA I # BUFPNT    /...
1554  5717                      JMP I OUT         /RETURN SKIPPING LF

1555  0000              RPGTEM, 0                 /CHARACTER STORAGE

1556  0000              RPGIN,  0
1557  3272                      DCA DGT           /SAVE INPUT CHARACTER
1560  1057                      TAD # MMFF        /ARE WE INPUTTING DECTAPE
1561  7640                      SZA CLA           /...
1562  5373                      JMP RPGMI         /YES, DO SO
1563  1052                      TAD # HILOR       /INPUT FROM HISPEED READER?
1564  7640                      SZA CLA           /...
1565  5371                      JMP RPGHI         /YES, DO SO
1566  1272                      TAD DGT           /NO, USE THE 33
1567  4555                      JMS I # QREADI    /...
1570  5756                      JMP I RPGIN       /RETURN
1571  4505              RPGHI,  JMS I # BREADI    /USE HISPEED READER
1572  5756                      JMP I RPGIN       /RETURN
1573  4522              RPGMI,  JMS I # FIXOKI    /MOVE DECTAPE BUFFER POINTER
1574  2047                      ISZ # BUFPNT      /...
1575  1447                      TAD I # BUFPNT    /GET CHARACTER
1576  3332                      DCA CHR           /...
1577  5313                      JMP DTFMR         /BUT DONT ECHO
                        L14,
```

```
                    /SHEET 37
                    /PAGE 16

1600                *1600
```

```
                        /SHEET 38
                        /FLOATING INPUT KONVERSION FOR FOSSIL

1600  0000      FINK,   0
1601  4515              JMS I Z DPV       /GO GET INPUT
1602  7200              CLA               /WHAT WAS LAST CHARACTER?
1603  1510              TAD I Z ICHR      /...
1604  1066              TAD Z MPER        /A PERIOD?
1605  7640              SZA CLA           /...
1606  5215              JMP FK1           /NO, LOOK FURTHER
1607  1313              TAD PRSW                  /LAST CHARACTER WAS A PERIOD
1610  7650              SNA CLA           /WAS IT THE...
1611  5217              JMP FK2 /SECOND PERIOD
1612  3516              DCA I Z DPNI      /CLEAR DECIMAL COUNTER
1613  3313              DCA PRSW                  /SET PERIOD SWITCH
1614  5514              JMP I Z DPS       /GO LOOK FOR MORE DIGITS

1615  1313      FK1,    TAD PRSW                  /NOT A PERIOD
1616  7650              SNA CLA           /ANY PERIOD SCEN?
1617  1516      FK2,    TAD I Z DPNI      /YES, GET NUMBER OF DECIMAL DIGITS AFTER PERIOD
1620  7041              CMA IAC           /...
1621  3312              DCA SEXP                  /IMPLIED DECIMAL EXPONENT
1622  4543              JMS I Z MSN       /CHECK FOR NEGATION

1623  7200      FK3,    CLA
1624  1314              TAD C27           /UN-NORMALIZED EXPONENT
1625  3443              DCA I Z X2        /MOVE TO STACK
1626  1527              TAD I Z HICI      /...
1627  3444              DCA I Z H2        /...
1630  1535              TAD I Z LWCI      /...
1631  3445              DCA I Z L2        /...
1632  4547              JMS I Z NOR       /NORMALIZE IT
1633  7200              CLA               /LOOK AT BREAK CHARACTER
1634  1510              TAD I Z ICHR      /...
1635  1311              TAD CHME                  /IS NEXT CHARACTER AN E?
1636  7440              SZA               /...
1637  5252              JMP CVRT                  /NO, SKIP EXPONENT READ
1640  4515              JMS I Z DPV       /YES, E, CONTINUE CONVERSION
1641  4543              JMS I Z MSN       /CHECK FOR NEGATION
1642  1527              TAD I Z HICI      /IS EXPONENT TOO LARGE?
1643  7510              SPA               /...
1644  7001              IAC               /...
1645  7440              SZA               /...
1646  5277              JMP EXTU                  /YES, COMPLAIN
1647  1535              TAD I Z LWCI      /NO, ADD IT TO IMPLIED...
1650  1312              TAD SEXP                  /EXPONENT
1651  3312              DCA SEXP                  /...
```

```
                        /SHEET 39
                        /FLOATING INPUT ARITHMETIC

1652  7200      CVRT,   CLA
1653  1312              TAD SEXP                /LOOK AT DECIMAL EXPONENT
1654  7450              SNA                     /...
1655  5600              JMP I FINK              /ZERO, CONVERSION DONE
1656  7700              SMA CLA                 /...
1657  5267              JMP CVR1                /NEGATIVE, GO DO IT
1660  1152              TAD Z OTEI              /POSITIVE, MULTIPLY BY 1/10
1661  3040              DCA Z X1                /...
1662  4574              JMS I Z XPN             /...
1663  4546              JMS I Z MULT            /...
1664  2312              ISZ SEXP                /INCREMENT EXP AND CHECK IF DONE
1665  5252              JMP CVRT                /NO
1666  5600              JMP I FINK              /YES, RETURN

1667  1164      CVR1,   TAD Z TENI              /MULTIPLY BY 10
1670  3040              DCA Z X1                /...
1671  4574              JMS I Z XPN             /...
1672  4546              JMS I Z MULT            /...
1673  7240              CLA CMA                 /DECREMENT EXP
1674  1312              TAD SEXP                /...
1675  3312              DCA SEXP                /...
1676  5252              JMP CVRT                /GO CHECK IF DONE

1677  4502      EXTU,   JMS I Z GOOF            /EXPONENT TOO BIG
1700  6162              6162                    /ERROR NO.12
1701  7340              CLA CLL CMA             /SET TO HIGHEST NUMBER,...
1702  7010              RAR                     /POSITIVE
1703  3443              DCA I Z X2              /...
1704  1443              TAD I Z X2              /...
1705  3444              DCA I Z H2              /...
1706  7240              CLA CMA                 /...
1707  3445              DCA I Z L2              /...
1710  5600              JMP I FINK              /RETURN

1711  7473      CHME,   0-305                   /CHARACTER E
1712  0000      SEXP,   0                       /DECIMAL EXPONENT
1713  0000      PRSW,   0                       /PERIOD SWITCH
1714  0027      C27,    27                      /IMPLIED EXPONENT
1715  0004      TEN,    4       /TEN (FLOATING POINT)
1716  2400              2400
1717  0000              0
1720  7775      OTEN,   7775    /ONE-TENTH (FLOATING POINT)
1721  3146              3146
1722  3150              3150
```

```
                        /SHEET 40
                        /DIGIT AND CHARACTER OUTPUT

1723  0000      OTDG,   0
1724  1346              TAD C260                /CONSTRUCT ASCII DIGIT
1725  4553              JMS I Z OUTI      /AND OUTPUT IT,
1726  5723              JMP I OTDG        /RETURN

1727  0000      OTCH,   0
1730  0347              AND R6            /CONSTRUCT ASCII CHARACTER
1731  3342              DCA OTM           /FROM SIXBIT CHARACTER
1732  1342              TAD OTM           /...
1733  0343              AND C40           /...
1734  7650              SNA CLA           /...
1735  1344              TAD C100                /...
1736  1345              TAD C200                /...
1737  1342              TAD OTM           /...
1740  4553              JMS I Z OUTI      /OUTPUT IT
1741  5727              JMP I OTCH        /RETURN

1742  0000      OTM,    0                 /TEMP FOR OTCH
1743  0040      C40,    40
1744  0100      C100,   100
1745  0200      C200,   200
1746  0260      C260,   260
1747  0077      R6,     77                /RIGHTMOST 6 BITS

                        /NEGATION OP CODES

1750  4520      CONJ,   JMS I Z ETTI      /FIXED NEGATION
1751  4537              JMS I Z NEG
1752  5500              JMP I Z INTI

1753  4573      CONG,   JMS I Z XET       /FLOATING NEGATION
1754  5351              JMP CONJ+1

                        /COMMON INTERP. STORAGE
1755  0000      FLAG,   0
1756  0000      DVAR,   0
```

```
                        /SHEET 41
                        /COUNTER STACK
                        /2% (OCTAL) LOCATIONS

1757  0003              CSTA,   3
1760  0003              3
1761  0003              3
1762  0003              3
1763  0003              3
1764  0003              3
1765  0003              3
1766  0003              3
1767  0003              3
1770  0003              3
1771  0003              3
1772  0003              3
1773  0003              3
1774  0003              3
1775  0003              3
1776  0003              3
1777  0003              3
                        CSTAL,
                        L16,
```

```
                    /SHEET 42
                    /PAGE 20

2000                *2000
```

```
                        /SHEET 43
                        /FLOATING ARITHMETIC FOR FOSSIL

2000  4575      XADD,   JMS I Z XTV     /FLOATING ADD
2001  1441              TAD I Z H1      /IS ARG1 ZERO?
2002  7650              SNA CLA         /...
2003  5500              JMP I Z INTI    /YES, ARG2 IS ANSWER
2004  1444              TAD I Z H2      /IS ARG2 ZERO?
2005  7650              SNA CLA         /...
2006  5224              JMP XAZ         /YES, ARG1 IS ANSWER
2007  4567              JMS I Z UNO     /NO, MOVE BOTH ARGS RIGHT 1 BIT
2010  4503              JMS I Z ALN     /SHIFT ARGUMENTS
2011  5222              JMP AFIN                /ALIGNMENT NOT POSSIBLE
2012  7300              CLA CLL         /ADD LOW ORDER PARTS
2013  1442              TAD I Z L1      /...
2014  1445              TAD I Z L2      /...
2015  3445              DCA I Z L2      /...
2016  7004              RAL             /SHIFT CARRY BIT
2017  1441              TAD I Z H1      /ADD HIGH ORDER PARTS
2020  1444              TAD I Z H2      /...
2021  3444              DCA I Z H2      /...
2022  4547      AFIN,   JMS I Z NOR     /RE-NORMALIZE
2023  5500              JMP I Z INTI    /NEXT INSTRUCTION

2024  4561      XAZ,    JMS I Z SWP     /SWAP ARGUMENTS
2025  5500              JMP I Z INTI    /NEXT INSTRUCTION

2026  4575      XSUB,   JMS I Z XTV     /FLOATING SUBTRACT NORMAL
2027  4537              JMS I Z NEG     /NEGATE ARGUMENT...
2030  5201              JMP XADD+1      /AND ADD

2031  4575      XRSU,   JMS I Z XTV     /FLOATING SUBTRACT REVERSED
2032  4561              JMS I Z SWP     /SWAP ARGUMENTS
2033  5227              JMP XSUB+1              /GO NEGATE AND ADD
```

```
                        /SHEET 44
                        /FLOATING MULTIPLY AND DIVIDE

2034  4575              XMUL,   JMS I Z XTV     /FLOATING MULTIPLY
2035  4237                      JMS MUS         /MULTIPLY ROUTINE ENTRY
2036  5500                      JMP I Z INTI    /NEXT INSTRUCTION

2037  0000              MUS,    0
2040  7200                      CLA
2041  1440                      TAD I Z X1      /ADD EXPONENTS
2042  1443                      TAD I Z X2      /...
2043  7001                      IAC             /PLUS ONE
2044  3443                      DCA I Z X2      /...
2045  4513                      JMS I Z MPY     /MULTIPLY FRACTIONS
2046  4547                      JMS I Z NOR     /NORMALIZE
2047  5637                      JMP I MUS       /RETURN

2050  4575              XDIV,   JMS I Z XTV     /FLOATING DIVIDE NORMAL
2051  4557                      JMS I Z SND     /UN-NORMALIZE SECOND ARGUMENT
2052  7200                      CLA             /IS DIVISOR ZERO?
2053  1441                      TAD I Z H1      /...
2054  7650                      SNA CLA         /...
2055  5270                      JMP ZERR                /YES, ERROR
2056  1440              OK,     TAD I Z X1      /NO, SUBTRACT EXPONENT
2057  7041                      CIA             /...
2060  1443                      TAD I Z X2      /...
2061  3443                      DCA I Z X2      /...
2062  4512                      JMS I Z DVD     /DIVIDE FRACTIONS
2063  2511                      ISZ I Z DDII    /SHOULD SIGN BE MINUS
2064  7410                      SKP             /NO
2065  4537                      JMS I Z NEG     /YES, MAKE IT SO
2066  4547                      JMS I Z NOR     /RE-NORMALIZE
2067  5500                      JMP I Z INTI    /NEXT INSTRUCTION
2070  4502              ZERR,   JMS I Z GOOF    /CALL ERROR ROUTINE
2071  6161                      6161            /ERROR NO.11
2072  7340                      CLA CLL CMA     /SET TO HIGHEST ANSWER
2073  7010                      RAR             /...
2074  3443                      DCA I Z X2      /...
2075  1443                      TAD I Z X2      /...
2076  3444                      DCA I Z H2      /...
2077  7240                      CLA CMA         /...
2100  3445                      DCA I Z L2      /...
2101  5500                      JMP I Z INTI    /NEXT INSTRUCTION


2102  4575              XRDV,   JMS I Z XTV     /FLOATIN DIVIDE REVERSED
2103  4561                      JMS I Z SWP     /SWAP ARGUMENTS
2104  5251                      JMP XDIV+1      /GO DIVIDE
```

```
                        /SHEET 45
                        /FIXED POINT OPERATIONS FOR FOSSIL

2105  4566      ADD,    JMS I Z TVAI    /FIXED ADD
2106  7200              CLA             /...
2107  1444              TAD I Z H2      /...
2110  1441      ADDS,   TAD I Z H1      /SUBTRACTION ENTRY
2111  3444              DCA I Z H2      /...
2112  5500              JMP I Z INTI    /NEXT INSTRUCTION

2113  4566      SUB,    JMS I Z TVAI    /FIXED SUBTRACT NORMAL
2114  7200              CLA             /NEGATE ARG2
2115  1444              TAD I Z H2      /...
2116  7041              CMA IAC         /...
2117  5310              JMP ADDS                /GO ADD

2120  4566      RSUB,   JMS I Z TVAI    /FIXED SUBTRACT REVERSED
2121  4562              JMS I Z SWP1    /SWAP ARGUMENTS
2122  5314              JMP SUB+1       /GO NEGATE AND ADD

2123  4566      MUL5,   JMS I Z TVAI    /FIXED MULTIPLY
2124  4513              JMS I Z MPY     /MULTIPLY USING LOW ORDER ZEROS
2125  7300              CLA CLL         /ANSWER MODULO 2048
2126  1445              TAD I Z L2      /...
2127  7004              RAL             /...
2130  3445              DCA I Z L2      /...
2131  1444              TAD I Z H2      /BUT WITH CORRECT SIGN
2132  7004              RAL             /...
2133  7200              CLA             /...
2134  1445              TAD I Z L2      /...
2135  7010              RAR             /...
2136  3444              DCA I Z H2      /...
2137  5500              JMP I Z INTI    /NEXT INSTRUCTION
```

```
                        /SHEET 46
                        /FIXED DIVIDE FOR FOSSIL

2140  4566              DIV5,   JMS I Z TVAI    /FIXED DIVIDE NORMAL
2141  1441                      TAD I Z H1      /IS DIVISOR ZERO?
2142  7652                      SNA CLA         /...
2143  5362                      JMP ERRD                /YES, ERROR
2144  1444                      TAD I Z H2      /NO, EXTEND TO TWO WORDS
2145  7104                      CLL RAL         /...
2146  3445                      DCA I Z L2      /...
2147  7430                      SZL             /...
2150  7040                      CMA             /...
2151  3444                      DCA I Z H2      /...
2152  4512                      JMS I Z DVD     /DIVIDE
2153  7200                      CLA             /QUOTIENT TO AC
2154  1444                      TAD I Z H2      /...
2155  2511                      ISZ I Z DDII    /IS SIGN MINUS?
2156  7410                      SKP             /NO
2157  7041                      CMA IAC         /YES, NEGATE IT
2160  3444                      DCA I Z H2      /...
2161  5500                      JMP I Z INTI    /NEXT INSTRUCTION
2162  4502              ERRD,   JMS I Z GOOF    /CALL ERROR ROUTINE
2163  6161                      6161            /ERROR NO. 11
2164  7340                      CLA CLL CMA     /HIGHEST ANSWER
2165  7010                      RAR             /...
2166  3444                      DCA I Z H2      /...
2167  5500                      JMP I Z INTI    /NEXT INSTRUCTION

2170  4566              RDIV,   JMS I Z TVAI    /FIXED DIVIDE REVERSED
2171  4562                      JMS I Z SWP1    /SWAP ARGUMENTS
2172  5341                      JMP DIV5+1      /GO DIVIDE
```

```
                        /SHEET 47
                        /FORMAT SKIP
2173  7200              FMT,    CLA             /SKIP OVER FORMAT
2174  1414                      TAD I Z ILC     /GET NEXT ELEMENT
2175  7640                      SZA CLA         /IS IT ZERO?
2176  5374                      JMP .-2         /NO, LOOK AGAIN
2177  5500                      JMP I Z INTI    /YES, GET NEXT INSTRUCTION

                        L20,
```

```
/SHEET 48
/PAGE 22

220V                *220V
```

```
                        /SHEET 49
                        /NORMALIZATION SUBROUTINE

2200  0000      NORM,   0               /NORMALIZE ARGUMENT TWO
2201  7300              CLA CLL         /ZERO EVERYTHING
2202  3246              DCA AMT         /...
2203  3245              DCA SIGN                /...
2204  1444              TAD I Z H2      /LOOK AT HI ORDER
2205  7510              SPA             /SET SIGN=0 OR 1
2206  2245              ISZ SIGN                /0 SIGN MEANS POSITIVE
2207  7640              SZA CLA         /IS NUMBER=0?
2210  5214              JMP .+4         /NO, SKIP LO TEST
2211  1445              TAD I Z L2      /HI=0, CHECK LO
2212  7650              SNA CLA         /...
2213  5243              JMP EXEF                /NUMBER IS ZERO, DONE
2214  1245              TAD SIGN                /NON-ZERO, WAS IT NEGATIVE
2215  7640              SZA CLA         /...
2216  4537              JMS I Z NEG     /IF SO, MAKE IT POSITIVE
2217  1444      LOP,    TAD I Z H2      /LOOK AT BIT ONE
2220  7104              CLL RAL         /...
2221  7710              SPA CLA         /IS BIT 1=1
2222  5233              JMP EXIT                /YES, GO ADJUST EXPONENT
2223  1445              TAD I Z L2      /NO, SHIFT LEFT
2224  7104              CLL RAL         /...
2225  3445              DCA I Z L2      /LO ORDER SHIFTED
2226  1444              TAD I Z H2      /AND NOW THE HI ORDER
2227  7004              RAL             /...
2230  3444              DCA I Z H2      /...
2231  2246              ISZ AMT         /COUNT OF NO. OF SHIFTS
2232  5217              JMP LOP         /GO LOOK AGAIN
2233  1246      EXIT,   TAD AMT         /HOW MANY SHIFTS?
2234  7041              CMA IAC         /SUBTRACT FROM EXPONENT
2235  1443              TAD I Z X2      /...
2236  3443              DCA I Z X2      /...
2237  1245              TAD SIGN        /WAS INPUT NEGATIVE?
2240  7640              SZA CLA         /...
2241  4537              JMS I Z NEG     /YES, NEGATE ANSWER
2242  5600              JMP I NORM      /RETURN
2243  3443      EXEF,   DCA I Z X2      /ZERO THE EXPONENT
2244  5600              JMP I NORM      /RETURN
2245  0000      SIGN,   0               /SIGN OF NUMBER; TEMP FOR ALGN
2246  0000      AMT,    0               /NO. OF SHIFTS
```

```
                        /SHEET 50
                        /ALIGNMENT FOR FLOATING POINT

2247  0000  ALGN,  0               /ALIGN ARGUMENTS
2250  7200        CLA             /WHICH EXPONENT IS GREATER?
2251  1440        TAD I Z X1      /...
2252  7041        CMA IAC         /...
2253  1443        TAD I Z X2      /...
2254  7450        SNA             /ZERO CHECK
2255  5320        JMP DONE                /NO ALIGNMENT NEEDED
2256  3245        DCA SIGN                /KEEP IN TEMPORARY
2257  1245        TAD SIGN                /...
2260  7710        SPA CLA         /POSITIVE MEANS TWO BIGGER
2261  5267        JMP TWO         /GO SHIFT TWO RIGHT
2262  1041  ONE,  TAD Z H1                /SHIFT ONE RIGHT BY...
2263  3330        DCA T3          /MOVING IT TO SHIFT REGISTERS
2264  1042        TAD Z L1                /...
2265  3331        DCA T4          /...
2266  5275        JMP BOTH                /GO SHIFT
2267  1440  TWO,  TAD I Z X1      /SHIFT TWO RIGHT
2270  3443        DCA I Z X2      /FIRST SET X2=X1;
2271  1044        TAD Z H2                /THEN USE SHIFT REGISTERS
2272  3330        DCA T3          /...
2273  1045        TAD Z L2                /...
2274  3331        DCA T4          /...
2275  1245  BOTH, TAD SIGN                /GET EXPONENT DIFFERENCE
2276  7500        SMA             /MAKE SURE IT IS NEGATIVE
2277  7041        CMA IAC         /...
2300  3246        DCA AMT         /PUT IT IN SHIFT COUNTER
2301  1327        TAD T2          /MAKE SURE IT IS LESS THAN....
2302  1246        TAD AMT         /24 BITS
2303  7710        SPA CLA         /...
2304  5323        JMP NOGO                /SORRY, TOO MUCH ALIGNMENT NEEDED
2305  7100  XX5,  CLL             /SHIFT RIGHT
2306  1730        TAD I T3                /HI ORDER
2307  7510        SPA             /...
2310  7020        CML             /...
2311  7010        RAR             /...
2312  3730        DCA I T3                /...
2313  1731        TAD I T4                /LO ORDER
2314  7010        RAR             /...
2315  3731        DCA I T4                /...
2316  2246        ISZ AMT         /ENUF SHIFTING?
2317  5305        JMP XX5         /NO, LOOP AGAIN

2320  7200  DONE, CLA             /YES, RETURN 2,4
2321  2247        ISZ ALGN                /...
2322  5647        JMP I ALGN      /...
2323  1245  NOGO, TAD SIGN                /RETURN LARGER NUMBER IN H2
2324  7510        SPA             /...
2325  4561        JMS I Z SWP     /...
2326  5647        JMP I ALGN      /RETURN

2327  0030  T2,   30              /24 BITS
2330  0000  T3,   0               /SHIFT REGISTER
```

```
2331  0000                T4,     0               /...
```

```
                        /SHEET 51
                        /ONE-BIT UNORMALIZATION

2332  0000      UNOR,   0               /UN-NORMALIZE BOTH ARGUMENTS
2333  7300              CLA CLL         /SHIFT RIGHT ONE BIT
2334  1441              TAD I Z H1      /HI ORDER
2335  7510              SPA             /PRESERVE SIGN
2336  7020              CML             /...
2337  7010              RAR             /...
2340  3441              DCA I Z H1      /...
2341  1442              TAD I Z L1      /LO ORDER
2342  7010              RAR             /...
2343  3442              DCA I Z L1      /...
2344  2440              ISZ I Z X1      /ADD ONE TO EXPONENT
2345  7000              NOP             /IN CASE OF SKIP BY ISZ
2346  4350              JMS SCND                /SEE BELOW
2347  5732              JMP I UNOR      /RETURN

2350  0000      SCND,   0               /UN-NORMALIZE SECOND ARGUMENT
2351  7300              CLA CLL         /SHIFT RIGHT ONE BIT
2352  1444              TAD I Z H2      /HI ORDER
2353  7510              SPA             /PRESERVE SIGN
2354  7020              CML             /...
2355  7010              RAR             /...
2356  3444              DCA I Z H2      /...
2357  1445              TAD I Z L2      /LO ORDER
2360  7010              RAR             /...
2361  3445              DCA I Z L2      /...
2362  2443              ISZ I Z X2      /ADD ONE TO EXPONENT
2363  5750              JMP I SCND      /RETURN
2364  5750              JMP I SCND      /RETURN EVEN IF ISZ SKIPS
```

```
                        /SHEET 52
                        /PAUSE AND GO TO

2365  1414              PGT,    TAD I Z ILC     /GET ADDR OF SUBR
2366  3371                      DCA PGTT                /PUT IT IN TEMP
2367  4771                      JMS I PGTT      /GO THERE
2370  5500                      JMP I Z INTI    /GET NEXT INSTRUCTION

2371  0000              PGTT,   0               /TEMP FOR JMS

2372  0000              QREAD,  0               /ASR 33 READ
2373  6031                      KSF             /WAIT FOR FLAG
2374  5373                      JMP .-1         /...
2375  6036                      KRB             /READ CHARACTER
2376  5772                      JMP I QREAD     /RETURN
2377  7402              F22,    HLT
                        L22,
```

/SHEET 53
/PAGE 24

2402 *2402

```
                        /SHEET 54
                        /DIVISION SUBROUTINE FOR FOSSIL
                        /DIVIDEND IN ARGUMENT TWO
                        /DIVISOR IN ARGUMENT ONE
                        /LEAVES QUOTIENT IN ARGUMENT TWO
                        /LEAVES REMAINDER IN ARGUMENT ONE

2400  0000              DDVD,   0
2401  7200                      CLA             /SET SIGN INDICATOR
2402  1064                      TAD Z MTW       /...
2403  3276                      DCA DD1         /...
2404  3272                      DCA QUOH                /CLEAR QUOTIENT REGISTERS
2405  3273                      DCA QUOL                /...
2406  1444                      TAD I Z H2      /GET HI ORDER ARG2
2407  7700                      SMA CLA         /IS IT NEGATIVE?
2410  5214                      JMP DD2         /NO, GO LOOK AT ARG1
2411  2276                      ISZ DD1         /YES, INDICATE ITS SIGN...
2412  4537                      JMS I Z NEG     /AND MAKE IT POSITIVE
2413  7200                      CLA             /...
2414  1441              DD2,    TAD I Z H1      /GET HI ORDER ARG2
2415  7510                      SPA             /IS IT NEGATIVE?
2416  2276                      ISZ DD1         /YES, INDICATE ITS SIGN
2417  7000                      NOP             /IN CASE ISZ SKIPPED
2420  7700                      SMA CLA         /IS IT NEGATIVE?
2421  4536                      JMS I Z NEG1    /NO, MAKE IT SO
2422  7300                      CLA CLL         /SET NUMBER OF BITS
2423  1274                      TAD MIF         /...
2424  3275                      DCA DV1         /...
2425  5247                      JMP DD4         /GO DIVIDE
```

```
                        /SHEET 55
                        /MORE DIVISION

2426  1445              DV3,    TAD I Z L2      /SHIFT LEFT ONE BIT
2427  7004                      RAL             /...
2430  3445                      DCA I Z L2      /...
2431  1444                      TAD I Z H2      /HI ORDER
2432  7004                      RAL             /...
2433  3444                      DCA I Z H2      /...
2434  1445                      TAD I Z L2      /ADD LO ORDERS
2435  1442                      TAD I Z L1      /...
2436  3271                      DCA SAV         /HOLD ANSWER UNTIL OVFLO
2437  7004                      RAL             /ADD CARRY BIT AND...
2440  1444                      TAD I Z H2      /HI ORDERS
2441  1441                      TAD I Z H1      /...
2442  7420                      SNL             /WAS THERE A CARRY BIT
2443  5247                      JMP DD4         /YES, SUBTRACT UNNEEDED
2444  3444                      DCA I Z H2      /NO, STORE ANSWER HI
2445  1271                      TAD SAV         /STORE ANSWER LO
2446  3445                      DCA I Z L2      /...
2447  7200              DD4,    CLA             /CARRY BIT SHIFTED...
2450  1273                      TAD QUOL                /INTO QUOTIENT
2451  7004                      RAL             /...
2452  3273                      DCA QUOL                /...
2453  1272                      TAD QUOH                /HI ORDER TOO
2454  7004                      RAL             /...
2455  3272                      DCA QUOH                /...
2456  2275                      ISZ DV1         /ARE WE DONE?
2457  5226                      JMP DV3         /NO, GO LOOP
2460  1444                      TAD I Z H2      /YES, SET UP REMAINDER
2461  3441                      DCA I Z H1      /...
2462  1445                      TAD I Z L2      /...
2463  3442                      DCA I Z L1      /...
2464  1272                      TAD QUOH                /SET UP QUOTIENT
2465  3444                      DCA I Z H2      /...
2466  1273                      TAD QUOL                /...
2467  3445                      DCA I Z L2      /...
2470  5603                      JMP I DDVD      /RETURN

2471  0000              SAV,    0               /TEMP UNTIL CARRY
2472  0000              QUOH,   0               /QUOTIENT REGISTER
2473  0000              QUOL,   0               /...
2474  7754              MIF,    0-30            /NUMBER OF BITS=24
2475  0000              DV1,    0               /SHIFT COUNTER
2476  0000              DD1,    *               /SIGN COUNTER
```

```
                        /SHEET 56
                        /GOTO AND IF

2477  7240      GOTO,   CLA CMA         /SUBTRACT ONE
2500  1414              TAD I Z ILC     /FROM NEXT ADDR
2501  3414              DCA Z ILC       /PLACE IN PSEUDO PROGRAM COUNTER
2502  5500              JMP I Z INTI    /GET NEXT INSTRUCTION

2503  4566      IF,     JMS I Z TVAI    /FIXED IF
2504  7200              CLA             /IS ARGUMENT NEGATIVE?
2505  1441              TAD I Z H1      /...
2506  7510              SPA             /...
2507  5314              JMP FIN         /YES, USE NEXT ADDR
2510  7650              SNA CLA         /IS ARGUMENT ZERO?
2511  5313              JMP ZWEI                /YES, SKIP TWO ADDR.
2512  2014      DREI,   ISZ Z ILC       /NO, SKIP ONE ADDR.
2513  2014      ZWEI,   ISZ Z ILC       /PICK ADDR UP FOR TRANSFER
2514  5277      EIN,    JMP GOTO

2515  4575      XIF,    JMS I Z XTV     /FLOATING IF
2516  5304              JMP IF+1                /GO LOOK AT ARGUMENT
```

```
                        /SHEET 57
                        /I-O ITEM FOR FOSSIL

2517  0000      IOI,    0
2520  7200              CLA             /LOOK AT NEXT LIST ITEM
2521  1414              TAD I Z ILC     /...
2522  3351              DCA TFA         /SAVE IT
2523  1351              TAD TFA         /...
2524  7450              SNA             /IS IT ZERO?
2525  5352              JMP ITL         /YES, END OF LIST
2526  4523              JMS I Z FOMI    /NO, SET FORMAT WORD
2527  7200              CLA             /IS ITEM FLOATING?
2530  1351              TAD TFA         /...
2531  7700              SMA CLA         /...
2532  7040              CMA             /NO, FIXED
2533  3056              DCA Z INTR      /INTERNAL MODE INDICATOR
2534  1351              TAD TFA         /GET 12 BIT ADDR
2535  0067              AND Z R10       /...
2536  1073              TAD Z LT2       /...
2537  3046              DCA Z IOAD      /...
2540  1351              TAD TFA         /IS THIS AN INDEXED VARIABLE?
2541  7004              RAL             /...
2542  7700              SMA CLA         /...
2543  5717              JMP I IOI       /NO, RETURN
2544  1046              TAD Z IOAD      /YES, GO GET INCREMENT
2545  4576              JMS I Z XXCI    /...
2546  1046              TAD Z IOAD      /ADD IT TO BASE ADDR
2547  3046              DCA Z IOAD      /...
2550  5717              JMP I IOI       /RETURN

2551  0000      TFA,    0               /TEMP FOR ADDRESS

2552  7240      ITL,    CLA CMA         /-1 TO STAGE INDICATOR
2553  3055              DCA Z STAG      /...
2554  4523              JMS I Z FOMI    /PROCESS LAST FORMAT ITEMS
2555  7200              CLA             /IS THIS DECTAPE STATEMENT?
2556  1057              TAD Z MMFF      /...
2557  7640              SZA CLA         /...
2560  5762              JMP I DTENDI    /YES, GO TO DT CLEANUP
2561  5503              JMP I Z INTI    /NO, GET NEXT INSTRUCTION

2562  5244      DTENDI, DTEND           /ADDRESS OF DT CLEAN UP
```

```
                        /SHEET 58
                        /CONSTANTS FOR EXPONENTIALS

2563  0007              EX1,    0007            /87.417497202
2564  2566                      2566
2565  5341                      5341
2566  0012              EX2,    0012            /-617.97226053
2567  5454                      5454
2570  0343                      0343
2571  7774              EX3,    7774            /0.03465735903
2572  2157                      2157
2573  5157                      5157
2574  0004              EX4,    0004            /9.95459578
2575  2372                      2372
2576  1402                      1402
2577  7402              F24,    HLT
                        L24,
```

```
                    /SHEET 59
                    /PAGE 26

2600                *2600
```

```
                        /SHEET 60
                        /MULTIPLY SUBROUTINE
2600  0000  DMUL,  0               /DOUBLE PRECISION MULTIPLY (SIGNED)
2601  7300          CLA CLL         /SET SIGN INDICATOR
2602  1064          TAD Z MTW       /...
2603  3316          DCA MM1         /...
2604  1444          TAD I Z H2      /IS ARG2 NEGATIVE?
2605  7510          SPA             /...
2606  2316          ISZ MM1         /YES, INDICATE
2607  7510          SPA             /...
2610  4537          JMS I Z NEG     /YES, MAKE IT POSITIVE
2611  7300          CLA CLL         /IS ARG1 NEGATIVE?
2612  1441          TAD I Z H1      /...
2613  7510          SPA             /...
2614  2316          ISZ MM1         /YES, INDICATE
2615  7510          SPA             /...
2616  4536          JMS I Z NEG1    /YES, MAKE IT POSITIVE
2617  7200          CLA             /...
2620  1444          TAD I Z H2      /FIRST LO ORDER PRODUCT
2621  3307          DCA MP2         /...
2622  1442          TAD I Z L1      /...
2623  4260          JMS MP4         /...
2624  3315          DCA C           /STORE RESULTS
2625  1311          TAD MP5         /...
2626  3314          DCA D           /...
2627  1441          TAD I Z H1      /SECOND LO ORDER PRODUCT
2630  3307          DCA MP2         /...
2631  1445          TAD I Z L2      /...
2632  4260          JMS MP4         /...
2633  1315          TAD C           /COMBINE RESULTS WITH...
2634  7204          CLA RAL         /FIRST LO ORDER PRODUCT
2635  1311          TAD MP5         /...
2636  1314          TAD D           /...
2637  3314          DCA D           /...
2640  7004          RAL             /SAVE HI ORDER CARRY
2641  3313          DCA KEEP                /...
2642  1444          TAD I Z H2      /HI ORDER PRODUCT
2643  3307          DCA MP2         /...
2644  1441          TAD I Z H1      /...
2645  4260          JMS MP4         /...
2646  1314          TAD D           /COMBINE WITH LO ORDER
2647  3445          DCA I Z L2      /STORE AS LO ORDER ANSWER
2650  7004          RAL             /ADD IN CARRY...
2651  1311          TAD MP5         /HI ORDER PRODUCT...
2652  1313          TAD KEEP                /AND PREVIOUS CARRY
2653  3444          DCA I Z H2      /STORE AS HI ORDER ANSWER
2654  2316          ISZ MM1         /SHOULD SIGN BE MINUS?
2655  5600          JMP I DMUL      /NO, RETURN
2656  4537          JMS I Z NEG     /YES, COMPLEMENT PRODUCT
2657  5600          JMP I DMUL      /RETURN
```

```
                        /SHEET 61
                        /SMALL MULTIPLY

2660  0000  MP4,   0             /SINGLE PRECISION MULTIPLY (POSITIVE)
2661  3306        DCA MP1         /AC X MP2 YIELDS MP5(HORD) AND AC(LORD)
2662  3311        DCA MP5         /CLEAR ANSWER STORAGE
2663  1312        TAD THIR              /NO OF BITS TO MULTIPLY
2664  3310        DCA MP3         /...
2665  1306  MP6,  TAD MP1         /SHIFT LOW ORDER BIT...
2666  7010        RAR             /TO LINK
2667  3306        DCA MP1         /...
2670  1311        TAD MP5         /IS MULTIPLY WANTED?
2671  7430        SZL             /...
2672  5303        JMP LPFB              /YES, ADD MULTIPLICAND
2673  7010  LPRT, RAR             /SHIFT HI ORDER ANSWER
2674  3311        DCA MP5         /...
2675  2310        ISZ MP3         /MORE DIGITS?
2676  5265        JMP MP6         /YES, LOOP AGAIN
2677  1306        TAD MP1         /LAST SHIFT
2700  7010        RAR             /...
2701  7100        CLL             /SAVE SPACE FOR USERS
2702  5660        JMP I MP4       /RETURN

2703  1307  LPFB, TAD MP2         /ADD MULTIPLICAND
2704  7020        CML             /MAKE CARRY POSSIBLE
2705  5273        JMP LPRT              /GO SHIFT

2706  0000  MP1,  0               /MULTIPLIER
2707  0000  MP2,  0               /MULTIPLICAND
2710  0000  MP3,  0               /COUNTER
2711  0000  MP5,  0
2712  7764  THIR, 0-14            /NO OF BITS=12
2713  0000  KEEP, 0               /CARRY STORAGE
2714  0000  D,    0               /LO ORDER RESULT STORAGE
2715  0000  C,    0               /...
2716  0000  MM1,  0               /SIGN INDICATOR
```

```
                        /SHEET 62
                        /CHECK SIZE OF STACKS

2717  0000      CHK,    0               /MEMORY BOUND CHECKS
2720  7200              CLA
2721  1363              TAD NNN         /SET NUMBER OF STACKS
2722  3361              DCA MMM
2723  1355              TAD ITEN                /POINTER TO FIRST STACK
2724  3015              DCA I TEMA
2725  1356              TAD ITWE                /INITIAL POINTER TO FIRST STACK
2726  3016              DCA I TEMB
2727  1357              TAD ITHR                /MAXIMUM POINTER TO FIRST STACK
2730  3017              DCA I TEMC
2731  1415      LLCC,   TAD I I TEMA    /- STACK POINTER
2732  7041              CMA IAC
2733  3362              DCA PPP
2734  1362              TAD PPP         /CHECK BOTTOM
2735  1416              TAD I I TEMB
2736  7747              SMA SZA CLA
2737  5347              JMP TULW
2740  1362              TAD PPP         /CHECK TOP
2741  1417              TAD I I TEMC
2742  7710              SPA CLA
2743  5352              JMP TUHI
2744  2361              ISZ MMM         /HAVE WE LOOKED AT ALL STACKS?
2745  5331              JMP LLCC
2746  5717              JMP I CHK

2747  4502      TULW,   JMS I I GOOF    /LOWER BOUND VIOLATION
2750  6766              6766
2751  5320              JMP CHK+1

2752  4502      TUHI,   JMS I I GOOF    / UPPER BOUND VIOLATION
2753  6767              6767
2754  5320              JMP CHK+1

2755  0007      ITEN,   10-1
2756  0017      ITWE,   20-1
2757  0027      ITHR,   30-1
2760  7773      NNN,    0-5             /-NUMBER OF STACKS TO BE CHECKED
2761  0000      MMM,    0
2762  0000      PPP,    0
```

```
                        /SHEET 63
                        /SIMPLE INDEX CALCULATOR

2763  0007      XXJ,    0
2764  7200              CLA             /LOOK AT NEXT ADDR
2765  1414              TAD I 7 ILC     /....
2766  3016              DCA 7 TEMB      /SAVE FOR MULTIPLE INDEX
2767  1016              TAD 7 TEMB      /...
2770  0067              AND 7 R10       /GET 12 BIT ADDR
2771  1073              TAD 7 LT2       /...
2772  3377              DCA XXT         /...
2773  7240              CLA CMA         /SUBTRACT ONE FROM...
2774  1777              TAD I XXT       /VARIABLE VALUE AND...
2775  1414              TAD I 7 ILC     /ADD INDEX CONSTANT
2776  5763              JMP I XXJ       /RETURN

2777  0000      XXT,    0

                L26,
```

```
/SHEET 64
/PAGE 30

3000                *3000
```

```
                        /SHEET 65
                        /FIXFLOAT KONVERSIONS

3000  4573      FFIX,   JMS I Z XET     /CONVERT FLOAT TO FIX
3001  1443              TAD I Z X2      /LOOK AT EXPONENT
3002  7710              SPA CLA         /IS IT NEGATIVE
3003  5233              JMP FOOF                /YES, ANSWER=0
3004  1443              TAD I Z X2      /NO, LOOK AT EXPONENT-11
3005  1244              TAD M13         /...
3006  7540              SMA SZA         /IS IT TOO LARGE?
3007  5240              JMP LATE                /YES, GO COMPLAIN
3010  7450              SNA             /IS IT ZERO
3011  5232              JMP FOOF-1      /YES, CALCULATION DONE
3012  3245              DCA CNTR                /NO, DEPOSIT IN SHIFT COUNTER
3013  1444              TAD I Z H2      /MAKE H2 POSITIVE
3014  7510              SPA             /...
3015  7041              CMA IAC         /...
3016  7110              CLL RAR         /SHIFT 1 BIT
3017  2245              ISZ CNTR                /SHIFTING DONE?
3020  5216              JMP .-2         /NO DO IT AGAIN
3021  3443              DCA I Z X2              /STORE RESULT
3022  7300              CLA CLL         /SET LINK TO INITIAL SIGN
3023  1444              TAD I Z H2      /...
3024  7710              SPA CLA         /...
3025  7020              CML             /...
3026  1443              TAD I Z X2      /GET ANSWER
3027  7430              SZL             /SHOULD IT BE NEGATIVE?
3030  7041              CMA IAC         /YES, MAKE IT SO
3031  7410              SKP             /ALLOW ZERO CASE ENTRY
3032  1444              TAD I Z H2      /IF EXPONENT WAS O.K., ENTER HERE
3033  3443      FOOF,   DCA I Z X2      /STORE ANSWER
3034  1064              TAD Z MTW       /MOVE STACK POINTER FROM...
3035  1010              TAD Z STK       /FLOATING TO FIXED
3036  3010              DCA Z STK       /...
3037  5500              JMP I Z INTI    /GET NEXT INSTRUCTION
3040  4502      LATE,   JMS I Z GOOF    /EXPONENT TOO LARGE, COMPLAIN
3041  6167              6167            /ERROR NO. 17
3042  7200              CLA             /ASSUME ANSWER OF ZERO...
3043  5233              JMP FOOF                /AND GO STORE IT

3044  7765      M13,    0-13            /OFFSCALE BY 11 BITS
3045  0007      CNTR,   0               /SHIFT COUNTER
```

```
                        /SHEET 66
                        /FIX TO FLOAT CONVERSION

3 46  72#3      FLOT,   CLA             /CONVERT FIX TO FLOAT
3 47  1441              TAD # STK       /LET X2 POINT TO ITEM...
3 5#  3443              DCA # X2                /ON STACK
3 51  1#62              TAD # PTW       /ADD 2 TO STACK POINTER
3 52  1#12              TAD # STK       /...
3 53  3#12              DCA # STK       /...
3 54  4574              JMS I # XPN     /GET H2 AND L2
3 55  1443              TAD I # X2      /MOVE INTEGER ON STACK
3 56  3444              DCA I # H2      /...
3 57  3445              DCA I # L2      /LO ORDER ZERO
3 6#  1264              TAD C13         /GIVE IT AN EXPONENT OF 11
3 61  3443              DCA I # X2      /...
3 62  4547              JMS I # NOR     /NORMALIZE IT
3 63  55#4              JMP I # INTI    /GET NEXT INSTRUCTION

3 64  #13       C13,    13              /INITIAL EXPONENT

                        /INTERP. SQUARE STORAGE
3 65  #####     xSQR,   #
3 66  #####             #
3 67  #####             #
```

```
                        /SHEET 67
                        /AN INTERPRETIVE SU@ROUTINE CALL

3070  7201      NSUB,   CLA IAC         /USE AS FOLLOWS
3071  1014              TAD @ ILC       /NSUB
3072  3412              DCA I @ CSTK    /LOCATION OF SUBROUTINE
3073  7240              CLA CMA
3074  1414              TAD I @ ILC
3075  3014              DCA @ ILC
3076  5500              JMP I @ INTI

3077  7240      LSUB,   CLA CMA         /USE AS FOLLOWS
3100  1012              TAD @ CSTK      /LSUB
3101  3012              DCA @ CSTK
3102  1012              TAD @ CSTK
3103  3015              DCA @ TEMA
3104  1415              TAD I @ TEMA
3105  3014              DCA @ ILC
3106  5500              JMP I @ INTI

                        /A JMS SUBROUTINE CALL
                        /TO THE INTERPRETER
3107  0000      OVL,    0               /USE AS FOLLOWS
3110  7200              CLA             /JMS I @ OVLI
3111  1014              TAD @ ILC       /CODE TO BE INTERPRETED
3112  3412              DCA I @ CSTK
3113  1307              TAD OVL         /PLACES JMS ADDR+1...
3114  3014              DCA @ ILC       /INTO ILC
3115  1707              TAD I OVL
3116  5532              JMP I @ IMPI

                        /AN INTERPRETIVE OP CODE

3117  7201      IOUT,   CLA IAC         /USE AS FOLLOWS
3120  1014              TAD @ ILC       /IOUT
3121  3307              DCA OVL         /HARDWARE EXECUTION BEGINS HERE
3122  7240              CLA CMA
3123  1012              TAD @ CSTK
3124  3012              DCA @ CSTK
3125  1012              TAD @ CSTK
3126  3015              DCA @ TEMA
3127  1415              TAD I @ TEMA
3130  3014              DCA @ ILC
3131  5707              JMP I OVL
```

```
                        /SHEET 68
                        /FOSSIL ERROR ROUTINE
                        /JMS FOLLOWED BY TWO DIGIT ERROR NUMBER IN 6 BIT FORM
3132  0000      ERRR,   0
3133  3017              DCA Z TEMC      /SAVE AC
3134  3057              DCA Z MMFF      /OUTPUT ON TTY
3135  3051              DCA Z HILOP     /...
3136  1732              TAD I ERRR      /GET ERROR NUMBER
3137  3373              DCA NUME                /...
3140  1364              TAD FINT                /NUMBER OF WORDS TO COUNTER
3141  3366              DCA CISZ                /...
3142  1365              TAD FITN                /TABLE ADDRESS TO POINTER
3143  3367              DCA TEMT                /...
3144  1060              TAD Z CRZ       /OUTPUT CR-LF
3145  4553              JMS I Z OUTI    /...
3146  1767      LUPJ,   TAD I TEMT      /OUTPUT TWO CHARACTERS
3147  7012              RTR             /LEFT CHARACTER
3150  7012              RTR             /...
3151  7012              RTR             /...
3152  4553              JMS I Z OTCI    /...
3153  1767              TAD I TEMT      /RIGHT CHARACTER
3154  4553              JMS I Z OTCI    /...
3155  2367              ISZ TEMT                /INCREMENT POINTER
3156  2366              ISZ CISZ                /MORE TO OUTPUT?
3157  5346              JMP LUPJ                /YES, LOOP AGAIN
3160  1017              TAD Z TEMC      /NO, PICK UP ENTRY AC
3161  4526              JMS I Z GRINDI  /GO HALT
3162  2332              ISZ ERRR                /SKIP ERROR NUMBER
3163  5732              JMP I ERRR      /RETURN
3164  7774      FINT,   0-4             /COUNT OF WORDS IN TABLE
3165  3170      FITN,   ERRT            /ADDR OF TABLE
3166  0000      CISZ,   0               /COUNTER OF WORDS OUTPUT
3167  0000      TEMT,   0               /POINTER TO TABLE POSITION
3170  2411      ERRT,   2411            /T,I
3171  1424              1424            /L,T
3172  4043              4043            /SPACE,NUMBER SIGN
3173  0000      NUME,   0               /LEFT, RIGHT

3174  7402      F30,    HLT
3175  7402              HLT
3176  7402              HLT
3177  7402              HLT
                        L30,
```

```
                    /SHEET 69

                    /ERROR CONDITIONS

                    /ERROR 11 IS ATTEMPT TO DIVIDE BY ZERO
                    /ERROR 12 IS FLOATING EXPONENT ON INPUT IS TOO LARGE
                    /ERROR 13 IS AN UNASSISGNED OP CODE IN USE
                    /ERROR 14 IS A TRANSFER TO CORE LOCATION ZERO OR ONE
                    /ERROR 15 IS A NON FORMAT STATEMENT USED FOR A FORMAT
                    /ERROR 16 IS AN ILLEGAL FORMAT STATEMENT
                    /ERROR 17 IS ATTEMPT TO FIx LARGE FLOATING NO.
                    /ERROR 20 IS AN ATTEMPT TO SQRT A NEGATIVE NUMBER
                    /ERROR 21 IS A NEG NUMBER RAISED TO A POWER.
                    /ERROR 22 IS AN ATTEMPT TO LOG A ZERO OR NEGATIVE NUMBER
                    /ERROR 31 IS A PHYSICAL ERROR ON DECTAPE
                    /ERROR 32 IS INABILITY TO FIND BLOCK ON DECTAPE
                    /ERROR 33 IS EXCEEDING DECTAPE BUFFER
                    /ERROR 34 IS MT SWITCH SET INCORRECTLY
                    /ERROR 76 IS AN UNDERFLOWING STACK
                    /ERROR 77 IS AN OVERFLOWING STACK

                    /PAGE 32

3200                *3200
```

```
                                /SHEET 71
                                /OPERATION DISPATCH TABLE

                                TABL,
3200  0740                      UNDF            /0000
3201  2105                      ADD             /0001
      0001                            FXAD=1
3202  2113                      SUB             /0002
      0002                            FXSB=2
3203  2123                      RSUB            /0003
      0003                            SUBR=3
3204  2123                      MUL5            /0004
      0004                            XMPY=4
3205  2170                      RDIV            /0005
      0005                            DIV=5
3206  2140                      DIV5            /0006
      0006                            DIVR=6
3207  3117                      IOUT            /0007
      0007                            ILVE=7
3210  3046                      FLOT            /0010
      0010                            FLOA=10
3211  3400                      FFIX            /0011
      0011                            UFLO=11
3212  2005                      XADD            /0012
      0012                            FADD=12
3213  2026                      XSUB            /0013
      0013                            FSUB=13
3214  2031                      XRSU            /0014
      0014                            FSBR=14
3215  2034                      XMUL            /0015
      0015                            FMPY=15
3216  2102                      XRDV            /0016
      0016                            FDIV=16
3217  2050                      XDIV            /0017
      0017                            FDVR=17
3220  3400                      DO              /0020
      0020                            THRO=20
3221  2477                      GOTO            /0021
      0021                            TRAN=21
3222  1352                      CGT             /0022
      0022                            CGOT=22
3223  2516                      XIF             /0023
      0023                            FIF=23
3224  0401                      INT             /0024
      0024                            CON=24
3225  4204                      ISIN            /0025
      0025                            SINE=25
3226  4336                      ICOS            /0026
      0026                            COSI=26
3227  4367                      ILOG            /0027
      0027                            FLOG=27
3230  4535                      IEXP            /0030
      0030                            FEXP=30
3231  4656                      IATN            /0031
      0031                            ARTN=31
```

```
3232  4772          ISQT          /0032
      0032                SQRT=32
3233  1750          CONJ          /0033
3234  0401          NOOP          /0034
      0034                DONO=34
3235  1753          CONG          /0035
      0035                FNEG=35
3236  5076          IFLX          /0036
      0036                FLFX=36
3237  5106          IFXI          /0037
      0037                FLXI=37
3240  5057          IFLF          /0040
      0040                FLFL=40
3241  5122          IFFI          /0041
      0041                FLFI=41
3242  3573          .HALT         /0042
      0042                STOP=42
3243  4000          ACTP          /0043
      0043                LESE=43
3244  4100          TYPE          /0044
      0044                WRTE=44
3245  2173          FMT           /0045
      0045                FRMT=45
3246  0400          PAWS          /0046
      0046                PAUS=46
3247  3451          CONT          /0047
3250  2503          IF            /0050
      0050                IFX=50
3251  3070          NSUB          /0051
      0051                SUBN=51
3252  3077          LSUB          /0052
      0052                SUBL=52
3253  2365          PGT           /0053
3254  5347          DTIC          /0054
3255  5337          MMIC          /0055
3256  0746          UNDF          /0056
3257  0746          UNDF          /0057
3260  0746          UNDF          /0060
3261  0746          UNDF          /0061
3262  0746          UNDF          /0062
3263  0746          UNDF          /0063
```

```
                        /SHEET 71
                        /EXTRA I/O ROUTINES

3264  0000      QTYPE,  0               /33 PRINTER/PUNCH
3265  6041              TSF             /WAIT FOR FLAG
3266  5265              JMP .-1         /...
3267  6046              TLS             /PRINT/PUNCH CHARACTER
3270  5664              JMP I QTYPE     /RETURN

3271  0000      BTYPE,  0               /HI SPEED PUNCH
3272  1677              TAD I RPGTI     /GET CHARACTER TO PUNCH
3273  6021              PSF             /WAIT FOR FLAG
3274  5273              JMP .-1         /...
3275  6026              PLS             /PUNCH CHARACTER
3276  5671              JMP I BTYPE     /RETURN
3277  1555      RPGTI,  RPGTEM

                        /MEMORY REFERENCE INTERPRETIVE OPS

          4002          LDST=4002               /FIXED LOAD STACK
          4401          STDI=4401               /STORE ON INDEX STACK
          4402          STST=4402               /FIXED STORE STACK
          5002          FLDS=5002               /FLOATING LOAD STACK
          5402          FSTS=5402               /FLOATING STORE STACK
          6002          LDSI=6002               /LOAD STACK INDEXED
          6402          STSI=6402               /STORE STACK INDEXED
          7002          FLDI=7002               /FLOATING LOAD STACK INDEXED
          7402          FSTI=7402               /FLOATING STORE STACK INDEXED
```

```
                        /SHEET 72
                        /THE FOSSIL STACK

        3300            *3300
3300    0006            STAK,   6
3301    0006                    6
3302    0006                    6
3303    0006                    6
3304    0006                    6
3305    0006                    6
3306    0006                    6
3307    0006                    6
3310    0006                    6
3311    0006                    6
3312    0006                    6
3313    0006                    6
3314    0006                    6
3315    0006                    6
3316    0006                    6
3317    0006                    6
3320    0006                    6
3321    0006                    6
3322    0006                    6
3323    0006                    6
3324    0006                    6
3325    0006                    6
3326    0006                    6
3327    0006                    6
3330    0006                    6
3331    0006                    6
3332    0006                    6
3333    0006                    6
3334    0006                    6
3335    0006                    6
3336    0006                    6
3337    0006                    6
3340    0006                    6
3341    0006                    6
3342    0006                    6
3343    0006                    6
3344    0006                    6
```

```
/SHEET 73
/MORE FOSSIL STACK

3345  0006                    6
3346  0006                    6
3347  0006                    6
3350  0006                    6
3351  0006                    6
3352  0006                    6
3353  0006                    6
3354  0006                    6
3355  0006                    6
3356  0006                    6
3357  0006                    6
3360  0006                    6
3361  0006                    6
3362  0006                    6
3363  0006                    6
3364  0006                    6
3365  0006                    6
3366  0006                    6
3367  0006                    6
3370  0006                    6
3371  0006                    6
3372  0006                    6
3373  0006                    6
3374  0006                    6
3375  0006                    6
3376  0006                    6
3377  0006                    6
STAKL,

L32,
```

```
                    /SHEET 74
                    /PAGE 34

3400                *3400
```

```
                        /SHEET 75
                        /DO LOOP CONTROL FOR FOSSIL

3400  7200      DO,     CLA
3401  1414              TAD I ≠ ILC       /MAKE CONTINUE INTO DO CALCULATOR
3402  3246              DCA DLM
3403  1250              TAD C47
3404  3646              DCA I DLM
3405  1013              TAD ≠ DSTK        /AM I RENTERING THIS DO?
3406  7041              CMA IAC           /-STACK POSITION
3407  1023              TAD ≠ FDST        /+STACK ORIGIN -1
3410  7450              SNA
3411  5226              JMP NNX           /NOTHING ON STACK
3412  3246              DCA DLM
3413  1023              TAD ≠ FDST        /ORIGIN -1
3414  3015              DCA ≠ TEMA
3415  1014              TAD ≠ ILC         /GET RANGE
3416  7041              CMA IAC           /NEGATE IT
3417  3247              DCA LJR
3420  1415      LUPD,   TAD I ≠ TEMA      /CHECK ALL ITEMS ON STACK
3421  1247              TAD LJR
3422  7650              SNA CLA
3423  5242              JMP INTP
3424  2246              ISZ DLM
3425  5220              JMP LUPD

3426  7200      NNX,    CLA               /PUSH RANGE ONTO STACK
3427  1014              TAD ≠ ILC
3430  3413              DCA I ≠ DSTK
3431  1414              TAD I ≠ ILC       /GET ADDR OF LOOP VARIABLE
3432  3246              DCA DLM
3433  1414              TAD I ≠ ILC       /GET ADDR OF INITIAL VALUE
3434  3247              DCA LJR
3435  1647              TAD I LJR         /SET LOOP VARIABLE TO INITIAL VALUE
3436  3646              DCA I DLM
3437  2014              ISZ ≠ ILC         /MOVE ILC PAST DO
3440  2014              ISZ ≠ ILC
3441  5500              JMP I ≠ INTI

3442  1013      INTP,   TAD ≠ DSTK        /THIS DO WAS ON STACK
3443  1246              TAD DLM           /ADJUST POINTER
3444  3013              DCA ≠ DSTK
3445  5226              JMP NNX

3446  0000      DLM,    0                 /COUNTER OR ADDR OF LOOP VARIABLE
3447  0000      LJR,    0
3450  0047      C47,    47                /OP CODE FOR DO CALCULATOR
```

```
                        /SHEET 76
                        /CONTINUE STATEMENT DO CALCULATOR

3451  7200      CONT,   CLA             /FIND SIZE OF DSTACK
3452  1013              TAD Z DSTK
3453  7041              CMA IAC
3454  1023              TAD Z FDST
3455  7450              SNA       /IF NO ENTRIES ON DSTACK
3456  5500              JMP I Z INTI    /GO ON TO NEXT INSTRUCTION
3457  3340              DCA CLUP
3460  1014              TAD Z ILC       /GET CURRENT ADDRESS
3461  7041              CMA IAC
3462  3341              DCA RCC
3463  1013              TAD Z DSTK      /SET POINTER TO DSTACK
3464  3342              DCA EHR
3465  7410              SKP
3466  7240      LUPC,   CLA CMA         /DECREMENT POINTER
3467  1342              TAD EHR
3470  3342              DCA EHR
3471  1742              TAD I EHR       /CHECK IF THIS CONTINUE ON DSTACK
3472  3343              DCA CAM
3473  1743              TAD I CAM
3474  1341              TAD RCC
3475  7450              SNA
3476  5302              JMP PERB                /EQUAL
3477  2340              ISZ CLUP                /NOT EQUAL, SHOULD WE TRY AGAIN?
3500  5266              JMP LUPC
3501  5500              JMP I Z INTI
```

```
                        /SHEET 77
                        /CONTINUE CONTINUED

3502  1347      PERR,   TAD CLUP            /REMOVE ALL ENTRIES ABOVE
3503  7040              CMA               /AND INCLUDING THIS ONE
3504  1023              TAD Z DST         /FROM DSTACK
3505  3013              DCA Z DSTK
3506  2343              ISZ CAM           /ADDR OF LOOP VARIABLE ADDR
3507  1062              TAD Z PTW         /+2
3510  1343              TAD CAM
3511  3340              DCA CLUP                /ADDR OF  FINAL VALUE ADDR
3512  1340              TAD CLUP
3513  3015              DCA Z TEMA        /ADDR OF STEPPING VALUE ADDR
3514  1743              TAD I CAM
3515  3343              DCA CAM           /LOOP VARIABLE ADDR
3516  1740              TAD I CLUP
3517  3340              DCA CLUP                /FINAL VALUE ADDR
3520  1415              TAD I Z TEMA
3521  3341              DCA RCC           /STEPPING VALUE ADDR
3522  1743              TAD I CAM         /LOOP VARABLE VALUE
3523  1741              TAD I RCC         /STEPPING VALUE
3524  3341              DCA RCC
3525  1341              TAD RCC           /TEST LOOP VARIABLE
3526  7041              CMA IAC
3527  1740              TAD I CLUP
3530  7710              SPA CLA
3531  5251              JMP CONT                /LAST TIME FOR THIS DO, GO LOOK 4 MORE
3532  1341              TAD RCC           /MORE, STORE INCREMENTED VALUE
3533  3743              DCA I CAM
3534  2013              ISZ Z DSTK        /PLACE THIS DO BACK ON STACK
3535  1015              TAD Z TEMA        /SET ILC FOR STATEMENT FOLLOWING DO
3536  3014              DCA Z ILC
3537  5500              JMP I Z INTI

3540  0000      CLUP,   0                 /LOOP COUNTER OR FINAL VALUE ADDR
3541  0000      RCC,    0                 /-CURRENT ADDRESS OR LOOP VARIABLE ADDR
3542  0000      EHR,    0                 /POSITION ON DSTACK BEING TESTED
3543  0000      CAM,    0                 /INDIRECT ADDR
```

```
                        /SHEET 78
                        /CONSTANTS FOR INTERPRETIVE ROUTINES

3544  0000              OREZ,   0
3545  0000                      0
3546  0000                      0
3547  0001              END,    0001
3550  2000                      2000
3551  0000                      0
3552  0002              OWT,    0002
3553  2000                      2000
3554  0000                      0
3555  0004              RUOF,   4
3556  0006              XIS,    6
3557  0000              LOG2,   0000
3560  2613                      2613
3561  4414                      4414

3562  0003              TWOP,   0003
3563  3110                      3110
3564  3755                      3755
3565  0002              PI,     0002
3566  3110                      3110
3567  3755                      3755
3570  0000              PIOF,   0000
3571  3110                      3110
3572  3755                      3755
                        /HALT OP CODE

3573  1377              HALT,   TAD HL1          /OUTPUT EXCLAMATION
3574  4553                      JMS I Z OUTI     /...
3575  4526                      JMS I Z GRINDI   /GO HALT
3576  5373                      JMP .-3          /NO RETURN POSSIBLE
3577  0241              HL1,    241              /EXCLAMATION
                        L34,
```

```
/SHEET 79
/PAGE 36

3600                    *3600
```

```
                        /SHEET 80
                        /XTRA-SPECIAL INDEX CALCULATOR

3620  0000  XXC,   0                 /ENTER WITH ARRAY ADDR IN AC
3621  3237        DCA WHR             /SAVE FOR ARRAY(-1)
3622  4577        JMS I Z XXJI        /GET FIRST SUBSCRIPT
3623  3236  LEV,  DCA VAL             /SAVE VALUE
3624  1016        TAD Z TEMB          /ARE THERE MORE SUBSCRIPTS?
3625  7610        SKP CLA             /CHANGE TO SPA CLA FOR DOUBLE SUBSCRIPT
3626  5214        JMP ON2             /YES, GO HANDLE THEM
3627  1056        TAD Z INTR          /FLOATING POINT?
3630  7700        SMA CLA             /...
3631  5231        JMP TTHR                    /YES, GO MULTIPLY BYTHREE
3632  1236        TAD VAL             /NO, GET SUBSCRIPT
3633  5600        JMP I XXC           /RETURN

3634  7240  ON2,  CLA CMA             /SUBTRACT ONE FROM BASE ADDR
3635  1237        TAD WHR             /...
3636  3237        DCA WHR             /SAVE IT
3637  1637        TAD I WHR           /GET DIMENSION
3640  3541        DCA I Z MP2I        /MULTIPLY BY FIRST SUBSCRIPT
3641  1236        TAD VAL             /...
3642  4542        JMS I Z MP4I        /...
3643  7004        RAL                 /TRUNCATE TO 11 BITS
3644  7110        CLL RAR             /...
3645  3235        DCA TRM             /SAVE FIRST PRODUCT
3646  4577        JMS I Z XXJI        /GET SECOND SUBSCRIPT
3647  1235        TAD TRM             /ADD FIRST PRODUCT
3650  5203        JMP LEV             /GO LOOK FOR MORE SUBSCRIPTS

3651  1236  TTHR, TAD VAL             /MULTIPLY BY THREE
3652  7104        CLL RAL             /...
3653  1236        TAD VAL             /...
3654  5600        JMP I XXC           /RETURN

3655  0000  TRM,  0                   /TERM
3656  0000  VAL,  0                   /VALUE
3657  0000  WHR,  0
```

```
                        /SHEET 81
                        /FORMAT CONTROL
3640  0000              FOMT,   0
3641  7300                      CLA CLL           /GET FORMAT POINTER
3642  1313                      TAD KEPT                /...
3643  3015                      DCA Z TEMA        /...
3644  7300              LUPF,   CLA CLL           /GET NEXT FORMAT CHARACTER
3645  1415                      TAD I Z TEMA      /...
3646  7450                      SNA               /IS IT ZERO?
3647  5337                      JMP PSET                /YES, END OF FORMAT
3650  7004              ENTR,   RAL               /BIT 1
3651  7430                      SZL               /...
3652  5270                      JMP CRLF                /ON=CR-LF
3653  7510                      SPA               /BIT 2
3654  5314                      JMP QUOT                /ON=TEXT
3655  7012                      RTR               /BIT 11
3656  7010                      RAR               /...
3657  7510                      SPA               /...
3660  5303                      JMP FI            /ON=FIXED
3661  7430                      SZL               /BIT 10
3662  5306                      JMP FE            /ON=FLOATING
3663  7006                      RTL               /RESTORE CHARACTER
3664  4502                      JMS I Z GOOF      /COMPLAIN ABOUT ILLEGAL CHAR
3665  6166                      6166              /ERROR NO. 16
3666  7604                      CLA OSR           /GET NEW CHARACTER FROM SWITCHES
3667  5250                      JMP ENTR                /TRY DECODING AGAIN

3670  7200              CRLF,   CLA               /CARRIAGE-RETURN LINE-FEED
3671  1053                      TAD Z MODE        /IS THIS INPUT ON OUTPUT?
3672  7710                      SPA CLA           /...
3673  5277                      JMP MTCKL         /CRLF CHECK ON INPUT
3674  1060                      TAD Z CRZ         /OUTPUT CR-LF
3675  4553                      JMS I Z OUTI      /...
3676  5244                      JMP LUPF                /LOOK AT NEXT CHAR.

3677  1057              MTCKL,  TAD Z MMFF        /ARE WE IN MICROTAPE I/O
3700  7440                      SZA               /...
3701  4534                      JMS I Z IXCI      /YES, IGNORE NEXT CHARACTER
3702  5244                      JMP LUPF                /GO LOOK AT NEXT FORMAT CHARACTER

3703  7240              FI,     CLA CMA           /INTEGER
3704  3054                      DCA Z XTRN        /MARK AS SUCH
3705  5310                      JMP KEP           /GO STORE POINTER

3706  7200              FE,     CLA               /FLOATING POINT
3707  3054                      DCA Z XTRN        /MARK AS SUCH
3710  1015              KEP,    TAD Z TEMA        /STORE FORMAT POINTER...
3711  3313                      DCA KEPT                /UNTIL NEXT REFERENCE
3712  5640                      JMP I FOMT        /RETURN
3713  0000              KEPT,   0                 /LOCAL STORAGE FOR FORMAT POINTER
```

```
                        /SHEET 82
                        /MORE FORMAT CONTROL

3714  7200              QUOT,   CLA             /QUOTED INFORMATION
3715  1053                      TAD Z MODE      /LINK ZERO MEANS WRITE
3716  7004                      RAL
3717  7200                      CLA             /CHECK FOR FINAL QUOTE
3720  1415                      TAD I Z TEMA    /LOOK AT NEXT CHARACTER
3721  7004                      RAL             /...
3722  7510                      SPA             /...
3723  5244                      JMP LUPF                /BIT ONE IMPLIES QUOTE
3724  7010                      RAR             /NO, MUST BE TEXT
3725  7430                      SZL             /INPUT
3726  5331                      JMP QIN         /READ INTO QUOTE
3727  4553                      JMS I Z OUTI    /WRITE FROM QUOTE
3730  5314                      JMP QUOT                /GO GET ANOTHER CHARACTER

3731  7240              QIN,    CLA CMA         /READ INTO FORMAT STATEMENT
3732  1015                      TAD Z TEMA      /RESET FORMAT POINTER
3733  3015                      DCA Z TEMA      /...
3734  4534                      JMS I Z IXCI    /GET A CHARACTER FROM READER
3735  3415                      DCA I Z TEMA    /SALT IT AWAY
3736  5314                      JMP QUOT                /GO GET ANOTHER CHARACTER

3737  1055              RSET,   TAD Z STAG      /LAST RUN THRU FORMAT?
3740  7640                      SZA CLA         /...
3741  5640                      JMP I FOMT      /YES, RETURN
3742  4362                      JMS SE          /NO, RESET TO BEGINNING
3743  5244                      JMP LUPF                /GO GET NEXT FORMAT CHARACTER
```

```
                        /SHEET 83
                        /I-O BEGIN

3744  0000      IOB,    0
3745  7200              CLA             /SET SWITCH TO...
3746  3055              DCA ≠ STAG      /NOT LAST PASS
3747  1414              TAD I ≠ ILC     /GET FORMAT ADDR
3750  3372              DCA IFMT                /...
3751  1772              TAD I IFMT      /IS IT A FORMAT STATEMENT?
3752  1373              TAD M45         /...
3753  7450              SNA             /...
3754  5360              JMP YFMT                /YES, SEE BELOW
3755  4502              JMS I ≠ GOOF    /NO, GO COMPLAIN
3756  6165              6165            /ERROR NO. 15
3757  5771              JMP I FMTI              /GET NEXT INSTRUCTION

3760  4362      YFMT,   JMS SE          /SET FORMAT POINTER
3761  5744              JMP I IOB       /RETURN

3762  0000      SE,     0
3763  7200              CLA
3764  1372              TAD IFMT                /BEGINNING OF FORMAT
3765  3313              DCA KEPT                /TO LOCAL STORAGE...
3766  1313              TAD KEPT                /...
3767  3015              DCA ≠ TEMA      /AND TO WORKING STORAGE
3770  5762              JMP I SE                /RETURN
3771  2173      FMTI,   FMT
3772  0000      IFMT,   0               /INITIAL FORMAT ADDR
3773  7733      M45,    0-45            /FORMAT STATEMENT CODE
3774  7402      F36,    HLT
3775  7402              HLT

                        L36,

      3776              *3776
                        F36T,
                        L36T,
3776  0021      PSTART, 21      /GO TO PROGRAM
3777  5200              5200    /I,A. OF COMPILED FIVETRAN
```

```
/SHEET 84
/PAGE 47

4000            *4
```

```
                        /SHEET 85
                        /ACCEPT ROUTINE FOR FOSSIL

4 00  7240      ACTP,   CLA CMA         /-1 MEANS INPUT
4 01  3053              DCA # MODE      /...
4 02  4533              JMS I # IOBI    /BEGIN FORMAT
4 03  4531      AIT,    JMS I # IOII    /LOOK AT MODES OF NEXT ITEM
4 04  7201              CLA IAC         /USE TOP OF STACK
4 05  1014              TAD # STK       /...
4 06  3043              DCA # X2                /...
4 07  4576              JMS I # XPN     /...
4 10  1057              TAD # MMFF      /IS THIS DT ROUTINE?
4 11  7640              SZA CLA         /...
4 12  5517              JMP I # DTJI    /YES, GO TO DT BUFFER ROUTINE
4 13  1054              TAD # XTRN      /NO, LOOK AT EXTERNAL MODE
4 14  7710              SPA CLA         /...
4 15  5246              JMP AFJ         /FIXED OUTSIDE
4 16  1277      AXJ,    TAD AFN         /FLOATING OUTSIDE, SET INSTRUCTION
4 17  3533              DCA I # INSI    /...
4 20  4521              JMS I # FNKI    /GO GET NUMBER
                        AXRET,
4 21  7200      AXN,    CLA             /INSTRUCTION CLA
4 22  1045              TAD # L2                /MOVE STACK POINTER UP 3
4 23  3014              DCA # STK       /...
4 24  1056              TAD # INTR      /LOOK AT INTERNAL MODE
4 25  7710              SPA CLA         /...
4 26  5236              JMP AXF         /FIXED INSIDE
4 27  1046      AXX,    TAD # IOAD      /FLOATING INSIDE, GET ADDR...
4 30  3233              DCA .+3         /OF VARIABLE
4 31  4501              JMS I # OVLI    /GO TO INTERPRETER
4 32  5402              FSTS            /FLOATING STORE
4 33  4033              .               /ADDR OF VARIABLE
4 34  0007              ILVE            /LEAVE INTERPRETER
4 35  5203              JMP AIT         /GET NEXT IO ITEM

4 36  1046      AXF,    TAD # IOAD      /GET ADDR OF VARIABLE
4 37  3243              DCA .+4         /...
4 40  4501              JMS I # OVLI    /GO TO INTERPRETER
4 41  0011              UFLO            /FLOAT TO FIX
4 42  4402              SIST            /FIXED STORE
4 43  4043              .               /ADDR OF VARIABLE
4 44  0007              ILVE            /LEAVE INTERPRETER
4 45  5203              JMP AIT         /GET NEXT I/O ITEM
```

```
                        /SHEET 86
                        /ACCEPT MORE

4046  1221      AFJ,    TAD AXN          /SET FOR MODULO 4096
4047  3533              DCA I Z INSI     /...
4050  4515              JMS I Z DPV      /INPUT NUMBER
4051  7340              CLA CLL CMA      /AND (3777
4052  7010              RAR              /...
4053  0535              AND I Z LWCI     /MODULO 2048
4054  7041              CMA IAC          /NEGATE
4055  2560              ISZ I Z SGNI     /SKIP IF NUMBER SHOULD BE MINUS
4056  7041              CMA IAC          /NEGATE
4057  3443              DCA I Z X2       /ONTO STACK WITH IT
                  AFRET,
4060  1056              TAD Z INTR       /LOOK AT INTERNAL MODE
4061  7710              SPA CLA          /...
4062  5274              JMP AFF          /FIXED INSIDE
4063  2010      AFX,    ISZ Z STK        /ADD ONE TO STACK POINTER
4064  1046              TAD Z IOAD       /GET ADDR OF VARIABLE
4065  3271              DCA .+4          /...
4066  4501              JMS I Z OVLI     /GO TO INTERPRETER
4067  0010              FLOA             /FIX TO FLOAT
4070  5402              FSTS             /FLOATING STORE
4071  4071              .                /ADDR OF VARIABLE
4072  0007              ILVE             /LEAVE INTERPRETER
4073  5203              JMP AIT          /GET NEXT I/O ITEM

4074  1443      AFF,    TAD I Z X2       /GET DATA
4075  3446              DCA I Z IOAD     /STORE IN VARIABLE
4076  5203              JMP AIT          /GET NEXT ITEM

4077  1527      AFN,    TAD I Z HICI     /INSTRUCTION FOR FINK
```

```
                        /SHEET 87
                        /TYPE ROUTINE FOR FOSSIL

4100  3053              TYPE,   DCA Z MODE      /0 INDICATES OUTPUT
4101  4530                      JMS I Z IOBI    /GO INITIALIZE FORMAT
4102  4531              TIT,    JMS I Z IOII    /SET MODES AND I/O ADDR
4103  2056                      ISZ Z INTR      /LOOK AT INTERNAL MODE
4104  5311                      JMP TXJ         /FLOATING
4105  2054              TFJ,    ISZ Z XTRN      /FIXED, LOOK AT EXTERNAL MODE
4106  5337                      JMP TFX         /FLOATING
4107  1446              TFF,    TAD I Z IOAD    /FIXED, PICK UP ITEM
4110  5330                      JMP TJF         /GO OUTPUT IT

4111  2054              TXJ,    ISZ Z XTRN      /LOOK AT EXTERNAL MODE
4112  5347                      JMP TXX         /FLOATING
4113  1046              TXF,    TAD Z IOAD      /FIXED, PICK UP VARIABLE ADDR
4114  3317                      DCA .+3         /...
4115  4501                      JMS I Z OVLI    /GO TO INTERPRETER
4116  5002                      FLDS            /FLOATING LOAD
4117  4117                      .               /ADDR OF VARIABLE
4120  0011                      UFLO            /FLOAT TO FIX CONVERSION
4121  0007                      ILVE            /LEAVE INTERPRETER
4122  7240                      CLA CMA         /MOVE STACK POINTER DOWN
4123  1010                      TAD Z STK       /...
4124  3010                      DCA Z STK       /...
4125  1010                      TAD Z STK       /GET ITEM TO OUTPUT
4126  3015                      DCA Z TEMA      /...
4127  1415                      TAD I Z TEMA    /...
4130  3015              TJF,    DCA Z TEMA      /HOLD IT IN TEMPORARY
4131  1057                      TAD Z MMFF      /IS THIS A DECTAPE OUTPUT
4132  7440                      SZA             /...
4133  5570                      JMP I Z WMMFI   /YES, GO TO DT BUFFERING
4134  1015                      TAD Z TEMA      /NO, GET ITEM
4135  4525                      JMS I Z FXPI    /GO TO OUTPUT ROUTINE
4136  5302                      JMP TIT         /GET NEXT ITEM
```

```
                        /SHEET 88
                        /TYPE MORE

4137  1046      TFX,    TAD Z IOAD      /GET VARIABLE ADDR
4140  3343              DCA .+3         /...
4141  4501              JMS I Z OVLI    /GO TO INTERPRETER
4142  4002              LDST            /FIXED LOAD
4143  4143              .               /VARIABLE ADDRESS
4144  0010              FLOA            /FIX TO FLOAT CONVERSION
4145  0007              ILVE            /LEAVE INTERPRETER
4146  5355              JMP TJX         /GO OUTPUT

4147  1046      TXX,    TAD Z IOAD      /GET VARIABLE ERROR
4150  3353              DCA .+3         /...
4151  4501              JMS I Z OVLI    /GO TO INTERPRETER
4152  5002              FLDS            /FLOATING LOAD
4153  4153              .               /VARIABLE ADDR
4154  0007              ILVE            /LEAVE INTERPRETER
4155  1063      TJX,    TAD Z MTH       /MOVE STACK POINTER DOWN
4156  1010              TAD Z STK       /...
4157  3010              DCA Z STK       /...
4160  7201              CLA IAC         /POINTER+1 TO X2
4161  1010              TAD Z STK       /...
4162  3043              DCA Z X2                /...
4163  4574              JMS I Z XPN     /H2=X2+1, L2+X2+2
4164  1057              TAD Z MMFF      /IS THIS DECTAPE OUTPUT?
4165  7640              SZA CLA         /...
4166  5571              JMP I Z WMMXI   /YES, GO TO DT BUFFERING
4167  4524              JMS I Z FONI    /NO, GO OUTPUT FRACTION
4170  7200              CLA             /...
4171  1376              TAD CEE         /OUTPUT CHARACTER E
4172  4550              JMS I Z OTCI    /...
4173  1504              TAD I Z BEXI    /OUTPUT ADJUSTED EXPONENT
4174  4525              JMS I Z FXPI    /...
4175  5302              JMP TIT         /GET NEXT ITEM

4176  0305      CEE,    305             /CHARACTER E
4177  7402      F40,    HLT
                L40,
```

```
                        /SHEET 89

        4200            *4200

                        /MT SWITCH TRAP
4200    5602                    JMP I .+2
4201    5603                    JMP I .+2
4202    0200                    200
4203    0201                    201
```

```
                        /SHEET 90
                        /INTERPRETIVE MODE SINE AND COSINE
                        /THIS ROUTINE CALCULATES FLOATING POINT SINES AS FOLLOWS:
                        /THE ARGUMENT IS FIRST REDUCED TO A UNIT CIRCLE (0<X<2PI)
                        /THEN IT IS FURTHER REDUCED TO THE FIRST QUADRANT
                        /THIS IS CALCULATED BY A SERIES EXPANSION TAKEN FROM P. 140 OF
                        /APPROXIMATIONS FOR DIGITAL COMPUTERS, BY CECIL HASTINGS.
4204  4501             ISIN,   JMS I Z OVLI      /GO TO INTERPRETER
4205  0051                     SUBN              /ENTER SUBROUTINE
4206  4211                     SIST              /SIN ADDR
4207  0007                     ILVE              /LEAVE INTERPRETER
4210  5500                     JMP I Z INTI      /GET NEXT INSTRUCTION
4211  5002             SIST,   FLDS              /GET X MOD 2 PI
4212  3562                     TWOP              /LOAD 2*PI
4213  0017                     FDVR              /CALCULATE X/2PI
4214  0051                     SUBN              /SAVE IT IN X
4215  5154                     SSSB              /...
4216  0011                     UFLO              /FIX RESULTS OF X/2*PI
4217  0010                     FLOA              /RE-FLOAT IT
4220  5002                     FLDS              /PICK UP ORIGINAL X/2*PI
4221  0025                     X                 /...
4222  0013                     FSUB              /SUBTRACT - GET RID OF EVEN CYCLES
4223  5002                     FLDS              /LOAD 2PI TO TURN BACK INTO RADIANS
4224  3562                     TWOP              /...
4225  0015                     FMPY              /MULTIPLY
4226  0051                     SUBN              /SAVE THIS RESULT IN X
4227  5154                     SSSB              /...
4230  5002                     FLDS              /PICK UP X AGAIN
4231  0025                     X                 /...
4232  0023                     FIF               /IS IT POSITIVE NEGATIVE OR ZERO?
4233  4236                     SM1               /NEGATIVE
4234  4241                     SZ1               /ZERO
4235  4242                     SP1               /POSITIVE
4236  0035             SM1,    FNEG              /SIN(-X)=-SIN(X)
4237  0025                     SINE              /RECURSIVE CALL TO SINE
4240  0035                     FNEG              /NEGATE THE ANSWER
4241  0052             SZ1,    SUBL              /SIN(0)=0
4242  5002             SP1,    FLDS              /IS X<PI?
4243  3565                     PI                /GET PI
4244  0013                     FSUB              /CALCULATE PI-X
4245  0023                     FIF               /IS THE RESULT POSITIVE, NEG, OR 0?
4246  4254                     SM3               /NEGATIVE, X>PI
4247  4251                     SZ2               /SIN(NPI)=0
4250  4263                     SP3               /POSITIVE, X<PI
4251  5002             SZ2,    FLDS              /LOAD ZERO ONTO THE STACK
4252  3544                     OREZ              /...
4253  0052                     SUBL              /EXIT
```

```
                        /SHEET 91
                        /SIN COS CONTINUED

4254  5002              SM3,    FLDS        /SIN(X)=-SIN(X-PI)=SIN(PI-X)
4255  0025                      X           /LOAD X
4256  5002                      FLDS        /LOAD PI
4257  3565                      PI          /...
4260  0013                      FSUB        /CALCULATE PI-X
4261  0021                      TRAN        /RETURN TO THE BEGINNING
4262  4211                      SIST        /...
4263  5002              SP3,    FLDS        /IS X<PI/2?
4264  0025                      X           /LOAD X
4265  5002                      FLDS        /LOAD PI/2
4266  4364                      PIOT        /...
4267  0013                      FSUB        /CALCULATE (PI/2)-X
4270  0023                      FIF         /IS THIS RESULT POSITIVE, NEG, OR 0?
4271  4254                      SM3         /NEGATIVE, (PI/2)<X<PI
4272  4274                      SZ4         /X=PI/2
4273  4277                      SP4         /POSITIVE, X IS IN FIRST QUADRANT
4274  5002              SZ4,    FLDS        /SIN(PI/2)=1
4275  3547                      ENO         /LOAD STACK WITH ONE
4276  0052                      SUBL        /EXIT
4277  5002              SP4,    FLDS        /ALGORITHM BEGINS HERE
4300  4364                      PIOT        /LOAD PI/2
4301  5002                      FLDS        /LOAD X, TO GET X/(PI/2) SINCE
4302  0025                      X           /ALGORITHM CALCULATES SIN(PI/2*X)
4303  0016                      FDIV        /FORM X/(PI/2)
4304  5402                      FSTS        /STORE THIS AS X
4305  0025                      X           /...
4306  0051                      SUBN        /FORM X**2
4307  5161                      SQRE        /...
4310  5002                      FLDS        /LOAD FIRST CONSTANT FOR LOOP
4311  4350                      C9          /...
```

```
                        /SHEET 92
                        /EVEN MORE SIN COS

4312  0020                      THRO        /DO LOOP
4313  4331                      SIL1        /RANGE OF DO LOOP
4314  1756                      DVAR        /RUNNING VARIABLE
4315  3547                      ENO         /STARTING AT ONE
4316  3555                      RUOF        /ENDING AT FOUR
4317  3547                      ENO         /INCREMENTED BY ONE
4320  5002                      FLDS        /GET X**2
4321  3065                      XSQR        /...
4322  0015                      FMPY        /MULTIPLY BY ACCUMULATED SUM
4323  4002                      LDST        /SET UP INDEXED LOAD
4324  1756                      DVAR        /GET CURRENT INDEX
4325  4401                      STOI        /STORE IT ON THE INDEX STACK
4326  7002                      FLDI        /GET C(J)
4327  4353                      SC          /...
4330  0012                      FADD        /ADD IT INTO CURRENT SUM
4331  0024  SIL1,               CON         /END OF DO LOOP RANGE
4332  5002                      FLDS        /GET X ON THE STACK
4333  0025                      X           /...
4334  0015                      FMPY        /MULTIPLY BY ACCUMULATED SUM
4335  0052                      SUBL        /EXIT

                        /COSINE ROUTINE BEGINS HERE

4336  4501  ICOS,               JMS I ≠ OVLI    /GO TO INTERPRETER
4337  0051                      SUBN        /ENTER SUBROUTINE
4340  4343                      COST        /COS ADDR
4341  0007                      ILVE        /LEAVE INTERPRETER
4342  5500                      JMP I ≠ INTI    /GET NEXT INSTRUCTION
4343  5002  COST,               FLDS        /COS(X)=SIN(PI/2-X)
4344  4364                      PIOT        /LOAD PI/2
4345  0013                      FSUB        /FORM PI/2-X
4346  0025                      SINE        /TAKE THE SINE
4347  0052                      SUBL        /EXIT
```

```
                        /SHEET 93
                        /CONSTANTS FOR SINE AND COSINE ALGORITHM

4350  7764              C9,     7764    /C9=.00015148419
4351  2366                      2366
4352  5735                      5735
4353  7771              SC,     7771    /C7=-.00467376557
4354  5466                      5466
4355  6317                      6317
4356  7775                      7775    /C5=.07968967928
4357  2431                      2431
4360  5053                      5053
4361  0000                      0000    /C3=-.64596371106
4362  5325                      5325
4363  0420                      0420
4364  0001              PIOT,   0001    /C1=1.570796326794
4365  3110                      3110
4366  3755                      3755
```

```
                        /SHEET 94
                        /INTERPRETIVE MODE LOGARITHM
                        /THIS ROUTINE CALCULATES LOGS BY THE FOLLOWING METHOD:
                        /LOG(X)=LOG((2**N)*F), WHERE 1<F<2
                        /       =NLOG(2)+LOG(F)
                        /LOG(F) IS CALCULATED WITH A SERIES EXPANSION FOR LN(1+X)
                        /TAKEN FROM PAGE 180 OF APPROXIMATIONS FOR DIGITAL COMPUTER
                        /BY CECIL HASTINGS

4367  4501              ILOG,   JMS I Z OVLI    /GO TO INTERPRETER
4370  0051                      SUBN            /ENTER SUBROUTINE
4371  4374                      LOST            /LOG ADDR
4372  0007                      ILVE            /LEAVE INTERPRETER
4373  5500                      JMP I Z INTI    /GET NEXT INSTRUCTION
4374  0051              LOST,   SUBN            /CALL SUBROUTINE TO GET ARG IN X
4375  5154                      SSSB            /...
4376  5002                      FLDS            /GET ARGUMENT IN X AGAIN
4377  0025                      X               /...
4400  0023                      FIF             /IS IT POSITIVE, NEGATIVE, OR ZERO?
4401  4404                      LOZ0            /NEGATIVE - ERROR
4402  4404                      LOZ0            /ZERO - NON-RECOVERABLE ERROR
4403  4413                      LOP0            /POSITIVE
4404  0007              LOZ0,   ILVE            /LEAVE INTERPRETER
4405  4502                      JMS I Z GOOF    /LOG OF 0 OR NEG NUMBER
4406  6262                      6262            /ERROR NO. 22
4407  4501                      JMS I Z OVLI    /GO TO INTERPRETER
4410  0035                      FNEG            /TAKE NEGATIVE OF X
4411  0021                      TRAN            /GO TRY AGAIN
4412  4374                      LOST            /...
4413  5002              LOP0,   FLDS            /GET FLOATING POINT ONE
4414  3547                      ENO             /...
4415  0013                      FSUB            /CALCULATE 1-X
4416  0023                      FIF             /IS X<1?
4417  4432                      LOM1            /NO, X>1, GO TO ALGORITHM
4420  4251                      SZ2             /X=1, LOG(1)=0, EXIT
4421  4422                      LOP1            /YES, X<1,
4422  5002              LOP1,   FLDS            /LOG(X)=-LOG(1/X)
4423  0025                      X               /SO PICK UP X
4424  5002                      FLDS            /PICK UP FLOATING POINT ONE
4425  3547                      ENO             /...
4426  0016                      FDIV            /CALCULATE 1/X
4427  0027                      FLOG            /RECURSIVE CALL TO LOG
4430  0035                      FNEG            /NEGATE THE RESULT
4431  0052                      SUBL            /EXIT
```

```
                        /SHEET 95
                        /MORE LOGS

4432  4002              LOM1,   LDST        /ALGORITHM BEGINS HERE
4433  3547                      ENO         /PICK UP INTEGER ONE
4434  4002                      LDST        /PICK UP THE EXPONENT OF X
4435  0025                      X           /...
4436  0002                      FXSB        /GET EXPONENT-1
4437  0010                      FLOA        /TURN IT INTO A FLOATING PT. NUMBER
4440  5002                      FLDS        /GET NATURAL LOG OF 2
4441  3557                      LOG2        /...
4442  0015                      FMPY        /FORM N LOG2
4443  4002                      LDST        /SET EXPONENT OF X TO 1
4444  3547                      ENO         /LOAD INTEGER 1
4445  4402                      STST        /STORE IN X
4446  0025                      X           /...
4447  5002                      FLDS        /ALGORITHM CALCULATES LN(1+X)
4450  3547                      ENO         /SO CALCULATE X-1
4451  5002                      FLDS        /...
4452  0025                      X           /...
4453  0013                      FSUB        /...
4454  5402                      FSTS        /STORE THE RESULT IN X
4455  0025                      X           /...
4456  5002                      FLDS        /PICK UP FIRST CONSTANT FOR LOOP
4457  4505                      LO8         /...
4460  0020                      THRO        /DO LOOP
4461  4477                      LOL1        /RANGE OF DO LOOP
4462  1756                      DVAR        /RUNNING VARIABLE
4463  3547                      ENO         /STARTING AT ONE
4464  2563                      EX1         /RUNNING TO SEVEN
4465  3547                      ENO         /INCREMENTED BY ONE
4466  5002                      FLDS        /GET X
4467  0025                      X           /...
4470  0015                      FMPY        /MULTIPLY BY ACCUMULATED SUM
4471  4002                      LDST        /PREPARE INDEXED LOAD
4472  1756                      DVAR        /GET CURRENT INDEX
4473  4401                      STOI        /STORE IT ON INDEX STACK
4474  7002                      FLDI        /GET A(I)
4475  4510                      LO7         /...
4476  0012                      FADD        /ADD IT INTO CURRENT SUM
4477  0024              LOL1,   CON         /CONTINUE - END OF DO LOOP RANGE
4500  5002                      FLDS        /GET X
4501  0025                      X           /...
4502  0015                      FMPY        /FINAL SERIES MULTIPLICATION
4503  0012                      FADD        /ADD IN EXPONENT PART
4504  0052                      SUBL        /EXIT
```

```
                        /SHEET 96
                        /CONSTANTS FOR LOGARITHM ALGORITHM

4505  7771              LO8,    7771          /-.0064535442
4506  4544                      4544
4507  1735                      1735
4510  7774              LO7,    7774          /.0360884937
4511  2236                      2236
4512  4304                      4304
4513  7775                      7775          /-.0953293897
4514  4746                      4746
4515  0771                      0771
4516  7776                      7776          /.1676540711
4517  2535                      2535
4520  3301                      3301
4521  7776                      7776          /-.2407338084
4522  4113                      4113
4523  7211                      7211
4524  7777                      7777          /.3317990258
4525  2517                      2517
4526  0307                      0307
4527  7777                      7777          /-.4998741238
4530  4000                      4000
4531  4100                      4100
4532  0000                      0000          /.9999964239
4533  3777                      3777
4534  7742                      7742
```

```
                        /SHEET 97
                        /INTERPRETIVE EXPONENTIAL
                        /THIS ROUTINE CALCULATES FLOATING POINT EXPONENTIALS
                        /E**X=2**(X*LOG2(E))=2**(N+F), WHERE
                        /N IS AN INTEGER AND F IS A FRACTION. 2**F IS CALCULATED AS
                        /2**F=1+2F/(A+RF**2-C/(D+4**2))
                        /THE CONSTANTS ARE FOUND ON SHEET 58 OF THIS LISTING

4535  4501             IEXP,   JMS I Z OVLI      /GO TO INTERPRETER
4536  0051                     SUBN               /ENTER SUBROUTINE
4537  4542                     EXST               /EXP ADDR
4540  0007                     ILVE               /LEAVE INTERPRETER
4541  5500                     JMP I Z INTI       /GET NEXT INSTRUCTION
4542  0051             EXST,   SUBN               /CALL SUBROUTINE TO GET ARGUMENT IN X
4543  5154                     SSSB               /...
4544  0023                     FIF                /IS X POSITIVE, NEGATIVE, OR ZERO?
4545  4550                     EXM1               /NEGATIVE
4546  4274                     SZ4                /EXP (0) = 1
4547  4560                     EXP1               /POSITIVE
4550  5002             EXM1,   FLDS               /EXP(-X)=1/EXP(X)
4551  0025                     X                  /HENCE, GET X BACK ON THESTACK
4552  0035                     FNEG               /NEGATE IT
4553  0030                     FEXP               /CALL EXPONENTIAL RECURSIVELY
4554  5002                     FLDS               /GET FLOATING POINT ONE
4555  3547                     ENO                /...
4556  0016                     FDIV               /CALCULATE 1/EXP(X)
4557  0052                     SUBL               /EXIT
4560  5002             EXP1,   FLDS               /SEPARATE FLOATING NUMBER
4561  3557                     LOG2               /GET NATURAL LOG OF 2
4562  5002                     FLDS               /GET X
4563  0025                     X                  /...
4564  0016                     FDIV               /CALCULATE X/LN(2)=X*LOG2(E)
4565  0051                     SUBN               /STORE THIS IN X
4566  5154                     SSSB               /...
4567  0011                     UFLO               /FIX THE NUMBER X*LOG2(E)
4570  4402                     STST               /THIS IS THE INTEGER PORTION
4571  1755                     FLAG     /OF 2**(X*LOG2(E))=2**(M+I)
4572  4002                     LDST               /LOAD THE INTEGER AGAIN
4573  1755                     FLAG               /...
4574  0010                     FLOA               /RE-FLOAT IT
4575  5002                     FLDS               /GET THE ORIGINAL X*LOG2(E)
4576  0025                     X                  /...
4577  0013                     FSUB               /X*LOG2(E) - FLOATF (FIXF(X*LOG2(E)))
4600  5402                     FSTS               /STORE THE FRACTION PART IN X
4601  0025                     X                  /...
```

```
                    /SHEET 98
                    /MORE EXPONENTIAL

4602  0051          SURN        /ALGORITHM BEGINS HERE
4603  5161          SQRE        /CALCULATE X**2
4604  5002          FLDS        /LOAD X**2
4605  3065          XSQR        /...
4606  5002          FLDS        /LOAD FIRST CONSTANT, D
4607  2563          EX1         /...
4610  0012          FADD        /CALCULATE X**2+D=Y+D
4611  5002          FLDS        /LOAD 2ND CONSTANT, C
4612  2566          EX2         /...
4613  0016          FDIV        /CALCULATE C/(Y+D)
4614  5002          FLDS        /LOAD X
4615  0025          X           /...
4616  0035          FNEG        /CALCULATE -X
4617  0012          FADD        /-X+C/(Y+D)
4620  5002          FLDS        /LOAD THIRD CONSTANT, B
4621  2571          EX3         /...
4622  5002          FLDS        /LOAD X**2
4623  3065          XSQR        /...
4624  0015          FMPY        /CALCULATE BY-X+C/(Y+D)
4625  0012          FADD        /...
4626  5002          FLDS        /LOAD FOURTH CONSTANT, A
4627  2574          EX4         /...
4630  0012          FADD        /CALCULATE A+BY-X+C/(Y+D)
4631  5002          FLDS        /LOAD X
4632  0025          X           /...
4633  5002          FLDS        /LOAD FLOATING POINT TWO
4634  3552          OWT         /...
4635  0015          FMPY        /FORM 2X
4636  0016          FDIV        /CALCULATE 2X (A+BY-X+C/(Y+D))
4637  5002          FLDS        /LOAD FLOATING POINT ONE
4640  3547          ENO         /...
4641  0012          FADD        /1+2X(A+BY-X+C/(Y+D))
4642  5402          FSTS        /STORE RESULT IN TEMP REGISTER
4643  0035          MET1        /...
4644  4002          LDST        /PICK UP EXPONENT PART
4645  0035          MET1        /...
4646  4002          LDST        /PICK UP M IN 2**M (FROM FLAG)
4647  1755          FLAG        /...
4650  0001          FXAD        /ADD IT INTO THE EXPONENT
4651  4002          LDST        /PICK UP LOW ORDER PARTS
4652  0036          MET1+1      /...
4653  4002          LDST        /LW ORDER FRACTION
4654  0037          MET1+2      /...
4655  0052          SURL        /EXIT
```

```
                        /SHEET 99
                        /INTERPRETIVE ARCTANGENT
                        /THIS ROUTINE CALCULATES THE ARCTANGENT OF A FLOATING POINT
                        /NUMBER X BY THE FOLLOWING ALGORITHM:
                        /ATAN(X)=((((((A13*Z+A11)*Z+A9)*Z+A7)*Z+15)*Z+A3)*Z+A1)*Y
                        /WHERE Z=Y**2 AND Y=(X-1)/(X+1)
                        /THE ALGORITHM IS TAKEN FROM PAGE 136 OF
                        /APPROXIMATIONS FOR DIGITAL COMPUTERS BY CECIL HASTINGS

4656  4501             IATN,   JMS I Z OVLI      /GO TO INTERPRETER
4657  0051                     SURN              /ENTER SUBROUTINE
4660  4663                     ARST              /ARCTAN ADDR
4661  0007                     ILVE              /LEAVE INTERPRETER
4662  5500                     JMP I Z INTI      /GET NEXT INSTRUCTION
4663  0051             ARST,   SURN              /CALL SUBROUTINE TO PUT ARGUMENT IN X
4664  5154                     SSSB              /...
4665  5002                     FLDS              /GET ARGUMENT ON STACK AGAIN
4666  0025                     X                 /...
4667  0023                     FIF               /IS IT POSITIVE, NEGATIVE, OR ZERO?
4670  4673                     ARMØ              /NEGATIVE - ATAN(-X)=-ATAN(X)
4671  4676                     ARZØ              /ZERO - EXIT
4672  4677                     ARPØ              /POSITIVE
4673  0035             ARMØ,   FNEG              /NEGATE THE ARGUMENT
4674  0031                     ARTN              /CALL ATAN RECURSIVELY
4675  0035                     FNEG              /NEGATE THE RESULT
4676  0052             ARZØ,   SUBL              /EXIT
4677  5002             ARPØ,   FLDS              /GET FLOATING POINT ONE
4700  3547                     ENO               /...
4701  0012                     FADD              /COMPUTE X+1
4702  5002                     FLDS              /GET FLOATING POINT ONE AGAIN
4703  3547                     ENO               /...
4704  5002                     FLDS              /GET X BACK AGAIN
4705  0025                     X                 /...
4706  0013                     FSUB              /COMPUTE X-1
4707  0016                     FDIV              /CALCULATE (X-1)/(X+1)
4710  5402                     FSTS              /THIS IS NOW THE ARGUMENT X
4711  0025                     X                 /...
4712  0051                     SUBN              /COMPUTE X SQUARED
4713  5161                     SQRE              /...
```

```
                        /SHEET 100
                        /MORE ARCTANGENT

4714  5002                    FLDS        /PICK UP AR13 FOR DO LOOP
4715  4745                    AR13        /...
4716  0020                    THRO        /DO LOOP
4717  4735                    ARL1        /RANGE OF DO LOOP
4720  1756                    DVAR        /RUNNING VARIABLE IS DVAR
4721  3547                    ENO         /STARTING AT ONE
4722  3556                    XIS         /ENDING AT SIX
4723  3547                    ENO         /INCREMENTED BY ONE EACH TIME
4724  5002                    FLDS        /PICK UP X**2
4725  3065                    XSQR        /...
4726  0015                    FMPY        /MULTIPLY BY CURRENT SUM
4727  4002                    LDST        /SET UP INDEXED VARIABLE
4730  1756                    DVAR        /GET THE CURRENT INDEX
4731  4401                    STOI        /STORE IT ON THE INDEX STACK
4732  7002                    FLDI        /PICK UP A(I)
4733  4750                    AR11        /...
4734  0012                    FADD        /ADD INTO CURRENT SUM
4735  0024              ARL1, CON         /CONTINUE - END OF DO LOOP RANGE
4736  5002                    FLDS        /GET FLOATING POINT X
4737  0025                    X           /...
4740  0015                    FMPY        /MULTIPLY BY ABOVE RESULTS
4741  5002                    FLDS        /GET PI/4
4742  3570                    PIOF        /...
4743  0012                    FADD        /ADD INTO ABOVE RESULTS
4744  0052                    SUBL        /EXIT
```

```
                        /SHEET 101
                        /CONSTANTS FOR ARCTANGENT CALCULATION

4745  7771      AR13,   7771          /A13=.006812411
4746  3371              3371
4747  6523              6523
4750  7774      AR11,   7774          /A11=-.033606269
4751  5662              5662
4752  6243              6243
4753  7775              7775          /A9=.079626318
4754  2430              2430
4755  4620              4620
4756  7776              7776          /A7=-.132335096
4757  5703              5703
4760  7223              7223
4761  7776              7776          /A5=.198078690
4762  3126              3126
4763  5222              5222
4764  7777              7777          /A3=-.333173758
4765  5253              5253
4766  2437              2437
4767  0000              0000          /A1+.999996115
4770  3777              3777
4771  7737              7737
```

```
                        /SHEET 102
                        /INTERPRETIVE SQUARE ROOT
                        /THIS ROUTINE CALCULATES FLOATING POINT SQUARE ROOTS BY SIX
                        /ITERATIONS OF NEWTONS METHOD

4772  4501              ISQT,   JMS I Z OVLI    /GO TO INTERPRETER
4773  0051                      SUBN            /ENTER SUBROUTINE
4774  4777                      SQST            /SQRT ADDR
4775  0007                      ILVE            /LEAVE INTERPRETER
4776  5500                      JMP I Z INTI    /GO GET NEXT INSTRUCTION
4777  0051              SQST,   SUBN            /GO TO ROUTINE TO SAVE STACK IN X
5000  5154                      SSSB            /...
5001  5002                      FLDS            /GET X BACK ON THE STACK
5002  0025                      X               /...
5003  0023                      FIF             /IS IT POSITIVE, NEGATIVE, OR ZERO?
5004  5050                      ERR1            /NEGATIVE - THIS IS AN ERROR
5005  5056                      SQZ1            /ZERO - EXIT IMMEDIATELY
5006  5007                      SQP1            /POSITIVE
5007  5402              SQP1,   FSTS            /STORE ARGUMENT IN TEMP REGISTER
5010  0035                      MET1            /...
5011  0007                      ILVE            /LEAVE INTERPRETER
5012  1035                      TAD Z MET1      /PICK UP EXPONENT OF ARGUMENT
5013  7100                      CLL             /DIVIDE IT BY 2...
5014  7510                      SPA             /TO GET A FIRST APPROXIMATION
5015  7020                      CML             /...
5016  7010                      RAR             /...
5017  3035                      DCA Z MET1      /STORE IN MET1
5020  4501                      JMS I Z OVLI    /GO TO INTERPRETER
5021  0020                      THRO            /DO LOOP
5022  5044                      SQL1            /RANGE OF DO LOOP
5023  1756                      DVAR            /RUNNING VARIABLE IS DVAR
5024  3547                      ENO             /STARTING AT ONE
5025  3556                      XIS             /ENDING AT SIX
5026  3547                      ENO             /INCREMENTED BY ONE
5027  5002                      FLDS            /PICK UP CURRENT APPROXIMATION, X(I)
5030  0035                      MET1            /...
5031  5002                      FLDS            /PICK UP NUMBER TO BE SQ-ROOTED
5032  0025                      X               /...
5033  0016                      FDIV            /FORM N/X(I)
5034  5002                      FLDS            /PICK UP X(I) AGAIN
5035  0035                      MET1            /...
5036  0012                      FADD            /FORM X(I)+N/X(I)
5037  5002                      FLDS            /GET FLOATING POINT TWO
5040  3552                      OWT             /...

5041  0017                      FDVR            /FORM 0.5*(X(I)+N/X(I))
5042  5402                      FSTS            /STORE IT TO FORM X(N+1)
5043  0035                      MET1            /...
5044  0024              SQL1,   CON             /CONTINUE - END OF DO LOOP
5045  5002                      FLDS            /PICK UP LAST ITERATION
5046  0035                      MET1            /...
5047  0052                      SUBL            /LEAVE SUBROUTINE
5050  0007              ERR1,   ILVE            /LEAVE INTERPRETER
5051  4502                      JMS I Z GOOF    /COMPLAIN ABOUT NEGATIVE NUMBER
5052  6260                      6260            /ERROR NO. 20
```

```
5153  4501                JMS I 7 OVLI    /GO TO INTERPRETER
5154  0035                FNEG            /TAKE NEGATIVE OF X
5155  0032                SQRT            /GET ITS SQRT
5156  0052          SQR1, SUBL            /RETURN
```

```
                        /SHEET 103
                        /POWER CALCULATIONS

                        /FLOATING TO FLOATING
                        /THIS CALCULATES A**B, WITH A AND B FLOATING, B ON
                        /TOP OF THE STACK, A NEXT ON THE STACK
5057  4501              IFLF,   JMS I 7 OVLI      /GO TO INTERPRETER
5060  0051                      SUBN              /ENTER SUBROUTINE
5061  5064                      F1ST              /ADDR OF ROUTINE
5062  0007                      ILVE              /LEAVE INTERPRETER
5063  5500                      JMP I 7 INTI      /GET NEXT INSTRUCTION
5064  5402              F1ST,   FSTS              /STORE TOP NUMBER IN TEMP REGISTER
5065  0035                      MET1              /...
5066  5402                      FSTS              /STORE NEXT NUMBER IN X
5067  0025                      X                 /...
5070  5002                      FLDS              /PICK THEM UP IN REVERSE ORDER
5071  0035                      MET1              /...
5072  5002                      FLDS              /...
5073  0025                      X                 /ARGUMENTS NOW IN REVERSE ORDER
5074  0041                      FLFI              /CALL FLOATING-TO-FLOATING INVERTED
5075  0052                      SUBL              /EXIT FROM SUBROUTINE
                        /FLOATING TO FIXED
                        /THIS CALCULATES A**B, WITH A FLOATING, B FIXED, B ON TOP
                        /OF THE STACK, A NEXT ON THE STACK
5076  4501              IFLX,   JMS I 7 OVLI      /GO TO INTERPRETER
5077  0051                      SUBN              /ENTER SUBROUTINE
5100  5103                      F3ST              /ADDR OF ROUTINE
5101  0007                      ILVE              /LEAVE INTERPRETER
5102  5500                      JMP I 7 INTI      /GET NEXT INSTRUCTION
5103  0010              F3ST,   FLOA              /TURN FIXED NUMBER INTO FLOATING PT.
5104  0040                      FLFL              /CALL FLOATING-TO-FLOATING ROUTINE
5105  0052                      SUBL              /EXIT FROM SUBROUTINE
                        /FLOATING TO FIXED, INVERTED
                        /THIS CALCULATES A**B, WITH A FLOATING, B FIXED, A ON TOP
                        /OF THE STACK, AND B SITTING NEXT ON THE STACK.
5106  4501              IFXI,   JMS I 7 OVLI      /GO TO INTERPRETER
5107  0051                      SUBN              /ENTER SUBROUTINE
5110  5113                      F4ST              /ADDR OF ROUTINE
5111  0007                      ILVE              /LEAVE INTERPRETER
5112  5500                      JMP I 7 INTI      /GET NEXT INSTRUCTION
5113  5402              F4ST,   FSTS              /STORE TOP NUMBER IN TEMP REGISTER
5114  0035                      MET1              /...
5115  0010                      FLOA              /FLOAT NEXT ARGUMENT ON STACK
5116  5002                      FLDS              /PICK UP THE OTHER ARGUMENT

5117  0035                      MET1              /...
5120  0041                      FLFI              /CALL FLOATING-TO-FLOATING-INVERTED
5121  0052                      SUBL              /EXIT FROM SUBROUTINE
```

```
                        /SHEET 104
                        /FLOATING TO FLOATING INVERTED
                        /THIS ROUTINE CALCULATES A**B, WHERE A AND B ARE BOTH
                        /FLOATING POINT NUMBERS.  A IS THE TOP NUMBER ON THE
                        /STACK, B IS THE 2ND NUMBER ON THE STACK.  THE RESULT
                        /IS CALCULATED AS A**B=EXP(B*LN(A))
                        /IF A IS NEGATIVE, THE RESULT IS, IN GENERAL, A COMPLEX NUMBER,
                        /SO NEGATIVE IS ILLEGAL
5122  4501              IFFI,   JMS I ≠ OVLI      /GO TO INTERPRETER
5123  0051                      SURN              /ENTER SUBROUTINE
5124  5127                      F2ST              /ADDR OF ROUTINE
5125  0007                      ILVE              /LEAVE INTERPRETER
5126  5500                      JMP I ≠ INTI      /GO GET NEXT INSTRUCTION
5127  0051              F2ST,   SURN              /STORE FIRST NUMBER IN X
5130  5154                      SSSB              /...
5131  5002                      FLDS              /PICK IT UP ON THE STACK AGAIN
5132  0025                      X                 /...
5133  0023                      FIF               /IS IT POSITIVE, NEGATIVE, OR ZERO?
5134  5145                      FLM1              /NEGATIVE, THIS IS AN ERROR
5135  5143                      FLZ1              /ZERO, THE RESULT IS ZERO
5136  5137                      FLP1              /POSITIVE
5137  0027              FLP1,   FLOG              /TAKE LOG OF TOP NUMBER
5140  0015                      FMPY              /MULTIPLY RESULT TIMES 2ND NUMBER
5141  0030                      FEXP              /TAKE THE EXPONENTIAL OF IT
5142  0052                      SURL              /EXIT
5143  0015              FLZ1,   FMPY              /ZERO RESULT, BUT CLEAR STACK
5144  0052                      SUBL              /EXIT FROM SUBROUTINE
5145  0007              FLM1,   ILVE              /LEAVE INTERPRETER
5146  4502                      JMS I ≠ GOOF      /GO COMPLAIN ABOUT NEGATIVE NUMBER
5147  6261                      6261              /ERROR NO. 21
5150  4501                      JMS I ≠ OVLI      /GO TO INTERPRETER
5151  0035                      FNEG              /TAKE NEGATIVE
5152  0041                      FLFI              /CALCULATE A**B
5153  0052                      SUBL              /RETURN
```

```
                        /SHEET 105
                        /SOME SUBROUTINES

                        /SAVE SPACE SUBROUTINE
                        /THIS IS A "MOVE-TO-MEMORY" SUBROUTINE THAT RESULTS
                        /IN THE TOP NUMBER ON THE STACK BEING STORED IN X, AND
                        /RETURNED AGAIN TO THE STACK.
5154  5402              SSSB,   FSTS            /STORE THE STACK IN X
5155  0025                      X               /...
5156  5002                      FLDS            /PUT IT BACK ON THE STACK
5157  0025                      X               /...
5160  0052                      SUBL            /EXIT FROM THE SUBROUTINE
                        /SQUARE ROUTINE
                        /THIS ROUTINE CALCULATES THE SQUARE OF THE NUMBER
                        /FOUND IN X, LEAVING THE RESULT IN XSQR.
5161  5002              SQRE,   FLDS            /PUT X ON THE STACK
5162  0025                      X               /...
5163  5002                      FLDS            /PUT ANOTHER X ON THE STACK
5164  0025                      X               /...
5165  0015                      FMPY            /MULTIPLY X TIMES X
5166  5402                      FSTS            /STORE RESULT IN XSQR
5167  3065                      XSQR            /...
5170  0052                      SUBL            /EXIT FROM SUBROUTINE
```

/SHEET 106
/PAGE 50

```
                        /SHEET 107
                        /HIGH SPEED READ

5171  0000  BREAD,  0
5172  6014          RFC
5173  6011          RSF
5174  5373          JMP .-1
5175  7200          CLA
5176  6012          RRB
5177  5771          JMP I BREAD

                    L5%,
```

```
                        /SHEET 108
                        /PAGE 52

        52XX            *5200

                                ILVE            /LEAVE INTERPRETER
5200    0007            JMS I 7 GOOF    /COMPLAIN ABOUT SA=5200 WITH ...
5201    4502            6364            /NO INTERPRETIVE CODE THERE.
5202    6364            JMP .-2         /ERR #34
5203    5201
```

```
                        /NEW SHEETS

                        /SHEET 109
                        /DECTAPE ROUTINES

                        /DECTAPE INITIALIZE
      5204              *5204
                        MTBEG,
5204  0000              DTBEG,  0
5205  7340                      CLA CMA CLL       /SET FOSSIL
5206  3057                      DCA DTFF          /DECTAPE FLAG
5207  6774                      DTLB              /CLEAR B REGISTER
5210  3266                      DCA RRWFLG /CLEAR RE-READ/WRITE FLAG
5211  1414                      TAD I ILC         /FETCH UNIT NO.
5212  0067                      AND R10
5213  1073                      TAD LT2
5214  3262                      DCA DTADR
5215  1662                      TAD I DTADR       /UNIT NUMBER
5216  7450                      SNA       /IF UNIT=0
5217  5667                      JMP I RRWBFI      /RE-READ/WRITE BUFFER
5220  7012                      RTR
5221  7012                      RTR
5222  0265                      AND DX7000
5223  1254                      TAD UFB
5224  3254                      DCA UFB
5225  1414                      TAD I ILC         /FETCH BLOCK NO.
5226  0067                      AND R10
5227  1073                      TAD LT2
5230  3262                      DCA DTADR
5231  1662                      TAD I DTADR
5232  3255                      DCA BLOCK
5233  1260                      TAD BUFSIZ /SET WDCNT=BUFSIZ
5234  3050                      DCA WDCNT
5235  7240                      CLA CMA
5236  1256                      TAD ADBUF         /RESET BUFFER POINTER
5237  3047                      DCA BUFPNT
5240  1053                      TAD MODE          /MODE=0 FOR OUTPUT
5241  7640                      SZA CLA /SKIP ON WRITE FLAG
5242  4252                      JMS DTGO          /READ NOW
5243  5604                      JMP I DTBEG       /WRITE LATER

                        /DECTAPE TERMINATE
5244  3057              DTEND,  DCA DTFF          /CLEAR FOSSIL DECTAPE FLAG
5245  1266                      TAD RRWFLG /RE-READ/WRITE=-1
5246  1053                      TAD MODE          /READ=-1
5247  7700                      SMA CLA /SKIP ON READ OR RE-READ/WRITE FLAG
5250  4252                      JMS DTGO
5251  5500                      JMP I INTI /FETCH NEXT INSTRUCTION
```

```
                        /SHEET 110
                        /ACTUAL DECTAPE READ OR WRITE

5252  0000      DTGO,   0
5253  4661              JMS I ARWTP     /CALL TC01 OR 552 PACKAGE
5254  0000      UFB,    0       /UNIT, FUNCTION, NO. OF BLOCKS
5255  0000      BLOCK,  0       /STARTING BLOCK OF TRANSFER
5256  5600      ADBUF,  BUFBEG  /STARTING ADDRESS OF TRANSFER
5257  5652              JMP I DTGO /RETURN WITH FUNCTION COMPLETED
                        /AND TAPE STOPPED
5260  7577      BUFSIZ, BUFBEG-BUFEND-2 /BUFFERSIZE FOR WDCNT
5261  5400      ARWTP,  RWTAPE
5262  0000      DTADR,  0       /ADDRESS OF DECTAPE PARAMETERS
5263  0201      DTRD,   0201    /READ 1 BLOCK
5264  0401      DTWR,   0401    /WRITE 1 BLOCK
5265  7000      DX7000, 7000    /UNIT MASK
5266  0000      RRWFLG, 0       /RE-READ/WRITE FLAG
5267  5566      RRWBF1, RRWBF
```

```
                        /SHEET 111
                        /DECTAPE WRITE ONE ITEM

5270  4356      WMMX,   JMS FLTOK       /FLOATING POINT
5271  2047              ISZ Z BUFPNT    /MOVE EXPONENT TO BUFFER
5272  1443              TAD I Z X2      /...
5273  3447              DCA I Z BUFPNT  /...
5274  2047              ISZ Z BUFPNT    /MOVE HI ORDER
5275  1444              TAD I Z H2      /...
5276  3447              DCA I Z BUFPNT  /...
5277  2047              ISZ Z BUFPNT    /MOVE LO ORDER
5300  1445              TAD I Z L2      /...
5301  3447              DCA I Z BUFPNT  /...
5302  5565              JMP I Z TITI    /GET NEXT ITEM

5303  7200      WMMF,   CLA
5304  4366              JMS FIXOK       /MAKE SURE THERE IS SPACE
5305  2047              ISZ Z BUFPNT    /MOVE ITEM TO BUFFER
5306  1015              TAD Z TEMA      /...
5307  3447              DCA I Z BUFPNT  /...
5310  5565              JMP I Z TITI    /GET NEXT ITEM
```

```
                        /SHEET 112
                        /DECTAPE ACCEPT ONE ITEM
5311  7200  DTJ,   CLA             /IS DT ITEM FLOATING OR FIXED?
5312  1054        TAD Z XTRN        /...
5313  7700        SMA CLA           /...
5314  5323        JMP DTJX                  /FLOATING POINT
5315  4366  DTJF, JMS FIXOK         /INTEGER
5316  2047        ISZ Z BUFPNT      /GET ITEM FROM BUFFER
5317  1447        TAD I Z BUFPNT    /...
5320  3443        DCA I Z X2        /STORE IT ON STACK
5321  5722        JMP I .+1         /GO STORE INTO VARIABLE
5322  4060        AFRET             /...
5323  4356  DTJX, JMS FLTOK         /CHECK BUFFER SIZE
5324  2047        ISZ Z BUFPNT      /GET EXPONENT FROM BUFFER
5325  1447        TAD I Z BUFPNT    /...
5326  3443        DCA I Z X2        /STORE IT ON STACK
5327  2047        ISZ Z BUFPNT      /GET HI ORDER
5330  1447        TAD I Z BUFPNT    /...
5331  3444        DCA I Z H2        /STORE ON STACK
5332  2047        ISZ Z BUFPNT      /GET LO ORDER
5333  1447        TAD I Z BUFPNT    /...
5334  3445        DCA I Z L2        /STORE ON STACK
5335  5736        JMP I .+1         /GO STORE STACK INTO VARIABLE
5336  4021        AXRET             /...
```

```
                        /SHEET 113
                        /DECTAPE CONTROL

5337  7200              MMIC,   CLA             /WRITE INSTRUCTION
5340  3053                      DCA Z MODE      /MODE=0 IMPLIES OUTPUT
5341  1264                      TAD DTWR        /WRITE ONE BLOCK
5342  3254                      DCA UFB
5343  4204                      JMS MTREG       /GO INITIALIZE
5344  5745                      JMP I .+1       /GO TO GENERAL OUTPUT ROUTINE
5345  4100                      TYPE            /...
5346  0004              MMINS,  4               /WRITE MODE=4

5347  7240              DTIC,   CLA CMA         /READ INSTRUCTION
5350  3053                      DCA Z MODE      /MODE=-1 IMPLIES INPUT
5351  1263                      TAD DTRD        /READ 1 BLOCK
5352  3254                      DCA UFB
5353  4204                      JMS MTREG       /GO INITIALIZE
5354  5755                      JMP I .+1       /GO TO GENERAL INPUT ROUTINE
5355  4000                      ACTP            /...
      0062              DTINS=Z PTW             /READ MODE=2

5356  0000              FLTOK,  0               /IS THERE BUFFER SPACE FOR A...
5357  7200                      CLA             /FLOATING NUMBER?
5360  1050                      TAD Z WDCNT     /INCREMENT COUNTER BY 3
5361  1061                      TAD Z PTH       /...
5362  7500                      SMA             /...
5363  5371                      JMP SCE         /NO, GO COMPLAIN
5364  3050                      DCA Z WDCNT     /YES, SAVE COUNTER
5365  5756                      JMP I FLTOK     /RETURN
5366  0000              FIXOK,  0               /BUFFER SPACE FOR INTEGER?
5367  2050                      ISZ Z WDCNT     /INCREMENT AND TEST COUNTER
5370  5766                      JMP I FIXOK     /YES, RETURN
5371  4502              SCE,    JMS I Z GOOF    /COMPLAIN - BUFFER EXCEEDED
5372  6363                      6363            /ERROR NO. 33
5373  5774                      JMP I .+1       /SKIP REMAINDER OF THIS INSTRUCTION
5374  2173                      FMT             /...
5375  7402              F52,    HLT
5376  7402                      HLT
5377  7402                      HLT
                        L52,
```

```
                        /SHEET 114
                        /PAGE 54

        5400            *5400/SHEET 115
                        /READ OR WRITE 128 WORD BLOCKS
                        /USING TC01 DECTAPE CONTROL

        5400            *5400
                        /READ OR WRITE INITIALIZE

5400    0000    RWTAPE, 0               /READ OR WRITE  STANDARD TAPE BLOCKS
5401    7300            CLA CLL
5402    1600            TAD I RWTAPE    /GET UNIT, FUNCTION, # OF BLOCKS
5403    2200            ISZ RWTAPE      /INCREMENT POINTER
5404    3326            DCA RWREGA      /A-REGISTER
5405    1600            TAD I RWTAPE    /GET STARTING BLOCK
5406    2200            ISZ RWTAPE      /INCREMENT POINTER
5407    3330            DCA RWBLK       /OBJECT BLOCK
5410    1330            TAD RWBLK       /GET OBJECT BLOCK AGAIN
5411    1347            TAD M003                /SUBTRACT -3
5412    3346            DCA REVBLK      /STORE FOR REVERSE SEARCH
5413    7040            CMA             /7777
5414    1600            TAD I RWTAPE    /GET BUFFER POINTER
5415    2200            ISZ RWTAPE      /INCREMENT POINTER
5416    3327            DCA RWCLOC      /CORE LOCATION
5417    1324            TAD RWM12
5420    3323            DCA RWTCNT      /CUMULATIVE ERROR COUNTER
5421    1334    RWBGN,  TAD RWADBN
5422    3732            DCA I RWADCA    /INITIALIZE CURRENT ADDRESS
5423    1326            TAD RWREGA /#OF BLOCKS FOR TRANSFER
5424    0342            AND RW0077
5425    7040            CMA
5426    3331            DCA RWBCNT /-(# OF BLOCKS TO BE TRANSFERRED+1)

                        /BEGIN SEARCHING REVERSE
5427    1326            TAD RWREGA      /INITIALIZE FOR SEARCHING
5430    0335            AND RW7000
5431    1336            TAD RW0610      /SEARCH REVERSE, CLEAR FLAGS, NORMAL
5432    6766            DTCA DTXA
5433    4302    RWREV,  JMS RWWAIT      /WAIT FOR BLOCK #
5434    5242            JMP RWFWD-4     /ERROR RETURN, ASSUME IN FRONT ENDZONE
5435    1325            TAD RWBN                /GET CURRENT BLOCK AT BREAK TIME
5436    7040            CMA
5437    1346            TAD REVBLK      /GET OBJECT BLOCK -3
5440    7710            SPA CLA /ARE WE AT OBJECT BLOCK-3
5441    5233            JMP RWREV       /CONTINUE REVERSE SEARCH
```

```
                        /SHEET 116
                        /START SEARCHING FORWARD

5442  1326                      TAD RWREGA
5443  0335                      AND RW7000
5444  1337                      TAD RW0210
5445  6766                      DTCA DTXA
5446  4302              RWFWD,  JMS RWWAIT /SEARCH FORWARD FOR OBJECT BLOCK
5447  5221                      JMP RWBGN       /ERROR RETURN, ASSUME IN BACK ENDZONE
5450  1325                      TAD RWBN        /CHECK FOR BLOCK
5451  7041                      CIA
5452  1330                      TAD RWBLK
5453  7450                      SNA     /AT OBJECT BLOCK?
5454  5260                      JMP .+4 /YES
5455  7710                      SPA CLA /PAST OBJECT BLOCK?
5456  5221                      JMP RWBGN       /YES, START OVER
5457  5246                      JMP RWFWD       /NO, CONTINUE FORWARD SEARCHING

                        /START FUNCTION FORWARD
5460  1326                      TAD RWREGA
5461  7112                      CLL RTR
5462  7010                      RAR     /GET FUNCTION IN BITS 6-8
5463  0343                      AND RW0070
5464  1340                      TAD RW0110
5465  6764                      DTXA    /XOR IN FUNCTION, XOR OUT SEARCH BIT
5466  1327                      TAD RWCLOC
5467  3732                      DCA I RWADCA    /INITIALIZE CURRENT ADDRESS FOR ACTUAL TRANSFER
5470  2331              RWAGN,  ISZ RWBCNT      /DONE?
5471  5275                      JMP .+4
5472  1341                      TAD RW0200 /YES STOP TAPES
5473  6764                      DTXA
5474  5600                      JMP I RWTAPE
5475  1344                      TAD RWM200      /PROCESS A BLOCK
5476  3733                      DCA I RWADWC    /SET UP WORD COUNT
5477  4302                      JMS RWWAIT
5500  5221                      JMP RWBGN       /ERROR RETURN, START OVER
5501  5270                      JMP RWAGN
```

```
5502  0000
5503  6764
5504  6771
5505  5304
5506  6772
5507  7700
5510  5321
5511  2323
5512  5702
5513  6761
5514  0341
5515  1345
5516  6764
5517  6772
5520  5350
5521  2302
5522  5702

5523  0000
5524  7766
5525  0000
5526  0000
5527  0000
5530  0000
5531  0000
5532  7755
5533  7754
5534  5525
5535  7000
5536  0610
5537  0210
5540  0110
5541  0200
5542  0077
5543  0070
5544  7600
5545  0003
5546  0000
5547  7775
```

```
/SHEET 116A
/READ OR WRITE WAIT

/WAIT LOOP FOR FLAG, EXIT TO CALL+1 IN EVENT OF AN
/ERROR, TO CALL+2 IF NO ERROR

RWWAIT, 0          /WAIT FOR DTF, THEN CHECK FOR ERRORS
        DTXA
        DTSF
        JMP .-1
        DTRB       /GET STATUS REGISTER B
        SMA CLA    /ANY ERRORS?
        JMP RWWOUT /NO ERRORS
        ISZ RWTCNT /ERROR, TRIED IT 10 TIMES
        JMP I RWWAIT     /NO
        DTRA       /STOP THE TAPES
        AND RW0200
        TAD RW0003 /SAVE THE FLAGS
        DTXA
        DTRB       /GET STATUS REGISTER B
        JMP DTEROR /COMPLAIN ABOUT ERROR
RWWOUT, ISZ RWWAIT
        JMP I RWWAIT     /NORMAL EXIT

/CONSTANTS AND VARIABLES
RWTCNT, 0
RWM12,  -12
RWBN,   0          /CONTAINS CURRENT BLOCK POINTED OUT AT BREAK TIME
RWREGA, 0          /STORED FROM RWTAPE (UNIT, FUNCTION, #
RWCLOC, 0
RWBLK,  0          /OBJECT BLOCK
RWBCNT, 0
RWADCA, 7755
RWADWC, 7754
RWADBN, RWBN
RW7000, 7000
RW0610, 0610
RW0210, 0210
RW0110, 0110
RW0200, 0200
RW0077, 0077
RW0070, 0070
RWM200, -200
RW0003, 0003
REVBLK, 0
M003,   -3
```

```
                        /SHEET 117
                        /REPORT DECTAPE ERROR

5550  0365              DTEROR, AND DT0400 /TEST FOR SELECT ERROR
5551  7650                      SNA CLA /SKIP ON SELECT ERROR
5552  5361                      JMP DTFATL
5553  6761                      DTRA
5554  0335                      AND RW7000
5555  4502                      JMS I GOOF /COMPLAIN WITH UNIT IN AC
5556  6361                      6361    /TILT 31, SELECT ERROR
5557  7300                      CLA CLL /CORRECT SWITCHES
5560  5217                      JMP RWBGN-2     /AND TRY AGAIN
5561  6772              DTFATL, DTRB    /HALT WITH STATUS B IN AC
5562  4502                      JMS I GOOF /REPORT THE CRASH
5563  6362                      6362    /TILT 32, FATAL ERROR
5564  5362                      JMP .-2 /NO RECOVERY
5565  0400              DT0400, 0400    /SELECT BIT MASK

                        /RE-READ/WRITE DECTAPE BUFFER
5566  2014              RRWBF,  ISZ ILC /IGNORE THE BLOCK NUMBER
5567  7240                      CLA CMA /SET THE RE-READ/WRITE FLAG
5570  3773                      DCA I RRWFI
5571  5772                      JMP I .+1
5572  5243                      DTEND-1
5573  5266              RRWFI,  RRWFLG
                        /DEFINITIONS FOR ASSEMBLER
      6761              DTRA=6761
      6762              DTCA=6762
      6764              DTXA=6764
      6771              DTSF=6771
      6772              DTRB=6772
      6774              DTLB=6774
      0057              DTFF=MMFF
```

```
                                    /FOSSIL DECTAPE ROUTINES FOR TC01 CONTROL
                                    /SHEET 118
                                    /DECTAPE BUFFER

          5600                      *5600
5600      3636                      BUFBEG, 3636      /START OF DECTAPE BUFFER
          5777                      *5777
5777      3636                      BUFEND, 3636

                                    L56,
                                    FIN,

          7577                      *7577
7577      0001                              1         /FOR DO LOOP INDEX OF ONE

                                    /END OF FOSSIL

                                    $


THERE ARE NO ERRORS
```

SYMBOL TABLE

ACTP	4000
ADBUF	5256
ADD	2105
ADDR	0561
ADDS	2110
AFF	4074
AFIN	2022
AFJ	4046
AFN	4077
AFRET	4060
AFX	4063
AGAN	1010
AIT	4003
ALGN	2247
ALN	0103
AMT	2246
ARL1	4735
ARMØ	4673
ARPØ	4677
ARST	4663
ARTN	0031
ARWTP	5261
ARZØ	4676
AR11	4750
AR13	4745
AXF	4036
AXJ	4016
AXN	4021
AXRET	4021
AXX	4027
BEG	0200
BEGI	0154
BEXI	0104
BEXP	1153
BLOCK	5255
BOTH	2275
BREAD	5171
BREADI	0105
BTYPE	3271
BTYPEI	0106
BUFBEG	5600
BUFEND	5777
BUFPNT	0047
BUFSIZ	5260
C	2715
CAM	3543
CEE	4176
CGOT	0422
CGT	1350
CHEK	2107
CHK	2717
CHLF	2775
CHME	1711

SYMBOL TABLE

CHR	1532
CHSP	1467
CISZ	3166
CKSM	0330
CLUP	3540
CMCR	1531
CMLF	0076
CNT	0556
CNTR	3045
CON	0024
CONG	1753
CONJ	1750
CONT	3451
COSI	0026
COST	4343
CPER	1345
CRLF	3670
CRZ	0060
CSTA	1757
CSTAI	2000
CSTK	0012
CVRT	1652
CVR1	1667
C100	1744
C13	3064
C200	1745
C260	1746
C27	1714
C40	1743
C47	3450
C53Z	0074
C9	4350
D	2714
DDII	0111
DDVD	2400
DD1	2476
DD2	2414
DD4	2447
DEX	0531
DEXL	0546
DGT	1472
DIV	0005
DIVR	0006
DIV5	2140
DLM	3446
DMUL	2600
DO	3400
DONE	2320
DONO	0034
DPCS	1033
DPCV	1000
DPM	1157
DPNI	0116

SYMBOL TABLE

DPS	0114
DPV	0115
DREI	2512
DSTA	1165
DSTAL	1200
DSTK	0013
DTADR	5262
DTBEG	5204
DTCA	6762
DTEND	5244
DTENDI	2562
DTEROR	5550
DTFATL	5561
DTFF	0057
DTFMR	1510
DTGO	5252
DTIC	5347
DTINS	0062
DTJ	5311
DTJF	5315
DTJI	0117
DTJX	5323
DTLB	6774
DTRA	6761
DTRB	6772
DTRD	5263
DTSF	6771
DTWR	5264
DTXA	6764
DT0400	5565
DVAR	1756
DVD	0112
DV1	2475
DV3	2426
DX7000	5265
EHR	3542
EIN	2514
END	3547
ENTR	3650
ERRD	2162
ERRR	3132
ERRT	3170
FRR1	5050
ETT	0636
ETTI	0120
EXEF	2243
EXIT	2233
EXM1	4550
EXP1	4560
EXST	4542
EXTU	1677
Ex1	2563
Ex2	2566

SYMBOL TABLE

FX3	2571
FX4	2574
FAD	0172
FADD	0012
FCST	0022
FDIV	0016
FDST	0023
FOVR	0017
FE	3706
FEXP	0030
FFIX	3000
FI	3703
FIF	0023
FILC	0024
FIN	6000
FINK	1600
FINT	3164
FIST	0021
FITN	3165
FIXOK	5366
FIXOKI	0122
FK1	1615
FK2	1617
FK3	1623
FLAG	1755
FLDI	7002
FLDS	5002
FLFI	0041
FLFL	0040
FLFX	0036
FLM1	5145
FLOA	0010
FLOG	0027
FLOT	3046
FLP1	5137
FLTOK	5356
FLXI	0037
FLZ1	5143
FMINUS	1031
FMPY	0015
FMT	2173
FMTI	3771
FNEG	0035
FNKI	0121
FN1	1245
FN2	1263
FN3	1272
FN4	1300
FN4A	1303
FN5	1310
FN5A	1313
FN6	1320
FN7	1311

SYMBOL TABLE

FOMI	0123
FOMT	3640
FONI	0124
FONK	1200
FOOF	3033
FOUR	1344
FRMT	0045
FSRR	0014
FSTI	7402
FSTK	0020
FSTS	5402
FSUB	0013
FUDG	1343
FWD	0226
FXAD	0001
FXP	1400
FXPI	0125
FXSB	0002
F00	0077
F02	0377
F1ST	5064
F2ST	5127
F22	2377
F24	2577
F3ST	5103
F30	3174
F36	3774
F36T	3776
F4ST	5113
F40	4177
F52	5375
GAR	1347
GOOF	0102
GOTO	2477
GRIND	0564
GRINDI	0126
HALT	3573
HANGON	0577
HDP	1474
HIC	1154
HICI	0127
HIE	0562
HIGH	0563
HILOP	0051
HILOR	0052
HL1	3577
H1	0041
H2	0044
IATN	4656
ICHR	0110
ICOS	4336
IOT	0163
IEXP	4535

SYMBOL TABLE

IF	2503
IFFI	5122
IFLF	5057
IFLX	5076
IFMT	3772
IFX	0050
IFXI	5106
IGN	0263
ILC	0014
ILOG	4367
ILVE	0007
IMP	0403
IMPI	0132
INC	0557
IND	0454
INS	1050
INSI	0133
INST	0560
INT	0401
INTI	0100
INTP	3442
INTR	0056
IOAD	0046
IOR	3744
IOREG	0355
IORI	0130
IOT	2517
IOTI	0131
IOUT	3117
IRET	0414
ISIN	4204
ISQT	4772
ISTA	0751
ISTAL	1000
ISTK	0011
ITEN	2755
ITHR	2757
ITL	2552
ITWE	2756
IXCH	1500
IXCI	0134
JMPT	1423
KEEP	2713
KEP	3710
KEPT	3713
LATE	3040
LDSI	6002
LDST	4002
LEAD	0314
LESE	0043
LEV	3603
LILC	0034
LJR	3447

SYMBOL TABLE

LLCC	2731
LOAD	0516
LOCONE	0354
LOG2	3557
LOL1	4477
LOM1	4432
LOOP	0204
LOP	2217
LOP0	4413
LOP1	4422
LOST	4374
LO70	4404
LO7	4510
LO8	4505
LPFB	2703
LPRT	2673
LSTK	0030
LSUB	3077
LTS	0272
LT2	0073
LT5	0072
LT6	0071
LUP	0446
LUPC	3466
LUPD	3420
LUPF	3644
LUPJ	3146
LUPP	1421
LUPY	0235
LWC	1155
LWC1	0135
L00	0100
L01	0200
L02	0400
L04	0600
L06	1000
L1	0042
L10	1200
L12	1400
L14	1600
L16	2000
L2	0045
L20	2200
L22	2400
L24	2600
L26	3000
L30	3200
L32	3400
L34	3600
L36	3776
L367	3776
L47	4200
L57	5200

SYMBOL TABLE

L52	5400
L56	6000
MAKE	0322
MET1	0035
MIDG	1161
MIF	2474
MINS	0720
MIM1	0733
MIRI	0140
MI10	0144
MMFF	0057
MMIC	5337
MMINS	5346
MMM	2761
MM1	2716
MNIN	1061
MNINF	1060
MNPO	1063
MODE	0053
MONT	0070
MPER	0066
MPY	0113
MP1	2706
MP2	2707
MP2I	0141
MP3	2710
MP4	2660
MP4I	0142
MP5	2711
MP6	2665
MRUB	1062
MSGN	1135
MSN	0143
MTAD	1120
MTREG	5204
MTCKL	3677
MTDI	0145
MTH	0063
MTRL	1105
MTW	0064
MT10	1065
MULT	0146
MUL5	2123
MUS	2037
M003	5547
M13	3044
M16	0065
M45	3773
M6	1342
NCN	1475
NEG	0137
NEG1	0136
NNN	2760

SYMBOL TABLE

NNX	3426
NOGO	2323
NOOP	0401
NOR	0147
NORM	2200
NREF	0474
NSUB	3070
NUME	3173
NUMI	1162
NZDIG	1446
NZFO	1231
NZFXP	1441
OK	2056
ONE	2262
ON2	3614
OREZ	3544
ORG	0214
OTCH	1727
OTCI	0150
OTDG	1723
OTDI	0151
OTEI	0152
OTEN	1720
OTM	1742
OUT	1517
OUTI	0153
OUTL	1523
OVL	3107
OVLI	0101
OWT	3552
PAUS	0046
PAWS	0400
PERB	3502
PGT	2365
PGTT	2371
PHOS	0246
PI	3565
PIOF	3570
PIOT	4364
PLUP	1471
PPLU	1451
PPP	2762
PRSW	1713
PRSWI	1064
PSEU	0221
PSTART	3776
PTP	0061
PTW	0062
PZH	1466
QIN	3731
QREAD	2372
QREADI	3155
QTYPE	3264

SYMBOL TABLE

CTYPEI	0156
QUOH	2472
QUOL	2473
QUOT	3714
RCC	3541
RDIV	2170
READ	0304
REAL	0334
RED	0300
REM	1160
REVBLK	5546
RPGHI	1571
RPGHO	1546
RPGI	0335
RPGIN	1556
RPGMI	1573
RPGMO	1550
RPGOUT	1533
RPGTEM	1555
RPGTI	3277
RR	1327
RRT	1346
RRWBF	5566
RRWBFI	5267
RRWFI	5573
RRWFLG	5266
RSET	3737
RSUB	2120
RTRY	0336
RUNF	3555
RWADRN	5534
RWADCA	5532
RWADWC	5533
RWAGN	5470
RWBCNT	5531
RWBGN	5421
RWBLK	5530
RWBN	5525
RWCLOC	5527
RWFWD	5446
RWM12	5524
RWM200	5544
RWREGA	5526
RWREV	5433
RWTAPE	5400
RWTCNT	5523
RWWAIT	5502
RWWOUT	5521
RW0003	5545
RW0070	5543
RW0077	5542
RW0110	5540
RW0200	5541

SYMBOL TABLE

RW0210	5537
RW0610	5536
RW7000	5535
R10	0067
R6	1747
SAV	2471
SC	4353
SCE	5371
SCND	2350
SE	3762
SEXP	1712
SFIX	0506
SGN	1156
SGNI	0160
SIGN	2245
SIL1	4331
SINE	0025
SIST	4211
SM1	4236
SM3	4254
SND	0157
SPCNT	1470
SP1	4242
SP3	4263
SP4	4277
SQL1	5044
SQP1	5007
SQRE	5161
SQRT	0032
SQST	4777
SQZ1	5056
SSSB	5154
STAG	0055
STAK	3300
STAKL	3400
STDP	1473
STK	0010
STOI	4401
STOP	0042
STSI	6402
STST	4402
SUB	2113
SUBL	0052
SUBN	0051
SUBR	0003
SWAP	0666
SWA1	0707
SWP	0161
SWPT	0706
SWP1	0162
SZ1	4241
SZ2	4251
SZ4	4274

SYMBOL TABLE

TABL	3200
TEMA	0015
TEMB	0016
TEMC	0017
TEMT	3167
TEMØ	0331
TEM1	0332
TEM2	0333
TEN	1715
TENI	0164
TFA	2551
TFF	4107
TFJ	4105
TFX	4137
THIR	2712
THRO	0020
TIC	1163
TIT	4102
TITI	0165
TJF	4130
TJX	4155
TRAN	0021
TRM	3635
TTHR	3631
TURG	0505
TUHI	2752
TULW	2747
TVA	0621
TVAI	0166
TWC	1164
TWO	2267
TWOP	3562
TXF	4113
TXJ	4111
TXX	4147
TYPE	4100
T2	2327
T3	2330
T4	2331
UFR	5254
UFLO	0011
UNDF	0746
UNO	0167
UNOR	2332
VAL	3636
WDCNT	0050
WHR	3637
WMMF	5303
WMMFI	0170
WMMX	5270
WMMXI	0171
WRTE	0044
X	0025

SYMBOL TABLE

XADD	2000
XAZ	2024
XDIV	2050
XET	0173
XETT	0612
XIF	2515
XIS	3556
XMPY	0004
XMUL	2034
XPN	0174
XPND	0645
XPN1	0656
XRDV	2102
XRSU	2031
XSQR	3065
XSUB	2026
XTRN	0054
XTV	0175
XTVA	0600
XXC	3600
XXCI	0176
XXJ	2763
XXJI	0177
XXT	2777
XX5	2305
X1	0040
X2	0043
YFMT	3760
ZERR	2070
ZWEI	2513

SYMBOL TABLE

FXAD	0001
FXSB	0002
SUBR	0003
XMPY	0004
DIV	0005
DIVR	0006
ILVE	0007
FLOA	0010
STK	0010
ISTK	0011
UFLO	0011
FADD	0012
CSTK	0012
DSTK	0013
FSUB	0013
FSBR	0014
ILC	0014
TEMA	0015
FMPY	0015
FDIV	0016
TEMB	0016
FDVR	0017
TEMC	0017
FSTK	0020
THRO	0020
FIST	0021
TRAN	0021
FCST	0022
CGOT	0022
FIF	0023
FDST	0023
FILC	0024
CON	0024
X	0025
SINE	0025
COSI	0026
FLOG	0027
LSTK	0030
FEXP	0030
ARTN	0031
SQRT	0032
LILC	0034
DONO	0034
MET1	0035
FNEG	0035
FLFX	0036
FLXI	0037
X1	0040
FLFL	0040
H1	0041
FLFI	0041
L1	0042
STOP	0042

SYMBOL TABLE

X2	0043
LESE	0043
WRTE	0044
H2	0044
FRMT	0045
L2	0045
PAUS	0046
IOAD	0046
BUFPNT	0047
WDCNT	0050
IFX	0050
SUBN	0051
HILOP	0051
SURL	0052
HILOR	0052
MODE	0053
XTRN	0054
STAG	0055
INTR	0056
MMFF	0057
DTFF	0057
CRZ	0060
PTH	0061
PTW	0062
DTINS	0062
MTH	0063
MTW	0064
M16	0065
MPER	0066
R10	0067
MODT	0070
LT6	0071
LT5	0072
LT2	0073
C53Z	0074
CHLF	0075
CMLF	0076
F00	0077
L00	0100
INTI	0100
OVLI	0101
GOOF	0102
ALN	0103
BEXI	0104
BREADI	0105
BTYPEI	0106
CHEK	0107
ICHR	0110
DDII	0111
OVD	0112
MPY	0113
OPS	0114
OPV	0115

SYMBOL TABLE

DPNI	0116
DTJI	0117
ETTI	0120
FNKI	0121
FIXOKI	0122
FOMI	0123
FONI	0124
FXPI	0125
GRINDI	0126
HICI	0127
IOBI	0130
IOII	0131
IMPI	0132
INSI	0133
IXCI	0134
LWCI	0135
NEG1	0136
NEG	0137
MIRI	0140
MP2I	0141
MP4I	0142
MSN	0143
MI1Ø	0144
MTDI	0145
MULT	0146
NOR	0147
OTCI	0150
OTDI	0151
OTFI	0152
OUTI	0153
REGI	0154
QREADI	0155
QTYPEI	0156
SND	0157
SGNI	0160
SWP	0161
SWP1	0162
TDT	0163
TENI	0164
TITI	0165
TVAI	0166
UNO	0167
WMMFI	0170
WMMXI	0171
FAD	0172
XET	0173
XPN	0174
XTV	0175
XXCI	0176
XXJI	0177
REG	0200
L01	0200
LOOP	0204

SYMBOL TABLE

ORG	0214
PSEU	0221
FWD	0226
LUPY	0235
PHOS	0246
IGN	0263
LTS	0272
RED	0300
READ	0304
LEAD	0314
MAKE	0322
CKSM	0330
TEM0	0331
TEM1	0332
TEM2	0333
REAL	0334
RPGI	0335
RTRY	0336
LOCONE	0354
IOBEG	0355
F02	0377
L02	0400
PAWS	0400
NOOP	0401
INT	0401
IMP	0403
IRET	0414
LUP	0446
IND	0454
NREF	0474
TUBG	0505
SFIX	0506
LOAD	0516
DEX	0531
DEXL	0546
CNT	0556
INC	0557
INST	0560
ADDR	0561
HIE	0562
HIGH	0563
GRIND	0564
HANGON	0577
XTVA	0600
L04	0600
XETT	0612
TVA	0621
ETT	0636
XPND	0645
XPN1	0656
SWAP	0666
SWPT	0706
SWA1	0727

SYMBOL TABLE

MINS	0720
MIN1	0733
UNDF	0746
ISTA	0751
L06	1000
ISTAL	1000
DPCV	1000
AGAN	1010
FMINUS	1031
DPCS	1033
INS	1050
MNINF	1060
MNIN	1061
MRUB	1062
MNPO	1063
PRSWI	1064
MT10	1065
MTRL	1105
MTAD	1120
MSGN	1135
REXP	1153
HIC	1154
LWC	1155
SGN	1156
OPN	1157
REM	1160
MIDG	1161
NUMI	1162
TIC	1163
TWC	1164
DSTA	1165
L10	1200
DSTAL	1200
FONK	1200
NZFO	1231
FN1	1245
FN2	1263
FN3	1272
FN4	1300
FN4A	1303
FN5	1310
FN7	1311
FN5A	1313
FN6	1320
RR	1327
M6	1342
FUDG	1343
FOUR	1344
CPER	1345
RRT	1346
GAR	1347
CGT	1350
FXP	1400

SYMBOL TABLE

L12	1400
LUPP	1421
JMPT	1423
NZFXP	1441
NZDIG	1446
PPLU	1451
PZH	1466
CHSP	1467
SPCNT	1470
PLUP	1471
DGT	1472
STDP	1473
HDP	1474
NCN	1475
IXCH	1500
DTFMR	1510
OUT	1517
OUTL	1523
CMCR	1531
CHR	1532
RPGOUT	1533
RPGHO	1546
RPGMO	1550
RPGTEM	1555
RPGIN	1556
RPGHI	1571
RPGMI	1573
FINK	1600
L14	1600
FK1	1615
FK2	1617
FK3	1623
CVRT	1652
CVR1	1667
EXTU	1677
CHME	1711
SEXP	1712
PRSW	1713
C27	1714
TEN	1715
OTEN	1720
OTDG	1723
OTCH	1727
OTM	1742
C40	1743
C100	1744
C200	1745
C260	1746
R6	1747
CONJ	1750
CONG	1753
FLAG	1755
CVAR	1756

SYMBOL TABLE

CSTA	1757
XADD	2000
L16	2000
CSTAL	2000
AFIN	2022
XA7	2024
XSUB	2026
XRSU	2031
XMUL	2034
MUS	2037
XDIV	2050
OK	2056
ZERR	2070
XRDV	2102
ADD	2105
ADDS	2110
SUR	2113
RSUB	2120
MUL5	2123
DIV5	2140
FRRD	2162
RDIV	2170
FMT	2173
L20	2200
NORM	2200
LOP	2217
EXIT	2233
EXEF	2243
SIGN	2245
AMT	2246
ALGN	2247
ONE	2262
TWO	2267
BOTH	2275
XX5	2305
DONE	2320
NOGO	2323
T2	2327
T3	2330
T4	2331
UNOR	2332
SCMD	2350
PGT	2365
PGTT	2371
ORFAD	2372
F22	2377
DOVD	2400
L22	2400
DO2	2414
DV3	2426
DO4	2447
SAV	2471
QUOH	2472

SYMBOL TABLE

QUOL	2473
MIF	2474
DV1	2475
DD1	2476
GOTO	2477
IF	2503
DREI	2512
ZWEI	2513
EIN	2514
XIF	2515
IOI	2517
TFA	2551
ITL	2552
DTENDI	2562
EX1	2563
EX2	2566
EX3	2571
EX4	2574
F24	2577
L24	2600
DMUL	2600
MP4	2660
MP6	2665
LPRT	2673
LPFB	2703
MP1	2706
MP2	2707
MP3	2710
MP5	2711
THIR	2712
KEEP	2713
D	2714
C	2715
MM1	2716
CHK	2717
LLCC	2731
TULW	2747
TUHI	2752
ITEN	2755
ITWE	2756
ITHR	2757
NNN	2760
MMM	2761
PPP	2762
XXJ	2763
XXT	2777
L26	3000
FFIX	3000
FOOF	3033
LATE	3040
M13	3044
CNTR	3045
FLOT	3046

SYMBOL TABLE

C13	3064
XSQR	3065
NSUB	3070
LSUB	3077
OVL	3107
IOUT	3117
FRRR	3132
LUPJ	3146
FINI	3164
FITN	3165
CISZ	3166
TEMT	3167
ERRT	3170
NUME	3173
F30	3174
L30	3200
TABL	3200
QTYPE	3264
RTYPE	3271
RPGTI	3277
STAK	3300
STAKL	3400
00	3400
L32	3400
LUPD	3420
NNX	3426
INTP	3442
DLM	3446
LJR	3447
C47	3450
CONT	3451
LUPC	3466
PERB	3502
CLUP	3540
RCC	3541
EHR	3542
CAM	3543
ORFZ	3544
END	3547
QWT	3552
RUOF	3555
XIS	3556
LOG2	3557
TWOP	3562
PI	3565
PIOF	3570
HALT	3573
HL1	3577
XXC	3600
L34	3600
LEV	3603
QN2	3614
TTHR	3631

SYMBOL TABLE

TRM	3635
VAL	3636
WHR	3637
FOMT	3640
LUPF	3644
ENTR	3650
CRLF	3670
MTCKL	3677
FI	3703
FE	3706
KEP	3710
KEPT	3713
QUOT	3714
QIN	3731
RSET	3737
IOB	3744
YFMT	3760
SE	3762
FMTI	3771
IFMT	3772
M45	3773
F36	3774
PSTART	3776
L36	3776
F36T	3776
L36T	3776
ACTP	4000
LDST	4002
AIT	4003
AXJ	4016
AXRET	4021
AXN	4021
AXX	4027
AXF	4036
AFJ	4046
AFRET	4060
AFX	4063
AFF	4074
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TIT	4102
TFJ	4105
TFF	4107
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TXF	4113
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SZ1	4241
SP1	4242
SZ2	4251
SM3	4254
SP3	4263
SZ4	4274
SP4	4277
SIL1	4331
ICOS	4336
COST	4343
C9	4350
SC	4353
PIOT	4364
ILOG	4367
LOST	4374
STOI	4401
STST	4402
LOZØ	4404
LOPØ	4413
LOP1	4422
LOM1	4432
LOL1	4477
LO8	4505
LO7	4510
IEXP	4535
EXST	4542
EXM1	4550
EXP1	4560
IATN	4656
ARST	4663
ARMØ	4673
ARZØ	4676
ARPØ	4677
ARL1	4735
AR13	4745
AR11	4750
ISQT	4772
SQST	4777
FLDS	5002
SQP1	5007
SQI1	5044
ERR1	5050
SQZ1	5056
IFLF	5057
F1ST	5064
IFLX	5076
F3ST	5103
IFX1	5106
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FLZ1	5143
FLM1	5145
SSSB	5154
SQRE	5161
BREAD	5171
L50	5200
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DTBEG	5204
DTEND	5244
DTGO	5252
UFB	5254
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ADBUF	5256
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DTADR	5262
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RRWFLG	5266
RRWBFI	5267
WMMX	5270
WMMF	5303
DTJ	5311
DTJF	5315
DTJX	5323
MMIC	5337
MMINS	5346
DTIC	5347
FLTOK	5356
FIXOK	5366
SCE	5371
F52	5375
RWTAPE	5400
L52	5400
FSTS	5402
RWBGN	5421
RWREV	5433
RWFWD	5446
RWAGN	5470
RWWAIT	5502
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RWBLK	5530
RWRCNT	5531
RWADCA	5532
RWADWC	5533
RWADBN	5534

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RW0110	5540
RW0200	5541
RW0077	5542
RW0070	5543
RWM200	5544
RW0003	5545
REVBLK	5546
M003	5547
DTERDR	5550
DTFATL	5561
DT0400	5565
RRWBF	5566
RRWFI	5573
BUFBEG	5600
BUFEND	5777
L56	6000
FIN	6000
LDSI	6002
STSI	6402
DTRA	6761
DTCA	6762
DTXA	6764
DTSF	6771
DTRB	6772
DTLB	6774
FLDI	7002
FSTI	7402