digital INTEROFFICE MEMORANDUM

ROB KRUYK
THE HAGUE

ONTVANGEN - 7 NOV. 1972

DATE: October 10, 1972

FROM: J. Duffy

DEPT: Small Systems

SUBJ: User functions and Commands in 8K Basic R/T

Before one tries to implement any functions or commands the following articles should be acquired.

1. Programming Languages 1972

2. Basic/RT User's Manual DEC-LB-U7ØB-D or the newer LAB8/e Manual, LAB8/e Software Systems User's Manual DEC-8E-ALUMA-A-D.

3. A Listing of Basic/RT DEC-8E-ABASA-A-LA.

1. Writing user functions in field Ø: There is no room in field Ø to write a user function. If it is desired to do so, a current function not being used can be deleted and replaced by the user function. For example, let the user function UUF square the value of the operand. The code for this example is on pp 12-46, Example 1 of Programming Languages 1972. If the function to be replaced is LOG which is at 6114 of field Ø, the origin of the function in the example would be *6114 instead of *7700. The function name would remain at location 1156. If a CDF is issued, the data field must be reset to 1.

2. Writing user functions in field 1: The room available to write user functions is from 65 to 174 of field 1. If additional space is needed in field 1, the value at PLIMIT (location 2561) can be changed. For example, if 64 locations are needed PLIMIT can be set to 7100, then locations 7000 to 7077 can be used by the user. The next important thing is that the floating point package can not be used from field 1. Hence the example given in 1 above could not be done from field 1. However, the FAC can be changed or an FPP subroutine can be called from field 1. An example of calling the FIX routine is shown at 677 of field 1 by routine UUPFIX. If a CDF Ø is given, a CDF 1Ø must be given before returning to field Ø.

To write a user function in field 1, put a 7747 at location 1156 of field Ø. At Location 764 of field 1 put UUF. Then put the UUF subroutine in available core. For example, if the subroutine is to start at location 65 of field 1 the user function overlay code should be

```
        FIELD Ø
        *1156
        7747

        FIELD 1
        *764
        UUF

        *65

UUF,    Ø
        §    code
        JMP I UUF
```

Note when the UUF subroutine is entered the argument of the function is in the FAC.

EXAMPLE 1. $UUF(A)=A^2$

UUF function in field Ø

```
        FENTER=4435
        FST=2000
        FWD=200
        FMP=6000
        FEXIT=0000
        FIELD Ø
        *1156
        UUF

        *6114

UUF,    Ø
        FENTER                  /ENTER FPP
        FST+FWD+X-.             /Save N
        FMP+FWD+X-.             /N*N
        FEXIT
        JMP I UUF

X,      Ø
        Ø
        Ø
        $
```

EXAMPLE 2. $UUF(A)=A^2$

UUF function in field 1

```
        FIELD Ø
        *1156
        7747'

        FIELD 1
        *764
        UUF

        *65

UUF,    Ø

        JMS  UUF1
        CDF  CIF Ø
        JMS  I UFLDO
        JMS  UUF1
        CDF  1Ø
        JMP  I UUF

UUF1,   Ø

        TAD  UM12
        DCA  UUF2
        TAD  UFLD1
        DCA  UUF3
        TAD  UFLDØ
        DCA  UUF4

UUF6,   CDF  1Ø
        TAD  I UUF3
        DCA  UUF5
        CDF  Ø,
        TAD  I UUF4
        CDF  1Ø
        DCA  I UUF3
        CDF  Ø
        TAD  UUF5
        DCA  I UUF4

        ISZ  UUF3
        ISZ  UUF4
        ISZ  UUF2
        JMP  UUF6

        JMP  I UUF1
```

/interchange field Ø + 1 code

/call UUF in field Ø
/reexchange code

/exit from UUF

/load number of words to exchange

/set field 1 and Ø addresses

/exchange values

/get next word

```
UUF2,   Ø
UUF3,   Ø
UUF4,   Ø
UUF5,   Ø
UM12, -12
UFLDØ, 6114
UFLD1, UUFX

UUFX,   Ø
        4435        /FENTER
        2205        /FST+FWD+X-.
        6204        /FMP+FWD+X-.
        0000        /FEXIT
        CDF CIF 1Ø
        5714        /JMP I UUF
        Ø           /X
        Ø
        Ø
```

In this example the user function was moved to field Ø, so that it could use the floating point package. The only restriction is that the UUF can't be called at the same time the LOG function is called. The example isn't a very good programming technique, but is meant only to demonstrate the calling sequence of a UUF in field 1.

3. Writing a user command in field Ø: The section in the Basic/RT user manual or the Basic/RT section of the new manual describes how to implement a user command. However, there is no available room in field Ø and some function or command must be eliminated to make room. To implement a user command in field Ø, store UCOM at location 306 of field Ø and write the command over an existing function. Example 3 writes the command over the ExP function.

Return to Basic by jumping to DEVCON, DEVCOM or SKIPIT as described in the Basic user's manual.'

4. Writing a user command in field 1: To put the command in field 1, put a 7743 at location 306 of field Ø and the UCOM address at 744 of field 1. At the end of the UCOM code exit back to field Ø by doing a

```
JMS I UJMP
DEVCON
```

or

```
JMS I UJMP
DEVCOM
```

or

```
JMS I UJMP
SKIPIT
```

depending on the condition of the user command as explained in the Basic/RT user's manual. When a user's command UCOM is entered the data field is for field 1 (CDF 1Ø). On exit the data field must also be field 1. Remember the floating point package can not be called from field 1.

EXAMPLE 3. User command in field Ø. In this example, UCOM A,B will multiply A times B, fix the answer, add 260 octal to the value and issue a TLS.

```
                    /BAS03
          0016      AC3=16
          4744      FIX=4744
          0177      GETWD=177
          7616      MEVAL=7616
          4435      FENTER=4435
          0200      FWD=200
          2000      FSTA=2000
          0000      FEXIT=0
          6000      FMU=6000
          7176      DEVCON=7176
          0306                *306
    00306 6114                UCOM
          6114                *6114
    06114 4740      UCOM,     JMS I XGETWD
    06115 4741                JMS I XMEVAL
    06116 4435                FENTER
    06117 2226                FSTA+FWD+TEMP-.
    06120 0000                FEXIT
    06121 4741                JMS I XMEVAL
    06122 4435                FENTER
    06123 6222                FMU+FWD+TEMP-.
    06124 0000                FEXIT
    06125 4742                JMS I XFIX
    06126 7200                CLA
    06127 1016                TAD AC3
    06130 1343                TAD UC260
    06131 6002                IOF
    06132 6041                TSF
    06133 5332                JMP .-1
    06134 6046                TLS
    06135 6001                ION
    06136 7200                CLA
    06137 5744                JMP I XDEVCO      /exit
    06140 0177      XGETWD,   GETWD
    06141 7616      XMEVAL,   MEVAL
    06142 4744      XFIX,     FIX
    06143 0260      UC260,    260
    06144 7176      XDEVCO,   DEVCON
    06145 0000      TEMP,     0;0;0
    06146 0000
    06147 0000
```

EXAMPLE 4. User command in field 1. In this example, UCOM will type a Ø on the teletype (it may overtype the previous line).

```
/BAS04                          PAL8-V7                         PAGE 1


                        /BAS04
                                FIELD 0
                                *306
00306  7743                     7743
       0001                     FIELD 1
       0054             UJMP=54
       7175             DEVCOM=7175
       0744                     *744
00744  0065                     UCOM
       0065                     *65
00065  7200             UCOM,   CLA
00066  6002                     IOF
00067  6041                     TSF
00070  5067                     JMP .-1
00071  1077                     TAD UC260
00072  6046                     TLS
00073  6001                     ION
00074  7200                     CLA
00075  4454                     JMS I UJMP
00076  7175                     DEVCOM
00077  0260             UC260,  260
```

When loading Basic/RT from field 1, it will automatically start up. When a user function or command is to be used, two binary tapes must be loaded in which case the automatic startup is undesirable. If the LAB8/e has 12K or more, put the binary loader in field 2. Load both tapes and start Basic/RT in field Ø, data field Ø at location 1000. In an 8K machine, load Basic/RT and let it start up. Hit a control C, halt the machine and load the overlay tape via the binary loader. Restart Basic/RT at 1000 or 6725 of field Ø, data field Ø. Note, when loading the overlay tape with the binary loader, make sure the data field is set correctly.

In conclusion, to do functions or user commands more complicated then shown above, the correct subroutine calling sequence can be established from the listing and the attached documentation. Basic/RT was created from 4K Basic Edusystem 1Ø. There is documentation for 4K Basic Edusystem 1Ø. The Basic/RT documentation considers only the changes from 4K Basic to 8K Basic/RT.

jkw

```
UN2LUP, AND GO THROUGH THE USER SYMBOL TABLE AGAIN, REALLOCATING
UN2NOT, SPACE FOR A SCALAR FOR EACH VARIABLE.
UN2IN,
        ALSO SET UP THE LOCATION COUNTER, PUSH DOWN LIST, READ POINTER,
        FOR TABLE, AND GOSUB TABLE FOR EXECUTION OF A 'RUN'.
LIMIT, POINTER TO FIRST WORD OF USER SPACE(VARIABLE SPACE STARTS HERE).
XXTHEN,POINTER TO 'THEN' SYMBOL(FAKES LINE GETTER INTO STARTING
        THE LINE WITH A LINE NUMBER).
IST,  POINTER TO 'LIS' PROCESSOR.
XEOF, POINTER TO (EOF) SYMBOL.
ERMSY,POINTER TO PERM, SYMBOL TABLE(USER SYMBOL TABLE IS BELOW IT).
OTNOW,POINTER TO INDIRECT STATEMENT HANDLER(INSERTS LINES).
ND,   THE END STATEMENT IS EXECUTEABLE, IT IS NOT EQUIVALENT TO STOP'.
        IT CLEARS VARIABLES, THE REASON FOR THIS IS THAT AFTER A STOP.
        ALL ARRAYS WHICH WERE DEFINED AT THE TIME OF THE STOP REMAIN
        DEFINED(INTERACTIVE!). IF THE USER THEN CONTINUES TYPING MORE
        PROGRAM, HE WILL EVENTUALLY COME UP AGAINST THE 'TOO-BIG ERROR'.
        HE HAS TO HAVE A WAY OF CLEARING HIS ARRAYS TO GET PAST THE
        ERROR, AND RATHER THAN ADDING A COMMAND, THE END STATEMENT WAS
        UTILIZED. SO THE WAY TO GET PAST THE 'TOO-BIG ERROR' IN THIS CASE IS
        TO TYPE A DIRECT 'END' STATEMENT.
TOP,  PRINT 'READY' AND GO TO WAIT FOR A TELETYPE COMMAND.
OOLONG,THE 'LINE TOO LONG' MESSAGE.
ELETED,THE 'DELETED' MESSAGE.
ETLRET,FOR RETURNING FROM 'GETLIN' FROM OFF PAGE,
        AFTER INSERTING A LINE, FIX UP LINENO DEFINITIONS,
        RETURN.
E'LIN, ROUTINE FOR GETTING A TRANSLATED(INTO INTERPRETIVE CODE FORM)
        LINE FROM THE TELETYPE. IT IS ENTERED WITH SOMETHING
        IN THE AC-THAT SOMETHING BEING A POINTER TO 'THEN' IF THE LINE
        IS MEANT TO START WITH A LINE NUMBER(AS OPPOSED TO A LITERAL).
EWLI', GET A NEW LINE.
EWCHAR,ONE CHARACTER PER WORD IN TRIMMED ASCII
        WATCHING OUT FOR 175-ALT, 176-ALT, '←' '@' AND (CR),
        IGNORE NONPRINTING CHARACTERS(AND '@').
UBIG,  IF THE LINE IS BIGGER THAN THE BUFFER CAN HANDLE, PRINT
        'LINE TOO LONG' AND TRY FOR A NEW LINE.
LTMODE,PRINT 'DELETED' AND TRY FOR A NEW LINE.
ARROW, REMOVE PREVIOUS CHARACTER(IF THERE WAS ONE).
ARRET, NOW THERE IS A WHOLE LINE OF ASCII IN THE BUFFER, START
LOOP,  SCANNING OFF SYMBOLS ONE AT A TIME, FROM LEFT TO RIGHT.

LOOP,  IF THERE IS A MATCH WITH THE PERMANENT SYMBOL TAELE, USE THAT
        AS THE DEFINITION(IGNORE ALL BLANKS IN THE PERM, SYMBOL TABLE).
LOOP,
SKIP,
MATCH, WATCH OUT FOR THE SPECIAL CASE OF 'REM'(STUFF AFTER 'REM' IS
        TREATED AS IF IT WAS QUOTED TEXT).
36,    LITERALS.
40,
122,
76&2,
OTHER, POINTER TO WHERE TO GO IF THERE IS NO MATCH IN THE PERM, SYMBOL
        TABLE.
TABLE, POINTER TO THE PERMANENT SYMBOL TABLE.
```

```
        .1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1 ETC. CHALK IT UP TO 'LINE TOO LONG'.
PTUBIG, POINTER TO 'LINE TOO LONG',
PGETLEE,POINTER TO RETURN FROM 'GETLIN',
NOTCR,  ITS NOT A CARRIAGE RETURN SO
        IF ITS A DIGIT OR '.', GO ACCUMULATE A LITERAL,
        IF ITS A LETTER, GO LOOKUP OR CREATE A VARIABLE,
REMPACK,OTHERWISE IT IS QUOTED(OR UNQUOTED) TEXT,
TXTPAK, PACK TWO SIXBIT CHARACTERS PER WORD,
LHALF,  END WITH ONE OR TWO ZERO CHARACTERS(AT SIGNS DONT EXIST),
RHALF,  AND
CRINTXT,CARRIAGE RETURN FORCES END OF TEXT,
DQINTXT,SO DOES ANOTHER DOUBLE QUOTE,
MTXXIT, THEN TRY FOR ANOTHER SYMBOL,
PLETTER,WHERE TO GO TO MAKE OR FIND A VARIABLE,
07753,  LITERALS
042??,
042,
THISTXT,TEMPORARY,
NONBLNK,ROUTINE WHICH SKIPS OVER BLANKS(EVERYWHERE EXCEPT TEXT),
032,    LITERALS,
07737,
PXXCRLF,POINTER TO (CRLF) SYMBOL,
PXXEXIT,POINTER TO (EXIT) SYMBOL,
LITRAL, CREATE A LITERAL OUT OF THE FLOATING POINT AC,
        DEPENDING ON HOW MANY LOW ORDER ZEROES, IT CAN BE
JUST1,  12 BITS,
ALL3,   36 BITS,
JUST2,  24 BITS, OR
JUST?,  0 BITS LONG,
POPER?, AUTO INDEX POINTER TO FLOATING POINT TEMPORARY,
PXXLIT0,POINTER TO ZERO LENGTH LITERAL SYMBOL,
DIGIT,  A NUMBER IS TO BE ACCUMULATED, SO SET 'SNUMFLG' AS A FLAG
        TO TELL WHETHER IT SHOULD BE A LITERAL OR A STATEMENT NUMBER,
DIGIN,  SCAN DIGIT BY DIGIT MULTIPLYING BY 10.0,
ITSDP,  AND COUNTING THE NUMBER OF DIGITS AFTER A DECIMAL POINT,
ITSE,   AND WATCHING OUT FOR 'E' EXPONENT,
ITSP,   ACCUMULATE THE EXPONENT
NOTSGN, EITHER PLUS OR MINUS,
07673,  LITERAL,(WHICH IS NOT EXECUTED SINCE THE PREV, INSTRUCTION
        MUST SKIP),
ONLY1,
ENDNUM, AND SUBTRACT THE NUMBER OF DIGITS AFTER THE DECIMAL POINT,
        THEN SCALE THE NUMBER UP OR DOWN,
MULEXP, MULTIPLY BY 10.0 OR DIVIDE BY 10.0,
STAT?0, NOW COMES THAT FLAG FOR LINE NUMBER OR LITERAL,
STAT?0, MAKE A LINE NUMBER OUT OF IT,
FDIGIT, FLOATING POINT TEMPORARY FOR ADDING DIGITS ARE THEY ARE HIT,
MULXTEN,MULTIPLY BY 10.0 INSTRUCTION,
DIVXTEN,WHEN ADDED TO 'MULXTEN' MAKES A DIVIDE BY 10.0 INSTRUCTION,
DPFLAG, DECIMAL POINT FLAG,
DECFLAC,NUMBER OF DIGITS AFTER THE DECIMAL POINT,
ISDIG,  SPACE SAVER WHICH CHECKS IF THE CHARACTER IS A DIGIT,
027,    LITERALS,
01742,
01774,
PLITRAL,POINTER TO LITERAL MAKER,
COMMON, SEARCH THROUGH
LUP,    USER SYMBOL TABLE FOR A GIVEN LINE NUMBER
NOT,    AND IF IT IS IN THERE RETURN A POINTER TO IT
IN,     OTHERWISE PUT IT IN THERE AND THEN RETURN
```

```
          A POINTER TO IT.
ETTER,    THERE WAS A LETTER WHICH MUST BE A VARIABLE,
          WHICH MAY OR MAY NOT BE FOLLOWED BY A DIGIT.
          MAKE THE VARIABLE NAME,
SIMPLV,   AND SEARCH THE USER SYMBOL TABLE FOR THAT VARIABLE NAME.
VSCHLUP,IF IT IS FOUND, RETURN A POINTER TO IT.
ISDEF?,
ITSDEF,
'SCHNOT,OTHERWISE PUT ONE IN,
          SET UP THE CORRESPONDING VARIABLE SPACE, AND RETURN A POINTER
          TO THAT,
 .000,    LITERAL,
TEN,      FLOATING POINT 10.0 ,
POP,      PUSH DOWN LIST POPPER,
FOURLF,   TEXT OF FOUR (CRLF)S,
UGH1,     LINE MAKES PROGRAM 'TOO BIG, LINE IGNORED' MESSAGE,
LIST,     DOES THE LIST COMMAND,
          CHECKS IF THERE IS A LINE NUMBER FOLLOWING THE COMMAND,
          IF THERE IS, AND IT IS DEFINED, LIST FROM THAT LINE,
LISTALL,OTHERWISE LIST FROM THE BEGINNING,
LISTSOM,
LISTLUP,LISTING IS STOPPED BY TYPING ANY CHARACTER,
          IF IT'S (EOF) THEN THE LISTING IS DONE,
          IF IT'S A LINE NUMBER, PRINT IT,
LIST2,    IF ITS A VARIABLE, PRINT IT,
PRINVAR,TEMPORARY WHICH HOLDS THE VARIABLE NAME,
LIST3,    IF IT'S A LITERAL, THEN PRINT IT,
LIST4,    IF IT'S TEXT, THEN PRINT IT
4LUP,     IN A LOOP,
LIST5,    OTHERWISE IT'S A SYSTEM SYMBOL, SO PRINT THAT,
PRINTXT,SUBROUTINE FOR PRINTING PACKED ASCII TEXT,
PRLOOP,
PRTXRET,
PRSUBP,
CRLFPR,
07741,    LITERAL,
PRINUM,   ROUTINE FOR PRINT LINE NUMBERS,
          IT DOES IT BY CONVERTING TO FLOATING POINT(WHICH THE OUTPUT
          ROUTINE WILL PRINT IN INTEGER FORM),
0233,     LITERAL,
RESTORE,MUST BE FOLLOWED BY (CRLF) OR '\'
          RESETS THE READ-DATA POINTER,
BREAK,    'STOP'
READY,    'READY'
CRLF=     A CARRIAGE RETURN LINE FEED,
MOREIN,   IF IT'S A (CRLF) OR '\' THEN ITS THE END OF THE 'INPUT' STATEMENT,
INPUT,    PRINT A '?',
          GET A LINE,(CHECKING FOR 'STOP') AND FOR EACH VARIABLE, USING
'NPLUP,   'GETVAR' AND 'STOVAR', SWITCH THE LOCATION COUNTER FOR A POINTER
          INTO THE LINE BUFFER AND SCAN A VALUE(EXPRESSIONS OK,),
          AND SWITCH THE LOCATION COUNTER BACK AFTERWARD,
 NPPTR,   TEMPORARY,
 NWDTMP,TEMPORARY,
 NLCTMP,TEMPORARY,
01765,    LITERAL,
PSTOP,    POINTER TO 'STOP' SYMBOL,
XGISIT,   ROUTINE WHICH IMPLEMENTS 'GET+ISIT',
XISIT,    ROUTINE WHICH IMPLEMENTS 'ISIT',
ISITLIT,ROUTINE WHICH CHECKS FOR AND ACCUMULATES LITERALS(AT RUNTIME),
          2000+N FROM @WORD MEANS AN N WORD LITERAL,
```

LOADED, RETURN WITH IT IN THE FLOATING AC.
ISLIT, SPACE SAVER IN ISITLIT.
ERROR, ERROR MESSAGE PRINTING ROUTINE.
QERROR, 'ERROR'
FPT, SLIGHTLY ABNORMAL FLOATING POINT PACKAGE- 27 BIT MANTISSA,
HAS 7 ADDRESSABLE INSTRUCTIONS!
FLOATING JUMP,
FLOATING STORE,
FLOATING LOAD,
FLOATING ADD,
FLOATING SUBTRACT,
FLOATING MULTIPLY,
AND FLOATING DIVIDE.
ADDRESSING IS IS PAGE ZERO DIRECT OR INDIRECT IF BIT 4 IS OFF.
OTHERWISE IT IS RELATIVE TO THE PROGRAM COUNTER,
THERE ARE ALSO THE SIX FLOATING POINT SKIPS, AND AN EXIT.
PLOOP, NOW YOU COME TO MY(L.W.E.) BASIC PHILOSOPHY ON DOCUMENTATION.
PPGZ, IF THE READER DOES NOT KNOW PDP-8 CODE WELL ENOUGH TO READ THE
PDOIT, LISTING, HE SHOULD NOT BE MODIFYING THE CODE, THIS IS ESPECIALLY
PNOADR, TRUE FOR NUMBER CRUNCHING.
PGOTO,
PJUMP,
PADDR,
POPER,
PSKIP,
PJMP
PSTO
IGHWD,
'6DD
'LAC,
'APPR, MORE OF BASIC '↑' EXPONENTIATION, IF THE SECOND ARGUMENT
WAS SUITABLE, IT IS DONE BY REPEATED MULTIPLICATION,
R1,
CN,
)P3,
\DD,
'SUB,
PADD,
LGNLI,
CKWDI,
ETSGI,
)FAD
'MUL,
PYLUP,
JLCLR,
'PLOOP,
'TEMP,
'577,
ORM,
TSIG,
BUMP,
DEFF,
1,
DIV,
JLP,
ZDI',
FLOOP,
SN,
0, '43
FIX, SUBROUTINE TO DO BASIC 'INT' TO FLOATING AC.(INT(-1.5)=-2);

```
        IT RETURNS WITH THE AC EQUAL TO THE LOW ORDER WORD PLUS
        (IF ZERO ORIGIN INDEXING, THEN 1, ELSE Ø).
FIXLOP,
ZFIXEX,
FIXLPIT,
SSFIX,
07595,
ARGERR, PRINT 'ARGUMENT ERROR'
DOTZERO,'.Ø'
OUTNUM, ROUTINETO PRINT FLOATING AC IN BASIC FORMAT. GIVES NO LEADING
        OR TRAILING SPACES.
NONZERO,
CVTLOOP,
FMT2,
FMT1,   THIS ENTIRE ROUTINE IS STOLEN FROM TSS8 BASIC.
FMT3,
TRYAGIN,
ZEROOUT,
DIGLOP,
'IXUP,
 17,    LITERALS,
 253,
)255,
)305,
)752',
>MPY,
PNEF',
FIXITUP,
)CC,
IORMIT,
IORMED,
 OTX1Ø,
 XPG'DD,
 VLOOP,
 XPOK,
MPY,
NUMBUF, BUFFER FOR HOLDING ACCUMULATED NUMBER BEFORE PRINTOUT.
02062'  LITERALS,
0761',
07773,
RND,    BASIC 'RND' FUNCTION.(CAN BE DELETED.).
FRNC',
'RNDX,
'RNDC1,
FSQR',
SQR,    BASIC 'SQR' FUNCTION.(CAN BE DELETED.).
SQLOOP,
SQEXIT,
SQEXIT,
)07E',
'N,     BASIC 'FN' FUNCTION.(CAN BE DELETED.).
        EXPECTS 'USEFN' TO HAVVE A POINTER TO A LINE STARTING 'DEF',
        IT CHECKS FOR THAT, THEN 'PUSH'ES THE VALUE OF THE FORMAL
        PARAMETER, SETS IT EQUAL TO THE ACTUAL PARAMETER,
        EVALUATES THE RIGHT SIDE OF THE 'DEF' STATEMENT,
        THEN 'POP'S THE OLD VALUE OF THE FORMAL PARAMETER.
PUSH'FN,
TAN,    BASIC 'TAN' FUNCTION.CAN BE DELETED.).
COS,    BASIC 'COS' FUNCTION.(CAN BE DELETED.).
SIN,    BASIC 'SIN' FUNCTION.(CAN BE DELETED.).
```

FSI' 1C.,
FSI'0CK,
PSG',
PINT,
FTA' T1,
FTA'.T2,
TSI'.Z,
FSI'.ZZ,
FSI'.C1,
FSINC3,
FSINC4,
FSINC5,
FSINC6,
CSINC7,
CSINM4,
UPARRX, BASIC '↑' USING EXTENDED FUNCTIONS.
FUPRC1, IF THE SECOND ARGUMENT IS SUITABLE, DO IT BY THE MULTIPLICATION
METHOD, OTHERWISE,
EXPLNS, A↑B = EXP(LOG(A)*B) WITH POSSIBLE NEGATIVE ARG, TO LCG,
PLOG,
PEXP,
EXP, BASIC 'EXP' FUNCTION.(CAN BE DELETED.),
FXXFFX,
PPINT,
FEXPI,
FEXPU,
FEXFF,
FEXPC1,
FEXPC2,
FEXPC3,
FEXPC4,
FEXPC5,
FEXPC6,
LOG, BASIC 'LOG' FUNCTION.(CAN BE DELETED.),
FLOGC2,
FLOGC3,
FLOGC4,
LOGFWD,
LOGACC,
LOGOK%,
FLOGC1,
ATN, BASIC 'ATN' FUNCTION.(CAN BE DELETED.),
ATNLOW,
ATNC01,
ATNEI=,
FATNC4,
FATNA=,
FATNT,
FATNTT,
FATNC1,
FATNC2,
FATNC3,
FATNC4,
ATNC5,
FATNC6,
FATNC7,
FATNC8,
FATNC9,
FATNC,
FATNCH,

```
FATNCJ,
LIMIT,  FIRST LOCATION OF USER FREE SPACE,
        'PLIMIT' IS THE ONLY POINTER TO IT SO THAT CHANGING 'PLIMIT'
        IS ENOUGH TO REMOVE THE FUNCTIONS, THE INITIAL DIALOG
        DOES THIS ON COMMAND.
PERMSYM,THIS IS THE HIGHEST LOCATION OF CHANGEABLE USER STORAGE.
        THE PERMANENT SYMBOL TABLE IS JUST ABOVE IT.

        ITS FORM IS EXACTLY WHAT IT LOOKS LIKE:
        CODE WORD;TEXT 'THE SYMBOLS PRINT NAME'

LINBUF, THE LINE INPUT BUFFER, TRANSLATED LINE STARTS HERE,
        THERE IS NO COUNTER FOR THE FULLNESS OF THE LINE EXCEPT WHEN IT
        IS JUST COLLECTED,
LBEGIN, MORE OF THE LINE INPUT BUFFER, UNTRANSLATED ASCII COMES IN
        STARTING HERE FROM THE TELETYPE,
ENDLIN, THE ASCII CAN EXTEND AS FAR AS 'ENDPDL', BUT THE TRANSLATED
        LINE MUST END AT 'ENDLIN',
PDLIST, PUSH DOWN LIST USED ONLY FOR EXPRESSIONS AND THINGS LIKE THAT,
        'PDL' POINTS INTO THIS,
ENDPDL, END OF THE PUSH DOWN LIST,
FORLIST,FOR TABLE, A MAXIMUM OF 8 TWO WORD ENTRIES,
        A VARIABLE, AND THE LOCATION OF THE 'TO' IN THE 'FOR' STATEMENT,
        'FORCT' IS THE ONES COMPLEMENT OF THE NUMBER OF ENTRIES,
GOLIST, GOSUB TABLE, A MAXIMUM OF 8 ENTRIES,
        A POINTER TO AFTER THE GOSUB,
        'GSBPTR' POINTS INTO HERE TO THE NEXT FREE SPACE,
GSBEND, END OF THE GOSUB TABLE,
        7756 THROUGH 7777 ARE UNTOUCHED BY EXECUTION OF BASIC,
```

LAB-8/E DOCUMENTATION

THIS IS A DESCRIPTION OF THE INTERNAL WORKINGS OF BASIC FOR THE LAB-8/E. SINCE LAB-8/E BASIC IS A MODIFICATION OF EDUSYS-10 (OTHERWISE KNOWN AS 4K BASIC), THIS DOCUMENT WILL ONLY DESCRIBE THE CHANGES MADE TO EDUSYS-10 TO PRODUCE LAB-8/E BASIC.

LAB-8/E BASIC WORKS APPROXIMATELY THE SAME WAY AS EDUSYS-10 DOES. IT DIFFERS IN THE FOLLOWING RESPECTS:

1) LAB-8/E BASIC USES 8K OF CORE AS OPPOSED TO 4K OF CORE.
2) LAB-8/E BASIC USES INTERUPTS AND HANDLES MORE DEIVCES.
3) LAB-8/E BASIC HAS ADDITIONAL CODE TO HANDLE THE SPECIAL COMMANDS WHICH PERTAIN TO THE LAB-8/E.

WHAT FOLLOWS IS A LIST OF THE CHANGES MADE TO IMPLEMENT THE ABOVE FEATURES. KNOWLEDGE IS ASSUMED OF BASIC AND EDUSYS-10. A BRIEF DESCRIPTION IS PROVIDED AT THE END OF THIS MEMO WHICH DECRIBES WHAT THE ROUTINES ADDED DO, AND WHAT KEY CORE LOCATIONS MEAN.

1) 8K MODIFICATION.

TO MAKE BASIC USE 8K, THE FOLLOWING CHANGE WAS MADE. IN 4K EVERYTHING RESIDED IN FIELD 0. IN THE 8K VERSION, EVERYTHING FROM THE ARRAY SPACE ON UP NOW RESIDES IN FIELD 1. IN ADDITION, SOME CODE NOW RESIDES IN FIELD ONE TO HANDLE THE CLOCK AND A-D INSTRUCTIONS. THUS A CORE MAP WOULD LOOK LIKE:

00000-10777 BASIC SYSTEM [ALL CODE NEEDED FOR BASIC]
11000-17755 BASIC SYMBOL AREA. THIS AREA IS THE SAME AS IN 4K BASIC:
IT CONSISTS OF THE FOLLOWING IN THIS ORDER:

1) ARRAY AND VARIABLE SPACE
2) FREE SPACE (EVERYTHING 'GROWS' INTO THIS SPACE)
3) CODIFIED (COMPILED) BASIC PROGRAM IMAGE.
4) USER SYMBOL TABLE AREA;
5) BASIC'S PERMANENT SYMBOL TABLE AREA.
6) THE LINEBUFFER (TTY AND TRANSLATED LINE BUFFER)
7) THE STACK.
8) THE FOR-NEXT LIST
9) THE GO SUB LIST.

THUS UPPER CORE IS THE AREA WHERE ALL THE DRIVING TABLES AND PROGRAM-VARIABLE AREAS ARE IN BASIC.

17734-17777 LEFT ALONE [PRESERVED FOR THE RIM LOADER]

ALL OF THE SPACE THAT WAS IN FREE FIELD Ø IS NOW OCCUPIED BY CODE, THE BINARY LOADER MUST BE IN FIELD ONE DURING LOADING, WHEN BASIC IS STARTED, IT WILL DESTROY IT (BECAUSE IT IS IN THE BUFFER AREA), ONLY THE RIM LOADER WILL BE PRESERVED, LAB-8/E BASIC MAY NOT BE LOADED BY PS/8.

NOW THAT THE CORE LAYOUT HAS BEEN ESTABLISHED, THE MODE OF OPERATION WILL BE DISCUSSED. BASIC IN IT'S NORMAL MODE OF OPERATION WILL BE 'DIDDLING' WITH THE SYMBOL TABLE [EITHER THE PERMANENT ONE OR THE USER'S ONE], OR IT WILL BE EDITING, READING IN, OR TRANSLATING A LINE. THE LINE BUFFER IS IN FIELD ONE, AS IS THE SYMBOL TABLE, FOR-NEXT LIST, GO SUB LIST, ETC. THEREFORE, BASIC WILL BE SPENDING MOST OF IT'S TIME IN FIELD ONE. THIS MEANS THAT BASIC'S NORMAL MODE OF OPERATION IS FOR THE DATA FIELD TO BE SET TO FIELD 1. THEREFORE, THE DATA FIELD IS ALWAYS SET TO FIELD ONE EXCEPT IN THOSE RARE INSTANCES WHERE BASIC MUST REFERENCE FIELD Ø DATA INDIRECT, ONE SUCH PLACE WHERE THIS HAPPENS IS THE FLOATING POINT PACKAGE, THE FLOATING POINT PACKAGE SPENDS MOST OF IT'S TIME IN FIELD ZERO MODE. TO FIND OUT WHERE SUCH SPOTS OCCUR, THE CDF INSTRUCTIONS ARE TAGGED WITH THE COMMENT "/////////// 8K INSERT", THUS IF THE READER IS MODIFYING ONE OF THESE SECTIONS, HE SHOULD BE CAREFUL OF PICKING UP INDIRECT DATA OR EXITING WITH THE DATA FIELD SET INCORRECTLY. ALL TOTALED, THERE ARE RELATIVELY FEW CDF INSTRUCTIONS FOR THE SIZE OF A PROGRAM LIKE BASIC.

II) INTERUPT I/O

WE NOW COME TO THE SECTION WHICH MAKES THE BIGGEST DIFFERENCE BETWEEN EDUSYS-12 AND LAB-8/E BASIC. INTERUPT I/O GIVES LAB-8/E BASIC A 'SIMULATED' BETTER RUN-TIME BECAUSE OF BUFFERING AND ALLOWS THE CLOCK TO BE USED IN A REAL-TIME MANNER. A BASIC OVERVIEW FOLLOWS:

IT WAS STATED IN THE PREVIOUS SECTION THAT BASIC SPENDS MOST OF IT'S TIME IN FIELD ONE. THAT IS MOSTLY CORRECT, IF WE TAKE THE WORD 'BASIC' AS MEANING THAT PART WHICH RUNS OR TRANSLATES THE PROGRAM, THERE EXIST OTHER SECTIONS OF THE PROGRAM WHICH RUN WITHOUT EVER REFERENCING ANYTHING IN FIELD ONE. THE I-O ROUTINES ARE ONE OF THESE. THE I-O ROUTINES ARE BASIC'S WAY OF DEALING WITH THE OUTSIDE WORLD. IF BASIC WANTS TO PUT OR GET A CHARACTER, IT CALLS THE I-O ROUTINES TO DO THIS TASK. WHEN THE CHARACTER

IS PROCESSED, OR WHEN ONE IS TYPED, THE I-O ROUTINES WILL RETURN TO BASIC AND BASIC WILL CONTINUE TO 'RUN' UNTIL IT WANTS ANOTHER CHARACTER OR UNITL IT WANTS TO OUTPUT ANOTHER CHARACTER. IN REALITY, BASIC IS USUALLY WAITING FOR INPUT. WHEN BASIC CALLS THE I-O ROUTINES, THE I-O ROUTINES CHECK TO SEE IF IT CAN DO WHAT BASIC WANTS. IF IT CAN, IT DOES IT AND RETURNS TO BASIC. IF IT CANNOT, THEN IT WILL WAIT FOR AN INTERUPT TO OCCUR AND SEE IF CAN PROCESS IT. IF IT STILL CANNOT, IT WILL WAIT AGAIN UNTIL THE DESIRED CONDTION IS MET. WHILE WAITING, THE I-O ROUTINES 'PUT BASIC TO SLEEP'. THEY DO THIS BY EXECUTING A LITTLE PROGRAM CALLED NULJOB. NULJOB IS RUN WHENEVER THE I-O ROUTINES ARE WAITING FOR AN INTERUPT. IN LAB-8/E BASIC, NULJOB IS THE ROUTINE WHICH DISPLAYS THE CONTENTS OF THE DISPLAY BUFFER.

BASIC CALLS THE I-O ROUTINES TO GET OR PUT A CHARACTER. THE USE OF THE SCOPE WILL BE DISCUSSED IN THE NEXT SECTION.

A) THE GET ROUTINE:

THIS ROUTINE REQUESTS THE I-O ROUTINES TO GET A CHARACTER. THERE IS A FLAG ASSOCIATED WITH THIS ROUTINE. THIS FLAG IS CALLED 'INDEV'. INDEV IS EITHER A 1 OR 2. IF IT'S A ONE, THE GET ROUTINE (CALLED GETCH) WILL GET A CHARACTER FROM THE TTY. IF IT'S A TWO, IT WILL GET IT FROM THE HIGH SPEED READER. THE SEQUENCE OF EVENTS IS AS FOLLOWS:

GETCH FIRST CHECKS THE DEVICE FLAG. IF IT'S A ONE, THEN IT CHECKS TO SEE IF A CHARACTER HAS BEEN TYPED. TYPED CHARACTERS ARE LEFT BY THE INTERUPT ROUTINES IN A LOCATION CALLED 'INCHAR'. IF NO CHARACTER HAS BEEN TYPED, IT CALLS A ROUTINE CALLED 'BIDLE'. BIDLE PUTS BASIC TO SLEEP (RUNS THE NULL JOB) UNTIL AN INTERUPT OCCURS. AFTER BIDLE RETURNS, GETCH AGAIN LOOPS AND CHECKS INCHAR. IF STILL NOT SET, IT PUTS ITSELF TO SLEEP AGAIN.

FOR THE HIGH SPEED READER, THE SEQUENCE IS DIFFERENT. THE ROUTINE 'GWHERE' FIRST REQUESTS A CHARACTER FROM THE HIGH SPEED READER. IT THEN INCREMENTS A COUNTER AND TESTS THE WORD 'HRCHAR'. ON AN INTERUPT FROM THE HIGH SPEED READER, THE INTERUPT ROUTINES PLACE THE CHARACTER IN HRCHAR. IF GWHERE GETS A CHARACTER FROM HRCHAR BEFORE TIME RUNS OUT, IT JUMPS TO THE MIDDLE OF GETCH. IF TIME RUNS OUT, THEN IT PRINTS THE MESSAGE 'TTY' ON THE TTY, AND THEN RESETS INDEV TO 1, AND THEN JUMPS TO NEAR THE BEGINNING OF GETCH TO WAIT FOR A TTY CHARACTER.

ASSUME THAT WE ARE NOW IN GETCH WITH A CHARACTER. WE NOW 'MASK' ALL ALTMODES INTO 175. IF RUBOUTS ARE SELECTED, WE MASK 177'S INTO 137'S. BACKSPACE (210) IS ALSO MASKED INTO 137. THUS SOME PRE-EDITING IS DONE ON THE CHARACTER. IT IS THEN RETURNED IN THE AC FROM GETCH.

) THE PUT ROUTINE:

THIS ROUTINE PRINTS A CHARACTER ON THE DESIRED OUTPUT DEVICE. IT IS ALOT MORE COMPLEX THEN GET. LIKE GET, THERE IS A FLAG ASSOCIATED WITH THE OUTPUT DEVICE. IT IS CALLED 'OUTDEV'. OUTDEV RANGES FROM Ø TO 3. Ø IS NO OUTPUT, 1 IS TTY OUTPUT, 2 IS PTP OUTPUT, AND 3 IS LPT OUTPUT. 'PUTER', THE OUTPUT ROUTINE, IS FULLY BUFFERED.

THEREFORE, IT IS POSSIBLE TO STORE AWAY CHARACTERS IN IT'S BUFFER TO BE OUTPUT LATER. THE BUFFER IS LOCATED AT OBLOW TO OBHIGH. THEREFORE, TO PPEVENT DEVICE MIX-UPS, PUTER HAS IT'S OWN OUTPUT FLAG. IT IS CALLED 'ODEV'. ODEV CONTAINS THE NUMBER OF THE DEVICE WHICH IS NOW USING THE BUFFER. SHOULD PUTER BE CALLED TO PRINT A CHARACTER ON A DEVICE THAT IS DIFFERENT FROM THE ONE WHICH IS NOW USING THE BUFFER, PUTER WILL WAIT (VIA BIDLE) UNTIL THE BUFFER IS EMPTY. THEN IT WILL CONTINUE. THERE ARE TWO OTHER POSSIBLITIES. ONE IS THAT THE BUFFER IS EMPTY, THE OTHER IS THAT THERE ARE CHARACTERS IN IT BUT GOING TO THE SAME DEVICE. IF THE BUFFER IS EMPTY, PUTER 'ASSIGNS' THE BUFFER TO THE DEVICE AND CALLS 'OUTIT' TO OUTPUT THE CHARACTER. OUTIT REMOVES ONE CHARACTER FROM THE BUFFER AND OUTPUTS IT, IF IT'S POSSIBLE. IF THERE ARE CHARACTERS IN THE BUFFER, THEN PUTER MERELY STICKS THE CHARACTER IN THE BUFFER AND RETURNS. THERE IS ONE OTHER FLAG ASSOCIATED WITH THE BUFFER THAT SHOULD CONCERN THE READER, IT IS CALLED 'CNTLO' AND IS THE CONTROL O FLAG. THIS FLAG ESSENTIALLY SAYS WHETHER OR NOT WE ARE UNDER A CONTROL O (SUPPRESS OUTPUT). IF WE ARE INDEED UNDER A CONTROL FLAG, THEN WE DO NOT PROCESS CHARACTERS. INSTEAD WE JUST RETURN IMMEDIATELY.

C). THE INTERUPT CHAIN:

THIS IS THE ROUTINE WHICH CHECKS THE DEVICES ON AN INTERUPT. IT BASICALLY DOES THE FOLLOWING. IT FIRST SAVES THE STATE OF THE MACHINE (AC, LINK, ETC.). IT THEN DOES IOT'S TO FIND OUT WHICH DEVICE IS INTERUPTING. IF IT CANNOT FIND IT, IT HALTS (A FATAL ERROR). IF IT DOES FIND IT, IT GOES TO THE CORRECT ROUTINE. ON AN OUTPUT FLAG (TTY,LPT, PTP) IT CLEARS THE FLAG AND THEN CALLS OUTIT TO PRINT THE NEXT CHARACTER. ON A HIGH SPEED READER INTERUPT, IT PUTS THE CHARACTER IN HRCHAR. ON TTY INTERUPT, IT CHECKS TO SEE IF IT'S A CONTROL CHARACTER (^C OR ^O). IF IT ISN'T, IT MERELY PLACES THE CHARACTER IN INCHAR. IF IT IS A ^O, THEN IT SETS THE CNTLO FLAG AND CALLS 'OUTDEL' TO DELETE THE PRESENT OUTPUT BUFFER. IF IT'S A ^C, IT CHECKS NOINT (DISCUSSED AT THE END). IF IT'S OK TO STOP BASIC NOW, IT THEN RESETS BASIC WITH A STOP-READY MESSAGE AND GOES TO EDIT (THE EDITOR PORTION). THE ONLY OTHER DEVICE IN THE INTERUPT CHAIN IS THE CLOCK, WHICH WILL BE DISCUSSED LATER. TO EXIT FROM AN INTERUPT, 'INTEXT' RESTORES THE MACHINE (AC, LINE, ETC.)

) LAB-8\E ADDITIONS:

THE LAB-8\E ADDITIONS ARE BASICALLY A SERIES OF COMMANDS WHICH ERATE ON THE LAB-8\E PERIPHERALS. SINCE THE READER IS FAMILIAR WITH USYS-10, THE ACTUAL IMPLEMENTAION WILL NOT BE DESCRIBED. JUST THEIR LATIONSHIP WITH THE REST OF BASIC WILL BE DESCRIBED.

A) THE NULL JOB (OR NULJOB). THIS ROUTINE IS CALLED WHENEVER BASIC IS WAITING FOR SOMETHING TO HAPPEN. IT RUNS THE SCOPE IN LAB-8/E BASIC. IT IS ALSO CALLED VIA THE "DELAY" COMMAND. THE DIFFERENCE IS JUST IN THE MANNER OF EXIT. THE FLAG 'NDELAY' CONTROLS THAT. NULJOB CHECKS TO SEE IF THERE IS A PLOTTING BUFFER ASSIGNED. IF THERE IS (DISB IS NON-ZERO) THEN IT WILL SET UP DISAUTO TO BE DISB. IT WILL THEN TAKE OUT X-Y PAIRS OF POINTS AND DISPLAY THEM. A MINUS ENTRY IS THE END OF LIST INDICATOR. ON END OF LIST, IT GOES BACK TO NULJOB AND CHECKS NDELAY TO SEE IF IT SHOULD RETURN TO THE CALLER, IF NOT, IT THEN RESTARTS ALL OVER AGAIN BY RECHECKING DISB.

B) THE PLOT STATEMENT.

WHENEVER A PLOT COMMAND IS ENCOUNTERED, BASIC GOES TO 'PLOT'. PLOT FIRST CHECKS TO SEE IF A BUFFER IS ASSIGNED. IF ONE IS NOT ASSIGNED, IT ASSIGNS SPACE BY CHANGING ARRLOC. IT THEN CALLS PLOTB TO SET UP THE CORRECT BUFFER WORDS. WHEN A BUFFER IS PRESENT, PLOT CALLS MEVAL. MEVAL EVALUATES AN EXPRESSION. IT THEN MULTIPLIES THIS EXPRESSION BY FSHIFT FOR CORRECT SCREEN SCALING. IT THEN CALLS DBLIT TO PLACE IN THE SCOPE BUFFER. IT THEN GOES THE SAME FOR THE Y VALUE (EXCEPT NOT MULTIPLYING). WHEN ALL IS DONE, IT THEN GOES TO DEVCON TO CLEAN UP THE COMMAND.

C) THE USE STATEMENT.

THIS STATEMENT ALLOCATES A SCOPE BUFFER IN BASIC. IT FIRST CHECKS TO SEE IF A BUFFER IS ASSIGNED. IF ONE IS, IT RETURNS. IF ONE ISN'T, THEN IT CALLS GETARY TO FIGURE OUT THE SIZE OF THE ARGUEMENT AND TO ALLOCATE THE SPACE [ACTUALLY, IT'S ALREADY ALOCATED]. IT THEN SETS DISB TO THE CORRECT ADDRESS AND THEN CALLS PLOTB TO SET UP BUFFER. IT THEN EXITS TO DEVCON.

D) THE CLEAR COMMAND.

THIS STATEMENT CAUSES THE SCOPE BUFFER TO BE CLEARED. IF THERE IS A BUFFER PRESENT (DISB<>0), THEN IT PLACES AN ABORT CODE (4000) AS THE FIRST INSTRUCTION IN THE BUFFER. NULJOB WILL STOP DISPLAYING ON THIS, HENCE NOTHING WILL BE DISPLAYED.

E) THE TST FUNCTION.

THE TST FUNCTION TESTS WHETHER OR NOT A CHARACTER HAS BEEN TYPED BY PLACING 'INCHAR' IN AC3 AND THEN NORMAL ZING IT. BECAUSE INCHAR IS ALWAYS ZERO IF NO CHARACTER HAS BEEN TYPED AND IS ALWAYS NON-ZERO IF A CHARACTER HAS BEEN TYPED, THIS MAKES TST BEHAVE AS DESIRED AND DESCRIBED.

F) THE GET AND PUT FUNCTIONS.

THE GET AND PUT FUNCTIONS PERFORM THERE TASKS BY MERELY CALLING PUTER AND GETCH WITH THE CORRECT ITEM IN THE AC. THEY INSERT-REMOVE THE 8 BIT CHARACTER FROM AC3. FAIRLY TRIVIAL ROUTINES.

G) THE RUBOUTS AND NO RUBOUTS COMMANDS.

THESE COMMANDS SET THE VARIABLE RBSWCH TO A 1 OR 0 DEPENDING ON WHETHER OR NOT TO PROCESS RUBOUTS. THE ROUTINE GETCH TESTS THIS FLAG WHEN INPUTING CHARACTERS.

H) THE TAB FUNCTION.

THIS FUNCTION IS THE FUNCTION WHICH CAN POSITION THE PRINT

HEAD TO THE DESIRED POSITION. IT CONSIST OF TWO PARTS.
THE FIRST IS THE ACTUAL TAB FUNCTION. THE SECOND IS CALLED
'TABDO' AND IS CALLED BY PRINT AFTER EVALUATING AN EXPRESSION
IF THE TABFLG IS SET. WHAT HAPPENS IS AS FOLLOWS:
WHEN TAB IS CALLED, IT FIRST FIXES THE ARGUMENT. IT THEN SETS
'TABFLG' TO INDICATE THAT WE HAVE PROCESSED A TAB FUNCTION.
IT THEN GETS THE PRESENT POSITION OF THE PRINT HEAD FROM
'COLUMN' AND RETURNS THIS AS THE FUNCTION VALUE. THUS TAB CAN
BE USED AS A REGUALR FUNCTION. IT THEN RETURNS TO THE CALLER.
THE PRINT STATEMENT PROCESSOR CHECKS TABFLG AFTER EVALUATING AN
EXPRESSION. IF IT'S SET (NON-ZERO) THEN IT GOES TO TABDO. TABDO
PICKS UP WHERE WE WANT TO GO TO (LEFT IN 'TABDES' BY TAB) AND
FIGURES OUT WHERE WE ARE BY USING COLUMN. IF WE ARE TO FAR IT
GIVES A CARRIAGE RETURN AND A NULL CHARACTER(TO PREVENT
TIMING PROBLEMS). IT THEN SPACES OVER THE CORRECT NUMBER OF
SPACES. WHEN DONE IT RETURNS TO 'PRINT+1' TO
FINISH PROCESS THE COMMAND. NOTE THAT WE CANNOT RETURN TO THE
SECTION WHICH CALLED IT BECAUSE IT WILL PRINT OUT A VALUE (
SUCH AS 23) BECAUSE IT WILL TAKE THE EVALUATED NUMBER AND
CONVERT IT TO ASCII.

THE FOLLOWING COMMANDS ARE ALL DONE IN (RESIDE) IN FIELD 1.

THE ADC FUNCTION.
THIS FUNCTION [RENAMED ZZADC] CALLS THE ROUTINE UADCB WITH
A ZERO AC. UADCB IS THE GENERAL A-D
DISPATCHER. UADCB HAS TWO COURSES OF ACTION DEPENDING ON THE AC.
THE USER SHOULD READ IT'S DESCRIPTION AT
THE END. UADCB WILL RETURN WITH THE CORRECT ADC VALUE IN THE
FAC. IT WILL THEN RETURN TO THE CALLER.

THE SET RATE COMMAND.
THIS COMMAND SETS THE CLOCK GOING FROM THE ARGUMENTS. IT
FIRST CALLS MEVAL [VIA UMEVAL] TO GET THE RATE (0-7). IT THEN
PLACES THIS IN THE COMMAND REGISTER ALONG WITH A 5010. THESE ARE
THE CORRECT HARDWARE FLAG BITS TO RUN IN 'NORMAL' CLOCK MODE.
IT THEN JUMPS TO USETM. USETM WILL EVALUATE THE NEXT EXPRESSION
[VIA UMEVAL] AND WILL THEN LOAD THE CLOCK REGISTER
WITH THIS NUMBER. IT THEN CLEARS THE TWO TIME REGISTERS (TIM1
AND TIM2). THESE ARE INCREMENTED EVERY TIME A CLOCK TIC OCCURS.
IT THEN RETURNS TO THE CALLER.

THE SET CLOCK COMMAND.
THIS IS SIMIALIAR TO THE SET RATE COMMAND EXCEPT THAT THE
ENTIRE 12 BITS OF THE MODE THE USER HAS SPECIFIED
IS USED. JUST BIT 8 IS SET ON TO INSURE INTERUPTS. THEN IT GOES
TO USETM.

THE WAITC COMMAND.
THIS COMMAND WAITS FOR A CLOCK TIC. IT FIRST PICKS UP THE LOW
ORDER WORD OF THE CLOCK COUNTER [TIM2] AND SAVES IT IN UTEMP.
IT THEN CALLS BIDLE TO PUT BASIC TO SLEEP. WHEN IT'S AWAKENED.
IT SEES IF THE TIME HAS CHANGED. IF IT HAS, IT RETURNS
VIA DEVCOM. IF IT HASN'T, IT GOES TO SLEEP AGAIN.

M) THE WAIT COMMAND.
THIS IS INTERNALLY IDENTICAL TO THE WAITC COMMAND. IT "FUDGES" THE TIME [TIM2] SO THAT WHEN AN INTERUPT OCCURS, IT LOOKS LIKE THE TIME HAS RUN OUT AND RETURNS.

N) THE ACCEPT COMMAND.
THE ACCEPT COMMAND WILL SET THE ACCEPT DATA SWITCH [ADACPT] IF AND ONLY IF WE HAVE A GOOD, CLEAN BUFFER [ABDGET>0]. IF WE DO NOT, WE FALL THROUGH TO THE 'REJECT' COMMAND.

O) THE REJECT COMMAND.
THE REJECT COMMAND CLEARS THE ACCEPT DATA FLAG [ADACPT]. IT RETURNS TO BASIC VIA DEVCOM.

P) THE REAL TIME COMMAND.
THIS COMMAND IS ONE OF THE MORE HAIRY OF THE NEW LAB-8/E BASIC COMMANDS. THE FOLLOWING IS WHAT OCCURS. IT FIRST CHECKS TO SEE IF WE ARE ACCEPTING DATA. IF WE ARE, THE COMMAND IS IGNORED [VIA SKIPIT]. IF WE ARE NOT ACCEPTING DATA, WE CALL GETARY TO GET US THE AREA THE USER REQUESTED. THIS DONE, WE THEN USE THIS INFORMATION TO SET THE BUFFER POINTERS [APUT1 AND APUT2] AND THE BUFFER LIMIT CONTROL INFORMATION [ADA1, ADA2, AND ADA3], WE THEN GET THE CHANNEL NUMBER TO START [VIA UMEVAL] AND PLACE IT IN ADCX. WE THEN GET THE NUMBER OF CHANNELS TO USE AND PLACE IT IN ADCUNT. WE FINALLY GET THE NUMBER OF TIME COUNTS TO DO AND LEAVE IT IN CT1, CT2 AND CT3. REMEMBER THAT THE TIME IS DOUBLE WORD, HENCE THE DOUBLE WORD ARITHMETIC AT THIS POINT. CT1 IS USED TO GIVE US A THREE WORD ZERO COUNTER SHOULD THE USER PUT IN 0 AS NUMBER OF COUNTS. NOTE THAT 2.36 IS A VERY LONG TIME. WE THEN ZERO OUT THE NUMBER OF SAMPLES PRESENTLY IN THE BUFFER [ACOUNT] AND TELL THE SYSTEM THAT WE'VE GOT A GOOD BUFFER [ABDGET >0].

Q) THE TIME FUNCTION [TIM]
THE TIME FUNCTION RETURNS THE NUMBER OF TICS, EVERY TIME THE CLOCK INTERUPTS, CLOCKI (THE CLOCK INTERUPT ROUTINE) INCREMENTS TIM2 AND THEN TIM1. TIM RETURNS THIS TIME IN THE AC.

R) THE ADB FUNCTION.
THIS FUNCTION CALLS UADCB WITH THE AC ALL 7777'S. UADCB WILL BE DESCRIBED NOW. UADCB IS THE MASTER A-D FUNCTION SWITCHER. UADCB EITHER DOES AN IMMEDIATE ADC IF THE AC IS ZERO OR WILL ATTEMPT TO GET A SAMPLE FROM THE USER'S A-D BUFFER IF THE AC IS NON-ZERO. IF THE AC IS ZERO, IT WILL CALL DOAD WITH THE INTEGERIZED AC3 (BITS 9-11). DOAD DOES AN A-D CONVERSION ON THE CHANNEL IN THE AC. IT THEN RETURNS THIS VALUE IN THE AC. UADCB THEN GOES TO UINAC, WHERE THE A-D VALUE IS PLACED IN THE FAC, NORMALIZED AND THEN BROUGHT INTO THE CORRECT NUMERIC RANGE (-1.V TO +1.V), THE FUNCTION THEN RETURNS. IF THE AC IS NOT ZERO (FOR AN ADB), IT CHECKS TO SEE IF THE BUFFER IS ACTIVE. IF NOT, AN ERROR IS GIVEN. IT THEN CHECKS TO SEE IF THE BUFFER IS ACTIVE, BUT THE TIME HAS RUN OUT. IF SO, ANOTHER MESSAGE IS GIVEN. IF ALL IS WELL, IT CALLS AGET TO GET AN A-D VALUE FROM THE USERS BUFFER. AGET IS MERELY THE RING BUFFER REMOVER. IF NOTHING IS IN THE BUFFER [ACOUNT=0], THEN AGET WILL PUT BASIC TO SLEEP. AGET RETURNS WITH CONVERTED NUMBER IN AC. UADCB THEN GOES TO UINAC WHICH WAS DESCRIBED ABOVE.

IMPORTANT ROUTINES AND LOCATIONS.

I) PAGE ZERO LOCATIONS.

0-2 USED FOR INTERUPT VECTOR.

DISAUTO, AJIO REGISTER USED AS POINTER TO NEXT ITEM TO BE DISPLAYED (EITHER AN X OR Y POINT). FOUND IN NULJOB.

INDEV, CONTAINS INPUT DEVICE NUMBER (1=TTY, 2=PTR)

OUTD2, CONTAINS OUTPUT DEVICE WHILE ACCEPTING AND ECHOING INPUT FROM THE TTY. IN OTHER WORDS, A TEMPORARY ASSIGNED JUST TO HOLD THE 'REAL' OUTPUT DEVICE.

OUTDEV, OUTPUT DEVICE THE ROUTINES WILL USE (0=NOTHING, 1=TTY, 2=PTP, 3=LPT)

ODEV, OUTPUT DEVICE CURRENTLY BEING USED BY THE BUFFER.

CNTLC, THE CONTROL O FLAG (+0). IF 0, NO CONTROL O.

NOINT, A LOCATION WHICH TELLS WHETHER OR NOT THE ^C CHARACTER CAN INTERUPT BASIC. CERTAIN PROCESSES (SUCH AS CORE JUGGLING) CANNOT BE INTERUPTTED. THEREFORE THEY SET THE NOINT SWITCH TO A 0001. WHEN DONE, THEY RESET IT TO A 0. IF A ^C SHOULD BE STRUCK, IT WILL NOT STOP BASIC, BUT IT WILL SET THE NOINT SWITCH TO A 7777. WHEN WE LEAVE THE CRITICAL PROCESS, NOINT WILL BE CHECKED TO SEE IF IT CONTAINS A 7777, AND IF SO, WE PROCEED AS IF A CONTROL C HAD JUST BEEN STRUCK.

RBSWCH, THIS IS THE RUBOUTS SWITCH. 0=IGNORE RUBOUTS, <> TREAT RUBOUTS LIKE BACK-ARROWS (←), WHICH IS SHIFT O.

DISB, ADDRESS OF PRESENT DISPLAY BUFFER. IF NONE IS PRESENT, THIS LOCATION IS ZERO. BUFFER IS ALWAYS IN UPPER CORE.

PRESET, THIS POINTS TO A ROUTINE WHICH RESETS ALL FLAGS BACK TO TTY INPUT AND OUTPUT AND CLEANS UP THE BUFFERS, NECESSARY AFTER AN ERROR OCCURS.

SPECINT, THIS POINTS TO SUBROUTINE WHICH CHECKS FOR ADDITIONAL DEVICE INTERUPTS BESIDES THE STANDARD ONES. THE CLOCK TEST IS LOCATED THERE.

PCONT, THIS POINTER POINTS TO A ROUTINE WHICH WAITS FOR OUTPUT TO TERMINATE (THE BUFFER EMPTY). THIS IS NECESSARY BECAUSE OTHERWISE ERROR AND/OR LISTING CONTROL INFORMATION MIGHT BE LOST IF A CONTROL O IS HIT AT THE WRONG TIME. IT ALSO RESETS THE CONTROL O FLAG. THIS ROUTINE IS ALSO SNEAKILY USED BY THE LIST * OPTION TO SET THE NULL AFTER CARRIAGE RETURN FLAG [PUTXRA]. IT STORES THE AC IN PUTXRA FIRST, THEN WAITS FOR OUTPUT TO TERMINATE. HENCE THIS IS A TWO FOLD ROUTINE.

DELOUT, THIS POINTS TO A ROUTINE WHICH DELETES THE CURRENT CONTENTS OF THE OUTPUT BUFFER, USED FREQUENTLY BY MANY ROUTINES.

CNCLR, THIS ROUTINE TESTS AND CLEARS THE NOINT FLAG DISCUSSED EARILER.

SPLEFT, THIS POINTER POINTS TO SUBROUTINE WHICH DETERMINES WHETHER OR NOT A GIVEN OPERATION WILL OVERFLOW FREE CORE. THE AMOUNT OF ROOM YOU WISH TO TAKE SHOULD BE IN THE AC. IF NO ROOM, THEN AN ERROR MESSAGE IS GIVEN.

II) N E W O R C H A N G E D R O U T I N E S

CLRCNT: THIS ROUTINE IS DESCRIBED BY CNCLR ABOVE.

PUTCH: THIS ROUTINE WAS CHANGED SLIGHTLY SO THAT IF PUTXRA WAS SET, A CERTAIN NUMBER OF NULL (ØØØ) CHARACTERS WOULD BE PUNCHED AFTER THE CRLF. THE NUMBER OF NULL'S PUNCHED IS A A FUNCTION OF THE NUMBER OF CHARACTERS ON THE LINE. ALL OTHER FUNCTIONS REMAIN THE SAME.

OBLOW: WHILE NOT A ROUTINE, THIS IS WHERE THE RING BUFFER FOR
OBHIGH: THE OUTPUT DEVICE IS LOCATED. RIGHT NOW IT IS ABOUT 8 LOCATIONS LONG. IT EXTENDS FROM OBLOW TO OBHIGH.

PUTJ: THIS IS THE "PUT" FUNCTION. IMPLEMENTATION IS DESCRIBED IN THE I-O SECTION, ALONG WITH THE FUNCTION GET.

GETJ: SEE ABOVE.

PRINT: THIS ROUTINE HAS CHANGED SOMEWHAT. THE FUNCTION "CHECKW" HAS BEEN INCORPORATED TO SEE WHETHER OR NOT SOMETHING WILL FIT ON THIS LINE.

CHECKW: THIS FUNCTION IS CALLED WITH THE NUMBER OF PLACES YOU DESIRE TO PRINT IN THE AC. ACTUALLY, THE AC IS # OF PLACES DESIRED MINUS 1 (N-1). IF NOT ENOUGH ROOM, AN AUTOMATIC CRLF IS GIVEN. PRINT ALSO CHECKS THE SIZE OF THE LINE ON THE OUTPUT DEVICE. SIZE IS LEFT IN TWIDTH.

LIST: LIST NOW CHECKS TO SEE IF A # WAS GIVEN. IF SO, IT SETS THE PUTXRA FLAG BY CALLING POINT TO WAIT FOR I/O TO TERMINATE. SEE DESCRIPTION ABOVE.

BEGFIX: THIS ROUTINE WAS ADDED TO ENABLE THE EASIER CONVERSION OF INTEGER NUMBERS TO FAC NUMBERS. BEGFIX DOES THE FOLLOWING: IT CLEARS AC1 & AC2, IT SETS THE SIGN TO POSITIVE. IT SETS THE EXPONENT TO 233, WHICH IS CORRECT FOR FIXING A NUMBER. IT ALSO CLEARS THE OVERFLOW FLAG (OV), IT THEN RETURNS TO THE CALLER.

INPUT: THIS ROUTINE NOW CHECKS TO SEE IF THE INPUT IS FROM THE READER. IF IT IS, NO QUESTION MARK (?) IS GIVEN AND NO ECHO OF DATA IS

DDVL. IF INPUT IS FROM THE TELETYPE, ALL IS AS BEFORE.

FPT: THE FLOATING POINT PACKAGE IS AS BEFORE, EXCEPT FOR SOME DEFS. THE ONLY TRICKY AREA IS THAT INDIRECTS GO THROUGH FIELD ONE, SO USE CAUTION.

TAB: DESCRIBED PREVIOUSLY (AS WITH TABDO).

INTER: THIS IS THE MAIN INTERUPT PROCESSOR. IT IS DESCRIBED ABOVE. THE ONLY THING NOT MENTIONED WAS BIDLE.

BIDLE: BIDLE IS A ROUTINE TO BE CALLED WHEN YOU WANT TO PUT BASIC TO SLEEP. ESSENTIALLY THIS SETS A FLAG CALLED BUSY. WHEN BASIC GOES TO EXIT FROM AN INTERUPT,
IT CHECKS THE STATUS OF BUSY. IF IT'S ZERO, IT EXITS NORMALLY. THIS MEANS IT WAS IN BASIC WHEN IT INTERUPTED. IF IT'S ONE, THEN IT WAS IN THE NULL JOB ROUTINE. IF SO, THEN NULLJOB COULD ONLY BE STARTED BY BIDLE, HENCE AFTER SERVICING THE INTERUPT, IT RETURNS FROM BIDLE AND CLEARS THE BUSY FLAG. WHEN BIDLE IS CALLED AGAIN, BIDLE WILL EXIT TO THE LOCATION AS DEFINED BY WHAT THE INTERUPT ROUTINES SAVED WHEN IN THE LAST BUSY 1 STATE. HENCE BUSY IS THE WORD WHICH KEEPS TRACK OF WHAT IS GOING ON.

INTEXT: THIS ROUTINE EXITS FROM AN INTERUPT. IT INTEROGATES 'BUSY' TO FIND OUT WHAT TO DO.

PUTER: DESCRIBED PREVIOUSLY.

OBOP: POPS UP EITHER INPUT OR OUTPUT BUFFER FLAG.

RESET1: THIS RESETS ALL DEVICES. SEE PRESET.

RESET2: THIS IS A MASTER RESET OF ALL HARDWARE STATUS FLAGS. ONLY CALLED WHEN STARTING UP BASIC.

OUTDEL: DESCRIBED ABOVE.

DEVCOM: GETS NEXT ITEM FROM USER STATEMENT, THEN CALLS DEVCON.

DEVCON: CHECKS TO SEE IF ITEM IS A C.R. IF NOT, THEN A SYNTAX ERROR RESULTS.

RTERR: THIS GIVES THE "RATE ERROR" MESSAGE.

GETARY: THIS ROUTINE LOOKS AT USER'S VARIABLE ARGUMENT. IT THEN PICKS UP SUBSCRIPTING INFORMATION. IT THEN CALLS GETADD TO RETURN LAST ELEMENT IN ARRAY. IT HAS THE FIRST, AND NOW THE LAST, SO IT HAS THE SIZE. IT LEAVES POINTER TO FIRST IN AC1 AND POINTER TO LAST IN AC2. THEN IT RETURNS.

PLOTB: THIS SETS UP DISPLAY BUFFER. IT SETS UP DISB TO POINT TO CORRECT LOCATION. IT PUTS A 4001 IN LAST WORD OF BUFFER, IT PUTS A 4000 IN FIRST WORD OF BUFFER SO NOTHING WILL BE DISPLAYED. THEN IT RETURNS.

DBLIT: THIS ROUTINE TAKES THE FAC AND STICKS IT IN THE BUFFER. IT FIRST CHECKS TO SEE IF IN RANGE (0 TO .9999999999) AND THEN IF NOT IT SETS DBAD. IT THEN FIXES FAC, AND THEN

?

CALLS DBPUT TO PUT IN WORD, IT THEN PUTS IN A 4000 TO END THE BUFFER.

DBPUT: THIS ROUTINE PUTS THE AC IN THE BUFFER, IF THE CONTENTS OF WHERE IT'S GOING=4001, THEN WE'VE RUN OUT OF ROOM AND A "TOO-BIG" MESSAGE IS GIVEN, IT RETURNS TO CALLER IF SUCCESSFULL,

UUDATA: THIS GIVES THE "A-D FULL" MESSAGE,

SETUF: THIS IS ORIGINALLY EDUSYS-10 CODE WHICH WAS MOVED BECAUSE WE NEEDED ROOM ELSEWHERE,

ISET: THIS ROUTINE INITIALIZES THE DISPLAY,

MEVAL: THIS ROUTINE EVALUATES AN EXPRESSION,
LEADING COMMAS ARE IGNORED,BAD SYNTAX GETS AN ERROR, RETURN IS TO CALLER WITH RESULTS IN FAC,

LLLJMS: THIS ROUTINE PROVIDES COMMUNICATION BETWEEN THE UPPER AND LOWER BANKS, TYPICAL CALL FROM UPPER IS

```
JMS     LLLJMS
YYYY
```

WHERE YYYY IS THE ROUTINE THE USER WISHES TO CALL IN LOWER BANK
RETURN IS ALWAYS TO UPPER FIELD,

LLLJMP: SAME AS LLLJMS EXCEPT THAT LLLJMS JMS'S AND LLLJMP JMP'S,

UNOAD: GIVES THE "NO A-D" MESSAGE,

CCINTK: THIS ROUTINE CHECKS THE CLOCK FLAG, IF UP, THEN IT GOES TO CLOCK1 IN FIELD 1,

TST: DESCRIBED PREVIOUSLY,

- - - - - -

F I E L D 1

CLOCK1: THIS ROUTINE IS EXECUTED ON A CLOCK INTERUPT,
IT FIRST CLEARS THE FLAG AND SAVES THE STATUS IN CLKSTS,
IT THEN INCREMENTS THE TIME OF DAY [TIM2 AND TIM1],
THEN CHECKS ADACPT AND ABDGET TO SEE IF WE'RE SAMPLING,
IF WE ARE, THEN IT PICKS UP THE CHANNEL [ADCX] AND CALLS
DOAD TO SAMPLE AS MANY TIMES AS NECESSARY AS DETERMINED BY
ADCUNT, IT CALLS APUT TO PLACE THE SAMPLES IN THE
BUFFER, IT THEN INCREMENTS CT3,CT2 AND/OR CT1 TO FIND OUT
WHETHER OR NOT DONE, IF DONE, IT CLEARS ADACPT AND SETS ABDGET
MINUS,
IT NOW CHECKS TO SEE IF THE CLOCK IS UP AGAIN, IF IT
IS , WE GET A RATE ERROR, IF IT ISN'T, WE CHECK FOR ^C TO SEE
IF IN THE REGION WHERE WE ARE INTERUPTING SO FAST THAT
WE CANNOT CHECK FOR A ^C IN THE TTY ROUTINES, BUT NOT FAST ENOUGH
SO THAT THE CLOCK FLAG TEST WILL CATCH IT, THIS CONDITION

COULD "LOCK OUT" BASIC SO NOTHING COULD HAPPEN, THAT IS
WHY WE MUST CHECK FOR ^C HERE, IF THIS IS THE CASE
THEN WE MUST TAKE THE SAME ACTION AS FOR THE CASE WHERE
WE COULD PHYSICALLY DETECT THE FACT THAT THE CLOCK WAS
RUNNING TOO FAST. WHEN WE DECIDE THAT THE CLOCK IS RUNNING TOO FAST,
WE STOP THE CLOCK (TO PREVENT FURTHER CLOCK INTERUPTS) AND
CALL 'RTERR' TO PRINT OUT THE ERROR MESSAGE ["RATE ERROR"];
IF THERE WAS NO ERROR, THEN WE EXIT NORMALLY VIA 'INTEXT'.

APUT: THIS PUTS A SAMPLE IN THE BUFFER, IF NO ROOM, WE GET
A BUFFER FULL MESSAGE, POINTERS ARE SET UP BY REAL TIME STATEMENT.

AGET: OPPOSITE OF APUT, IF NOTHING THERE, IT PUTS BASIC TO
SLEEP UNTIL AN INTERUPT OCCURS', DESCRIBED PREVIOUSLY.

ABOP: THIS BOPS UP POINTERS OF APUT AND AGET, LIMITS SET BY
REAL TIME STATEMENT, ADA1,ADA2 AND ADA3 ARE DETERMINING
LIMITS AND FACTORS.

UCLS: CLS FUNCTION, PICKS UP CLKSTS AND RETURNS IT.

UCLC: EXECUTES 6137 AND RETURNS RESULTS IN FAC.

UUULLL: THIS IS THE UPPER CORE RESETER'.

DOAD: TAKES AC AS CHANNEL NUMBER AND DOES CONVERSION, HAS
TIML OUT INCASE NO A-D OR A-D NOT WORKING.

USETF: THIS ROUTINE TAKES THE AC AND MAKES IT INTO A GOOD FAC,
IT CALLS BEGFIX AND ANORM.

UUAC1-3: THESE ROUTINES ADD AC1 -AC3
RESPECTIVELY TO THE AC, THEY GET IT FROM FIELD Ø.

UUMEVAL: MEVAL FUDGE CALL

UUPFIX: FIX FUDGE CALL.

UUDEVC: DEVCON FUDGE CALL.

UUJMS: UPPER CORE COUNTER PART OF LLLJMS

UUJMP: UPPER CORE COUNTER PART OF LLLJMP

UPCOMDO: UPPER CORE COMMAND DISPATCHER, VERY SIMPLE.

UPFUN: UPPER CORE FUNCTION DISPATCHER', ALSO SIMPLE.

```
/BASIC.L8E


/                    L A B - 8 ◊ E   B A S I C
/
/
/               COPYRIGHT 1971, DIGITAL EQUIPMENT CORPORATION
/               MAYNARD, MASS. (01754)
/
/               WRITTEN BY JACK BURNESS



/                    THIS BASIC IS A COMBINATION OF LAB-8/E BASIC
/                    AND 8K-BASIC FOR THE PDP-8. TO CREATE IT
/                    FOR THE LAB-8/E SET "MACHINE=1", TO CREATE I
T FOR
/                    THE PDP-8 SET "MACHINE=0".

          MACHINE=1
```

```
/                    THIS CODE OVERLAYS THE BINARY LOADER IN FIELD
/                    ONE TO MAKE LAB-8/E BASIC SELF STARTING.

          IFNZRO  MACHINE<
          FIELD   1

          *7700
7700  5457      JMP I   UGETND  =6000)

          *6000
6000  3153      DCA     UTEMP   Store checksum temporary (should be ◊)
6001  1211      TAD     INTHLT  get HLT instr
6002  3612      DCA I   INTPLC  put it into 7700
6003  1153      TAD     UTEMP   get checksum
6004  7440      SZA             was is zero
6005  5612      JMP I   INTPLC  NO/HLT will non zero acc
6006  6213      CIF CDF 1       YES go to field ◊
```

6

7

```
/00000  +-----------+
/       !  SYSTEM   !
/11000  +-----------+
/       !  ARRAY    !
/       !  SPACE    !
/       +-----------+
/       !  FREE     !
/       +-----------+
/       ! CODIFIED  !
/       !  BASIC    !
/       +-----------+
/       !  SYMBOL   !
/       !  TABLE    !
/       +-----------+
/       !  LINEBUF  !
/       +-----------+
/       !  STACK    !
/       +-----------+
/       !  FORLIST  !
/       +-----------+
/       !  GOLIST   !
/17756  +-----------+
/       !   RIM     !
/       !  LOADER   !
/17777  +-----------+
```

```
/4200   +
/4201   -
/4302   *
/4303   /
/4404   ^
/4105   =
/4106   <
/4107   >
/4110   <=
```

```
/4110   =<
/4111   >=
/4111   =>
/4112   <>
/4213   (UMINUS)
/4114   (DONE)
/4115   ,
/4116   ;
/4117   )
/4121   TO
/4122   STEP
/4123   (
/4124   FN
/4125   COS
/4126   TAN
/4127   ATN
/4130   LOG
/4131   EXP
/4132   SQR
/4133   ABS
/4134   SGN
/4135   INT
/4136   RND
/4137   SIN
/6000   (CRLF)
/6000   0
/6001   END
/6002   FOR
/6003   GOSUB
/6004   GOTO
/6005   THEN
/6006   IF
/6007   INPUT
/6010   LET
/6011   NEXT
/6012   PRINT
/6013   RETURN
/6014   STOP
/6015   DIM
/6016   RESTORE
/6017   DEF
/6020   READ
/6021   DATA
/6022   (EXIT)
/6023   (EOF)

FEXIT=0000
FSNE=0040
FSEQ=0050
FSGE=0100
FSLT=0110
FSGT=0140
FSLE=0150
```

```
FJMP=1000
FJMPI=1400
FST=2000
FSTI=2400
FLD=3000
FLDI=3400
FAD=4000
FADI=4400
FSB=5000
FSBI=5400
FMP=6000
FMPI=6400
FDV=7000
FDVI=7400
FWD=200
BAND=600


ADCL=6530
ADLM=6531
ADST=6532
ADRB=6533
ADSK=6534
ADSE=6535
ADLE=6536
ADRS=6537
DILC=6150
DICD=6151
DISD=6152
DILX=6153
DILY=6154
DIXY=6155
DILE=6156
DIRE=6157
CLEN=6134
CLAB=6133
CLDE=6132
CLZE=6130
CLSK=6131
CLCA=6137
CLSA=6135
CLBA=6136


*^Z
```

```
6207  5610          JMP I   .+1
6210  1370          START

6211  7402  INTHLT, HLT
6212  7700  INTPLC, 7700
```

and start it up!

>

/BASIC4.52

```
FIELD  0                /TO HELP BINARY LOADER IN CASE HE BL
```

OWS IT.

```
0000  0000          0                       /INTERUPT ROUTINES.
0001  5402          JMP I   .+1             /UP, UP AND AWAY.
0002  6500          INTER

0003  0000  ARRLOC, 0
0004  0002  CODELOC,0
0005  0000  PSYMTAB,0
0006  0000  NSYMTAB,0
0007  0215  0215,   215
0010  0212  0212,   212
0011  0260  0260,   260
0012  0000  OV,     0
0013  0000  INDEX1, 0
0014  0000  INDEX2, 0
0015  0000  DISAUTO,0
0016  0000  AC3,    0
0017  0000  AC2,    0
0020  0000  AC1,    0
0021  0000  OP3,    0
0022  0000  OP2,    0
0023  0000  OP1,    0
0024  0000  ACS,    0
0025  0000  ACE,    0
0026  0000  OPS,    0
0027  0177  0177,   177
0030  0000  OPE,    0
0031  0000  TMP,    0
0032  7271  PGETCH, GETCH
0033  0741  PPUTCH, PUTCH
0034  0000  DIMFLAG,0
0035  4200  FENTER=JMS I .;FPT
0036  0000  PDL,    0
0037  7512  PLINBUF,LINBUF
0040  0266  MLINBUF,-LINBUF
0041  7135  MENDLIN,-ENDLIN
0042  0000  PATEMP, 0
0043  0000  DECEXP, 0
0044  5335  PNUMBUF,NUMBUF
0045  0000  LOCCTR, 0
0046  0000  PEADLOC,0
0047  7353  PARGERR,ARGERR
0050  0000  NORD,   0
0051  0240  0240,   240
0052  0000  LINENO, 0
0053  0000  GOTEMP, 0
0054  7740  07740,  7740
0055  7777  07777,  7777
0056  0000  EPTR,   0
0057  0000  FPTR,   0
0060  0000  GPTR,   0
0061  0000  HPTR,   0
0062  0002  02,     2
0063  0000  FORCT,  0
0064  0000  SNUMFLG,0
```

```
0165  0012  012,     12
0166  0000  OLDOP,   0
0167  0000  ADDRESS,0
0170  0077  077,     77
0171  0377  0377,    377
0172  0007  07,      7
0173  0000  OPERAND,0;0;0
0174  0000
0175  0000
0176  7501  PTEXT,   XXTEXT
0177  4142  PERROR,  ERROR
0200  6441  PSXERR,  SXERR
0201  1404  PEVAL,   EVAL
0202  1400  PGETADD, GETADDR
0203  0213  PEXECUT, EXECUTE
0204  2354  PPUSH,   PUSH
0205  3651  PPOP,    POP
0206  4744  PFIX,    FIX
0207  1232  PGOTOPR, GOTOPR
0210  0472  PPASSCR, PASSCR
0211  1015  PGETOPR, GETOPR
0212  0341  PSTOVAR, STOVAR
0213  0311  PGETVAR, GETVAR
0214  3732  PPRINTX, PRINTXT
0215  1674  PGETBLK, GETBLK
0216  2747  PSLOOP,  SLOOP
0217  5000  POUTNUM, OUTNUM
0220  2405  PEDIT,   EDIT
0221  6430  PSTICKI, STICKIT
0222  3110  PNONBLN, NONBLNK
0223  3747  PPRINUM, PRINUM
0224  2603  PGETLIN, GETLIN
0225  7644  PPDLIST, PDLIST
0226  0000  COLUMN,  0
0227  0000  INDEV,   3
0230  0000  OUTD2,   0
0231  0000  OUTDEV,  0
0232  0000  OUDEV,   0
0233  0000  CNTLO,   0
0234  0000  NOINT,   0
IOAL TIMES.
0235  0000  RMSWCH,  0
0236  0000  DISB,    0
0237  7116  PRESET,  RESET1
0240  7735  SPECINT, CCINTK
0241  7325  PCONT,   CONT
0242  7146  DELOUT,  OUTDEL
0243  0367  C.CLR,   CLRCNT
0244  6413  SPLEFT,  RMLEFT
0245  0000  PTEN,    TEN
0246  4500  PANORM,  ANORM
0247  4432  PAR1,    AR1
0250  4654  PAL1,    AL1
0251  2014  ONE,     2014
0252  0000  ZERO,    0;0;0
0253  0000
```

/THIS PREVENTS INTERUPTS DURING CRIT

```
0154  0000
0155  7200  O200,    200
0156  0000  FPFLAG,  0
0157  4435  POADD,   OADD
0160  0004  O4,      4
0161  2332  PLINFIX,LINFIX
0162  7745  O7745,   7745
0163  6432  PCHKFIT,CHKFIT
0164  7725  PGOLIST,GOLIST
0165  0000  GSBPTR,  0
            GFT=1
0166  4073  ISIT=JMS I .;XISIT;XGISIT
0167  4066
0170  7352  MUSTBE=JMS I .;XMUST;XGMUST
0171  7345
0172  7563  PLBEGIN,LBEGIN
0173  0214  MLBEGIN,-LBEGIN-1
0174  0074  MLEND,   -ENDPDL
0175  4104  PISITLI,ISITLIT

            PAGE

            *.-1

0177  0000  GETWD,   0
0200  1445          TAD I   LOCCTR
0201  3052          DCA     WORD
0202  2045          ISZ     LOCCTR
0203  5577          JMP I   GETWD
0204  0215  PLETDO,  LETDO
0205  4570  LETDO,   MUSTBE          /'='
0206  3673          3673
0207  4571          JMS I   PEVAL
0210  4570          MUSTBE          /(CR) OR '0'
0211  2000          2000
0212  4341          JMS     STOVAR
0213  4177  EXECUTE,JMS     GETWD
0214  1274          TAD     PLETDO
0215  3311          DCA     GETVAR
0216  1450          TAD I   WORD
0217  7510          SPA
0220  5231          JMP     KEYWD
0221  7540          SZA CLA         /IS IT A LINENO
0222  5313          JMP     NOTKWD  /NO
0223  1050          TAD     WORD
0224  3052          DCA     LINENO
0225  4177          JMS     GETWD
022c  1450          TAD I   WORD
```

```
0227  7710          SMA CLA
0230  5313          JMP     NOTKWD
0231  7332  KEYWD,  CLA CLL CML RTR
0232  1450          TAD I   WORD
0233  7420          SNL                 /IS IT A STATEMENT WORD
0234  5532          JMP I   PSXERR      /NO
0235  1240          TAD     SJUMP
0236  3237          DCA     .+1
0237  7402          HLT
0240  5641  SJUMP,  JMP I   .+1
0241  0213          EXECUTE
0242  2067          END
0243  0413          FOR
0244  0515          GOSUB
0245  0517          GOTO
0246  0375          IF
0247  4407        * INPUT
0250  0312          LET
0251  0536          NEXT
0252  2173          PRINT
0253  0677          RETURN
0254  2673          STOP
0255  6472          DIM
0256  3773          RESTORE
0257  0457          SKIPIT
0260  1576          DEF
0261  1623          READ
0262  0457          SKIPIT
0263  2432          EXIT
0264  2576          STOP
0265  7173          TTYIN
0266  7165          TTYOUT
0267  7163          LPTOUT *
0270  7164          PTPOUT
0271  7172          PTRIN
0272  6441          SXERR               /THIS SLOT IS NOW FREE. (6031)
0273  5573          RUBO
0274  5574          NORUBO
                    IFNZRO  MACHINE<

0275  7633          CLEAR
0276  7654          DELAY
0277  7446          USE
0300  7447          PLOT
0301  7743          REALTIME
0302  7743          SETRATE
0303  7743          SETCLOCK
0304  7743          WAITC
0305  7743          WAIT
0306  6441          SXERR               /"UCOM" --- USER COMMAND.
0307  7743          ACCEPT
0310  7743          REJECT>
```

```
                IFZERO  MACHINE<
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                SXERR
                        >


0311  0000  GETVAR, 0
0312  4177  LET,    JMS     GETWD
0313  4570  NOTKWD, MUSTBE          /A VARIABLE
0314  7000          7000
0315  1350          TAD     WORD
0316  3343          DCA     VAR
0317  3344          DCA     SSONE
0320  3345          DCA     SSTWO
0321  4567          GET+ISIT                /'('
0322  3755          3755
0323  5711          JMP I   GETVAR  /NO
0324  4521          JMS I   PEVAL
0325  4536          JMS I   PFIX
0326  3344          DCA     SSONE
0327  4556          ISIT            /','
0330  3763          3763
0331  5335          JMP     NOCOMMA /NO
0332  4521          JMS I   PEVAL
0333  4536          JMS I   PFIX
0334  3345          DCA     SSTWO
0335  4572  NOCOMMA,MUSTBE          /')'
0336  3761          3761
0337  4177          JMS     GETWD
0340  5711          JMP I   GETVAR
0341  0000  STOVAR, 0
0342  4532          JMS I   PGETADDR
0343  0000  VAR,    0
0344  0000  SSONE,  0
0345  0000  SSTWO,  0
0346  4435          FENTER
0347  2467          FSTI    ADDRESS
0350  0000          FEXIT
0351  5741          JMP I   STOVAR
0352  4477  FNERR,  JMS I   PERROR
0353  0525          TEXT 'FUNCTION'
0354  1616
0355  2411
```

```
0356  1716
0357  0000
0360  0000  CLRCNT, 0                        /ROUTINE WHICH CHECKS STATUS OF CONT
FOL C FLAG.
0361  7201          CLA IAC
0362  1134          TAD     NOINT           /WAS IT SET TO -1?
0363  7552          SNA CLA
0364  5767          JMP I   PBOMB           /YEP. GIVE STOP MESSAGE.
0365  3134          DCA     NOINT           /NOPE. RESET IT.
0366  5760          JMP I   CLRCNT          /AND EXIT

0367  6672  PBOMB,  CNTLCR


0370  4477  SPACERR,JMS I   PERROR
0371  2417          TEXT 'TOO-BIG'
0372  1755
0373  0211
0374  0700


0375  4531  IF,     JMS I   PEVAL
0376  4435          FENTER
0377  2073          FST     OPERAND
0400  0002          FEXIT
0401  4572          MUSTBE          /'THEN'
0402  1774          1774
0403  1073          TAD     OPERAND
0404  7750          SPA SNA CLA
0405  5267          JMP     SKIPIT
0406  4567          GET+ISIT        /A LINENO
0407  0000          0000
0410  5612          JMP I   XEXECU
0411  5323          JMP     GOTO+1
0412  0214  XEXECU, EXECUTE+1
0413  4571  FOR,    GET+MUSTBE      /A VARIABLE
0414  7000          7000
0415  4357          JMS     FINDIT
0416  5235          JMP     NOTHERE
```

```
0417  7201          CLA IAC
0420  1413          TAD     INDEX1
0421  3414          DCA     INDEX2
0422  7240          CLA CMA
0423  1413          TAD     INDEX1
0424  3413          DCA     INDEX1
0425  5232          JMP     INLUPF
0426  1414  LUPF,   TAD I   INDEX2
0427  3413          DCA I   INDEX1
0430  1414          TAD I   INDEX2
0431  3413          DCA I   INDEX1
0432  2453  INLUPF, ISZ     GOTEMP
0433  5226          JMP     LUPF
0434  2463          ISZ     FORCT
0435  1063  NOTHERE,TAD     FORCT
0436  1334          TAD     011
0437  7750          SPA SNA CLA             /CAN'T FIT 9 IN FORLIST
0440  5331          JMP     FORERR
0441  1450          TAD     WORD
0442  7041          CIA
0443  3413          DCA I   INDEX1
0444  1450          TAD     WORD
0445  3252          DCA     FORVAR
0446  4571          GET+MUSTBE      /'='
0447  3673          3673
0450  4571          JMS I   PEVAL
0451  4532          JMS I   PGETADDR
0452  0000  FORVAR, 0
0453  0000          0
0454  0000          0
0455  4435          FENTER
0456  2467          FSTI    ADDRESS
0457  0000          FEXIT
0460  4573          MUSTBE          /'TO'
0461  3757          3757
0462  1745          TAD     LOCCTR
0463  3413          DCA I   INDEX1
0464  7243          CLA CMA
0465  1063          TAD     FORCT
0466  3063          DCA     FORCT


0467  4571  SKIPIT, JMS I   PIGNORE        /LOOK FOR "◊" OR C.R.
0470  5533          JMP I   PEXECUTE       /AND EXECUTEPTHE NEXT STATEMENT.


0471  2115  PIGNORE,IGNORE
```

```
0472  0232  PASSCR, 0                       /THIS LOOKS FOR A REAL C.R.
0473  4571          JMS I   PIGNORE         /LOOK FOR "0" OR C.R.
0474  2356          ISZ     WORD
0475  4556          ISIT
0476  4120          4120                    /A REAL C.R. ?
0477  5273          JMP     .-4             /NOPE. A SLASH.
0500  5672          JMP I   PASSCR          /AND RETURN TO CALLER.



0501  4477  FORERR, JMS I   PERROR
0502  0517          TEXT 'FOR'
0503  2220
0504  0311  011,     11
0505  4177  GOSUB,  JMS     GETWD
0506  4332          JMS     GOBOTH
0507  1165          TAD     GSBPTR
0510  1325          TAD     MGSBEND
0511  7650          SNA CLA
0512  5326          JMP     DEEPERR
0513  1345          TAD     LOCCTR
0514  3565          DCA I   GSBPTR
0515  2165          ISZ     GSBPTR
0516  5321          JMP     GOTO+2
0517  4177  GOTO,   JMS     GETWD
0520  4332          JMS     GOBOTH
0521  2353          ISZ     GOTEMP
0522  1453          TAD I   GOTEMP
0523  3345          DCA     LOCCTR
0524  5643          JMP I   PEXECUTE
0525  0323  MGSBEND,-GSBEND
0526  4477  DEEPERR,JMS I   PERROR
0527  3717          TEXT 'GOSUB'
0530  2325
0531  0220
0532  0120  GOBOTH, 0
0533  4570          MUSTBE          /A LINENO
0534  0042          0042
0535  1456          TAD     WORD
0536  3353          DCA     GOTEMP
0537  2156          ISZ     WORD
0540  4566          ISIT            /DEFINED
0541  0000          0000
0542  5353          JMP     ISITDF
0543  4477          JMS I   PERROR
0544  1411          TEXT 'LINENO'
```

```
0545  1605
0546  1617
0547  0000
0550  4571  ISITDF, GET+MUSTBE      /(CR) OR '0'
0551  2000          2000
0552  5732          JMP I   GOBOTH
0553  0000  VARTEMP,0;0;0
0554  0000
0555  0000
0556  7744  PXFORLI,FORLIST-1
0557  0000  FINDIT, 0
0560  1063          TAD     FORCT
0561  3053          DCA     GOTEMP
0562  1356          TAD     PXFORLIST
0563  3013          DCA     INDEX1
0564  5372          JMP     INLOOP
0565  1413  FINDLUP,TAD I   INDEX1
0566  1052          TAD     WORD
0567  7650          SNA CLA
0570  5375          JMP     FOUND
0571  2013          ISZ     INDEX1
0572  2053  INLOOP, ISZ     GOTEMP
0573  5365          JMP     FINDLUP
0574  5757          JMP I   FINDIT
0575  2357  FOUND,  ISZ     FINDIT
0576  5757          JMP I   FINDIT

              PAGE
0600  4571  NEXT,   GET+MUSTBE      /A VARIABLE
0601  7000          7000
0602  4672          JMS I   PFINDIT
0603  5273          JMP     NEXTERR
0604  1052          TAD     WORD
0605  3237          DCA     NEXTVAR
0606  4571          GET+MUSTBE      /(CR) OR '0'
0607  2000          2000
0610  1045          TAD     LOCCTR
0611  3271          DCA     LOCTEMP
0612  1413          TAD I   INDEX1
0613  3045          DCA     LOCCTR
0614  4531          JMS I   PEVAL
0615  4435          FENTER
0616  2303          FST+FWD+FORLIM-.
0617  0000          FEXIT
0620  4566          ISIT            /(CR) OR '0'
0621  2000          2000
0622  5225          JMP     TRYSTEP /NO
0623  4435          FENTER
0624  3151          FLD     ONE
0625  1217          FJMP+FWD+GOTSTEP-.
0626  4570  TRYSTEP,MUSTBE          /'STEP'
0627  3756          3756
0630  4531          JMS I   PEVAL
0631  4570          MUSTBE          /(CR) OR '0'
```

```
0632  2000          2000
0633  4435          FENTER
0634  2272  GOTSTEP,FST+FWD+FORSTEP-.
0635  0004          FEXIT
0636  4502          JMS I   PGETADDR
0637  0000  NEXTVAR,0
0640  0000          0
0641  0000          0
0642  4435          FENTER
0643  3467          FLDI    ADDRESS
0644  4262          FAD+FWD+FORSTEP-.
0645  2672          FST+BKWD+.-VARTEMP
0646  5253          FSB+FWD+FORLIM-.
0647  0030          FEXIT
0650  1224          TAD     ACS
0651  1324          TAD     FORSTEP
0652  7710          SMA CLA
0653  1020          TAD     AC1
0654  7540          SZA CLA
0655  5253          JMP     FORDONE
0656  4435          FENTER
0657  3734          FLD+BKWD+.-VARTEMP
0660  2467          FSTI    ADDRESS
0661  0030          FEXIT
0662  5523          JMP I   PEXECUTE
0663  1271  FORDONE,TAD     LOCTEMP
0664  3245          DCA     LOCCTR
0665  2263          ISZ     FORCT
0666  2253          ISZ     GOTEMP
0667  5265          JMP     .-2
0670  5503          JMP I   PEXECUTE
0671  0000  LOCTEMP,0
0672  0657  PFINDIT,FINDIT
0673  4477  NEXTERR,JMS I   PERROR
0674  1615          TEXT 'NEXT'
0675  3024
0676  2000
0677  4571  RETURN, GET+MUSTBE      /(CR) OR '0'
0700  2000          2000
0701  1165          TAD     GSBPTR
0702  1320          TAD     MGOLIST
0703  7650          SNA CLA
0704  5313          JMP     RETNERR
0705  7240          CLA CMA
0706  1165          TAD I   GSBPTR
0707  3165          DCA I   GSBPTR
0710  1565          TAD I   GSBPTR
0711  3245          DCA I   LOCCTR
0712  5503          JMP I   PEXECUTE
0713  4477  RETNERR,JMS I   PERROR
0714  2235          TEXT 'RETURN'
0715  2425
0716  2216
0717  0000
0720  0353  MGOLIST,-GOLIST
```

```
0721  0000  FORLIM, 0;0;0
0722  0000
0723  0000
0724  0000  FORSTEP,0;0
0725  0000
0726  0000  SGN,    0
0727  4435          FENTER
0730  0132          FSGE
0731  3205          FLD+FWD+MNSONE-.
0732  0152          FSLE
0733  3151          FLD     ONE
0734  0134          FEXIT
0735  5726          JMP I   SGN
0736  6014  MNSONE, 6014;0;0
0737  0000
0740  0000
0741  0000  PUTCH,  0
0742  3326          DCA     SGN
0743  1326          TAD     SGN
0744  0027  PCCUNT, AND     0177
0745  1374          TAD     07763A
0746  7640          SZA CLA                 /IS IT A C.R.
0747  5357          JMP     PNOCR           /NOPE.
0750  1344          TAD     PCCUNT          /ADD IN EXTRA PLACES FOR GOOD LUCK.
0751  1126          TAD     COLUMN          /SAVE COLUMN:POSITION
0752  3237          DCA     NEXTVAR
0753  3126          DCA     COLUMN
0754  1237          TAD     NEXTVAR         /REGET WHERE WE WERE.
0755  0376          AND     PUTXRA          /ARE WE INSERTING NULL CHARACTERS?
0756  7110          CLL RAR                 /NOW DIVIDE BY 2.
0757  7172  PNOCR,  CLL CML CMA RAR         /AND NOW INVERT AND DIVIDE BY 2 AGAI
N.
0760  3237          DCA     NEXTVAR         /SAVE FOR LATER USE. THIS IS NULL CO
UNTER.
0761  1326          TAD     SGN             /RECALL THE CHARACTER.
0762  0375          AND     0140A
0763  7440          SZA
0764  1365          TAD     07640A
0765  7640  07640A, SZA CLA
0766  2126          ISZ     COLUMN
0767  1326          TAD     SGN
0770  4777          JMS I   JPUTCH
0771  2237          ISZ     NEXTVAR         /INCREMENT THE COUNTER
0772  5370          JMP     .-2             /GIVE NULLS UNTIL IT'S SATISFIED.
0773  5741          JMP I   PUTCH

0774  7763  07763A, 7763
0775  0140  0140A,  140
0776  0000  PUTXRA, 0                       /NULL AFTER C.R. WORD.
0777  7042  JPUTCH, PUTER
```

```
                        PAGE

1000  4603  START,  JMS I   XRESTA          /REST FLAGS AND DEVICES.
1001  5602           JMP I   .+1
1002  2447           SCRATCH
1003  7610  XRESTA, ISET

1004  2447  EVAL,   2
1005  4177           JMS     GETWD
1006  1234           TAD     EVAL
1007  4534  EVALGO, JMS I   PPUSH
1010  1363           TAD     04014
1011  4534           JMS I   PPUSH
1012  5216           JMP     GETOPR+1
1013  1364  ISUMIN, TAD     04213
1014  4534           JMS I   PPUSH
1015  4177  GETOPR, JMS     GETWD
1016  4566           ISIT            /'-'
1017  3577           3577
1020  7410           SKP
1021  5213           JMP     ISUMIN
1022  4566           ISIT            /'+'
1023  3534           3600
1024  7410           SKP
1025  5215           JMP     GETOPR
1026  4556           ISIT            /'('
1027  3755           3755
1030  5235           JMP     NOPAREN /NO
1031  4234           JMS     EVAL
1032  4574           MUSTBE          /')'
1033  3761           3761
1034  5547           JMP I   PGOTOPR
1035  4566  NOPAREN,ISIT            /A VARIABLE
1036  7230           7300
1037  5335           JMP     NOTVAR  /NO
1040  3276           DCA     ONESS
1041  3277           DCA     TWOSS
1042  1356           TAD     WORD
1043  3275           DCA     WDTEMP
1044  4567           GET+ISIT        /'('
1045  3755           3755
1046  5274           JMP     GOTSS   /NO
1047  1275           TAD     WDTEMP
1050  4534           JMS I   PPUSH
1051  4234           JMS     EVAL
1052  4556           ISIT            /','
1053  3763           3763
1054  5264           JMP     ONEDIM
1055  4546           JMS I   PFIX
1056  4534           JMS I   PPUSH
1057  4234           JMS     EVAL
1060  4546           JMS I   PFIX
1061  3277           DCA     TWOSS
```

```
1062  4535          JMS I   PPOP
1063  5266          JMP     .+3
1064  3277  ONEDIM, DCA     TWOSS
1065  4536          JMS I   PFIX
1066  3276          DCA     ONESS
1067  4572          MUSTBE          /')'
1070  3761          3761
1071  4535          JMS I   PPOP
1072  3275          DCA     WDTEMP
1073  4177          JMS     GETWD
1074  4532  GOTSS,  JMS I   PGETADDR
1075  0000  WDTEMP, 0
1076  0000  ONESS,  0
1077  0000  TWOSS,  0
1100  4435          FENTER
1101  3467          FLDI    ADDRESS
1102  0000          FEXIT
1103  5704          JMP I   .+1
1104  1203          OPDONE
1105  4575  NOTVAR, JMS I   PISITLIT /ISIT A LITERAL
1106  5314          JMP     ISITFUN /NO
1107  5527          JMP I   PGOTOPR /IT IS IN THE AC NOW
1110  1450  ISITFUN,TAD I   WORD
1111  1362          TAD     03754           /-4024, WHICH IS BEGINNING OF FUNCTI
ONS.
1112  7510          SPA                     /IS IT A LEGAL FUNCTION?
1113  5520          JMP I   PSXERR          /NO, EXIT WITH MESSAGE.
1114  7450          SNA                     /WAS IT 'FN'
1115  4177          JMS     GETWD           /YES,SKIP OVER LETTER
1116  4534          JMS I   PPUSH
1117  4571          GET+MUSTBE              /'('
1120  3755          3755
1121  4204          JMS     EVAL
1122  4535          JMS I   PPOP
1123  1330          TAD     FJUMP
1124  3325          DCA     .+1
1125  7442          HLT
1126  5727          JMP I   .+1
1127  1200          FNEXIT
1130  4731  FJUMP,  JMS I   FUNTAB
1131  5453  FUNTAB, FN
1132  5516          COS
1133  5537          TAN
1134  6200          ATN
1135  6114          LOG
1136  6417          EXP
1137  5412          SQR
1140  6425          ABS
1141  0726          SGN
1142  6434          INT
1143  5353          RND
1144  5024          SIN
1145  1761          PUTJ                    /POINTER TO PUT CHAR ROUTINE.
1146  6441          SXERR                   /FOR THE MISC. FUNCTIONS.
1147  6441          SXERR
1150  6441          SXERR
```

```
1151  1770          GETJ                    /GET A CHAR FROM THE TTY.

                    IFNZRO  MACHINE<

1152  7747          ADC                     /"NORMAL" A-D CONVERSION RETURN.
1153  7757          TST                     /"TEST CHARACTER BUFFER".
1154  7747          TIM                     /TIME (# OF CLOCK TICKS).

                          >

                    IFZERO  MACHINE<

                    SXERR
                    TST
                    SXERR
                          >
1155  5547          TAB                     /TAB FUNCTION IS IMPLEMENTED.

1156  6441          SXERR                   /UNIMPLEMENTED USER FUNCTION.


                    IFNZRO  MACHINE<

1157  7747          CLS                     /GET STATUS OF LAST TICK.
1160  7747          CLC                     /GET CLOCK COUNT BUFFER.
1161  7747          ADB                     /GET CONVERSION FROM BUFFER.

                          >

                    IFZERO  MACHINE<

                    SXERR
                    SXERR
                    SXERR

                          >


1162  3754  03754,  3754
1163  4014  04014,  4014
1164  4213  04213,  4213
```

```
OBLOW=.
OBHIGH=FNEXIT-1
```

PAGE

```
1200  4577  FNEXIT, MUSTBE       /')'
1201  3761           3761
1202  4177  GOTOPR,  JMS      GETWD
1203  4545  OPDONE,  JMS I    PPOP
1204  3466           DCA      OLDOP
1205  1450           TAD I    WORD
1206  0272           AND      0700
1207  7552           SNA CLA
1210  5223           JMP      ITSOP
1211  1454           TAD I    WORD
1212  0275           AND      07077
1213  1273           TAD      03755
1214  7100           CLL
1215  1356           TAD      023
1216  7520           SNL CLA
1217  5502           JMP I    PSXERR
1220  1356  ITSOP,   TAD      OLDOP
```

```
1221  3272          AND     0700
1222  3271          DCA     OTEMP
1223  1450          TAD I   WORD
1224  0272          AND     0700
1225  7041          CIA
1226  1271          TAD     OTEMP
1227  7710          SMA CLA
1230  5247          JMP     DOITNOW
1231  1056          TAD     OLDOP
1232  4504          JMS I   PPUSH
1233  4435          FENTER
1234  2273          FST     OPERAND
1235  0000          FEXIT
1236  1273          TAD     OPERAND
1237  4504          JMS I   PPUSH
1240  1274          TAD     OPERAND+1
1241  4504          JMS I   PPUSH
1242  1275          TAD     OPERAND+2
1243  4504          JMS I   PPUSH
1244  1450          TAD I   WORD
1245  4504          JMS I   PPUSH
1246  5611          JMP I   PGETOPR
1247  1056  DOITNOW,TAD     OLDOP
1250  0277          AND     077
1251  1274          TAD     07764A
1252  7450          SNA
1253  5363          JMP     UDOPER
1254  7001          IAC
1255  7650          SNA CLA
1256  5321          JMP     UMOPER
1257  1056          TAD     OLDOP
1260  0277          AND     077
1261  1276          TAD     OJUMP
1262  3271          DCA     OTEMP
1263  4505          JMS I   PPOP
1264  3275          DCA     OPERAND+2
1265  4505          JMS I   PPOP
1266  3274          DCA     OPERAND+1
1267  4505          JMS I   PPOP
1270  3273          DCA     OPERAND
1271  7402  OTEMP,  HLT
1272  0700  0700,   700
1273  3755  03755,  3755
1274  7764  07764A, 7764
1275  7077  07077,  7077
1276  5677  OJUMP,  JMP I   .+1
1277  1312          PLUS
1300  1316          MINUS
1301  1327          STAR
1302  1332          SLASH
1303  5742          UPARRX  /OR 'UPARROW' IF NO EXTENDED FNS
1304  1342          RELATE
1305  1342          RELATE
1306  1342          RELATE
1307  1342          RELATE
```

```
1310  1342          RELATE
1311  1342          RELATE
1312  4435  PLUS,   FENTER
1313  4473          FAD     OPERAND
1314  0002  FADEXT, FEXIT
1315  5233          JMP     OPDONE
1316  4435  MINUS,  FENTER
1317  5473          FSB     OPERAND
1320  0002          FEXIT
1321  1422  UNOPER, TAD     AC1
1322  7640          SZA CLA
1323  7330          CLA CLL CML RAR
1324  1024          TAD     AC5
1325  3024          DCA     AC5     /DIRECT REF TO FLOATING AC
1326  5243          JMP     OPDONE
1327  4435  STAR,   FENTER
1330  6273          FMP     OPERAND
1331  1615          FJMP+BKWD+.-FADEXT
1332  4435  SLASH,  FENTER
1333  2234          FST+FWD+SLSHTMP-.
1334  3273          FLD     OPERAND
1335  7242          FDV+FWD+SLSHTMP-.
1336  1622          FJMP+BKWD+.-FADEXT
1337  0000  SLSHTMP,0;0;0
1340  0000
1341  0000
1342  1266  RELATE, TAD     OLDOP
1343  1267          TAD     CONST
1344  3353          DCA     THESKIP
1345  6231          CDF     0               /!!!!!!!!! 8 K INSERT.
1346  1753          TAD I   THESKIP
1347  6211          CDF     10              /!!!!!!!!! 8 K INSERT.
1350  3353          DCA     THESKIP
1351  4435          FENTER
1352  5273          FSB     OPERAND
1353  7402  THESKIP,HLT
1354  1234          FJMP+FWD+4
1355  3151          FLD     ONE
1356  0002          FEXIT
1357  5213          JMP     OPDONE
1360  3152          FLD     ZERO
1361  0002          FEXIT
1362  5203          JMP     OPDONE
1363  4515  UDOPER, JMS I   PPOP
1364  3266          DCA     OLDOP
1365  5466          JMP I   OLDOP
1366  0023  023,     23
1367  5263  CONST,  5-4104
1370  0052          FSEQ            /  =
1371  0142          FSGT            /  <
1372  0112          FSLT            /  >
1373  0102          FSGE            /  <=
1374  0152          FSLE            /  >=
1375  0042          FSNE            /  <>
```

```
                        PAGE

1400  0000  GETADDR,0
1401  6231            CDF     0               /!!!!!!!!!!! 8 K INSERT.
1402  1600            TAD I   GETADDR
1403  3414            DCA     INDEX2
1404  2200            ISZ     GETADDR
1405  1600            TAD I   GETADDR
1406  3362            DCA     GSS1
1407  2200            ISZ     GETADDR
1410  1600            TAD I   GETADDR
1411  3363            DCA     GSS2
1412  2200            ISZ     GETADDR
1413  6211            CDF     10              /!!!!!!!!!!! 8 K INSERT.
1414  1414            TAD I   INDEX2
1415  3367            DCA     ADDRESS
1416  2367            ISZ     ADDRESS
1417  1362            TAD     GSS1
1420  7650            SNA CLA
1421  5224            JMP     NOSS1
1422  1414            TAD I   INDEX2
1423  7450            SNA
1424  5261            JMP     ALLOC
1425  7140            CLL CMA
1426  1362            TAD     GSS1
1427  7030            SZL CLA
1430  5372            JMP     SSERR
1431  1414            TAD I   INDEX2
1432  3364            DCA     GDIM2
1433  1363            TAD     GSS2
1434  7452            SNA
1435  5253            JMP     NOSS2
1436  7141            CLL CIA
1437  1364            TAD     GDIM2
1440  7620            SNL CLA
1441  5372            JMP     SSERR
1442  1362            TAD     GSS1
1443  7041            CIA
1444  3362            DCA     GSS1
1445  7410            SKP
1446  1364            TAD     GDIM2
1447  2362            ISZ     GSS1
1450  5246            JMP     .-2
1451  1363            TAD     GSS2
1452  3362            DCA     GSS1
1453  1362  NOSS2,    TAD     GSS1
1454  7104            CLL RAL
1455  1362            TAD     GSS1
```

```
1456  1457          TAD     ADDRESS
1457  3067          DCA     ADDRESS
1460  5630  NOSS1,  JMP I   GETADDR
1461  2034  ALLOC,  ISZ     DIMFLAG
1462  7410          SKP
1463  5273          JMP     ISDIM
1464  3034          DCA     DIMFLAG
1465  1363          TAD     GSS2
1466  7640          SZA CLA
1467  1367          TAD     013
1470  3363          DCA     GSS2
1471  1367          TAD     013
1472  3362          DCA     GSS1
1473  1363  ISDIM,  TAD     GSS2
1474  7450          SNA
1475  7201          CLA IAC
1476  7041          CIA
1477  3364          DCA     GDIM2
1500  2134          ISZ     NOINT           /FORBID INTERUPTS NOW.
1501  7301          CLA CLL IAC
1502  1362          TAD     GSS1
1503  7430          SZL
1504  5765          JMP I   PSPACERR
1505  2364          ISZ     GDIM2
1506  5302          JMP     .-4
1507  3364          DCA     GDIM2
1510  1364          TAD     GDIM2
1511  7124          CLL CML RAL
1512  7420          SNL
1513  1364          TAD     GDIM2
1514  3364          DCA     GDIM2
1515  1364          TAD     GDIM2
1516  7430          SZL
1517  5765          JMP I   PSPACERR
1520  4644          JMS I   SPLEFT
1521  7410          SKP
1522  5765          JMP I   PSPACERR
1523  7344          CLA CLL CMA RAL
1524  1314          TAD     INDEX2
1525  3014          DCA     INDEX2
1526  1363          TAD     ARRLOC
1527  3414          DCA I   INDEX2
1530  1362          TAD     GSS1
1531  3414          DCA I   INDEX2
1532  1363          TAD     GSS2
1533  3414          DCA I   INDEX2
1534  7240          CLA CMA
1535  1367          TAD     ADDRESS
1536  3067          DCA     ADDRESS
1537  1366          TAD     07774
1540  3363          DCA     GSS2
1541  1467          TAD I   ADDRESS
1542  2367          ISZ     ADDRESS
1543  4521          JMS I   PSTICKIT
1544  2363          ISZ     GSS2
```

```
1545  5341          JMP     .-4
1546  1364          TAD     GDIM2
1547  7041          CIA
1550  1165          TAD     04
1551  3364          DCA     GDIM2
1552  4521          JMS I   PSTICKIT
1553  2364          ISZ     GDIM2
1554  5352          JMP     .-2
1555  7345          CLA CLL CMA RTL
1556  1233          TAD     GETADDR
1557  3232          DCA     GETADDR
1560  4543          JMS I   CNCLR         /CHECK FOR CONTROL C.
1561  5221          JMP     GETADDR+1
1562  0000  GSS1,    0
1563  0000  GSS2,    0
1564  0000  GDIM2,   0
1565  0370  PSPACER,SPACERR
1566  7774  07774,   7774
1567  0013  013,     13              /(12) IF 1 ORG INDEXING
1570  4477  SSERR,   JMS I   PERROR
1571  2325          TEXT 'SUBSCRIPT'
1572  0223
1573  0322
1574  1122
1575  2400

1576  1352  DEF,    TAD     LINENO
1577  3413          DCA     INDEX1
1600  1413          TAD I   INDEX1
1601  3220          DCA     USERFN
1602  4571          GET+MUSTBE      /'FN'
1603  3754          3754
1604  4571          GET+MUSTBE      /A VARIABLE
1605  7000          7000
1606  4571          GET+MUSTBE      /'('
1607  3755          3755
1610  4571          GET+MUSTBE      /A VARIABLE
1611  7000          7000
1612  4571          GET+MUSTBE      /')'
1613  3751          3761
1614  4571          GET+MUSTBE      /'='
1615  3673          3673
1616  5617          JMP I   PSKIPIT
1617  0457  PSKIPIT,SKIPIT
1620  0000  USERFN, 0
1621  4576  MORERD, MUSTBE          /','
1622  3763          3763
1623  4513  READ,   JMS I   PGETVAR
1624  7240          CLA CMA
1625  1345          TAD     LOCCTR
1626  3273          DCA     LOCTMP
```

only 1 arg allowed?!

→ JMP *

```
1627  1246          TAD     READLOC
1630  3445          DCA     LOCCTR
1631  4567          GET+ISIT        /(CR) OR '0'
1632  2000          2000
1633  7410          SKP
1634  5260          JMP     SEARCH
1635  4566          ISIT            /A LINENO
1636  0000          0000
1637  7410          SKP
1640  5260          JMP     SEARCH
1641  4566          ISIT            /','
1642  3763          3763
1643  5267          JMP     DATAERR
1644  4541  ISSOME, JMS I   PEVAL
1645  7210          CLA CMA
1646  1045          TAD     LOCCTR
1647  3446          DCA     READLOC
1650  1273          TAD     LOCTMP
1651  3445          DCA     LOCCTR
1652  4512          JMS I   PSTOVAR
1653  4567          GET+ISIT        /(CR) OR '0'
1654  2000          2000
1655  5221          JMP     MORERD
1656  5633          JMP I   PEXECUTE
1657  4177  SCHMOR, JMS     GETWD
1660  4566  SEARCH, ISIT            /'DATA'
1661  1757          1757
1662  7410          SKP
1663  5244          JMP     ISSOME
1664  4566          ISIT            /(EOF)
1665  1755          1755
1666  5257          JMP     SCHMOR
1667  4477  DATAERR,JMS I   PERROR
1670  2401          TEXT 'DATA'
1671  2401
1672  0000
1673  0000  LOCTMP, 0
1674  0000  GETBLK, 0
1675  4563          JMS I   PCHKFIT
1676  1004          TAD     CODELOC
1677  3045          DCA     LOCCTR
1700  1004          TAD     CODELOC
1701  1356          TAD     ABCDEF
1702  3004          DCA     CODELOC
1703  1004          TAD     CODELOC
1704  3357          DCA     BCDEFG
1705  1045          TAD     PSYMTAB         /UPDATE SYMBOL TABLE NOW.
1706  1356          TAD     ABCDEF          /BY ADDING IN CORRECTION FACTOR.
1707  3045          DCA     PSYMTAB

1710  1445  GTBKLP, TAD I   LOCCTR          /MOVE TEXT NOW.
1711  2045          ISZ     LOCCTR
1712  3757          DCA I   BCDEFG
1713  2357          ISZ     BCDEFG
1714  1357          TAD     BCDEFG          /NOW CHECK FOR END.
```

```
1715  7041          CIA
1716  1245          TAD     PSYMTAB
1717  7640          SZA CLA
1720  5314          JMP     GTBKLP

1721  7240          CLA CMA
1722  1436          TAD     NSYMTAB
1723  3436          DCA     NSYMTAB
1724  1165          TAD     GSBPTR
1725  7040          CMA
1726  1164          TAD     PGOLIST
1727  3357          DCA     BCDEFG
1730  1164          TAD     PGOLIST
1731  3050          DCA     WORD
1732  1356          TAD     ABCDEF
1733  1450          TAD I   WORD
1734  3450          DCA I   WORD
1735  2050          ISZ     WORD
1736  2357          ISZ     BCDEFG
1737  5332          JMP     .-5
1740  1053          TAD     FORCT
1741  3357          DCA     BCDEFG
1742  1353          TAD     PPFORLIS
1743  3350          DCA     WORD
1744  5352          JMP     .+6
1745  1356          TAD     ABCDEF
1746  1450          TAD I   WORD
1747  3450          DCA I   WORD
1750  2350          ISZ     WORD
1751  2150          ISZ     WORD
1752  2357          ISZ     BCDEFG
1753  5345          JMP     .-6
1754  1245          TAD     PSYMTAB
1755  5674          JMP I   GETBLK
1756  7774  ABCDEF, -4
1757  0034  BCDEFG, 0
1760  7736  PPFORLI,FORLIST+1
1761  0040  PUTJ,   0
1762  4536          JMS I   PFIX
1763  7200          CLA
1764  1216          TAD     AC3
1765  4433          JMS I   PPUTCH
1766  4546          JMS I   PANORM
1767  5761          JMP I   PUTJ


1770  0042  GETJ,   0                       /GETS A CHARACTER FROM THE TTY.
1771  4776          JMS I   PBEGFIX         /CLEAN UP THE FAC
1772  4432          JMS I   PGETCH          /FECTH A CHAR.
1773  3216          DCA     AC3             /SAVE IT, BABY!
1774  4546          JMS I   PANORM         /AND NORMALIZE AC.
1775  5772          JMP I   GETJ            /AND RETURN NOW.

1776  3762  PBEGFIX,BEGFIX
```

```
                        PAGE

2000  2134  NOTNOW, ISZ     NOINT          /RESET AC SWITCH SO NO INTERUPT NOW.

2001  2350          ISZ     WORD
2002  1450          TAD I   WORD
2003  7450          SNA
2004  5232          JMP     INSERT
2005  3371          DCA     LOWLOC
2006  3450          DCA I   WORD
2007  1371          TAD     LOWLOC
2010  3045          DCA     LOCCTR
2011  4516          JMS I   PPASSCR
2012  1371  MOVE,   TAD     LOWLOC
2013  7041          CIA
2014  1304          TAD     CODELOC
2015  7550          SNA CLA
2016  5230          JMP     INSRT5
2017  7340          CLA CLL CMA
2020  1371          TAD     LOWLOC
2021  3371          DCA     LOWLOC
2022  7340          CLA CLL CMA
2023  1045          TAD     LOCCTR
2024  3045          DCA     LOCCTR
2025  1771          TAD I   LOWLOC
2026  3445          DCA I   LOCCTR
2027  5212          JMP     MOVE
2030  1045  INSRT5, TAD     LOCCTR
2031  3004          DCA     CODELOC
2032  1357  INSERT, TAD     FPTR
2033  1446          TAD     MLINBUF
2034  7447          CMA
2035  3357          DCA     FPTR
2036  7326          CLA CLL CML RTL
2037  1357          TAD     FPTR
2040  7452          SNA
2041  5313          JMP     FIXLIN
2042  7140          CMA
2043  4553          JMS I   PCHKFIT
2044  1004          TAD     CODELOC
2045  3045          DCA     LOCCTR
2046  1437          TAD I   PLINBUF
2047  7001          IAC
2050  3413          DCA     INDEX1
2051  1413          TAD I   INDEX1
```

```
2052  3073          DCA     OPERAND
2053  1413          TAD I   INDEX1
2054  3074          DCA     OPERAND+1
2055  4336          JMS     COMPARE
2056  5261          JMP     NOTFRST
2057  4361          JMS     SUBRA
2060  5343          JMP     TRANSF
2061  4516  NOTFRST,JMS I   PPASSCR
2062  4336          JMS     COMPAR
2063  5261          JMP     NOTFRST
2064  1045          TAD     LOCCTR
2065  3360          DCA     LSTLOC
2066  1024          TAD     CODELOC
2067  3045          DCA     LOCCTR
2070  4361          JMS     SUBRA
2071  4177          JMS     GETWD
2072  1050  MOVLUP, TAD     WORD
2073  3772          DCA I   PUTLOC
2074  2372          ISZ     PUTLOC
2075  4177          JMS     GETWD
2076  1350          TAD     LSTLOC
2077  7041          CIA
2100  1045          TAD     LOCCTR
2101  7640          SZA CLA
2102  5272          JMP     MOVLUP
2103  1037  TRANSF, TAD     PLINBUF
2104  3760          DCA     GPTR
2105  1460  TRALUP, TAD I   GPTR
2106  2260          ISZ     GPTR
2107  3772          DCA I   PUTLOC
2110  2372          ISZ     PUTLOC
2111  2057          ISZ     FPTR
2112  5305          JMP     TRALUP
2113  4561  FIXLIN, JMS I   PLINFIX
2114  5520          JMP I   PEDIT


2115  0000  IGNORE, 0               /THIS ROUTINE LOOKS FOR A "0" OR A C
.R.
2116  4567          GET+ISIT
2117  5000          5000            /TEXT?
2120  5327          JMP     NOTBAD  /NOPE.
2121  4177          JMS     GETWD
2122  1050          TAD     WORD
2123  7770          AND     077
2124  7640          SZA CLA         /END OF TEXT?
2125  5321          JMP     .-4     /NOPE.
2126  5316          JMP     IGNORE+1 /YEP. GET NEXT ITEM.

2127  4575  NOTBAD, JMS I   PISITLIT /IS IT A LITERAL?
2130  7410          SKP
2131  5316          JMP     IGNORE+1 /YES.
2132  4566          ISIT
2133  2000          2000            /"0" OR C.R.
```

```
2134  5316          JMP     IGNORE+1        / N 0
2135  5715          JMP I   IGNORE          /YES. RETURN TO CALLER.



2136  0000  COMPARE,0
2137  4567          GET+ISIT        /A LINENO
2140  0002          0002
2141  5356          JMP     IAMLESS
2142  1350          TAD     WORD
2143  7001          IAC
2144  3013          DCA     INDEX1
2145  1413          TAD I   INDEX1
2146  7141          CLL CIA
2147  1073          TAD     OPERAND
2150  7640          SZA CLA
2151  5355          JMP     FRSTNE
2152  1413          TAD I   INDEX1
2153  7141          CLL CIA
2154  1074          TAD     OPERAND+1
2155  7620  FRSTNE, SNL CLA         /IS OPERAND<THIS LINENO
2156  2336  IAMLESS,ISZ     COMPARE /YES
2157  5736          JMP I   COMPARE
2160  0000  LSTLOC, 0
2161  0000  SUBRA,  0
2162  1757          TAD     FPTR
2163  7100          CLL
2164  1024          TAD     CODELOC
2165  3034          DCA     CODELOC
2166  1034          TAD     CODELOC
2167  3372          DCA     PUTLOC
2170  5751          JMP I   SUBRA
2171  0000  LOWLOC, 0
2172  0000  PUTLOC, 0



2173  4177  PRINT,  JMS     GETWD           /THIS INSTRUCTION MAY BE COMBINED WI
TH THE GET INSTRUCTION BEL
2174  7346          CLA CLL CMA RTL         /7775=-3 FOR DEVICE CHECK.
2175  1131          TAD     OUTDEV          /MULTIPLY DEVICE BY 3.
2176  1131          TAD     OUTDEV
2177  1131          TAD     OUTDEV          /SO THAT LPT=6, PTP=3, AND TTY=0.
2200  1361          TAD     0110            /NOW ADD IN 72. THUS TTY=72,LPT=80.
2201  3357          DCA     TWIDTH          /AND SAVE FOR FUTURE USE.
```

```
:202  4566          ISIT                    /CHECK FOR FIRST COMMA. ONCE ONLY CH
:CK.
:203  3763          3763
:204  5237          JMP     PRINTC          /NO. CONTINUE CHECKING.
:205  5277          JMP     PRINBLK         /YEP. GIVE BLANK, THEN TAB OVER.

:206  4177  PRINTG, JMS     GETWD           /GET NEXT ELEMENT AFTER A TEXT ELEME
IT.

:207  3345  PRINTC, DCA     TABFLG          /RESET TAB INDICATER.
:210  4566          ISIT                    /CHECK TO SEE IF CARRIAGE RETURN.
:211  2000          2000
:212  5216          JMP     NOPCR           /NOT A CARRIAGE RETURN. CONTINUE CHE
CKING.

:213  4514          JMS I   PPRINTXT
:214  6531          CRLF
:215  5503          JMP I   PEXECUTE

:216  4566  NOPCR,  ISIT                    /IS IT A COMMA (",")
:217  3763          3763
:220  5316          JMP     PRENT           /NO. FINISH CHECKING BELOW.
:221  5303          JMP     PRINCOM         /IT IS. PROCESS THE COMMA NOW.

:222  4565  PRINTHS,ISIT                    /TEXT
:223  5000          5000
:224  5236          JMP     NOTTXT
:225  4177  PRINQUO,JMS     GETWD
:226  1352          TAD     WORD
:227  7012          RTR
:230  7012          RTR
:231  7012          RTR
:232  4260          JMS     PRINHAF
:233  1350          TAD     WORD
:234  4260          JMS     PRINHAF
:235  5225          JMP     PRINQUO
:236  1241  NOTTXT, TAD     PPRINRET
:237  5640          JMP I   PEVALGO
:240  1337  PEVALGO,EVALGO
:241  2242  PPRINRE,PRINRET
:242  1345  PRINRET,TAD     TABFLG          /WAS THERE A TAB PRESENT?
:243  7640          SZA CLA
:244  5752          JMP I   TABTHR          /YEP. EXECUTE TAB CORRECTER.
:245  1362          TAD     014             /SEE IF ROOM FOR 13 PLACES(1+12).
:246  4346          JMS     CHECKW
:247  1324          TAD     ACS
:250  7710          SPA CLA
:251  5254          JMP     .+3
:252  1351          TAD     0240
:253  4433          JMS I   PPUTCH
:254  4517          JMS I   POUTNUM
:255  1051          TAD     0240
:256  4433          JMS I   PPUTCH
:257  5237          JMP     PRINTC          /GO BACK AND GET NEXT.
:260  0000  PRINHAF,0
:261  0370          AND     077
```

```
2262  7452          SNA
2263  5236          JMP     PRINTG          /GO SKIP PAST TEXT ELEMENT AND CHECK
NEXT.
2264  1326          TAD     007736
2265  7450          SNA
2266  5660          JMP I   PRINHAF
2267  1362          TAD     02
2270  0270          AND     077
2271  1251          TAD     0240
2272  3024          DCA     ACS             /SAVE CHARACTER FOR A SECOND.
2273  4346          JMS     CHECKW          /CHECK TO SEE IF IT'LL FIT ON THE LI
NE.
2274  1024          TAD     ACS             /RESTORE THE CHARACTER.
2275  4433          JMS I   PPUTCH
2276  5660          JMP I   PRINHAF

2277  7230  PRINBLK,CLA                     /MAKE SURE AC IS ZERO.
2300  1251          TAD     0240
2301  4433          JMS I   PPUTCH
2302  4346          JMS     CHECKW          /CHECK TO SEE IF ROOM FOR ONE MORE.
2303  1125  PRINCOM,TAD     COLUMN          /SEE IF COLUMN ON COMMA BOUNDRY.
2304  7452          SNA
2305  5312          JMP     PRINSEM         /YEP.
2306  1327          TAD     07762           /SUBTRACT A LITTLE AN CHECK AGAIN.
2307  7500          SMA                     /TOO FAR?
2310  5304          JMP     .-4             /NOPE.
2311  5277          JMP     PRINBLK         /YEP. GIVE BLANK AND LOOP AGAIN.

2312  4567  PRINSEM,GET+ISIT                /(CR) OR '0'
2313  2000          2000
2314  7410          SKP
2315  5643          JMP I   PEXECUTE/YES
2316  4566  PRENT,  ISIT                    /';'
2317  3762          3762
2320  7410          SKP
2321  5312          JMP     PRINSEM /YES
2322  4566          ISIT                    /','
2323  3763          3763
2324  5222          JMP     PRINTHS
2325  5277          JMP     PRINBLK
2326  7736  007736, 7736
2327  7762  07762,  7762
2330  0000  LINFIX, 0
2331  1004          TAD     CODELOC
2332  3045          DCA     LOCCTR
2333  4177  LFXLUP, JMS     GETAD
2334  1450          TAD I   WORD
2335  7640          SZA CLA                 /IS IT A LINENO
2336  5730          JMP I   LINFIX  /NO
2337  2050          ISZ     WORD
2340  7240          CLA CMA
2341  1045          TAD     LOCCTR
2342  3450          DCA I   WORD
2343  4512          JMS I   PPASSCR
2344  5333          JMP     LFXLUP
```

```
0345  2230  TABFLG, 0                       /TAB FOUND FLAG.


0346  2000  CHECKW, 0                       /THIS ROUTINE CHECKS FOR LINE TOO LO
G.
0347  1126          TAD     COLUMN          /GET WHERE AT NOW.
0350  7240          CMA                     /-WHEREAT-#OF PLACES IN OUT CHAR.
0351  1357          TAD     TWIDTH          /ADD IN WIDTH OF DEVICE.
0352  7730          SMA CLA                 /TOO BIG.
0353  5746          JMP I   CHECKW          /NAH. RETURN TO SENDER.
0354  4514          JMS I   PPRINTXT        /YEP.GIVE C.R.L.F.
0355  6531          CRLF
0356  5746          JMP I   CHECKW          /AND RETURN TO SENDER.

0357  0000  TWIDTH, 0                       /0 IS OK SINCE IT'LL BE SET UP CORRE
TLY.
0360  0014  014,    14                      /MAGIC CONSTANT.
0361  0110  0110,   110                     /WDTH OF TTY PAPER.

0362  6350  TABTHR, TABDO                   /ROUTINE WHICH PROCESS TAB CHARACTER


0363  0073  MENDPDL,-ENDPDL-1

0364  0000  PUSH,   0
0365  3436          DCA I   PDL
0366  2036          ISZ     PDL
0367  1436          TAD     PDL
0370  1363          TAD     MENDPDL
0371  7640          SZA CLA
0372  5754          JMP I   PUSH
0373  4477          JMS I   PERROR
0374  0532          TEXT 'EXPRESSION'
0375  2022
0376  0523
0377  2311
0400  1716
0401  0020


0402  4541  EXIT,   JMS I   PCONT          /WAIT FOR BUFFER TO EMPTY AND THEN C
ONTINUE.
0403  1037          TAD     0215
0404  4433          JMS I   PPUTCH
```

```
:425  1010  EDIT,   TAD      0212
:426  4433         JMS I    PPUTCH
:427  1132         TAD      OUTD2          /RESET DEVICE
:430  3131         DCA      OUTDEV
:431  4543         JMS I    CNCLR          /CHECK TO SEE IF ^C WAS TYPED.
:432  1362         TAD      PXXTHEN
:433  4524         JMS I    PGETLIN
:434  1437         TAD I    PLINBUF
:435  3452         DCA      WORD
:436  1452         TAD I    WORD
:437  7650         SNA CLA
:440  5766         JMP I    PNOTNOW
:441  1010         TAD      0212
:442  4433         JMS I    PPUTCH
:443  1132         TAD      OUTD2          /RESET I/O DEVICE.
:444  3131         DCA      OUTDEV
:445  4566         ISIT              /'RUN'
:446  3736         3736
:447  7410         SKP
:450  5252         JMP      RUN
:451  4566         ISIT              /'LIS'
:452  3737         3737
:453  7410         SKP
:454  5763         JMP I    PLIST
:455  4566         ISIT              /'SCR'
:456  3735         3735
:457  5254         JMP      IMMED
:460  1365  SCRATCH,TAD      PPERMSYM
:461  3374         DCA      CODELOC
:462  1364         TAD      PXXEOF
:463  3765         DCA I    PPERMSYM
:464  1365         TAD      PPERMSYM
:465  7001         IAC
:466  3345         DCA      PSYMTAB
:467  7240         CLA CMA
:470  3346         DCA      NSYMTAB
:471  4537         JMS I    PRESET         /RESET DEVICES AFTER SCRATCH.
:472  4262  RUN,    JMS      CLEARV
:473  5543         JMP I    PEXECUTE
:474  1337  IMMED,  TAD      PLINBUF
:475  3345         DCA      LOCCTR
:476  1364         TAD      PXXEOF
:477  3352         DCA      LINENO
:500  5533         JMP I    PEXECUTE

:501  7600  PJSET,  SETUP

:502  0000  CLEARV, 0
:503  4561         JMS I    PJSET
:504  5333         JMP      RUNIN
:505  1450  RUNLUP, TAD I    EPTR
:506  1352         TAD      070000A
:507  7640         SZA CLA           /IS IT A VARIABLE
:510  5277         JMP      RUNNOT   /NO
:511  2456         ISZ      EPTR
```

```
2472  1456          TAD I   EPTR
2473  3460          DCA     GPTR
2474  1460          TAD I   GPTR
2475  3456          DCA I   EPTR
2476  7410          SKP
2477  2456  RUNNOT, ISZ     EPTR
2500  2456          ISZ     EPTR
2501  2456          ISZ     EPTR
2502  2456          ISZ     EPTR
2503  2457  RUNIN,  ISZ     FPTR
2504  5265          JMP     RUNLUP
2505  1361          TAD     PLIMIT
2506  3033          DCA     ARRLOC
2507  1035          TAD     PSYMTAB
2510  3056          DCA     EPTR
2511  1032          TAD     NSYMTAB
2512  3057          DCA     FPTR
2513  5343          JMP     RUN2IN
2514  1456  RUN2LUP,TAD I   EPTR
2515  1360          TAD     07000A
2516  7640          SZA CLA         /IS IT A VARIABLE.
2517  5337          JMP     RUN2NOT /NO
2520  2456          ISZ     EPTR
2521  1456          TAD I   EPTR
2522  3031          DCA     TMP
2523  1033          TAD     ARRLOC
2524  3456          DCA I   EPTR
2525  1031          TAD     TMP
2526  4521          JMS I   PSTICKIT
2527  4521          JMS I   PSTICKIT
2530  4521          JMS I   PSTICKIT
2531  4521          JMS I   PSTICKIT
2532  2456          ISZ     EPTR
2533  3456          DCA I   EPTR
2534  2456          ISZ     EPTR
2535  3456          DCA I   EPTR
2536  5342          JMP     .+4
2537  2456  RUN2NOT,ISZ     EPTR
2540  2456          ISZ     EPTR
2541  2456          ISZ     EPTR
2542  2456          ISZ     EPTR
2543  2457  RUN2IN, ISZ     FPTR
2544  5314          JMP     RUN2LUP
2545  1034          TAD     CODELOC
2546  3045          DCA     LOCCTR
2547  1125          TAD     PPDLIST.
2550  3036          DCA     PDL
2551  1034          TAD     CODELOC
2552  3046          DCA     READLOC
2553  7240          CLA CMA
2554  3063          DCA     FORCT
2555  1164          TAD     PGOLIST
2556  3165          DCA     GSBPTR
2557  5662          JMP I   CLEARV
2560  7000  07000A, 7000
```

```
2561  1430  PLIMIT, LIMIT          /FIRST WORD OF USER AREA
2562  7253  PXXTHEN,XXTHEN
2563  3630  PLIST,  LIST
2564  7532  PXXEOF, XXEOF
2565  7022  PPERMSY,PERMSYM
2566  2446  PNOTNOW,NOTNOW
2567  4252  END,    JMS     CLEARV
2570  4537  STOP,   JMS I   PRESET        /RESET ALL DEVICES NOW,
2571  4541           JMS I   PCONT         /AND WAIT FOR I/O TO FINISH UP.
2572  4514           JMS I   PPRINTXT      /AND GIVE THE STOP MESSAGE
2573  6525           READY
2574  5520           JMP I   PEDIT
```



```
2620  4561  GETLRET,JMS I   PLINFIX
2621  4543          JMS I   CNCLR         /CHECK TO SEE IF ^C WAS TYPED WHILE
HERE.
2622  5633          JMP I   GETLIN
2623  0000  GETLIN, 0
2624  3254          DCA     SNUMFLG
2625  1131          TAD     OUTDEV        /GET THE OUTPUT DEVICE.
2626  3132          DCA     OUTD2         /SAVE FOR A SECOND.
2627  3131          DCA     OUTDEV        /TURN OFF THE OUTPUT DEVICE.
2630  1172  NEWLIN, TAD     PLBEGIN
2631  3255          DCA     EPTR
2632  1374          TAD     0402
2633  3456          DCA I   EPTR
2634  2256          ISZ     EPTR
2635  4432  NEWCHAR,JMS I   PGETCH
2636  3456          DCA I   EPTR
2637  7240          CLA CMA               /CHECK THE INPUT DEVICE NOW.
2640  1127          TAD     INDEV         /GET IT, BABY.
2641  7640          SZA CLA               /IS IT THE TTY?
2642  5225          JMP     .+4           /NOPE.
2643  3133          DCA     CNTLO         /IT IS. RESET CONTROL O.
```

```
2624  7201          CLA IAC                 /AND TEMPORARILY SET THE OUTPUT TO T
HE TTY.
2625  3131          DCA     OUTDEV
2626  1456          TAD I   EPTR
2627  1374          TAD     07603
2630  7452          SNA                     /IS IT ALT-MODE (175)
2631  5263          JMP     ALTMODE /YES
2632  1367          TAD     036
2633  7450          SNA                     /IS IT '0'
2634  5266          JMP     BARROW  /YES
2635  1371          TAD     0122
2636  7452          SNA                     /IS IT (CAR. RET.)
2637  5340          JMP     CARRET  /YES
2640  1375          TAD     07715
2641  7452          SNA                     /IS IT '@'
2642  5215          JMP     NEWCHAR /YES
2643  0372          AND     0140B
2644  7440          SZA
2645  1363          TAD     076408
2646  7640          SZA CLA                 /IS IT A PRINTABLE CHARACTER
2647  5215          JMP     NEWCHAR /NO
2650  1456          TAD I   EPTR
2651  4433          JMS I   PPUTCH
2652  1356          TAD     EPTR
2653  2056          ISZ     EPTR
2654  1174          TAD     MLEND
2655  7640          SZA CLA
2656  5215          JMP     NEWCHAR
2657  4537  TUBIG,  JMS I   PRESET          /RESET ALL DEVICES NOW.
2660  4514          JMS I   PPRINTXT        /AND GIVE THE ERROR MESSAGES
.
2661  5162          TOOLONG
2662  5214          JMP     NEWLIN
2663  4514  ALTMODE,JMS I   PPRINTXT
2664  6521          DELETED
2665  5214          JMP     NEWLIN
2666  1356  BARROW, TAD     EPTR
2667  1173          TAD     MLBEGIN
2670  7650          SNA CLA
2671  5215          JMP     NEWCHAR
2672  7240          CLA CMA
2673  1056          TAD     EPTR
2674  3456          DCA     EPTR
2675  1373          TAD     03737B
2676  4433          JMS I   PPUTCH
2677  5215          JMP     NEWCHAR
2700  1027  CARRET, TAD     0215
2701  4433          JMS I   PPUTCH
2702  2134          ISZ     NOINT           /SET FLAG TO PREVENT INTERUPTS AS OF
NOW.
2703  1172          TAD     PLBEGIN /EPTR=BEGINNING OF STRING
2704  3156          DCA     EPTR    /FPTR=WHERE TRANSLATED SYMBOL GOES
2705  1337          TAD     PLINBUF /GPRE=CHAR IN STRING(.GE. EPTR)
2706  3357          DCA     FPTR    /HPTR=POSITION IN TABLE
2707  1377  SLOOP,  TAD     PTABLE
2710  3151          DCA     HPTR
2711  1356  GLOOP,  TAD     EPTR
2712  3360          DCA     GPTR
```

```
2713  1461          TAD I   HPTR
2714  7650          SNA CLA
2715  5776          JMP I   POTHER
2716  1461          TAD     HPTR
2717  3456          DCA     WORD
2720  2461          ISZ     HPTR
2721  3424          DCA     ACS
2722  1462  HLOOP,  TAD I   GPTR
2723  1454          TAD     07740
2724  7640          SZA CLA
2725  5330          JMP     BSKIP
2726  2450          ISZ     GPTR
2727  5322          JMP     HLOOP
2730  7330  BSKIP,  CLA CLL CML RAR
2731  1424          TAD     ACS
2732  3424          DCA     ACS
2733  1461          TAD I   HPTR
2734  7430          SZL
2735  2461          ISZ     HPTR
2736  7430          SZL
2737  5343          JMP     .+4
2740  7012          RTR
2741  7012          RTR
2742  7012          RTR
2743  0070          AND     077
2744  7450          SNA
2745  5766          JMP I   JMATCH
2746  1454          TAD     07740
2747  7450          SNA
2750  5330          JMP     BSKIP
2751  0076          AND     077
2752  1376          TAD     040
2753  7041          CIA
2754  1462          TAD I   GPTR
2755  2462          ISZ     GPTR
2756  7650          SNA CLA
2757  5322          JMP     HLOOP
2760  1461          TAD I   HPTR
2761  0076          AND     077
2762  2461          ISZ     HPTR
2763  7640  076408, SZA CLA
2764  5362          JMP     .-4
2765  5311          JMP     GLOOP
2766  6506  JMATCH, AMATCH
2767  0036  036,    36
2770  0040  040,    40
2771  0122  0122,   122
2772  0140  0140B,  140
2773  3737  03737B, 3737
2774  7603  07603,  7603
2775  7715  07715,  7715
2776  3302  POTHER, OTHER
2777  7423  PTABLE, XXPLUS
```

```
                        PAGE


3000  4310  OTHER,  JMS     NONBLNK
3001  1331          TAD     077638
3002  7440          SZA
3003  5223          JMP     NOTCR
3004  1325          TAD     PXXCRLF
3005  3457          DCA I   FPTR
3006  1457          TAD     FPTR
3007  3313          DCA     INDEX1
3010  1326          TAD     PXXEXIT
3011  3413          DCA I   INDEX1
3012  1413          TAD     INDEX1
3013  1441          TAD     MENDLIN
3014  7450          SNA
3015  5622          JMP I   PGETLRET
3016  7710          SPA CLA
3017  5213          JMP     .-7
3020  5621          JMP I   PTUBIG
3021  2657  PTUBIG, TUBIG
3022  2613  PGETLRE,GETLRET
3023  1322  NOTCR,  TAD     07737
3024  7450          SNA
3025  5724          JMP I   JDIGIT
3026  1332          TAD     07764B
3027  7100          CLL
3030  1465          TAD     012
3031  7432          SZL
3032  5724          JMP I   JDIGIT
3033  1330          TAD     07725A
3034  7100          CLL
3035  1321          TAD     032
3036  7430          SZL
3037  5733          JMP I   PLETTER
3040  7330          CLA CLL CML RAR
3041  1456          TAD I   EPTR
3042  3456          DCA I   EPTR
3043  1376  REMPACK,TAD     PTEXT
3044  3457          DCA I   FPTR
3045  2457          ISZ     FPTR
3046  3347  TXTPAK, DCA     THISTXT
3047  1450          TAD I   EPTR
3050  1341          TAD     07763B
3051  7450          SNA
3052  5270          JMP     CRINTXT
3053  1344          TAD     07753
3054  7650          SNA CLA
3055  5370          JMP     DQINTXT
```

```
3056  1456          TAD I   EPTR
3057  0370          AND     077
3060  3456          DCA I   EPTR
3061  1347          TAD     THISTXT
3062  7450          SNA
3063  5272          JMP     LHALF
3064  1456          TAD I   EPTR
3065  3457          DCA I   FPTR
3066  2057          ISZ     FPTR
3067  5274          JMP     RHALF
3070  1455  LHALF,  TAD I   EPTR
3071  7100          CLL RTL
3072  7006          RTL
3073  7006          RTL
3074  2056  RHALF,  ISZ     EPTR
3075  5246          JMP     TXTPAK
3076  1347  CRINTXT,TAD     THISTXT
3077  5723          JMP I   JTXXIT

3100  7725  077254, 7725
3101  7763  077634, 7763
3102  7764  077644, 7764

3103  3446  PLETTER,LETTER
3104  7753  07753,  7753
3105  4200  04200,  4200
3106  0042  042,    42
3107  0000  THISTXT,0
3110  0000  NONBLNK,0
3111  1456          TAD I   EPTR
3112  1054          TAD     07740
3113  7640          SZA CLA
3114  5317          JMP     .+3
3115  2056          ISZ     EPTR
3116  5311          JMP     NONBLNK+1
3117  1456          TAD I   EPTR
3120  5710          JMP I   NONBLNK
3121  0032  032,    32
3122  7737  07737,  7737
3123  3221  JTXXIT, MTXXIT
3124  3234  JDIGIT, DIGIT
3125  7226  PXXCRLF,XXCRLF
3126  7505  PXXEXIT,XXEXIT
3127  0172  POPERA, OPERAND-1
3130  7506  PXXLIT0,XXLIT0
3131  4435  LITRAL, FENTER
3132  2073          FST     OPERAND
3133  0240          FEXIT
3134  1075          TAD     OPERAND+2
3135  7040          SZA CLA
3136  5346          JMP     ALL3
3137  1074          TAD     OPERAND+1
3140  7040          SZA CLA
3141  5347          JMP     JUST2
```

```
3142  1473          TAD     OPERAND
3143  7650          SNA CLA
3144  5350          JMP     JUST0
3145  7344  JUST1,  CLA CLL CMA RAL
3146  7301  ALL3,   IAC
3147  1362  JUST2,  TAD     02
3150  7343  JUST0,  CMA
3151  3331          DCA     TMP
3152  1327          TAD     POPERA
3153  3313          DCA     INDEX1
3154  1331          TAD     TMP
3155  7342          CMA
3156  1332          TAD     PXXLIT0
3157  5363          JMP     JUST0P
3160  6201  JUST0F, CDF     0               /!!!!!!!!!!!! 8 K INSERT.
3161  1413          TAD I   INDEX1
3162  6211          CDF     10              /!!!!!!!!!!!! 8  K INSERT.
3163  3457  JUST0P, DCA I   FPTR
3164  2357          ISZ     FPTR
3165  2331          ISZ     TMP
3166  5360          JMP     JUST0F
3167  5516          JMP I   PSLOOP


3170  1307  DGINTXT,TAD     THISTXT
3171  2356          ISZ     EPTR
3172  7440          SZA
3173  5376          JMP     .+3
3174  1305          TAD     04200
3175  5723          JMP I   JTXXIT
3176  1306          TAD     042
3177  3457          DCA I   FPTR
3200  2357          ISZ     FPTR
3201  3457  JTXXIT, DCA I   FPTR
3202  2357          ISZ     FPTR
3203  5516          JMP I   PSLOOP


3204  7200  DIGIT,  CLA
3205  1464          TAD I   SNUMFLG
3206  1370          TAD     01774
3207  7440          SZA             /IS IT 'GOTO' OR 'THEN'
3210  7001          IAC
3211  7440          SZA             /OR 'GOSUB'
3212  1375          TAD     01742
3213  7650          SNA CLA         /OR 'LIST'
3214  7240          CLA CMA         /YES
3215  3464          DCA     SNUMFLG
3216  4435          FENTER
3217  3152          FLD     ZERO
3220  7000          FEXIT
3221  3365          DCA     DPFLAG
3222  3366          DCA     DECFRAC
3223  7410          SKP
```

```
3224  2056  DIGIN,  ISZ     EPTR
3225  4522          JMS I   PNONBLNK
3226  1316          TAD     07673
3227  7450          SNA
3230  5263          JMP     ITSE
3231  1370          TAD     027
3232  7450          SNA
3233  5256          JMP     ITSDP
3234  1374          TAD     07764C
3235  7100          CLL
3236  1055          TAD     012
3237  7424          SNL
3240  5331          JMP     ENDNUM
3241  7110          CLL RAR
3242  1373          TAD     02040A
3243  3356          DCA     FDIGIT
3244  7210          RAR
3245  3351          DCA     FDIGIT+1
3246  4435          FENTER
3247  6545          FMPI    PTEN
3250  4310          FAD+FWD+FDIGIT-.
3251  0100          FEXIT
3252  1365          TAD     DPFLAG
3253  7640          SZA CLA
3254  2356          ISZ     DECFRAC
3255  5224          JMP     DIGIN
3256  1365  ITSDP,  TAD     DPFLAG
3257  7640          SZA CLA
3260  5331          JMP     ENDNUM
3261  2365          ISZ     DPFLAG
3262  5224          JMP     DIGIN
3263  3356  ITSE,   DCA     FDIGIT
3264  1364          TAD     SNUMFLG
3265  7640          SZA CLA
3266  5331          JMP     ENDNUM
3267  2056          ISZ     EPTR
3270  4522          JMS I   PNONBLNK
3271  1371          TAD     07725B
3272  7450          SNA
3273  5302          JMP     ITSP
3274  1372          TAD     07776
3275  7640          SZA CLA
3276  5341          JMP     NOTSGN
3277  2356          ISZ     FDIGIT
3300  2056  ITSP,   ISZ     EPTR
3301  4757  NOTSGN, JMS I   JISDIG
3302  5331          JMP     ENDNUM
3303  2056          ISZ     EPTR
3304  3351          DCA     FDIGIT+1
3305  4757          JMS I   JISDIG
3306  5322          JMP     ONLY1
3307  7200          CLA
3310  1351          TAD     FDIGIT+1
3311  7106          CLL RTL
3312  1351          TAD     FDIGIT+1
```

```
3313  7104          CLL RAL
3314  3361          DCA     FDIGIT+1
3315  4767          JMS I   JISDIG
3316  7673  07673,  7673
3317  1361          TAD     FDIGIT+1
3320  3361          DCA     FDIGIT+1
3321  2356          ISZ     EPTR
3322  1360  ONLY1,  TAD     FDIGIT
3323  7110          CLL RAR
3324  1361          TAD     FDIGIT+1
3325  7420          SNL
3326  7041          CIA
3327  1366          TAD     DECFRAC
3330  3356          DCA     DECFRAC
3331  7200  ENDNUM, CLA
3332  1356          TAD     DECFRAC
3333  7700          SMA CLA
3334  1364          TAD     DIVXTEN
3335  1363          TAD     MULXTEN
3336  3346          DCA     MULEXP
3337  1366          TAD     DECFRAC
3340  7510          SPA
3341  7041          CIA
3342  7040          CMA
3343  3366          DCA     DECFRAC
3344  5350          JMP     .+4
3345  4435          FENTER
3346  7402  MULEXP, HLT
3347  0000          FEXIT
3350  2366          ISZ     DECFRAC
3351  5345          JMP     .-4
3352  2354          ISZ     SNUMFLG
3353  5777          JMP I   PLITRAL
3354  4006          JMS I   PFIX
3355  7200          CLA
3356  5757          JMP I   PCOMMON
3357  3400  PCOMMON,COMMON
3360  0000  FDIGIT, 0;0;0
3361  0000
3362  0000
3363  6545  MULXTEN,FMPI    PTEN
3364  1000  DIVXTEN,FDV-FMP
3365  0000  DPFLAG, 0
3366  0000  DECFRAC,0
3367  6532  JISDIG, ISDIG
3370  0027  027,    27
3371  7725  07725B, 7725
3372  7776  07776,  7776
3373  2040  02040A, 2040
3374  7764  07764C, 7764
3375  1742  01742,  1742
3376  1774  01774,  1774
3377  3131  PLITRAL,LITRAL
```

```
                        PAGE

3400  1035  COMMON,   TAD      PSYMTAB
3401  3450            DCA      GPTR
3402  1036            TAD      NSYMTAB
3403  3051            DCA      HPTR
3404  5231            JMP      IN
3405  1460  LUP,      TAD I    GPTR
3406  2050            ISZ      GPTR
3407  2050            ISZ      GPTR
3410  7640            SZA CLA                 /IS IT A LINENO
3411  5227            JMP      NOT            /NO
3412  1460            TAD I    GPTR
3413  2050            ISZ      GPTR
3414  7041            CIA
3415  1017            TAD      AC2
3416  7640            SZA CLA
3417  5232            JMP      NOT+1
3420  1460            TAD I    GPTR
3421  7041            CIA
3422  1016            TAD      AC3
3423  7640            SZA CLA
3424  5230            JMP      NOT+1
3425  7346            CLA CLL CMA RTL
3426  5312            JMP      ISDEF2
3427  2050  NOT,      ISZ      GPTR
3430  2050            ISZ      GPTR
3431  2051  IN,       ISZ      HPTR
3432  5235            JMP      LUP
3433  4515            JMS I    PGETBLK
3434  3064            DCA      SNUMFLG
3435  3464            DCA I    SNUMFLG
3436  1064            TAD      SNUMFLG
3437  3013            DCA      INDEX1
3440  3413            DCA I    INDEX1
3441  1017            TAD      AC2
3442  3413            DCA I    INDEX1
3443  1016            TAD      AC3
3444  3413            DCA I    INDEX1
3445  5314            JMP      ITSDEF
3446  7041  LETTER,   IAC
3447  7106            CLL RTL
3450  7006            RTL
3451  7006            RTL
3452  3031            DCA      TMP
3453  2056            ISZ      EPTR
3454  4522            JMS I    PNONBLNK
3455  1273            TAD      07706C
3456  7100            CLL
```

```
3457  1065          TAD     012
3460  7520          SNL CLA
3461  5266          JMP     SIMPLV
3462  1456          TAD I   EPTR
3463  1031          TAD     TMP
3464  3031          DCA     TMP
3465  2056          ISZ     EPTR
3466  1035  SIMPLV, TAD     PSYMTAB
3467  3062          DCA     GPTR
3470  1036          TAD     NSYMTAB
3471  3061          DCA     HPTR
3472  5324          JMP     VSCHIN
3473  7706  07706C, 7706
3474  7000  07000B, 7000
3475  1460  VSCHLUP,TAD I   GPTR
3476  1274          TAD     07000B
3477  7640          SZA CLA
3500  5320          JMP     VSCHNOT
3501  2060          ISZ     GPTR
3502  1460          TAD I   GPTR
3503  3064          DCA     SNUMFLG
3504  1464          TAD I   SNUMFLG
3505  7041          CIA
3506  1031          TAD     TMP
3507  7640          SZA CLA
3510  5321          JMP     VSCHNOT+1
3511  7240          CLA CMA
3512  1062  ISDEF2, TAD     GPTR
3513  3064          DCA     SNUMFLG
3514  1064  ITSDEF, TAD     SNUMFLG
3515  3457          DCA I   FPTR
3516  2057          ISZ     FPTR
3517  5516          JMP I   PSLOOP
3520  2062  VSCHNOT,ISZ     GPTR
3521  2060          ISZ     GPTR
3522  2060          ISZ     GPTR
3523  2060          ISZ     GPTR
3524  2061  VSCHIN, ISZ     HPTR
3525  5275          JMP     VSCHLUP
3526  4515          JMS I   PGETBLK
3527  3064          DCA     SNUMFLG
3530  7240          CLA CMA
3531  1064          TAD     SNUMFLG
3532  3413          DCA     INDEX1
3533  1350          TAD     01000
3534  3413          DCA I   INDEX1
3535  1305          TAD     ARRLOC
3536  3413          DCA I   INDEX1
3537  3413          DCA I   INDEX1
3540  3413          DCA I   INDEX1
3541  4563          JMS I   PCHKFIT
3542  1031          TAD     TMP
3543  4521          JMS I   PSTICKIT
3544  4521          JMS I   PSTICKIT
3545  4521          JMS I   PSTICKIT
```

```
3546  4521          JMS I   PSTICKIT
3547  5314          JMP     ITSDEF
3550  1000  01000,  1000
3551  0000  POP,    0
3552  7240          CLA CMA
3553  1036          TAD     PDL
3554  3036          DCA     PDL
3555  1436          TAD I   PDL
3556  5751          JMP I   POP
3557  3737  FOURLF, TEXT '0000'
3560  3737
3561  0000
3562  3724  UGH1,   TEXT '@TOO BIG. LINE IGNORED@'
3563  1717
3564  4022
3565  1107
3566  5646
3567  1411
3570  1635
3571  4011
3572  0716
3573  1722
3574  0524
3575  3700
```

```
                PAGE

3600  1746  LIST,   TAD I   PXLINBUF
3601  3450          DCA     WORD
3602  4556          ISIT                    /CHECK FOR A "*"
3603  3476          3476
3604  5210          JMP     .+4             /NOPE.
3605  7240          CLA CMA                 /YEP. SET UP PUTXRA BY GIVING A PHOO
NEY
3606  4541          JMS I   PCONT           /CALL TO THE WAIT ROUTINE.
3607  4177          JMS     GETWD           /AND GET ANOTHER WORD NOW.
3610  4566          ISIT            /LINENO
3611  0000          0000
3612  5216          JMP     LISTALL
3613  2350          ISZ     WORD
3614  1450          TAD I   WORD
3615  7452          SNA
3616  1324  LISTALL,TAD     CODELOC
3617  3345  LISTSOM,DCA     LOCCTR
3620  4177  LISTLUP,JMS     GETWD
3621  4556          ISIT            /(EOF)
3622  1755          1755
```

```
3623  5230          JMP     LNOEND          /NOT DONE YET
3624  4541          JMS I   PCOWT           /WAIT FOR I/O TO FINISH AND CLEAN UP
3625  4332          JMS     PRINTXT
3626  3557          FOURLF
3627  552?          JMP I   PEDIT
3630  4556  LNOEND, ISIT    .               /A LINENO
3631  0200          0000
3632  5240          JMP     LIST2   /NO
3633  1250          TAD     WORD
3634  4523          JMS I   PPRINUM
3635  1251          TAD     0240
3636  4433          JMS I   PPUTCH
3637  5220          JMP     LISTLUP
3640  4556  LIST2,  ISIT            /A VARIABLE
3641  7200          7200
3642  5255          JMP     LIST3
3643  2250          ISZ     WORD
3644  1452          TAD I   WORD
3645  3250          DCA     WORD
3646  1450          TAD I   WORD
3647  3253          DCA     PRINVAR
3650  4332          JMS     PRINTXT
3651  3653          PRINVAR
3652  5220          JMP     LISTLUP
3653  0000  PRINVAR,0
3654  0000          0
3655  4575  LIST3,  JMS I   PISITLIT /ISIT A LITERAL
3656  5261          JMP     LIST4   /NO
3657  4517          JMS I   POUTNUM /PRINT IT
3660  5220          JMP     LISTLUP
3661  4566  LIST4,  ISIT            /(TEXT)
3662  5000          5000
3663  5276          JMP     LIST5
3664  4177  L4LUP,  JMS     GETWD
3665  1250          TAD     WORD
3666  3253          DCA     PRINVAR
3667  4332          JMS     PRINTXT
3670  3653          PRINVAR
3671  1254          TAD     WORD
3672  0277          AND     077
3673  7540          SZA CLA
3674  5264          JMP     L4LUP
3675  5220          JMP     LISTLUP
3676  1250  LIST5,  TAD     WORD    /ITS A SYSTEM SYMBOL
3677  7001          IAC
3700  4332          JMS     PRINTXT
3701  5220          JMP     LISTLUP
3702  0000  PRINTXT,0
3703  7441          SZA
3704  5310          JMP     JBPENT+1        /!!!!!!!!!!!! 8 K INSERT.
3705  6201          CDF     0               /!!!!!!!!!!!! 8 K INSERT.
3706  1702          TAD I   PRINTXT
3707  2302  JBPENT, ISZ     PRINTXT
3710  3042          DCA     PRTEMP
3711  1442  PRLOOP, TAD I   PRTEMP
```

```
3712  7012          RTR
3713  7012          RTR
3714  7012          RTR
3715  4324          JMS     PRSUBR
3716  1442          TAD I   PRTEMP
3717  4324          JMS     PRSUBR
3720  2442          ISZ     PRTEMP
3721  5311          JMP     PRLOOP
3722  6211  PRTXRET,CDF     10              /!!!!!!!!! 8 K INSERT.
3723  5742          JMP I   PRINTXT
3724  0000  PRSUBR, 0
3725  0076          AND     077
3726  7450          SNA
3727  5322          JMP     PRTXRET
3730  1345          TAD     07741
3731  7450          SNA
3732  5344          JMP     CRLFPR
3733  1376          TAD     077
3734  0076          AND     077
3735  1451          TAD     0240
3736  4433          JMS I   PPUTCH
3737  5724          JMP I   PRSUBR
3740  1337  CRLFPR, TAD     0215
3741  4433          JMS I   PPUTCH
3742  1312          TAD     0212
3743  4433          JMS I   PPUTCH
3744  5724          JMP I   PRSUBR
3745  7741  07741,  7741
3746  7513  PXLINBU,LINBUF+1
3747  0000  PRINUM, 0
3750  7001          IAC
3751  3413          DCA     INDEX1
3752  4362          JMS     BEGFIX          /SET UP PAC TO RECEIVE INTEGER DATA.

3753  1413          TAD I   INDEX1
3754  3417          DCA     AC2
3755  1413          TAD I   INDEX1
3756  3416          DCA     AC3
3757  4546          JMS I   PANORM
3760  4517          JMS I   POUTNUM
3761  5747          JMP I   PRINUM



3762  0000  BEGFIX, 0                       /SETS UP FOR INTEGER TO AC MODE.
3763  3017          DCA     AC2             /CLEAR THEM ALL, EXCEPT FOR LOW WORD

3764  3026          DCA     AC1
3765  3012          DCA     OV
3766  3024          DCA     ACS
3767  1372          TAD     0233
3770  3025          DCA     ACE
3771  5762          JMP I   BEGFIX

3772  0233  0233,   233
```

```
3773  4571  RESTORE,GET+MUSTBE      /(CR) OR '0'
3774  2000          2000
3775  1004          TAD     CODELOC
3776  3046          DCA     READLOC
3777  5503          JMP I   PEXECUTE
```

```
                    PAGE


4000  4566  MOREIN, ISIT            /(CR) OR '0'
4001  2000          2000
4002  5234          JMP     INPLUP
4003  1012          TAD     0212
4004  4433          JMS I   PPUTCH
4005  1130          TAD     OUTD2           /GET THE OLD OUTPUT DEVICE.
4006  3131          DCA     OUTDEV          /AND RESET IT.
4007  7240  INPUT,  CLA CMA                 /CHECK THE INPUT DEVICE NOW.
4010  1127          TAD     INDEV           /ARE WE INPUT FROM THE TELETYPE.
4011  7640          SZA CLA
4012  5224          JMP     IPNOPE          /NOPE.
4013  1131          TAD     OUTDEV          /GET THE OUTPUT DEVICE.
4014  4504          JMS I   PPUSH           /SAVE IT FOR A SECOND.
4015  7201          CLA IAC                 /SET OUTPUT DEVICE TO TTY FOR "?"
4016  3131          DCA     OUTDEV
4017  4541          JMS I   PCOWT           /WAIT FOR OUTPUT TO FINISH, THEN CON
TINUE.
4020  1073          TAD     077
4021  4433          JMS I   PPUTCH
4022  4515          JMS I   PPOP            /RESET OUTPUT DEVICE NOW.
4023  3131          DCA     OUTDEV
4024  1045  IPNOPE, TAD     LOCCTR
4025  3565          DCA I   GSBPTR
4026  1076          TAD     PTEXT
4027  4524          JMS I   PGETLIN
4030  1565          TAD I   GSBPTR
```

```
4031  3045          DCA     LOCCTR
4032  1437          TAD     PLINBUF
4033  3253          DCA     INPPTR
4034  4513  INPLUP, JMS I   PGETVAR
4035  1450          TAD     WORD
4036  3254          DCA     INWDTMP
4037  1245          TAD     LOCCTR
4040  3255          DCA     INLCTMP
4041  1253          TAD     INPPTR
4042  3045          DCA     LOCCTR
4043  4541          JMS I   PEVAL
4044  1245          TAD     LOCCTR
4045  3253          DCA     INPPTR
4046  1255          TAD     INLCTMP
4047  3045          DCA     LOCCTR
4050  4512          JMS I   PSTOVAR
4051  7332          CLA CLL CML RTR
4052  1664          TAD I   INWDTMP
4053  7640          SZA CLA
4054  5230          JMP     MOREIN
4055  1310          TAD     0212
4056  4433          JMS I   PPUTCH
4057  1130          TAD     OUTD2           /RESET THE DEV, BABY
4060  3131          DCA     OUTDEV
4061  3125          DCA     COLUMN
4062  5603          JMP I   PEXECUTE
4063  0000  INPPTR, 0
4064  0000  INWDTMP,0
4065  0000  INLCTMP,0
4066  0000  XGISIT, 0
4067  4177          JMS     GETWD
4070  1266          TAD     XGISIT
4071  3273          DCA     XISIT
4072  5274          JMP     XISIT+1
4073  7300  XISIT,  0
4074  1450          TAD I   WORD
4075  6201          CDF     0               /!!!!!!!!!!!!! 8 K INSERT.
4076  1673          TAD I   XISIT
4077  6211          CDF     10              /!!!!!!!!!!!!! 8 K INSERT.
4100  2273          ISZ     XISIT
4101  7054          SMA CLA
4102  2273          ISZ     XISIT
4103  5673          JMP I   XISIT
4104  0000  ISITLIT,0
4105  1450          TAD I   WORD
4106  7146          CLL CMA RTL
4107  7332          CML RTR
4110  3024          DCA     ACS
4111  1024          TAD     ACS
4112  1150          TAD     04
4113  7020          SNL CLA
4114  5704          JMP I   ISITLIT
4115  2304          ISZ     ISITLIT
4116  3020          DCA     AC1
4117  3017          DCA     AC2
```

```
4120  3016          DCA     AC3
4121  4333          JMS     ISLIT
4122  3016          DCA     AC3
4123  4333          JMS     ISLIT
4124  3017          DCA     AC2
4125  4333          JMS     ISLIT
4126  3020          DCA     AC1
4127  4435  LOADED, FENTER
4130  3016          FLD     AC3
4131  0002          FEXIT
4132  5704          JMP I   ISITLIT
4133  0000  ISLIT,  0
4134  2024          ISZ     ACS
4135  7410          SKP
4136  5327          JMP     LOADED
4137  4177          JMS     GETWD
4140  1050          TAD     WORD
4141  5733          JMP I   ISLIT
4142  0000  ERROR,  0
4143  4537          JMS I   PRESET          /RESET ALL I/O DEVICES.
4144  4514          JMS I   PPRINTXT
4145  6531          CRLF
4146  1342          TAD     ERROR
4147  3351          DCA     .+2
4150  4514          JMS I   PPRINTXT
4151  7432          HLT
4152  4514          JMS I   PPRINTXT
4153  4176          QERROR
4154  1452          TAD I   LINENO
4155  7710          SPA CLA
4156  5363          JMP     .+5
4157  4514          JMS I   PPRINTXT
4160  6451          ATLINE
4161  1452          TAD     LINENO
4162  4523          JMS I   PPRINUM
4163  4514          JMS I   PPRINTXT
4164  6531          CRLF
4165  1125          TAD     PPDLIST
4166  3036          DCA     PDL
4167  5520          JMP I   PEDIT
4170  4005  QERROR, TEXT ' ERROR'
4171  2222
4172  1722
4173  0000
```

```
        PAGE

/       JMS     FPT     /ENTER FLOATING POINT PACK
```

```
                        /       0000            /FEXIT
                        /       0040            /FSNE
                        /       0050            /FSEQ
                        /       0100            /FSGE
                        /       0110            /FSLT
                        /       0140            /FSGT
                        /       0150            /FSLE
                        /               IF BIT 4 OFF THEN SAME AS PDP-8
                        /               IF BIT 4 ON THEN IF BIT 3 OFF THEN RELATIVE
PLUS
                        /                                       IF BIT 3 ON THEN RELATIVE M
INDS
                        /       1XXX            /FJMP
                        /       2XXX            /FST
                        /       3XXX            /FLD
                        /       4XXX            /FAD
                        /       5XXX            /FSB
                        /       6XXX            /FMP
                        /       7XXX            /FDV
4200  0020  FPT,       0
4201  5204              JMP     .+3
4202  4546  FPLOOP,     JMS I   PANORM
4203  2212              ISZ     FPT
4204  6201              CDF     0               /!!!!!!!! 8 K INSERT.
4205  1630              TAD I   FPT
4206  7006              RTL
4207  7006              RTL
4210  0072              AND     07
4211  7452              SNA
4212  5305              JMP     FPOPER
4213  3273              DCA     FPGOTO
4214  1630              TAD I   FPT
4215  0156              AND     0200
4216  7652              SNA CLA
4217  5227              JMP     FPPGZ
4220  1631              TAD I   FPT
4221  0177              AND     0177
4222  7430              SZL
4223  7041              CIA
4224  1273              TAD     FPT
4225  3334              DCA     FPADDR
4226  5237              JMP     FPDOIT
4227  1630  FPPGZ,      TAD I   FPT
4230  0177              AND     0177
4231  3334              DCA     FPADDR
4232  7420              SNL
4233  5237              JMP     FPDOIT
4234  1734              TAD I   FPADDR
4235  3334              DCA     FPADDR
4236  6211              CDF     10              /!!!!!!!! 8 K INSERT.
4237  7346  FPDOIT,     CLA CLL CMA RTL
4240  1273              TAD     FPGOTO
4241  7710              SPA CLA
4242  5277              JMP     FPNOADR
4243  7334              CLA CLL CML RAR
4244  0734              AND I   FPADDR
4245  3326              DCA     OPS
```

```
4246  1734          TAD I   FPADDR
4247  7640          SZA CLA
4250  7041          CMA
4251  3156          DCA     FPFLAG
4252  1734          TAD I   FPADDR
4253  7012          RTR
4254  7010          RAR
4255  0371          AND     0377
4256  3130          DCA     OPE
4257  1734          TAD I   FPADDR
4260  0372          AND     07
4261  3123          DCA     OP1
4262  2334          ISZ     FPADDR
4263  1734          TAD I   FPADDR
4264  3122          DCA     OP2
4265  2334          ISZ     FPADDR
4266  1734          TAD I   FPADDR
4267  3121          DCA     OP3
4270  1273  FPNOADR,TAD     FPGOTO
4271  1274          TAD     FPJUMP
4272  3273          DCA     .+1
4273  7432  FPGOTO, HLT
4274  5674  FPJUMP, JMP I   .
4275  4317          FPJMP
4276  4322          FPSTO
4277  4351          FPLAC
4300  4456          FPADD
4301  4453          FPSUB
4302  4537          FPMUL
4303  4567          FPDIV
4304  0000  FPADDR, 0
4305  1600  FPOPER, TAD I   FPT
4306  6211          CDF     10              /!!!!!!!!!!! 8 K INSERT.
4307  7450          SNA
4310  5634          JMP I   FPT
4311  1345          TAD     07600
4312  3314          DCA     FPSKIP
4313  4333          JMS     HIGHWD
4314  7432  FPSKIP, HLT
4315  2234          ISZ     FPT
4316  5273          JMP     FPLOOP+1
4317  1324  FPJMP,  TAD     FPADDR
4320  3234          DCA     FPT
4321  5244          JMP     FPLOOP+2
4322  4333  FPSTO,  JMS     HIGHWD
4323  3734          DCA I   FPADDR
4324  2334          ISZ     FPADDR
4325  1317          TAD     AC2
4326  3734          DCA I   FPADDR
4327  2334          ISZ     FPADDR
4330  1316          TAD     AC3
4331  3734          DCA I   FPADDR
4332  5273          JMP     FPLOOP+1
4333  0000  HIGHWD, 0
4334  1325          TAD     ACE
```

```
4335  7104          CLL RAL
4336  7500          SMA
4337  7106          CLL RTL
4340  7530          SPA SZL
4341  5345          JMP     07600
4342  1024          TAD     AC5
4343  1020          TAD     AC1
4344  5733          JMP I   HIGHWD
4345  7600  07600,  7600
4346  1071          TAD     0377
4347  3025          DCA     ACE
4350  5334          JMP     HIGHWD+1
4351  1026  FPLAC,  TAD     OPS
4352  3024          DCA     AC5
4353  1030          TAD     OPE
4354  3025          DCA     ACE
4355  1023          TAD     OP1
4356  3020          DCA     AC1
4357  1022          TAD     OP2
4360  3017          DCA     AC2
4361  1021          TAD     OP3
4362  3016          DCA     AC3
4363  3012          DCA     OV
4364  5242          JMP     FPLOOP
4365  7041  UPARR2, CIA             /(CMA) IF 1 ORG INDEXING
4366  3013          DCA     INDEX1
4367  4435          FENTER
4370  3151          FLD     ONE
4371  0000          FEXIT
4372  5376          JMP     .+4
4373  4435          FENTER
4374  5373          FMP     OPERAND
4375  0000          FEXIT
4376  2013          ISZ     INDEX1
4377  5373          JMP     .-4
4400  5601          JMP I   .+1
4401  1203          OPDONE


4402  0000  AR1,    0
4403  1020          TAD     AC1
4404  7110          CLL RAR
4405  3120          DCA     AC1
4406  1017          TAD     AC2
4407  7010          RAR
4410  3017          DCA     AC2
4411  1016          TAD     AC3
4412  7010          RAR
4413  3016          DCA     AC3
4414  7010          RAR
4415  3012          DCA     OV
4416  5602          JMP I   AR1
```

```
4417  0000  ACN,    0
4420  1234          TAD     POP3
4421  3235          DCA     OADD
4422  7340          CLA CLL CMA RTL
4423  3232          DCA     AR1
4424  7024          CML RAL
4425  1635          TAD I   OADD
4426  7041          CIA
4427  3635          DCA I   OADD
4430  2235          ISZ     OADD
4431  2232          ISZ     AR1
4432  5224          JMP     .-6
4433  5617          JMP I   ACN
4434  0021  POP3,   OP3
4435  0000  OADD,   0
4436  7100          CLL
4437  1016          TAD     AC3
4440  1021          TAD     OP3
4441  3016          DCA     AC3
4442  7004          RAL
4443  1017          TAD     AC2
4444  1022          TAD     OP2
4445  3017          DCA     AC2
4446  7004          RAL
4447  1024          TAD     AC1
4450  1023          TAD     OP1
4451  3022          DCA     AC1
4452  5635          JMP I   OADD
4453  7330  FPSUB,  CLA CLL CML RAR
4454  1026          TAD     OPS
4455  3326          DCA     OPS
4456  2156  FPADD,  ISZ     FPFLAG
4457  5326          JMP     EOFAD
4460  1025          TAD     ACE
4461  7141          CLL CIA
4462  1032          TAD     OPE
4463  7430          SZL
4464  5342          JMP     BCKWDS
4465  3235          DCA     OADD
4466  1023  ALGNLP, TAD     OP1
4467  7110          CLL RAR
4470  3023          DCA     OP1
4471  1022          TAD     OP2
4472  7210          RAR
4473  3022          DCA     OP2
4474  1021          TAD     OP3
4475  7212          RAR
4476  3021          DCA     OP3
4477  2235          ISZ     OADD
4500  5256          JMP     ALGNLP
4501  5312          JMP     SETSGN
4502  7040  BCKWDS, CMA
4503  3235          DCA     OADD
4504  1032          TAD     OPE
4505  3025          DCA     ACE
```

```
4526  7410          SKP
4527  4232          JMS     AR1
4530  2235          ISZ     OADD
4531  5327          JMP     .-2
4532  1024  SETSGN, TAD     ACS
4533  1026          TAD     OPS
4534  7710          SPA CLA
4535  4217          JMS     ACN
4536  4235          JMS     OADD
4537  1022          TAD     AC1
4540  7700          SMA CLA
4541  5326          JMP     EOFAD
4542  7346          CLA CLL CMA RTL
4543  4217          JMS     ACN
4544  1026          TAD     OPS
4545  3024          DCA     ACS
4546  3012  EOFAD,  DCA     OV
4547  5775          JMP I   PFPLOOP
4550  2156  FPMUL,  ISZ     FPFLAG
4551  5371          JMP     MULCLR
4552  1024          TAD     ACS
4553  1026          TAD     OPS
4554  3024          DCA     ACS
4555  1025          TAD     ACE
4556  1030          TAD     OPE
4557  1377          TAD     07577
4560  3025          DCA     ACE
4561  1022          TAD     AC1
4562  3026          DCA     OPS
4563  1017          TAD     AC2
4564  3030          DCA     OPE
4565  1016          TAD     AC3
4566  3031          DCA     TMP
4567  3022          DCA     AC1
4570  1152          TAD     07745
4571  3370          DCA     FPTEMP
4572  4232  MPYLUP, JMS     AR1
4573  1026          TAD     OPS
4574  7010          RAR
4575  3026          DCA     OPS
4576  1030          TAD     OPE
4577  7010          RAR
4600  3030          DCA     OPE
4601  1031          TAD     TMP
4602  7010          RAR
4603  3031          DCA     TMP
4604  7430          SZL
4605  4235          JMS     OADD
4606  2370          ISZ     FPTEMP
4607  5352          JMP     MPYLUP
4610  5775          JMP I   PFPLOOP
4611  7346  MULCLR, CLA CLL CMA RTL
4612  3025          DCA     ACE
4613  3022          DCA     AC1
4614  5775          JMP I   PFPLOOP
```

```
4575  4202  PFPLOOP,FPLOOP
4576  0000  FPTEMP, 0
4577  7577  0/577,  7577
```

```
                PAGE

4600  0000  ANORM,  0
4601  1324          TAD     AC1
4602  7450          SNA                     /IS HIGH WORD ZERO?
4603  5212          JMP     MAYZERO         /YEP. ENTIRE NUMBER MAY BE ZERO.
4604  1355          TAD     07770
4605  7710          SPA CLA
4606  5220          JMP     NOTBIG
4607  4547          JMS I   PAR1
4610  2025          ISZ     ACE
4611  5201          JMP     ANORM+1

4612  1017  MAYZERO,TAD     AC2             /IS SECOND WORD ZERO?
4613  7640          SZA CLA
4614  5220          JMP     NOTBIG          /NOPE. NORMAL NORMALIZE.
4615  1016          TAD     AC3             /1 & 2 ARE ZERO. IS THIRD WORD?
4616  7650          SNA CLA
4617  5246          JMP     UNDERF          /YEP. CLEAR AC. ALL ZERO.

4620  1012  NOTBIG, TAD     OV
4621  7650          SNA CLA
4622  5233          JMP     NOBUMP
4623  2016          ISZ     AC3
4624  5233          JMP     NOBUMP
4625  2017          ISZ     AC2
4626  5233          JMP     NOBUMP
4627  2024          ISZ     AC1
4630  3012          DCA     OV
4631  5201          JMP     ANORM+1
4632  7240          CLA CMA
4633  1025  NOBUMP, TAD     ACE
4634  7510          SPA
4635  5246          JMP     UNDERF
4636  3025          DCA     ACE
4637  7346          CLA CLL CMA RTL
4640  1024          TAD     AC1
4641  7740          SMA SZA CLA
4642  5600          JMP I   ANORM
4643  4254          JMS     AL1
4644  5232          JMP     NOBUMP-1
4645  7200  UNDERF, CLA
4646  3024          DCA     ACS
```

```
4647  3025          DCA     ACE
4650  3020          DCA     AC1
4651  3017          DCA     AC2
4652  3016          DCA     AC3
4653  5630          JMP I   ANORM
4654  0000  AL1,     0
4655  1016          TAD     AC3
4656  7104          CLL RAL
4657  3016          DCA     AC3
4660  1017          TAD     AC2
4661  7004          RAL
4662  3017          DCA     AC2
4663  1020          TAD     AC1
4664  7004          RAL
4665  3020          DCA     AC1
4666  5654          JMP I   AL1
4667  6211  FPDIV,  CDF     0               /!!!!!!!!!!!!!!!!!! 8 K INSERT.
4670  2156          ISZ     FPFLAG
4671  5336          JMP     FPZDIV
4672  1024          TAD     ACS
4673  1026          TAD     OPS
4674  3024          DCA     ACS
4675  1027          TAD     OPE
4676  7041          CIA
4677  1025          TAD     ACE
4700  1027          TAD     0177
4701  3025          DCA     ACE
4702  3031          DCA     TMP
4703  1343          TAD     07743
4704  3220          DCA     ANORM
4705  7332  DIVLP,  CLA CLL CML RAR
4706  0023          AND     OP1
4707  1022          TAD     AC1
4710  7700          SMA CLA
4711  4742          JMS I   PACN
4712  4557          JMS I   POADD
4713  1031          TAD     TMP
4714  7004          RAL
4715  3031          DCA     TMP
4716  1030          TAD     OPE
4717  7004          RAL
4720  3030          DCA     OPE
4721  1026          TAD     OPS
4722  7004          RAL
4723  3026          DCA     OPS
4724  4556          JMS I   PAL1
4725  2220          ISZ     ANORM
4726  5346          JMP     DIVLP
4727  1026          TAD     OPS
4730  3020          DCA     AC1
4731  1030          TAD     OPE
4732  3017          DCA     AC2
4733  1031          TAD     TMP
4734  3016          DCA     AC3
4735  5741          JMP I   PPFLOOP
```

```
4736  1071  FPZDIV, TAD     0377
4737  3225          DCA     ACE
4740  5741          JMP I   PPFLOOP
4741  4242  PPFLOOP,FPLOOP
4742  4417  PACN,   ACN
4743  7743  07743,  7743
4744  0000  FIX,    0
4745  1021          TAD     AC1
4746  7650          SNA CLA
4747  5367          JMP     ZFIXEX
4750  1225  FIXLUP, TAD     ACE
4751  1377          TAD     07545
4752  7700          SMA CLA
4753  5373          JMP     FIXEXIT
4754  4547          JMS I   PAR1
4755  1024          TAD     ACS
4756  0212          AND     OV
4757  7640          SZA CLA
4760  2016          ISZ     AC3
4761  5365          JMP     .+4
4762  2017          ISZ     AC2
4763  5365          JMP     .+2
4764  2020          ISZ     AC1
4765  2025          ISZ     ACE
4766  5350          JMP     FIXLUP
4767  3025  ZFIXEX, DCA     ACE
4770  3020          DCA     AC1
4771  3017          DCA     AC2
4772  3016          DCA     AC3
4773  3012  FIXEXIT,DCA     OV
4774  1016          TAD     AC3
4775  7001  SSFIX,  IAC             /(NOP) IF 1 ORG INDEXING
4776  5744          JMP I   FIX
4777  7545  07545,  7545
```

```
                PAGE

5200  0000  OUTNUN, 0
5201  6211          CDF     0               /!!!!!!!!!! 8 K INSERT.
5202  1024          TAD     ACS
5203  7710          SMA CLA
5204  5207          JMP     .+3
5205  1351          TAD     0255
5206  4433          JMS I   PPUTCH
5207  1020          TAD     AC1
5210  7640          SZA CLA
5211  5216          JMP     NONZERO
```

```
5012  1011          TAD     0260
5013  4433          JMS I   PPUTCH
5014  6211          CDF     10              /''''''''''' 8 K INSERT.
5015  5632          JMP I   OUTNUM
5016  4746  NONZERO,JMS I   FIXUP
5017  1355          TAD     07771
5020  3042          DCA     PRTEMP
5021  1014          TAD     PNUMBUF
5022  3025          DCA     ACE
5023  5230          JMP     .+5
5024  1026  CVTLOOP,TAD     AC1
5025  0027          AND     0177
5026  3020          DCA     AC1
5027  4762          JMS I   PMPY
5030  1020          TAD     AC1
5031  7006          RTL
5032  7006          RTL
5033  7006          RTL
5034  0347          AND     017
5035  1011          TAD     0260
5036  3425          DCA I   ACE
5037  2025          ISZ     ACE
5040  2042          ISZ     PRTEMP
5041  5224          JMP     CVTLOOP
5042  7326          CLA CLL CML RTL
5043  1043          TAD     DECEXP
5044  7450          SNA
5045  5325          JMP     FMT1    /.0NNNNNNN
5046  7510          SPA
5047  5253          JMP     FMT2    /N.NNNNNNE-NN
5050  1355          TAD     07770
5051  7710          SPA CLA
5052  5332          JMP     FMT3    /OTHER THAN N.NNNNNNE+NN
5053  7200  FMT2,   CLA             /N.NNNNNNE+NN
5054  1044          TAD     PNUMBUF
5055  3025          DCA     ACE
5056  1357          TAD     07772
5057  3042          DCA     PRTEMP
5060  1425          TAD I   ACE
5061  4433          JMS I   PPUTCH
5062  1356          TAD     0256A
5063  4433          JMS I   PPUTCH
5064  2025          ISZ     ACE
5065  1425          TAD I   ACE
5066  4433          JMS I   PPUTCH
5067  2042          ISZ     PRTEMP
5070  5264          JMP     .-4
5071  1352          TAD     0305
5072  4433          JMS I   PPUTCH
5073  1043          TAD     DECEXP
5074  7710          SPA CLA
5075  7326          CLA CLL CML RTL
5076  1350          TAD     0253
5077  4433          JMS I   PPUTCH
5100  3025          DCA     ACE
```

```
5121  1043          TAD     DECEXP
5122  7510          SPA
5123  7041          CIA
5124  3043          DCA     DECEXP
5125  1043          TAD     DECEXP
5126  1354          TAD     07766
5127  7510          SPA
5130  5314          JMP     .+4
5131  3043          DCA     DECEXP
5132  2025          ISZ     ACE
5133  5325          JMP     .-6
5134  7200          CLA
5135  1025          TAD     ACE
5136  1011          TAD     0260
5137  4433          JMS I   PPUTCH
5140  1043          TAD     DECEXP
5141  1011          TAD     0260
5142  4433          JMS I   PPUTCH
5143  6211  FMTENF, CDF     10              /!!!!!!!!!! 8_K_INSERT.
5144  5600          JMP I   OUTNUM
5145  4514  FMT1,   JMS I   PPRINTXT
5146  7371          DOTZERO
5147  6231          CDF     0               /!!!!!!!!!! 8 K INSERT.
5150  1355  FMT3,   TAD     07771
5151  3042          DCA     PRTEMP
5152  1361          TAD     PNBF6
5153  3025  TRYAGIN,DCA     ACE
5154  1425          TAD I   ACE
5155  1353          TAD     07520
5156  7640          SZA CLA
5157  5344          JMP     ZERDONE
5160  2042          ISZ     PRTEMP
5161  7240          CLA CMA
5162  1025          TAD     ACE
5163  5333          JMP     TRYAGIN
5164  5745  ZERDONE,JMP I   .+1              /!!!!!!!!! 8 K INSERT.
5165  6545          PZERDONE                /!!!!!!!!! 8 K INSERT.
5166  5207  FIXUP,  FIXITUP
5167  0017  017,    17
5170  0253  0253,   253
5171  0255  0255,   255
5172  0305  0305,   305
5173  7520  07520,  7520
5174  7766  07766,  7766
5175  7771  07771,  7771
5176  0256  0256A,  256
5177  7772  07772,  7772
5200  5321  PMPY,   MPY
5201  5343  PNBF6,  NUMBUF+6


5202  3714  TOOLONG,TEXT '%LINE TOO LONG%'
5203  1116
5204  0540
5205  2417
```

```
166  1742
167  1417
170  1627
171  3740
```

PAGE

```
200  0220  FIXITUP,0
201  1225        TAD     ACE
202  1345        TAD     07610
203  3225        DCA     ACE
204  7416        SKP
205  1243  OCC,  TAD     DECEXP
206  3243        DCA     DECEXP
207  1220  NORMIT, TAD   AC1
210  7415        RTL
211  7630        SZL CLA
212  5224        JMP     NORMED
213  4550        JMS I   PAL1
214  7240        CLA CMA
215  1225        TAD     ACE
216  3225        DCA     ACE
217  5237        JMP     NORMIT
220  1225  NORMED, TAD   ACE
221  7542        SMA SZA
222  5236        JMP     NOTX10
223  7240        CLA
224  4547        JMS I   PAR1
225  4547        JMS I   PAR1
226  4547        JMS I   PAR1
227  4547        JMS I   PAR1
230  4321        JMS     MPY
231  1225        TAD     ACE
232  1164        TAD     04
233  3225        DCA     ACE
234  7240        CLA CMA
235  5205        JMP     OCC
236  1346  NOTX10, TAD   07773
237  7510        SPA
240  5265        JMP     EXPOK
241  7240        CLA
242  1354  EXPGOOD,TAD   07740
243  3321        DCA     MPY
244  7100        CLL
245  1220  DVLOOP, TAD   AC1
246  1347        TAD     05400
247  7502        SMA
250  3220        DCA     AC1
```

```
251  7264            CLA CML CMA RAL
252  3023            DCA     OP1
253  4556            JMS I   PAL1
254  2023            ISZ     OP1
255  2016            ISZ     AC3
256  2321            ISZ     MPY
257  5245            JMP     DVLOOP
260  1020            TAD     AC1
261  0371            AND     0377
262  3020            DCA     AC1
263  7201            CLA IAC
264  5245            JMP     OCC
265  3042  EXPOK,    DCA     PRTEMP
266  7410            SKP
267  4547            JMS I   PAR1
270  2042            ISZ     PRTEMP
271  5267            JMP     .-2
272  1020            TAD     AC1
273  1347            TAD     05400
274  7720            SMA CLA
275  5242            JMP     EXPGOOD
276  7330            CLA CLL
277  1016            TAD     AC3
300  1344            TAD     02062
301  3016            DCA     AC3
302  7430            SZL
303  2017            ISZ     AC2
304  7410            SKP
305  2020            ISZ     AC1
306  1020            TAD     AC1
307  1347            TAD     05400
310  7540            SZA CLA
311  5637            JMP I   FIXITUP
312  1155            TAD     0200
313  3020            DCA     AC1
314  3017            DCA     AC2
315  3016            DCA     AC3
316  2043            ISZ     DECEXP
317  7000            NOP
320  5636            JMP I   FIXITUP
321  0000  MPY,      0
322  4556            JMS I   PAL1
323  1020            TAD     AC1
324  3023            DCA     OP1
325  1017            TAD     AC2
326  3022            DCA     OP2
327  1016            TAD     AC3
330  3021            DCA     OP3
331  4552            JMS I   PAL1
332  4553            JMS I   PAL1
333  4557            JMS I   POADD
334  5721            JMP I   MPY
335  0000  NUMBUF,   0;0;0;0;0;0;0
336  0000
337  0000
```

```
340  0000
341  0000
342  0000
343  0000
344  2062   02062,   2062
345  7610   07610,   7610
346  7773   07773,   7773
347  5400   05400,   5400


350  0000   RNDJMP,  FEXIT
351  4546            JMS I    PANORM
352  5753            JMP I    RND

353  0000   RND,     0
354  4435            FENTER
355  3227            FLD+FWD+FRNDX-.
356  0000            FEXIT
357  1021            TAD      OP3
360  7006            RTL
361  7006            RTL
362  7006            RTL
363  3020            DCA      AC1
364  1020            TAD      AC1
365  7010            RAR
366  0054            AND      07740
367  3017            DCA      AC2
370  3016            DCA      AC3
371  4557            JMS I    POADD
372  4557            JMS I    POADD
373  4557            JMS I    POADD
374  1030            TAD      OPE
375  3025            DCA      ACE
376  1020            TAD      AC1
377  0072            AND      07
400  3020            DCA      AC1
401  4435            FENTER
402  2232            FST+FWD+FRNDX-.
403  1633            FJMP+BKWD+.-RNDJMP

404  2004   FRNDX,   2004;4173;1231
405  4173
406  1231


407  0000   FSQRX,   0;0;0
410  0000
411  0000
```

```
5412 ????  SQR,    0
5413 4435          FENTER
5414 2473          FST      OPERAND
5415 ????          FSNE
5416 1232          FJMP+FWD+SQEXIT-.
5417 0000          FEXIT
5420 1024          TAD      ACS
5421 7710          SPA CLA
5422 5447          JMP I    PARGERR
5423 1225          TAD      ACE
5424 1252          TAD      007600
5425 7137          CLL
5426 7510          SPA
5427 7020          CML
5430 7010          RAR
5431 1155          TAD      0200
5432 3025          DCA      ACE
5433 1255          TAD      07770
5434 3013          DCA      INDEX1
5435 4435  SQLOOP, FENTER
5436 2627          FST+BKWD+.-FSQRX
5437 3073          FLD      OPERAND
5440 7631          FDV+BKWD+.-FSQRX
5441 4632          FAD+BKWD+.-FSQRX
5442 ????          FEXIT
5443 7242          CLA CMA
5444 1025          TAD      ACE
5445 3025          DCA      ACE
5446 2013          ISZ      INDEX1
5447 5235          JMP      SQLOOP
5450 ????  SQEXIT, FEXIT
5451 5612          JMP I    .SQR
5452 7600  007600, 7600
5453 ????  FN,     0
5454 1145          TAD      LOCCTR
5455 4534          JMS I    PPUSH
5456 1050          TAD      WORD
5457 4534          JMS I    PPUSH
5460 6241          CDF      0                    /!!!!!!! 8 K INSERT
5461 1745          TAD I    PUSERFN
5462 6211          CDF      10                   /!!!!!!!! 8 K INSERT.
5463 7441          IAC
5464 3045          DCA      LOCCTR
5465 4567          GET+ISIT          /'DEF'
5466 1761          1761
5467 5746          JMP I    PFNERR   /NO
5470 4177          JMS      GETWD    /SKIP 'FN'
5471 4177          JMS      GETWD    /SKIP LETTER
5472 4177          JMS      GETWD    /SKIP '('
5473 4567          GET+ISIT          /A VARIABLE
5474 7200          7200
5475 5746          JMP I    PFNERR   /NO
5476 2050          ISZ      WORD
5477 1450          TAD I    WORD
5500 3013          DCA      INDEX1
```

```
5001  1413          TAD I   INDEX1
5002  4504          JMS I   PPUSH
5003  1413          TAD I   INDEX1
5004  4504          JMS I   PPUSH
5005  1413          TAD I   INDEX1
5006  4504          JMS I   PPUSH
5007  1213          TAD     INDEX1
5010  4504          JMS I   PPUSH
5011  7344          CLA CLL CMA RAL
5012  1013          TAD     INDEX1
5013  3413          DCA     INDEX1
5014  4435          FENTER
5015  2413          FSTI    INDEX1
5016  0000          FEXIT
5017  4177          JMS     GETWD   /SKIP ')'
5020  4177          JMS     GETWD   /SKIP '='
5021  4501          JMS I   PEVAL
5022  4515          JMS I   PPOP
5023  3150          DCA     WORD
5024  4505          JMS I   PPOP
5025  3450          DCA I   WORD
5026  7240          CLA CMA
5027  1250          TAD     WORD
5030  3050          DCA     WORD
5031  4505          JMS I   PPOP
5032  3450          DCA I   WORD
5033  7240          CLA CMA
5034  1250          TAD     WORD
5035  3050          DCA     WORD
5036  4505          JMS I   PPOP
5037  3450          DCA I   WORD
5040  4505          JMS I   PPOP
5041  3450          DCA     WORD
5042  4505          JMS I   PPOP
5043  3345          DCA     LOCCTR
5044  5653          JMP I   FN
5045  1520  PUSERFN,USERFN


5046  0352  PFNERR, FNERR


5047  0000  TAB,    0                       /FUNCTION "TAB" IN PRINT STATEMENT.
5050  4506          JMS I   PFIX            /FIX THE FAC NOW.
5051  6201          CDF     0               /SET DATA FIELD TO FIELD ZERO.
5052  7201          CLA IAC                 /SET FLAG TO INDICATE WE'VE DONE THI
                    FUNCTION.
5053  3771          DCA I   PTABFLG         /AND STORE AWAY.
5054  1024          TAD     ACS             /GET SIGN OF FAC
```

```
5655  7650          SNA CLA                 /WAS IT A POSITIVE NUMBER?
5656  1016          TAD     AC3             /YEP. PICK UP DESIRED POSITION.
5657  0071          AND     0377            /MAXIMUM OF 256 COLUMNS.
5660  3770          DCA I   PTABDES         /SAVE AWAY FOR ACTUAL SPACER TO USE.

5661  4772          JMS I   TBEGFIX         /PREPARE TO RETURN PRESENT COLUMN NU
MBER.
5662  7201          CLA IAC
5663  1126          TAD     COLUMN          /INCREMENT TO ACCOUNT FOR DIFFERENCE
.
5664  3016          DCA     AC3             /AND STORE AWAY.
5665  6211          CDF     10              /RESET DATA FIELD NOW.
5666  4546          JMS I   PANORM          /NORMALIZE AC NOW.
5667  5747          JMP I   TAB             /AND RETURN NOW.

5670  6367  PTABDES,TABDES                  /POINTER TO DESIRED LOCATION OF PRIN
THEAD.
5671  2345  PTABFLG,TABFLG                  /POINTER TO TAB IN PRINT FLAG.
5672  3762  TBEGFIX,BEGFIX                  /POINTER TO MINI-FIX-SET-UP ROUTINE.
```

```
5673  7201  RUBO,   CLA IAC                /SET RUBOUT SWITCH.
5674  3135  NORUBO, DCA     RBSWCH
5675  5776          JMP I   .+1             /AND CLEAN IT UP.
5676  7175          DEVCOM                  /CLEAN-UP POINTER.
```

```
                    PAGE
```

```
5700  0000  TAN,    0
5701  4435          FENTER
5702  2275          FST+FWD+FTANT1-.
5703  0000          FEXIT
5704  4216          JMS     COS
5705  4435          FENTER
5706  2274          FST+FWD+FTANT2-.
5707  3277          FLD+FWD+FTANT1-.
5710  0000          FEXIT
5711  4224          JMS     SIN
5712  4435          FENTER
```

```
5613  7267          FDV+FWD+FTANT2-.
5614  0030          FEXIT
5615  5620          JMP I   TAN
5616  0000  COS,     0
5617  4435          FENTER
5620  4312          FAD+FWD+FSINC7-.
5621  0030          FEXIT
5622  4224          JMS     SIN
5623  5616          JMP I   COS
5624  0000  SIN,     0
5625  4435          FENTER
5626  7265          FDV+FWD+FSINC1-.
5627  2256          FST+FWD+FSINZ-.
5630  0030          FEXIT
5631  3024          DCA     ACS
5632  4676          JMS I   PINT
5633  7330          CLA CLL CML RAR
5634  2335          AND     FSINZ
5635  3024          DCA     ACS
5636  4435          FENTER
5637  5246          FSB+FWD+FSINZ-.
5640  6275          FMP+FWD+FSINM4-.
5641  2244  FSIN10, FST+FWD+FSINZ-.
5642  0030          FEXIT
5643  3024          DCA     ACS
5644  4435          FENTER
5645  5151          FSB     ONE
5646  0147          FSGT
5647  1210          FJMP+FWD+FSINOK-.
5650  3235          FLD+FWD+FSINZ-.
5651  0032          FEXIT
5652  4675          JMS I   PSGN
5653  2025          ISZ     ACE
5654  4435          FENTER
5655  5230          FSB+FWD+FSINZ-.
5656  1515          FJMP+BKWD+.-FSIN10
5657  3226  FSINOK, FLD+FWD+FSINZ-.
5660  6225          FMP+FWD+FSINZ-.
5661  2227          FST+FWD+FSINZZ-.
5662  6234          FMP+FWD+FSINC3-.
5663  4236          FAD+FWD+FSINC4-.
5664  6224          FMP+FWD+FSINZZ-.
5665  4237          FAD+FWD+FSINC5-.
5666  6222          FMP+FWD+FSINZZ-.
5667  4240          FAD+FWD+FSINC6-.
5670  6222          FMP+FWD+FSINZZ-.
5671  4241          FAD+FWD+FSINC7-.
5672  6213          FMP+FWD+FSINZ-.
5673  0032          FEXIT
5674  5624          JMP I   SIN
5675  0726  PSGN,    SGN
5676  6434  PINT,    INT
5677  0000  FTANT1, 0;0;0
5700  0002
5701  0000
```

```
5702  0000  FTANT2, 0;0;0
5703  0000
5704  0000
5705  0000  FSINZ,  0;0;0
5706  0000
5707  0000
5710  0000  FSINZZ, 0;0;0
5711  0000
5712  0000
5713  2036  FSINC1, 2036;2207;7325
5714  2207
5715  7325
5716  1644  FSINC3, 1644;7553;6722
5717  7553
5720  6722
5721  5714  FSINC4, 5714;6223;1432
5722  6223
5723  1432
5724  1756  FSINC5, 1755;0632;1276
5725  0632
5726  1276
5727  6005  FSINC6, 6005;1256;7406
5730  1256
5731  7406
5732  2016  FSINC7, 2016;2207;7325
5733  2207
5734  7325
5735  6034  FSINM4, 6034;0000;0000
5736  0000
5737  0000
5740  4435  UPARRX, FENTER
5741  2034        FST+BKWD+.-FSINZ
5742  0100        FSGE
5743  1221        FJMP+FWD+EXPLONG-.
5744  0000        FEXIT
5745  4676        JMS I   PINT
5746  4435        FENTER
5747  5642        FSB+BKWD+.-FSINZ
5750  0057        FSEQ
5751  1213        FJMP+FWD+EXPLONG-.
5752  3645        FLD+BKWD+.-FSINZ
5753  5207        FSB+FWD+FUPRC1-.
5754  0150        FSLE
5755  1207        FJMP+FWD+EXPLONG-.
5756  3651        FLD+BKWD+.-FSINZ.
5757  0000        FEXIT
5760  5761        JMP I   .+1
5761  6457        UPARROW
5762  2077  FUPRC1, 2077;7700
5763  7700
5764  3073  EXPLONG,FLD     OPERAND
5765  0000        FEXIT
5766  4775        JMS I   PLOG
5767  4435        FENTER
5770  6663        FMP+BKWD+.-FSINZ
```

```
5771  0000          FEXIT
5772  4776          JMS I   PEXP
5773  5774          JMP I   .+1
5774  1203          OPDONE
5775  6114  PLOG,   LOG
577e  6002  PEXP,   EXP
```

```
              PAGE


5000  0002  EXP,    0
5001  4435          FENTER
5002  7272          FDV+FWD+FEXPC1-.
5003  2261          FST+FWD+FEXPU-.
5004  2200          FEXIT
5005  4660          JMS I   PPINT
5006  7330          CLA CLL CML RAR
5007  1024          TAD     ACS
5010  3424          DCA     ACS
5011  4435          FENTER
5012  2247          FST+FWD+FEXPI-.
5013  4251          FAD+FWD+FEXPU-.
5014  2253          FST+FWD+FEXPF-.
5015  6252          FMP+FWD+FEXPF-.
5016  4257          FAD+FWD+FEXPC2-.
5017  2245          FST+FWD+FEXPU-.
5020  3241          FLD+FWD+FEXPI-.
5021  0000          FEXIT
5022  4560          JMS I   PFIX
5023  7040  FXXPFX, NOP             /(IAC IF 1 ORG INDEXING)
5024  3261          DCA     FEXPI
5025  1024          TAD     ACS
5026  7164          CMA CLL CML RAL
5027  1261          TAD     FEXPI
5030  7420          SNL
5031  7041          CIA
5032  7001          IAC
5033  3261          DCA     FEXPI
5034  4435          FENTER
5035  3243          FLD+FWD+FEXPC3-.
5036  7226          FDV+FWD+FEXPU-.
5037  4244          FAD+FWD+FEXPC4-.
5040  5227          FSB+FWD+FEXPF-.
5041  2223          FST+FWD+FEXPU-.
5042  3225          FLD+FWD+FEXPF-.
5043  6224          FMP+FWD+FEXPF-.
5044  6242          FMP+FWD+FEXPC5-.
5045  4217          FAD+FWD+FEXPU-.
```

```
5046  2216          FST+FWD+FEXPU-.
5047  3220          FLD+FWD+FEXPF-.
5050  7214          FDV+FWD+FEXPU-.
5051  4244          FAD+FWD+FEXPC6-.
5052  2215          FST+FWD+FEXPF-.
5053  0400          FEXIT
5054  1025          TAD     ACE
5055  1261          TAD     FEXPI
5056  3025          DCA     ACE
5057  5607          JMP I   EXP
5060  6434  PPINT,  INT
5061  0204  FEXPI,  0;0;0
5062  0000
5063  0000
5064  0000  FEXPU,  0;0;0
5065  0047
5066  0000
5067  0000  FEXPF,  0;0;0
5070  0002
5071  0000
5072  2005  FEXPC1, 2005;4271;0300
5073  4271
5074  0300
5075  2075  FEXPC2, 2075;3552;7022
5076  3552
5077  7022
5100  6124  FEXPC3, 6124;6477;0715
5101  6477
5102  0715
5103  2044  FEXPC4, 2044;7643;0062
5104  7643
5105  0062
5106  1744  FEXPC5, 1744;3372;3400
5107  3372
5110  3400
5111  2004  FEXPC6, 2004;0000;0000
5112  0000
5113  0000
5114  0000  LOG,    0
5115  1024          TAD     ACS
6116  7710          SPA CLA
6117  5447          JMP I   PARGERR
6120  1025          TAD     ACE
6121  3355          DCA     LOGACE
6122  1156          TAD     0200
6123  3025          DCA     ACE
6124  4435          FENTER
6125  2641          FST+BKWD+.-FEXPU
6126  4244          FAD+FWD+FLOGC1-.
6127  2640          FST+BKWD+.-FEXPF
6130  3644          FLD+BKWD+.-FEXPU
6131  5241          FSB+FWD+FLOGC1-.
6132  7643          FDV+BKWD+.-FEXPF
6133  2044          FST+BKWD+.-FEXPF
6134  6645          FMP+BKWD+.-FEXPF
```

```
6135  6216          FMP+FWD+FLOGC2-.
6136  4224          FAD+FWD+FLOGC3-.
6137  6656          FMP+BKWD+.-FEXPF
6140  6651          FMP+BKWD+.-FEXPF
6141  4220          FAD+FWD+FLOGC4-.
6142  6653          FMP+BKWD+.-FEXPF
6143  5632          FSB+BKWD+.-FEXPC6
6144  2655          FST+BKWD+.-FEXPF
6145  3217          FLD+FWD+LOGFWD-.
6146  5221          FSB+FWD+LOGOKW-.
6147  4652          FAD+BKWD+.-FEXPF
6150  6656          FMP+BKWD+.-FEXPC1
6151  0000          FEXIT
6152  5714          JMP I   LOG
6153  2004  FLOGC2, 2004;6253;2521
6154  6253
6155  2521
6156  2007  FLOGC3, 2007;5421;3604
6157  5421
6160  3604
6161  2025  FLOGC4, 2025;6125;1007
6162  6125
6163  1007
6164  2174  LOGFWD, 2174
6165  0000  LOGACE, 0
6166  0000          0
6167  2174  LOGOKW, 2174;0200;0
6170  0200
6171  0000
6172  2005  FLOGC1, 2005;5202;3632
6173  5202
6174  3632
```

PAGE

```
6200  0000  ATN,    0
6201  1024          TAD     ACS
6202  3272          DCA     FATNSX
6203  3024          DCA     ACS
6204  4435          FENTER
6205  2271          FST+FWD+FATNT-.
6206  2265          FST+FWD+FATNAX-.
6207  5275          FSB+FWD+FATNC1-.
6210  0140          FSGT
6211  1254          FJMP+FWD+ATNBIG-.
```

```
6212  5275          FSB+FWD+FATNC2-.
6213  0142          FSGT
6214  1234          FJMP+FWD+ATNLOW-.
6215  3151          FLD     ONE
6216  7260          FDV+FWD+FATNT-.
6217  2257          FST+FWD+FATNT-.
6220  3152  ATNLOW, FLD     ZERO
6221  2316          FST+FWD+FATNC-.
6222  3254          FLD+FWD+FATNT-.
6223  5267          FSB+FWD+FATNC3-.
6224  0100          FSGE
6225  1212          FJMP+FWD+ATNNOT-.
6226  3250          FLD+FWD+FATNT-.
6227  4266          FAD+FWD+FATNC4-.
6230  2246          FST+FWD+FATNT-.
6231  3314          FLD+FWD+FATNCJ-.
6232  7244          FDV+FWD+FATNT-.
6233  4262          FAD+FWD+FATNC4-.
6234  2242          FST+FWD+FATNT-.
6235  3263          FLD+FWD+FATNC5-.
6236  2341          FST+FWD+FATNC-.
6237  3237  ATNNOT, FLD+FWD+FATNT-.
6240  6236          FMP+FWD+FATNT-.
6241  2240          FST+FWD+FATNTT-.
6242  3261          FLD+FWD+FATNC6-.
6243  6236          FMP+FWD+FATNTT-.
6244  4262          FAD+FWD+FATNC7-.
6245  6234          FMP+FWD+FATNTT-.
6246  4263          FAD+FWD+FATNC8-.
6247  6232          FMP+FWD+FATNTT-.
6250  4264          FAD+FWD+FATNC9-.
6251  6232          FMP+FWD+FATNTT-.
6252  4151          FAD     ONE
6253  6223          FMP+FWD+FATNT-.
6254  4263          FAD+FWD+FATNC-.
6255  2221          FST+FWD+FATNT-.
6256  3215          FLD+FWD+FATNAX-.
6257  5151          FSB     ONE
6260  0142          FSGT
6261  1234          FJMP+FWD+ATNBIG-.
6262  3256          FLD+FWD+FATNCH-.
6263  5213          FSB+FWD+FATNT-.
6264  2212          FST+FWD+FATNT-.
6265  3211  ATNBIG, FLD+FWD+FATNT-.
6266  0330          FEXIT
6267  1272          TAD     FATNSX
6270  3124          DCA     ACS.
6271  5644          JMP I   ATN
6272  0000  FATNSX, 0
6273  0000  FATNAX, 0;0;0
6274  0000
6275  0000
6276  0000  FATNT,  0;0;0
6277  0000
6300  0000
```

```
6301  0200  FATNTT, 0;0;0
6302  0000
6303  0000
6304  1634  FATNC1, 1634;0000;0000
6305  0000
6306  0000
6307  2007  FATNC2, 2007;7776;0000
6310  7776
6311  0000
6312  1774  FATNC3, 1774;2230;2427
6313  2230
6314  2427
6315  2016  FATNC4, 2016;7331;7272
6316  7331
6317  7272
6320  2004  FATNC5, 2004;1405;2216
6321  1405
6322  2216
6323  1756  FATNC6, 1756;0462;4562
6324  0462
6325  4562
6326  5764  FATNC7, 5764;4221;3433
6327  4221
6330  3433
6331  1766  FATNC8, 1766;3141;6672
6332  3141
6333  6672
6334  5775  FATNC9, 5775;2525;2337
6335  2525
6336  2337
6337  0000  FATNC,  0;0;0
6340  0000
6341  0000
6342  2016  FATNCH, 2016;2207;7325
6343  2207
6344  7325
6345  6034  FATNCJ, 6034;0000;0000
6346  0000
6347  0000
```

```
6350  1126  TABDO,  TAD   COLUMN        /GET WHERE WE ARE NOW.
6351  7041           CIA
6352  1367           TAD   TABDES       /COMPARE AGAINST WHERE WE WANT TO BE
6353  7710           SMA SZA CLA        /DO WE HAVE TO BACK UP?
6354  5363           JMP   TABOK        /NOPE.
```

```
6355  1007          TAD     0215            /YEP. GIVE C.R.
6356  4433          JMS I   PPUTCH          /SEND IT
6357  4433          JMS I   PPUTCH          /ALSO SEND A NULL CHARACTER TO ALL T
TY TO RETURN.
6360  1126  TABOK,  TAD     COLUMN          /GET WHERE WE ARE.
6361  7040          CMA                     /NEGATE-1
6362  1357          TAD     TABDES          /WHERE DO WE WANT TO BE?
6363  7750          SNA SPA CLA             /?
6364  5770          JMP I   TPRINT          /HERE. EXIT.
6365  1051          TAD     0240            /FARTHER UP.
6366  5357          JMP     TABOK-1         /GIVE SPACE AND LOOP AGAIN.


6367  0000  TABDES, 0
6370  2207  TPRINT, PRINTC                  /NORMAL EXIT LOCATION.
```



```
6400  0000  CHKFIT, 0
6401  1163          TAD     04
6402  4544          JMS I   SPLEFT
6403  5630          JMP I   CHKFIT
6404  4561          JMS I   PLINFIX
6405  4537          JMS I   PRESET          /RESET ALL I/O DEVICES.
6406  4514          JMS I   PPRINTXT
6407  3552          UGH1
6410  3454          DCA     SNUMFLG         /RESET THIS FLAG NOW
6411  5612          JMP I   .+1             /THIS MAY BE RIGHT.
6412  2510          NEWLIN
```

```
6413  0000  RMLEFT, 0
6414  7100        CLL
6415  1233        TAD     ARRLOC
6416  7430        SZL
6417  5223        JMP     NORLFT
6420  7041        CIA
6421  1234        TAD     CODELOC
6422  7020        SML CLA
6423  2213  NORLFT, ISZ     RMLEFT
6424  5613        JMP I   RMLEFT


6425  0000  ABS,    0
6426  3424        DCA     ACS
6427  5625        JMP I   ABS


6430  0000  STICKIT,0
6431  3433        DCA I   ARRLOC
6432  2233        ISZ     ARRLOC
6433  5630        JMP I   STICKIT


6434  0000  INT,    0
6435  4536        JMS I   PFIX
6436  7200        CLA
6437  4546        JMS I   PANORM
6440  5634        JMP I   INT


6441  0000  SXERR,  0                   /INCASE THIS IS JMS'D TO.
6442  7200        CLA
6443  3241        DCA     SXERR         /AND REMAKE INTO AN "AND"
6444  4477        JMS I   PERROR
6445  2331        TEXT 'SYNTAX'
6446  1524
6447  0130
6450  0000
6451  4431  ATLINE, TEXT ' AT LINE !
6452  2440
```

```
6453  1411
6454  1635
6455  4400



6456  7570  07570,  7570
6457  1024  UPARROW,TAD     ACS
6460  7730          SMA CLA
6461  1256          TAD     07570
6462  1325          TAD     ACE
6463  7740          SMA CLA
6464  5447          JMP I   PARGERR
6465  4506          JMS I   PFIX
6466  5667          JMP I   .+1
6467  4365          UPARR2

6470  4570  MOREDIM,MUSTBE        /',
6471  3763          3763
6472  7240  DIM,    CLA CMA
6473  3334          DCA     DIMFLAG
6474  4531          JMS I   PEVAL
6475  4560          ISIT            /(CR) OR '0'
6476  2000          2000
6477  5270          JMP     MOREDIM
6500  5503          JMP I   PEXECUTE/YES



6501  4004  DELETED,TEXT ' DELETED0'
6502  0514
6503  0524
6504  0514
6505  3720



6506  1356  AMATCH, TAD     WORD
6507  3364          DCA     SNUMFLG
6510  1364          TAD     SNUMFLG
6511  3457          DCA I   FPTR
```

```
6512  2057          ISZ     FPTR
6513  1060          TAD     GPTR
6514  3056          DCA     EPTR
6515  4556          ISJT            /'REM'
6516  1762          1762
6517  5516          JMP I   PSLOOP
6520  5721          JMP I   .+1
6521  3043          REMPACK


6522  3723  BREAK,  3723;2417;2056
6523  2417
6524  2056
6525  3722  READY,  TEXT '@READY.@@'
6526  0571
6527  0431
6530  5637
6531  3700
      CRLF=.-1

6532  0000  ISDIG,  0
6533  4522          JMS I   PNONBLNK
6534  1344          TAD     07706A
6535  7100          CLL
6536  1065          TAD     012
6537  7420          SNL
6540  7210          CLA
6541  7430          SZL
6542  2332          ISZ     ISDIG
6543  5732          JMP I   ISDIG
6544  7706  07706A, 7706


6545  1342  PZERDON,TAD     PRTEMP
```

```
6546  1043          TAD     DECEXP
6547  7717          SPA CLA
6550  5354          JMP     .+4
6551  1043          TAD     DECEXP
6552  7041          CMA
6553  3242          DCA     PRTEMP
6554  1044          TAD     PNUMBUF
6555  3025          DCA     ACE
6556  7344          CLA CLL CMA RAL
6557  7040  DIGLUP, CMA
6560  1043          TAD     DECEXP
6561  7440          SZA
6562  5365          JMP     .+3
6563  1375          TAD     0256B
6564  4433          JMS I   PPUTCH
6565  3043          DCA     DECEXP
6566  1425          TAD I   ACE
6567  4433          JMS I   PPUTCH
6570  2025          ISZ     ACE
6571  2442          ISZ     PRTEMP
6572  5357          JMP     DIGLUP
6573  5774          JMP I   .+1           /!!!!!!!! 8 K INSERT RETURN.
6574  5123          FMTENF

6575  0256  0256B,  256
```

```
                        LSF=6661
                        LCF=6662
                        LLS=6666

6600 3334  INTER,  DCA     INTAC          /SAVE ALL IMPORTANT STUFF ON INTERUP
T.
6601 7310          RAR
6602 3335          DCA     INTL
6603 6234          RIB
6604 0370          AND     070
6605 1375          TAD     06202
6606 3371          DCA     INTCIF         /SAVE INSTRUCTION FIELD
6607 6234          RIB
6610 0072          AND     07
6611 7106          CLL RTL                /SHIFT IT OVER
6612 7004          RAL
6613 1215          TAD     06201A         /AND THE INSTUCTION FIELD
6614 3370          DCA     INTCDF
6615 6231  06201A, CDF     0              /JUST IN CASE.

                   IFZERO  MAChINE<
                   NOP                    /TO KEEP PAGE SAME SIZE.
                           >

                   IFNZRO  MACHINE<
6616 4540          JMS I   SPECINT        /CHECK FOR SPECIAL INTERUPT DEVICE.
                             >

6617 6241          TSF                    /IS IT THE TELEPRINTER.
6620 5223          JMP     .+3            /NO
6621 6242          TCF
6622 5312          JMP     INODUN         /YEP. CLEAN IT UP.
6623 6661          LSF                    /PRINTER?
6624 5227          JMP     .+3
6625 6662          LCF                    /YEP.
6626 5312          JMP     INODUN
6627 6221          PSF                    /PUNCH?
6630 5233          JMP     .+3
6631 6222          PCF
6632 5312          JMP     INODUN
6633 6011          RSF                    /READER?
6634 5241          JMP     INOPPP         /NOPE.
6635 7330          CLA CLL CML RAR        /4000 TO AC
6636 6312          RRB                    /READ IN THE CHARACTER.
6637 3740          DCA I   PHRCHAR
```

printer interrupt