IDENTIFICATION

Product Code:	DEC-12-FRZA-D
Product Name:	CREF12
Date Created	July 1, 1970
Maintainer:	Software Services

IDENTIFICATION

Product Code:	DEC-12-FRZA-D
Product Name:	CREF12
Date Created	July 1, 1970
Maintainer:	Software Services

DEC-12-FRZA-D
July, 1970

Copyright (C) 1970 by Digital Equipment Corporation

The material in this handbook, including but not limited to instruction times and operating speeds, is for information purposes and is subject to change without notice.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts:

DEC	PDP
FLIP CHIP	FOCAL
DIGITAL	COMPUTER LAB

The equipment described herein is covered by patents and patents pending.

For additional copies order DEC-12-FRZA-D from Program Library, Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01754 Price $1.00

1.0 INTRODUCTION

In many situations of assembling, debugging, and modifying programs, a cross-reference listing is an invaluable aid. This listing is particularly useful when a programmer wishes to make changes in a large program or one he does not know well.

A cross-reference is an alphabetical listing of all user-defined symbols with the line numbers at which the symbol was defined and used. Thus, the various places that a tagged location or an equated symbol is used are easily identified. CREF12 provides this facility to the DIAL-MS[1] user.

It should be noted that the usefulness of a CREF (CRoss-REFerence) is almost directly proportional to the quality of the coding. In particular, the following principles should be used in new coding in order to make the best use of CREF12:

1. Use symbolic references for beta registers, auto-index registers, page zero constants and temporaries, and fixed core locations.

2. Avoid use of large displacements from a tag (e.g., TAD X+12 or JMP Y-6) because references to X and Y, respectively, rather than the locations actually used, will appear in the CREF.

2.0 ENVIRONMENT

CREF12 (including its header) occupies six blocks in the DIAL file area of any unit. It is loaded into locations Ø through 2377 of field 1 and is entered at 2ØØ in field 1.

3.0 USING CREF12

CREF12 is intended for use in conjunction with the LISTAPE pseudo-op of the DIAL-MS Assembler. LISTAPE (with a positive argument) produces a normal assembler listing on a mass-storage device, rather than on the console Teletype(R) or line printer. The resulting data may then be processed by CREF12 to produce a full cross-reference of user-defined symbols and, optionally, the assembly listing.

To use CREF12, insert a LISTAPE n pseudo-op in the program of interest, where n is an expression whose value is between Ø and 17, octal, and is taken as the

---

(R) Teletype is a registered trademark of Teletype Corporation.

[1] LAP6-DIAL-MS is commonly referred to as DIAL-MS.

unit number of a scratch tape (Ø-7) or disk (1Ø-17) on which the Assembler listing will be produced. The user must exercise caution in assigning units for LISTAPE because the listing information is written directly on the unit starting at block zero without regard to anything else that may be on the same unit. Therefore, unit n should be either a scratch tape or a logical disk devoted to scratch work.

3.1 Operating Procedures

1. Set all six sense switches on. Be sure the tape or disk unit assigned by the LISTAPE pseudo-op is ready and WRITE ENABLEd.
2. Assemble the program with the LIST Command (refer to the LAP6-DIAL Programmer's Reference Manual, DEC-12-SE2D-D).
3. If a printer is to be used for the CREF, it should be ready at this time. When the Editor display returns, load CREF12 by typing →LO CREF12,Ø↵
4. The following message is printed:

   UNIT #?

   Type an octal number between Ø and 17, followed by carriage return, for the unit on which the listing was written.
5. The next message is

   LISTING [Y OR N]?

   Type Y if the full assembly listing and CREF are desired; N if only the CREF is needed.
6. CREF12 will then type:

   PRINTER [Y OR N]?

   Type Y if the output is to be produced on a line printer (it must be ready before Y is entered), or N if the output is to be to the console Teletype.

Assuming the specified unit is available and ready, CREF12 will then read the listing (printing it if requested) and print the cross-reference table.

3.2 Error Conditions

Under some conditions, CREF12 will not be able to produce the cross-reference desired.

1. If there were errors in the assembly, CREF12 may interpret the program incorrectly, or may even be unable to process it at all. In the latter event, it will print "BAD INPUT" and return to DIAL-MS.
2. If there is a large number of symbols and references, the cross-reference table may overflow. In this case, CREF12 prints:

   CORE OVERFLOWED AT LINE NO. XXXX

where XXXX is the last line number processed. CREF12 then prints the cross-reference up to that line, and returns to DIAL-MS. This problem will arise if (NSYM*5 + NREF) is greater than 4Ø94, where NSYM is the number of user-defined symbols in the program, and NREF is the number of references to user-defined symbols. If there are more than 818_{10} symbols, this message will occur during the first pass, with XXXX equal to ØØØØ. CREF12 will print "BAD INPUT" and return to DIAL-MS.

If a program containing a LISTAPE pseudo-op is to be assembled without getting a CREF, use the normal assembly procedure with the sense switches off; this disables the LISTAPE function.

4.0 INTERNAL DESCRIPTION

After reading the DIAL-MS I/O routines into 7ØØØ-7777 of field 1, CREF12 requests three parameters from the user: the unit from which to read the listing, if the listing is to be printed, and if a line printer is to be used for the output. CREF12 then begins its first pass over the data. The routine MAIN rewinds the input, initializes counters, and calls the subroutines GETLIN and ENDLST to get a line of input and check it for the separator between the listing proper and the symbol table, respectively. This separator is a line with one of two messages, "NO ERRORS" or "XXXX ERRORS". If the input runs out (indicated by a word of zero) before the separator is found, the input is invalid and processing is terminated with the message "BAD INPUT". If the separator is found, SYMBUILD takes over and reads the symbol table. Each symbol is stored in stripped ASCII form in field Ø, followed by two words of zero.

When the end of data is found, control passes to PART2, which rewinds the input file. MAJOR calls GETLIN and ENDLST to get successive lines from the file and test for the end of the listing proper. After checking for the separator, MAJOR flows into SCAN, which collects a symbol at NAME, calls NSERCH to search the symbol table for it, and (if it finds the symbol) stores the line number with the symbol in field Ø. Control returns to SCAN until either carriage return, slash, or "TEXT" is found. Control then returns to MAJOR to get a new line.

When a separator is found, control transfers to DUMP, which prints a header, then reads each symbol from the file. Each symbol and its value are printed, followed by the line number at which the symbol was defined, and then the line numbers at which the references to it were made.

Output is terminated, and control returns to DIAL-MS, when the end of the symbol table is found.

The functions of minor routines are as follows:

BOPUP - Maintains SYSCOUNT to keep track of field Ø utilization and issue the message "CORE OVERFLOWED AT LINE NO. xxxx" when the symbol table overflows. Called by SCAN when a reference is to be added to the symbol table.

CRLF - Go to a new line on the Teletype or line printer.

GETBLK - Get 8 blocks from the input file. Used by GETLIN when the input buffer is empty, and by MAIN and PART2 to rewind the input and read the first buffer load.

GETC - Obtain the next character from the current line and return it in CHAR and the AC. Used by many routines.

GETLIN - Get a line (a string of characters terminated by zero or line feed) from the input file. If LISTSW is non-zero, print it.

IMOVE - Move a block of data across field boundaries. Used by SYMBUILD to move a new entry into the symbol table.

IPUSH - Move a portion of the symbol table down. During SYMBUILD, the symbol table is built by pushing previous entries down to lower core addresses and entering each new symbol at the end of the list (at the top of field Ø). During SCAN, references to each symbol are stored following the symbol. IPUSH is called to make room for each entry.

ISNUM - Examine the first four characters of the current line. If not octal digits, return to P+1. Otherwise, convert them to binary, store binary at LINENO, and return to P+2. Called only by MAJOR.

IZERO - Search the symbol table, starting at the location addressed by TEMP, for a word of zero. If none is found, return to P+1. Otherwise, return to P+2 with TEMP pointing to the zero. Called by NSERCH to look for the next symbol and by SCAN to find the end of the references to the current symbol.

LIMIT - Compare the value in the AC to two limits. If the AC is zero, return to address in P+3; if AC is out of limits, return to address in P+4. If AC is within the limits, return to P+5. Used by many routines.

NSERCH - Find the symbol table entry which matches the symbol at NAME. Return to P+1 if no match is found, or to P+2 if successful. Called only by SCAN.

POCTAL - Print the value in the AC, converted to octal characters. Used by BOPUP to print the line number at which overflow occurs and by DUMP to print the cross-reference line numbers.

TTY - Print a character string.

```
0000                    *20
0001                    /       CREF12  PDP-12 CROSS REFERENCE PROGRAM
0002                    /
0003                    /       JUD LEONARD
0004                    /       JUNE 9, 1970
0005                    /
0006                    /
0007                            PMODE
0010                    /
0011                            FIELD   1
0012                    /
0013                    /
0014                            *14
0015                    /
0016                    /                       AUTO-INDEX AND BETA REGISTERS
0017                    /
0020        0014  0000  AUTO1,  0
0021        0015  0000  AUTO2,  0
0022        0016  0000  AUTO3,  0
0023        0017  0000  AUTO4,  0
0024                    /
0025                    /                       SYSTEM VARIABLES
0026                    /
0027        0020  0000  SYSCOUNT,0
0030        0021  0000  LP,      0
0031        0022  0000  LISTSW,  0
0032        0023  0000  LSTREQ,  0
0033        0024  0000  TEMP,    0
0034        0025  0000  START,   0
0035        0026  0000  COUNT,   0
0036        0027  0000  CHAR,    0
0037        0030  0022  LINENO,  0
0040        0031  2312  LPOINT,  CURLIN
0041        0032  0000  LLEN,    0
0042        0033  7773  LINE,    -5
0043        0034  0000  NAME,    0
0044        0035  0000           0
0045        0036  0000           0
0046        0037  0000           0
0047        0040  0000           0
0050                    /
0051                            EJECT
-
```

```
0052                    /
0053                    /               GLOBAL SUBROUTINE POINTERS
0054                    /
0055      0041  1663    PCRLF,  CRLF
0056      0042  1647    PTTY,   TTY
0057      0043  1443    PGETLIN,GETLIN
0060      0044  0766    PGETC,  GETC
0061      0045  1267    PLIMIT, LIMIT
0062      0046  1672    PPUTC,  PUTC
0063      0047  0415    PENDLST,ENDLST
0064      0050  1200    PIPUSH, IPUSH
0065      0051  1232    PIMOVE, IMOVE
0066      0052  1600    PPOCTAL,POCTAL
0067      0053  1400    PGETBLK,GETBLK
0070      0054  1432    PBLOCK, BLOCK
0071                    /
0072                    /               CONSTANTS
0073                    /
0074      0055  7777    BOOT,   7777
0075      0056  7774    READ,   7774
0076                    /
0077      0057  0007    P7,     7
0100      0060  0215    CARRET, 215
0101      0061  0212    LINFED, 212
0102      0062  7563    MCARET, -215
0103      0063  7566    MLINFD, -212
0104      0064  0100    LPPAGE, 100             /LINES PER PAGE
0105      0065  7700    MLPAGE, -100
0106      0066  0017    EJCOM,  17
0107                    /
0110      0067  5373    MTEXT,  -2405           /MINUS
0111      0070  4754            -3024           /SIXBIT
0112      0071  3740            -4040           /"TEXT  "
0113                    /
0114                    /
0115                    BUFFER=3000
0116                    BUFLOC=26
0117                    /
0120                    /
0121                    /
0122                            EJECT
-
```

```
0123                    /
0124                    /
0125                            PAGE
0126                    /
0127    0200    0002            0002            /FORCE MODE
0130    0201    6141            LINC
0131                            LMODE
0132    0202    1020            LDA I
0133    0203    0020            20
0134    0204    0004            ESF                     /I/O PRESET
0135    0205    0647            LDF     7
0136    0206    0700            RDC                     /FIRST HALF OF I/O ROUTINES
0137    0207    6322            6\322
0140    0210    0700            RDC                     /READ REST OF I/O ROUTINES
0141    0211    7323            7\323
0142    0212    1020            LDA I
0143    0213    0010            10
0144    0214    0001            AXO                     /SET NO PAUSE
0145    0215    0707            CHK                     /MOVE TAPE TO DIAL
0146    0216    0277            277
0147    0217    0002            PDP
0150                            PMODE
0151    0220    7200            CLA                     /NULL CHAR
0152    0221    6046            TLS                     /TO PRIME TTY
0153    0222    7200    RESTART,CLA
0154    0223    3023            DCA     LSTREQ          /CLEAR LISTING REQUEST
0155    0224    3021            DCA     LP              /SET NO PRINTER
0156    0225    4441            JMS I   PCRLF
0157    0226    4442            JMS I   PTTY            /ASK FOR UNIT
0160    0227    2312            INIT
0161    0230    3722            DCA I   PPOINTER
0162    0231    4310    TLOOP,  JMS     GETTTY          /ASSEMBLE UNIT NO
0163    0232    4445            JMS I   PLIMIT
0164    0233    0260            260
0165    0234    0267            267
0166    0235    0222            RESTART
0167    0236    0251            USET
0170    0237    1722            TAD I   PPOINTER
0171    0240    7110            CLL RAR                 /MOVE ONE OR ZERO TO LINK
0172    0241    7640            SZA CLA                 /ATTEMPT TO SPECIFY GT 17?
0173    0242    5222            JMP     RESTART         /YES - TRY AGAIN
0174    0243    7006            RTL
0175    0244    7006            RTL
0176    0245    1027            TAD     CHAR
0177    0246    0324            AND     P17
0200    0247    3722            DCA I   PPOINTER
0201    0250    5231            JMP     TLOOP
0202                    /
0203    0251    1027    USET,   TAD     CHAR            /NOT A DIGIT
0204    0252    1062            TAD     MCARET          /IS IT CR?
0205    0253    7640            SZA CLA
0206    0254    5222            JMP     RESTART         /NO = ERROR
0207                    /
0210                            EJECT
-
```

```
0211                    /
0212                    /
0213        0255  4442  LSTSET, JMS I   PTTY            /ASK FOR LISTING
0214        0256  2322          LST
0215        0257  4310          JMS     GETTTY          /WAIT FOR RESPONSE
0216        0260  4441          JMS I   PCRLF
0217        0261  1027          TAD     CHAR            /COMPARE RESPONSE ...
0220        0262  1325          TAD     MCN             /... TO N
0221        0263  7450          SNA                     /EQUAL?
0222        0264  5271          JMP     PRTSET          /YES - NO LISTING
0223        0265  1326          TAD     CNMCY           /COMPARE TO Y
0224        0266  7640          SZA CLA                 /EQUAL?
0225        0267  5255          JMP     LSTSET          /NO - HE GOOFED
0226        0270  2023          ISZ     LSTREQ          /YES - SET LISTING REQUESTED
0227                    /
0230                    /
0231        0271  4442  PRTSET, JMS I   PTTY            /ASK FOR PRINTER
0232        0272  2343          PRT
0233        0273  4310          JMS     GETTTY
0234        0274  4441          JMS I   PCRLF
0235        0275  1027          TAD     CHAR
0236        0276  1325          TAD     MCN
0237        0277  7450          SNA
0240        0300  5723          JMP I   PMAIN           /NO PRINTER
0241        0301  1326          TAD     CNMCY
0242        0302  7640          SZA CLA
0243        0303  5271          JMP     PRTSET          /NEITHER Y NOR N
0244        0304  2021          ISZ     LP              /YES - SET PRINTER SWITCH
0245        0305  1066          TAD     EJCOM
0246        0306  6664          LPR                     /GO TO TOP OF PAGE
0247        0307  5723          JMP I   PMAIN           /BEGIN THE BEGUINNE
0250                    /
0251                    /
0252        0310  0000  GETTTY, 0
0253        0311  6032          KCC
0254        0312  6031          KSF
0255        0313  5312          JMP     .-1
0256        0314  6036          KRB
0257        0315  3027          DCA     CHAR
0260        0316  1027          TAD     CHAR
0261        0317  4446          JMS I   PPUTC
0262        0320  1027          TAD     CHAR
0263        0321  5710          JMP I   GETTTY
0264                    /
0265                    /
0266        0322  1430  PPOINTER,POINTER
0267        0323  0400  PMAIN,   MAIN
0270        0324  0017  P17,     17
0271        0325  7462  MCN,     -316            /-"N
0272        0326  7765  CNMCY,   316-331         /"N-"Y
0273                    /
0274                    EJECT
-
```

```
0275                    /
0276                            PAGE
0277                    /
0300                    /
0301                    /               HERE WE GO
0302                    /
0303        0400  4441  MAIN,    JMS I   PCRLF
0304        0401  7200            CLA
0305        0402  3454            DCA I   PBLOCK
0306        0403  4453            JMS I   PGETBLK         /RESET THE INPUT UNIT
0307        0404  7240            CLA CMA
0310        0405  3025            DCA     START           /SET START TO END OF FIELD 0
0311        0406  7201            CLA IAC
0312        0407  3020            DCA     SYSCOUNT        /RESET THE SYSTEM COUNTER
0313                    /
0314                    /
0315        0410  4443  MLOOP,    JMS I   PGETLIN         /GET A LINE FROM THE INPUT FILE
0316        0411  2163            NOGOOD                  /THERES A ZERO WHERE IT DOESNT BELONG
0317        0412  4215            JMS     ENDLST          /LOOK FOR END OF LISTING
0320        0413  0456            SYMBUILD                /BUILD SYMBOL TABLE
0321        0414  5210            JMP     MLOOP           /ELSE TRY NEXT LINE
0322                            EJECT
-
```

```
0323                    /
0324                    /       CHECK CURRENT LINE FOR END OF LISTING
0325                    /               LINE WILL BE EITHER "NO ERRORS" OR "XXXX ERRORS"
0326                    /
0327        0415  0000  ENDLST, 0
0330        0416  7200          CLA
0331        0417  1615          TAD I   ENDLST          /ADDR FOR END OF LISTING RETURN
0332        0420  3254          DCA     ENDRET
0333        0421  2215          ISZ     ENDLST          /NOT=END RETURN
0334        0422  1244          TAD     ENDMES          /MESSAGE AT END OF LISTING
0335        0423  3014          DCA     AUTO1
0336        0424  1253          TAD     ENDLEN          /MESSAGE LENGTH
0337        0425  3016          DCA     AUTO3
0340        0426  1431          TAD I   LPOINT          /LOOK AT FIRST CHAR
0341        0427  1255          TAD     NEGN            /COMPARE TO N
0342        0430  7640          SZA CLA                 /SKIP IF "NO ERRORS" MESS
0343        0431  7105          CLL IAC RAL             /SET UP A TWO
0344        0432  7101          CLL IAC                 /NOW ONE OR THREE
0345        0433  1031          TAD     LPOINT          /ADDED TO START OF LINE
0346        0434  3015          DCA     AUTO2
0347        0435  1414  ENDLUP, TAD I   AUTO1
0350        0436  1415          TAD I   AUTO2
0351        0437  7640          SZA CLA                 /MATCH?
0352        0440  5615          JMP I   ENDLST          /NO - RETURN
0353        0441  2016          ISZ     AUTO3
0354        0442  5235          JMP     ENDLUP
0355        0443  5654          JMP I   ENDRET          /GOT IT - RETURN
0356                    /
0357                    /
0360        0444  0444  ENDMES, .
0361        0445  7540          -240    /BLANK
0362        0446  7473          -305    /E
0363        0447  7456          -322    /R
0364        0450  7456          -322    /R
0365        0451  7461          -317    /O
0366        0452  7456          -322    /R
0367        0453  7772  ENDLEN, ENDMES-.+1
0370                    /
0371        0454  0000  ENDRET, 0
0372        0455  7462  NEGN,   -316            /-"N
0373                    /
0374                    EJECT
-
```

```
0375                    /
0376                    /
0377                    /       READ THE SYMBOL TABLE LISTING, BUILDING AN EQUIVALENT TABLE
0400                    /               IN FIELD 0
0401                    /
0402                    /
0403    0456    4443    SYMBUILD,JMS I  PGETLIN         /GET A LINE
0404    0457    0600            PART2                   /BEGIN SEARCH IF END OF FILE
0405    0460    1431            TAD I   LPOINT          /GET FIRST CHAR OF SYMBOL
0406    0461    4445            JMS I   PLIMIT          /VALID SYMBOL?
0407    0462    0301            301
0410    0463    0332            332                     /IF NOT ALPHA, IGNORE
0411    0464    0456            SYMBUILD
0412    0465    0456            SYMBUILD
0413    0466    6141            LINC
0414                            LMODE
0415    0467    0074            SET I   AUTO1
0416    0470    4033            NAME=4000
0417    0471    0075            SET I   AUTO2
0420    0472    7771            -6
0421    0473    0002    MBT,    PDP
0422                            PMODE
0423    0474    4444            JMS I   PGETC
0424    0475    6141            LINC
0425                            LMODE
0426    0476    1374            STH I   AUTO1
0427    0477    0235            XSK I   AUTO2
0430    0500    6473            JMP     MBT
0431    0501    0002            PDP
0432                            PMODE
0433    0502    7300            CLA CLL
0434    0503    3037            DCA     NAME+3
0435    0504    3040            DCA     NAME+4
0436    0505    1342            TAD     P5
0437    0506    1020            TAD     SYSCOUNT
0440    0507    3020            DCA     SYSCOUNT        /UPDATE CORE UTILIZATION COUNT
0441    0510    7430            SZL                     /OVERFLOW?
0442    0511    5327            JMP     BOPOUT          /YES - PRINT ONLY THIS MUCH
0443    0512    4450            JMS I   PIPUSH
0444    0513    7777            7777                    /PUSH DOWN FROM TOP OF FIELD 0
0445    0514    0005            5                       /FOR OPENING OF 5 WORDS
0446    0515    4451            JMS I   PIMOVE
0447    0516    6211            CDF     10
0450    0517    0034            NAME
0451    0520    6201            CDF     0
0452    0521    7773            7773
0453    0522    0005            5
0454    0523    5256            JMP     SYMBUILD
0455                    /
0456                    /
0457                            EJECT
```

```
0460                    /
0461                    /
0462        0524  0000  BOPUP,  0
0463        0525  2020          ISZ     SYSCOUNT        /INCR STORAGE USE COUNT
0464        0526  5724          JMP I   BOPUP           /NORMAL RETURN
0465        0527  4442  BOPOUT, JMS I   PTTY            /OOPS - TOO MUCH FOR CORE
0466        0530  2253          MESS1
0467        0531  1030          TAD     LINENO
0470        0532  4452          JMS I   PPOCTAL
0471        0533  4441          JMS I   PCRLF
0472        0534  4441          JMS I   PCRLF
0473        0535  4443  BOPRST, JMS I   PGETLIN         /SCAN TO END OF LISTING
0474        0536  2163          NOGOOD                  /BAD DATA
0475        0537  4447          JMS I   PENDLST         /IS THIS THE END
0476        0540  2000          DUMP
0477        0541  5535          JMP     BOPRST          /TRY NEXT LINE
0500                    /
0501                    /
0502        0542  0005  P5,     5
0503                    /
0504                    EJECT
-
```

```
0505                    /
0506                            PAGE
0507                    /
0510                    /       READ THE LISTING BY LINES, BUILDING THE CROSS REFERENCE
0511                    /
0512    0600    7200    PART2,  CLA
0513    0601    3454            DCA I   PBLOCK          /START FROM BLOCK ZERO
0514    0602    4453            JMS I   PGETBLK         /REWIND THE INPUT UNIT NOW
0515    0603    1023            TAD     LSTREQ          /DOES HE WANT A LISTING?
0516    0604    3022            DCA     LISTSW          /START LISTING
0517                    /
0520                    /
0521    0605    4443    MAJOR,  JMS I   PGETLIN         /GET A LINE NOW
0522    0606    2163            NOGOOD                  /SHOULDNT BE ZEROS HERE
0523    0607    4447            JMS I   PENDLST        /END OF LISTING?
0524    0610    2000            DUMP                    /YES - DUMP CREF
0525    0611    1354            TAD     MMARGIN         /NO - VERIFY LINE LENGTH
0526    0612    1032            TAD     LLEN
0527    0613    7710            SPA CLA                 /IS LINE TOO SHORT?
0530    0614    5205            JMP     MAJOR           /YES - GET NEXT
0531    0615    4762            JMS I   PISNUM          /NO - IS THERE A LINE NO?
0532    0616    5205            JMP     MAJOR           /NO - GET NEXT LINE
0533    0617    1355            TAD     MARGIN          /YES - SKIP OVER ASM JUNK
0534    0620    1031            TAD     LPOINT
0535    0621    3031            DCA     LPOINT
0536                    /
0537                    /
0540    0622    4366    SCAN,   JMS     GETC            /LOOK FOR A SYMBOL
0541    0623    1360            TAD     MSLASH          /COMMENT?
0542    0624    7650            SNA CLA
0543    0625    5205            JMP     MAJOR           /YES - GO TO NEXT LINE
0544    0626    1027            TAD     CHAR
0545    0627    4445            JMS I   PLIMIT
0546    0630    0301            301
0547    0631    0332            332                     /A TO Z
0550    0632    0605            MAJOR                   /ZERO IMPLIES EOL
0551    0633    0622            SCAN                    /SEARCH FOR ALPHA
0552    0634    6141            LINC
0553                            LMODE
0554    0635    1020            LDA I
0555    0636    4040
0555                            TEXT    "  "
0556    0637    1040            STA
0557    0640    0034            NAME
0560    0641    1040            STA
0561    0642    0035            NAME+1
0562    0643    4036            STC     NAME+2
0563    0644    0074            SET I   AUTO1
0564    0645    4033            NAME-4000
0565    0646    0075            SET I   AUTO2
0566    0647    7771            -6
0567    0650    2027    SOK,    ADD     CHAR
0570    0651    1374            STH I   AUTO1           /STORE IN 6BIT
0571                    /
0572                            EJECT
-
```

```
0573                    /
0574        0652  0002  SLOOP,  PDP
0575                            PMODE
0576        0653  4366          JMS     GETC
0577        0654  4445          JMS I   PLIMIT
0600        0655  0301          301
0601        0656  0332          332                     /A TO Z
0602        0657  2163          NOGOOD
0603        0660  0662          .+2
0604        0661  5270          JMP     SEND
0605        0662  1027          TAD     CHAR
0606        0663  4445          JMS I   PLIMIT
0607        0664  0260          260
0610        0665  0271          271                     /0 TO 9
0611        0666  2163          NOGOOD
0612        0667  0676          SDUNE
0613                    /
0614                    /
0615        0670  6141  SEND,   LINC
0616                            LMODE
0617        0671  0235          XSK I   AUTO2           /END OF SYMBOL?
0620        0672  6650          JMP     SOK             /NO - PUT CHAR INTO NAME
0621        0673  0075          SET I   AUTO2           /YES - FORCE END NEXT TIME
0622        0674  7776          -1
0623        0675  6652          JMP     SLOOP           /SCAN TO DELIMITER
0624                    /
0625                            EJECT
```

```
0626                    /
0627                    /
0630                            PMODE
0631                    /
0632                    /       SYMBOL IS ASSEMBLED AT NAME,
0633                    /               CHECK THE TERMINATOR,
0634                    /
0635                    /
0636    0676    1027    SDUNE,  TAD     CHAR
0637    0677    1356            TAD     MEQ
0640    0700    7450            SNA
0641    0701    5343            JMP     ASSY            /SYMBOL DEFINITION (VIA =)
0642    0702    1357            TAD     EQMCOM
0643    0703    7650            SNA CLA
0644    0704    5343            JMP     ASSY            /TAG DEFINITION
0645                    /
0646                    /       IS THE SYMBOL THE TEXT PSEUDO-OP
0647                    /
0650    0705    1034            TAD     NAME            /FIRST 2 CHARS OF SYMBOL
0651    0706    1067            TAD     MTEXT
0652    0707    7640            SZA CLA                 /DO THE FIRST TWO MATCH?
0653    0710    5321            JMP     SAVREF          /NO
0654    0711    1035            TAD     NAME+1          /YES-CHECK NEXT
0655    0712    1070            TAD     MTEXT+1
0656    0713    7640            SZA CLA                 /DO THESE MATCH?
0657    0714    5321            JMP SAVREF              /NO
0660    0715    1036            TAD     NAME+2          /YES-CHECK FOR BLANKS
0661    0716    1071            TAD     MTEXT+2
0662    0717    7650            SNA CLA                 /LAST CHANCE
0663    0720    5765            JMP I   PTEXT           /START TEXT-MODE SCAN
0664    0721    4761    SAVREF, JMS I   PNSERCH         /THIS IS A REFERENCE, NOT A DEFINITION
0665    0722    5222            JMP     SCAN            /NOT A USER SYMBOL - RESUME SCAN
0666    0723    2024            ISZ     TEMP            /SKIP OVER END OF NAME
0667    0724    2024            ISZ     TEMP            /SKIP OVER DEFINITION LINENO
0670    0725    4763            JMS I   PIZERO          /SCAN FOR END OF REFERENCES
0671    0726    7402            HLT
0672    0727    4764            JMS I   PBOPUP          /INCR COUNTER, TEST CORE OVERFLOW
0673    0730    7240            CLA CMA
0674    0731    1024            TAD     TEMP
0675    0732    3334            DCA     BP1
0676    0733    4450            JMS I   PIPUSH          /MAKE SPACE FOR THIS LINE NO
0677    0734    0000    BP1,    0
0700    0735    0001            1
0701    0736    6201            CDF     0
0702    0737    1030            TAD     LINENO
0703    0740    3734            DCA I   BP1             /STORE THIS LINE NO
0704    0741    6211            CDF     10
0705    0742    5222            JMP     SCAN            /CONTINUE SCAN
0706                    /
0707                            EJECT
=
```

```
0710                    /
0711                    /               IF SYMBOL DEFINED HERE,
0712                    /               INSERT LINENO IN FIRST WORD AFTER NAME
0713                    /
0714                    /
0715    0743    4761    ASSY,   JMS I   PNSERCH
0716    0744    5222            JMP     SCAN            /SHOULDNT HAPPEN
0717    0745    7200            CLA
0720    0746    2024            ISZ     TEMP
0721    0747    6201            CDF     0
0722    0750    1030            TAD     LINENO
0723    0751    3424            DCA I   TEMP
0724    0752    6211            CDF     10
0725    0753    5222            JMP     SCAN            /RESUME SCAN
0726                    /
0727                    /
0730                    /
0731    0754    7747    MMARGIN,-4-6=4-2-4-2-3
0732    0755    0022    MARGIN, 6+4+2+4+2
0733    0756    7503    MEQ,    -275
0734    0757    0021    EQMCOM, 275=254
0735    0760    7521    MSLASH, =257
0736                    /
0737                    /
0740    0761    1043    PNSERCH,NSERCH
0741    0762    1000    PISNUM, ISNUM
0742    0763    1027    PIZERO, IZERO
0743    0764    0524    PBOPUP, BOPUP
0744    0765    1105    PTEXT,  TXTMODE
0745                    /
0746                    /
0747                    /
0750                    /
0751                    /
0752                    /
0753    0766    0000    GETC,   0
0754    0767    7200            CLA
0755    0770    1431            TAD I   LPOINT          /NEXT CHAR FROM CURRENT LINE
0756    0771    3027            DCA     CHAR
0757    0772    2031            ISZ     LPOINT          /POINT TO NEXT
0760    0773    1027            TAD     CHAR
0761    0774    5766            JMP I   GETC            /RETURN WITH IT
0762                    /
0763                    /
0764                    EJECT
-
```

```
0765                    /
0766                    /
0767                            PAGE
0770                    /
0771                    /       ASSEMBLE CURRENT LINE NUMBER IN BINARY AT LINENO.
0772                    /               NORMAL RETURN TO P+2; ALT RETURN TO P+1 IF
0773                    /               NEXT FOUR CHARACTERS ARE NOT OCTAL DIGITS.
0774                    /
0775    1000  0000  ISNUM,  0
0776    1001  7200          CLA
0777    1002  3030          DCA     LINENO          /CLEAR LINE NO
1000    1003  1225          TAD     M4
1001    1004  3014          DCA     AUTO1
1002    1005  4444  ISNLP,  JMS I   PGETC
1003    1006  4445          JMS I   PLIMIT
1004    1007  0260          260
1005    1010  0267          267                     /OCTAL DIGITS
1006    1011  2163          NOGOOD
1007    1012  1024          WRONG
1010    1013  1030          TAD     LINENO
1011    1014  7106          CLL RTL
1012    1015  7004          RAL
1013    1016  1027          TAD     CHAR
1014    1017  1226          TAD     MZERO
1015    1020  3030          DCA     LINENO
1016    1021  2014          ISZ     AUTO1
1017    1022  5205          JMP     ISNLP
1020    1023  2200          ISZ     ISNUM
1021    1024  5600  WRONG,  JMP I   ISNUM
1022                    /
1023    1025  7774  M4,     -4
1024    1026  7520  MZERO,  -260
1025                    /
1026                    /
1027                    /       IF WORD AT TEMP IS ZERO, TAKE SECOND RETURN,
1030                    /               ELSE, INCREMENT TEMP AND TRY AGAIN,
1031                    /               IF TEMP OVERFLOWS, TAKE FIRST RETURN.
1032                    /
1033                    /
1034    1027  0000  IZERO,  0
1035    1030  7200          CLA
1036    1031  6201          CDF     0
1037    1032  1424          TAD I   TEMP
1040    1033  6211          CDF     10
1041    1034  7450          SNA
1042    1035  2227          ISZ     IZERO
1043    1036  7650          SNA CLA
1044    1037  5627          JMP I   IZERO
1045    1040  2024          ISZ     TEMP
1046    1041  5231          JMP     IZERO+2
1047    1042  5627          JMP I   IZERO
1050                    /
1051                            EJECT
-
```

```
1052                    /
1053                    /               FIND NAME IN SYMBOL TABLE
1054                    /
1055    1043    0000    NSERCH, 0
1056    1044    7200            CLA
1057    1045    1025            TAD     START           /START OF SYMBOL TABLE
1060    1046    3024            DCA     TEMP
1061                    /
1062    1047    1303    NLOOP,  TAD     PNAME           /POINTER TO NAME - 1
1063    1050    3014            DCA     AUTO1
1064    1051    1304            TAD     M3              /6 CHARS = 3 WORDS
1065    1052    3015            DCA     AUTO2
1066                    /
1067    1053    2024    NLOOP2, ISZ     TEMP            /INCR POINTER
1070    1054    7410            SKP                     /NOT END OF CORE
1071    1055    5643            JMP I   NSERCH          /IF TEMP OVERFLOWS, NO FIND
1072    1056    6201            CDF     0
1073    1057    1424            TAD I   TEMP            /WORD OF SYMBOL
1074    1060    6211            CDF     10
1075    1061    7041            CIA
1076    1062    1414            TAD I   AUTO1           /COMPARE TO NAME
1077                    /
1100                    /       COULD TEST HERE FOR END OF SEARCH
1101                    /
1102    1063    7640            SZA CLA                 /EQUAL?
1103    1064    5271            JMP     NBAD            /NO - GO TO NEXT SYMBOL
1104    1065    2015            ISZ     AUTO2           /YES - END OF SYMBOL?
1105    1066    5253            JMP     NLOOP2          /NO - COMPARE NEXT WORD
1106    1067    2243            ISZ     NSERCH          /YES - MATCH IS HERE
1107    1070    5643            JMP I   NSERCH          /RETURN P+2
1110                    /
1111    1071    1015    NBAD,   TAD     AUTO2           /REMAINING LENGTH OF SYMBOL
1112    1072    7041            CIA
1113    1073    7101            CLL IAC                 /POS FORM + 1
1114    1074    1024            TAD     TEMP            /INCR TEMP TO REFS
1115    1075    3024            DCA     TEMP
1116    1076    7430            SZL                     /END OF CORE?
1117    1077    5643            JMP I   NSERCH          /YES - NO FIND
1120    1100    4227            JMS     IZERO           /NO - SEARCH FOR END OF REFS
1121    1101    5643            JMP I   NSERCH          /END OF CORE
1122    1102    5247            JMP     NLOOP           /GOT NEXT SYMBOL, COMPARE IT
1123                    /
1124                    /
1125    1103    0033    PNAME,  NAME-1
1126    1104    7775    M3,     -3
1127                    /
1130                    /
1131                            EJECT
```

```
1132                    /
1133                    /       WE HAVE SEEN A TEXT PSUEDO-OP
1134                    /           IGNORE INPUT UNTIL DELIMITER
1135                    /
1136                    /
1137    1105    1027    TXTMODE,TAD     CHAR            /PSEUDO-OP TERMINATOR
1140    1106    7450            SNA                     /IS IT ZERO?
1141    1107    5312            JMP     GETDEL          /YES = DELIMITER IS ON NEXT LINE
1142    1110    1062            TAD     MCARET
1143    1111    7650            SNA CLA                 /IS IT CAR RETURN?
1144    1112    4327    GETDEL, JMS     TXTLIN          /YES=GET NEXT LINE
1145    1113    4444            JMS I   PGETC           /GET NEXT CHAR FROM LINE
1146    1114    7041            CIA
1147    1115    3344            DCA     TXTEND          /HOLD THAT
1150                    /
1151    1116    4444    TXTLP,  JMS I   PGETC           /GET NEXT CHAR FROM LINE
1152    1117    1344            TAD     TXTEND          /IS IT DELIMITER?
1153    1120    7650            SNA CLA
1154    1121    5745            JMP I   TMAJOR          /YES = RESUME MAJOR SCAN
1155    1122    1027            TAD     CHAR
1156    1123    1062            TAD     MCARET          /EOL?
1157    1124    7650            SNA CLA
1160    1125    4327            JMS     TXTLIN          /YES = GET ANOTHER LINE
1161    1126    5316            JMP     TXTLP           /NO = KEEP TRYING
1162                    /
1163                    /
1164    1127    0000    TXTLIN, 0
1165    1130    4443            JMS I   PGETLIN
1166    1131    2163            NOGOOD
1167    1132    4447            JMS I   PENDLST         /CHECK FOR END OF LISTING
1170    1133    2000            DUMP
1171    1134    1346            TAD     MEDGE           /IS LINE LONG ENOUGH?
1172    1135    1032            TAD     LLEN
1173    1136    7710            SPA CLA
1174    1137    5330            JMP     TXTLIN+1        /NO = GET NEXT
1175    1140    1347            TAD     EDGE            /YES = SKIP OVER JUNK
1176    1141    1031            TAD     LPOINT
1177    1142    3031            DCA     LPOINT
1200    1143    5727            JMP I   TXTLIN          /AND CONTINUE SCAN
1201                    /
1202                    /
1203    1144    0000    TXTEND, 0
1204    1145    0605    TMAJOR, MAJOR
1205    1146    7747    MEDGE,  -31             /MINIMUM LINE WIDTH
1206    1147    0026    EDGE,   26
1207                    /
1210                    /
1211                    EJECT
```

```
1212                    /
1213                    /
1214                    /
1215                    /
1216                            PAGE
1217                    /
1220                    /
1221                    /       MOVE DOWN A PORTION OF THE TABLE IN FIELD Ø
1222                    /               TO MAKE SPACE FOR A NEW ENTRY
1223                    /
1224    1200  0000    IPUSH,  Ø
1225    1201  7200            CLA
1226    1202  1600            TAD I   IPUSH           /ADDR OF LAST WORD TO PUSH
1227    1203  2200            ISZ     IPUSH
1230    1204  7041            CIA
1231    1205  1025            TAD     START           /GIVES MINUS NUMBER OF WORDS MOVED
1232    1206  3016            DCA     AUTO3           /STORE MINUS COUNT
1233    1207  1025            TAD     START           /BEGIN OF SYM TAB -1
1234    1210  3014            DCA     AUTO1
1235    1211  1600            TAD I   IPUSH           /DISTANCE TO PUSH
1236    1212  2200            ISZ     IPUSH
1237    1213  7041            CIA
1240    1214  1025            TAD     START           /FROM OLD START
1241    1215  3025            DCA     START           /GIVES NEW START
1242    1216  1025            TAD     START
1243    1217  3015            DCA     AUTO2
1244    1220  1016            TAD     AUTO3
1245    1221  7650            SNA CLA                 /IS COUNT ZERO?
1246    1222  5600            JMP I   IPUSH           /YES = EXIT NOW
1247    1223  6201            CDF     Ø               /DATA IS IN FIELD Ø
1250    1224  1414    IPLP,   TAD I   AUTO1           /GET A WORD
1251    1225  3415            DCA I   AUTO2           /MOVE IT
1252    1226  2016            ISZ     AUTO3           /TEST COUNT
1253    1227  5224            JMP     IPLP
1254    1230  6211            CDF     10
1255    1231  5600            JMP I   IPUSH
1256                    /
1257                    /
1260                            EJECT
*
```

```
1261                    /
1262                    /       MOVE DATA ACROSS FIELDS
1263                    /
1264                    /
1265      1232  0000    IMOVE,  0
1266      1233  7200            CLA
1267      1234  4263            JMS     IMGET
1270      1235  3253            DCA     IMCDF1
1271      1236  7240            CLA CMA
1272      1237  4263            JMS     IMGET
1273      1240  3014            DCA     AUTO1
1274      1241  4263            JMS     IMGET
1275      1242  3255            DCA     IMCDF2
1276      1243  7240            CLA CMA
1277      1244  4263            JMS     IMGET
1300      1245  3015            DCA     AUTO2
1301      1246  4263            JMS     IMGET
1302      1247  7450            SNA
1303      1250  5632            JMP I   IMOVE
1304      1251  7041            CIA
1305      1252  3016            DCA     AUTO3
1306      1253  0000    IMCDF1, 0
1307      1254  1414            TAD I   AUTO1
1310      1255  0000    IMCDF2, 0
1311      1256  3415            DCA I   AUTO2
1312      1257  2016            ISZ     AUTO3
1313      1260  5253            JMP     IMCDF1
1314      1261  6211            CDF     10
1315      1262  5632            JMP I   IMOVE
1316                    /
1317                    /
1320      1263  0000    IMGET,  0
1321      1264  1632            TAD I   IMOVE
1322      1265  2232            ISZ     IMOVE
1323      1266  5663            JMP I   IMGET
1324                    /
1325                    EJECT
-
```

```
1326                    /
1327                    /                   CHECK THAT THE AC IS WITHIN LIMITS
1330                    /
1331    1267    0000    LIMIT,  0
1332    1270    3322            DCA     LTEMP           /STORE COMPARISON VALUE
1333    1271    1667            TAD I   LIMIT           /LOWER LIMIT
1334    1272    2267            ISZ     LIMIT
1335    1273    3323            DCA     LOW
1336    1274    1667            TAD I   LIMIT           /UPPER LIMIT
1337    1275    2267            ISZ     LIMIT
1340    1276    3324            DCA     HIGH
1341    1277    1667            TAD I   LIMIT           /ZERO RETURN
1342    1300    2267            ISZ     LIMIT
1343    1301    3325            DCA     LEND
1344    1302    1667            TAD I   LIMIT           /OUT OF BOUNDS RETURN
1345    1303    2267            ISZ     LIMIT
1346    1304    3326            DCA     LNO
1347    1305    1322            TAD     LTEMP           /GET TEST VALUE
1350    1306    7450            SNA                     /ZERO?
1351    1307    5725            JMP I   LEND            /YES = TAKE P+3 RETURN
1352    1310    7041            CIA
1353    1311    1324            TAD     HIGH            /COMPARE TO UPPER BOUND
1354    1312    7710            SPA CLA
1355    1313    5726            JMP I   LNO             /OUT OF BOUNDS
1356    1314    1323            TAD     LOW
1357    1315    7041            CIA
1360    1316    1322            TAD     LTEMP
1361    1317    7710            SPA CLA
1362    1320    5726            JMP I   LNO             /OUT OF BOUNDS
1363    1321    5667            JMP I   LIMIT           /OK
1364                    /
1365                    /
1366                    /
1367    1322    0000    LTEMP,  0
1370    1323    0000    LOW,    0
1371    1324    0000    HIGH,   0
1372    1325    0000    LEND,   0
1373    1326    0000    LNO,    0
1374                    /
1375                    /
1376                    EJECT
-
```

```
1377                    /
1400                            PAGE
1401                    /
1402                    /       GET A BLOCK FROM THE LISTING FILE
1403                    /
1404    1400    0000    GETBLK, 0
1405    1401    7200            CLA
1406    1402    6201            CDF     0
1407    1403    1641            TAD I   P7750           /SAVE
1410    1404    3237            DCA     S7750           /DISK
1411    1405    1642            TAD I   P7751           /DATA-BREAK
1412    1406    3240            DCA     S7751           /LOCATIONS
1413    1407    6211            CDF     10
1414    1410    4456            JMS I   READ            /READ BLOCK
1415    1411    1430            POINTER
1416    1412    6201            CDF     0
1417    1413    1237            TAD     S7750           /RESTORE
1420    1414    3641            DCA I   P7750           /DISK
1421    1415    1240            TAD     S7751           /DATA-BREAK
1422    1416    3642            DCA I   P7751           /WORDS
1423    1417    6211            CDF     10
1424    1420    1234            TAD     MBUFLN          /RESET POINTERS
1425    1421    3370            DCA     BCOUNT
1426    1422    1235            TAD     PBUFF
1427    1423    3367            DCA     BPOINT
1430    1424    1232            TAD     BLOCK           /UPDATE BLOCK NO
1431    1425    1236            TAD     EIGHT
1432    1426    3232            DCA     BLOCK
1433    1427    5600            JMP I   GETBLK
1434                    /
1435                    /
1436    1430    0000    POINTER,0
1437    1431    0026            BUFLOC
1440    1432    0000    BLOCK,  0
1441    1433    0010            10
1442                    /
1443                    /
1444    1434    4000    MBUFLN, -4000
1445    1435    5000    PBUFF,  BUFFER
1446    1436    0010    EIGHT,  10
1447                    /
1450    1437    0000    S7750,  0
1451    1440    0000    S7751,  0
1452                    /
1453    1441    7750    P7750,  7750
1454    1442    7751    P7751,  7751
1455                    /
1456                    /
1457                            EJECT
-
```

```
1460                    /
1461                    /
1462                    /       GET NEXT LINE OF LISTING
1463                    /
1464    1443    0000    GETLIN, 0
1465    1444    7200            CLA
1466    1445    1643            TAD I   GETLIN          /ALT RETURN IF ZERO IN INPUT
1467    1446    3374            DCA     ZERET
1470    1447    2243            ISZ     GETLIN          /NOW HAS NORMAL RETURN ADDR
1471    1450    1373            TAD     PCURL
1472    1451    3031            DCA     LPOINT          /RESET LINE POINTER
1473    1452    1372            TAD     PCURL-1
1474    1453    3014            DCA     AUTO1           /SET LINE BUILD POINTER
1475    1454    3032            DCA     LLEN            /CLEAR LENGTH
1476    1455    1767            TAD I   BPOINT          /GET FIRST CHAR OF NEXT LINE
1477    1456    1063            TAD     MLINFD          /LINE FEED?
1500    1457    7450            SNA
1501    1460    5302            JMP     NULLIN          /YES = NULL LINE
1502    1461    1347            TAD     LFMCR           /CAR RET?
1503    1462    7650            SNA CLA
1504    1463    5302            JMP     NULLIN          /YES = NULL LINE
1505    1464    4351    NXTONE, JMS     NXTCHR          /NO = GET A CHAR
1506    1465    3414            DCA I   AUTO1           /INSERT IN LINE
1507    1466    2032            ISZ     LLEN            /INCR LENGTH
1510    1467    1022            TAD     LISTSW          /LIST IT?
1511    1470    7650            SNA CLA
1512    1471    5274            JMP     EOLTST          /NO - TEST FOR END OF LINE
1513    1472    1027            TAD     CHAR
1514    1473    4446            JMS I   PPUTC           /YES - OUTPUT IT
1515    1474    1027    EOLTST, TAD     CHAR
1516    1475    1063            TAD     MLINFD          /COMPARE TO LINE FEED
1517    1476    7640            SZA CLA                 /EOL?
1520    1477    5264            JMP     NXTONE          /NO - GET ANOTHER
1521    1500    3414            DCA I   AUTO1           /SAFETY TERMINATOR
1522    1501    5643            JMP I   GETLIN          /TAKE NORMAL RETURN
1523                    /
1524                    /       WHATCHA GOT HERE IS AN EMPTY LINE
1525                    /       ... IT STARTS WITH CR OR LF
1526                    /
1527    1502    1022    NULLIN, TAD     LISTSW          /ARE WE LISTING?
1530    1503    7640            SZA CLA
1531    1504    5316            JMP     LSTNUL          /YES
1532    1505    4351    SKPNUL, JMS     NXTCHR          /GET CHARACTER
1533    1506    1063            TAD     MLINFD          /IS IT ...
1534    1507    7450            SNA                     /LINE FEED?
1535    1510    5305            JMP     SKPNUL          /YES - IGNORE IT
1536    1511    1347            TAD     LFMCR
1537    1512    7650            SNA CLA                 /IS IT CR?
1540    1513    5305            JMP     SKPNUL          /YES - IGNORE
1541    1514    1027            TAD     CHAR
1542    1515    5265            JMP     NXTONE+1        /REAL CHAR - BUILD LINE
1543                    /
1544                    EJECT
-
```

```
1545                    /
1546                    /
1547    1516    1021    LSTNUL, TAD     LP              /IS THERE A PRINTER?
1550    1517    7650            SNA CLA
1551    1520    5335            JMP     TYPNUL          /NO - TYPE IT
1552    1521    1033            TAD     LINE            /CURRENT LINE ON PAGE
1553    1522    1064            TAD     LPPAGE          /ARE WE AT TOP OF PAGE?
1554    1523    7650            SNA CLA
1555    1524    5305            JMP     SKPNUL          /YES - IGNORE NULL LINES
1556    1525    1065            TAD     MLPAGE          /RESET LINE COUNT
1557    1526    3033            DCA     LINE
1560    1527    1066            TAD     EJCOM           /TOP OF FORM COMMAND
1561    1530    6661            LSD                     /WAIT FOR PRINTER
1562    1531    5330            JMP     .-1
1563    1532    6652            LCF                     /CLEAR FLAGS
1564    1533    6664            LPR                     /PRINT AND EJECT
1565    1534    5305            JMP     SKPNUL
1566                    /
1567    1535    4351    TYPNUL, JMS     NXTCHR          /GET CHARACTER
1570    1536    4750            JMS I   PLTT            /TYPE IT
1571    1537    1767            TAD I   BPOINT          /NEXT CHAR
1572    1540    1063            TAD     MLINFD          /IS IT LF?
1573    1541    7450            SNA
1574    1542    5335            JMP     TYPNUL          /YES - TYPE IT
1575    1543    1347            TAD     LFMCR           /IS IT CR?
1576    1544    7650            SNA CLA
1577    1545    5335            JMP     TYPNUL          /YES - TYPE IT
1600    1546    5264            JMP     NXTONE          /ELSE BUILD LINE
1601                    /
1602                    /
1603                    /
1604    1547    7775    LFMCR,  212=215
1605                    /
1606    1550    1765    PLTT,   LTT
1607                    /
1610                    /
1611    1551    0000    NXTCHR, 0
1612    1552    7200            CLA
1613    1553    1767            TAD I   BPOINT
1614    1554    0371            AND     CHRMSK
1615    1555    7450            SNA                     /WATCH OUT FOR ZEROS
1616    1556    5774            JMP I   ZERET
1617    1557    3027            DCA     CHAR
1620    1560    2367            ISZ     BPOINT
1621    1561    1027            TAD     CHAR
1622    1562    2370            ISZ     BCOUNT
1623    1563    5751            JMP I   NXTCHR
1624    1564    4200            JMS     GETBLK
1625    1565    1027            TAD     CHAR
1626    1566    5751            JMP I   NXTCHR
1627                    /
1630    1567    0000    BPOINT, 0
1631    1570    0000    BCOUNT, 0
1632    1571    0377    CHRMSK, 377
1633    1572    2311            CURLIN-1
1634    1573    2312    PCURL,  CURLIN
1635                    /
1636    1574    0000    ZERET,  0
1637                    /
1640                    EJECT
```

```
1641                    /
1642                    /
1643                            PAGE
1644                    /       PRINT AC IN OCTAL
1645                    /
1646                    /
1647    1600    0000    POCTAL, 0
1650    1601    3245            DCA     W4
1651    1602    1245            TAD     W4
1652    1603    7012            RTR
1653    1604    7010            RAR
1654    1605    3244            DCA     W3
1655    1606    1245            TAD     W4
1656    1607    0057            AND     P7
1657    1610    1241            TAD     CZERO
1660    1611    3245            DCA     W4
1661    1612    1244            TAD     W3
1662    1613    7012            RTR
1663    1614    7010            RAR
1664    1615    3243            DCA     W2
1665    1616    1244            TAD     W3
1666    1617    0057            AND     P7
1667    1620    1241            TAD     CZERO
1670    1621    3244            DCA     W3
1671    1622    1243            TAD     W2
1672    1623    7012            RTR
1673    1624    7010            RAR
1674    1625    3242            DCA     W1
1675    1626    1243            TAD     W2
1676    1627    0057            AND     P7
1677    1630    1241            TAD     CZERO
1700    1631    3243            DCA     W2
1701    1632    1242            TAD     W1
1702    1633    0057            AND     P7
1703    1634    1241            TAD     CZERO
1704    1635    3242            DCA     W1
1705    1636    4247            JMS     TTY
1706    1637    1642            W1
1707    1640    5600            JMP I   POCTAL
1710                    /
1711    1641    0260    CZERO,  260
1712                    /
1713    1642    0000    W1,     0
1714    1643    0000    W2,     0
1715    1644    0000    W3,     0
1716    1645    0000    W4,     0
1717    1646    0000            0
1720                    /
1721                            EJECT
-
```

```
1722                    /
1723        1647  0000  TTY,    0
1724        1650  7200          CLA
1725        1651  1647          TAD I   TTY
1726        1652  3262          DCA     TYTEMP
1727        1653  2247          ISZ     TTY
1730        1654  1662  TL,     TAD I   TYTEMP
1731        1655  2262          ISZ     TYTEMP
1732        1656  7450          SNA
1733        1657  5647          JMP I   TTY
1734        1660  4272          JMS     PUTC
1735        1661  5254          JMP     TL
1736                    /
1737        1662  0000  TYTEMP, 0
1740                    /
1741                    /
1742        1663  0000  CRLF,   0
1743        1664  4247          JMS     TTY
1744        1665  1667          C
1745        1666  5663          JMP I   CRLF
1746                    /
1747        1667  0215  C,      215
1750        1670  0212          212
1751        1671  0000          0
1752                    /
1753                    /
1754                    /
1755                    /
1756        1672  0000  PUTC,   0
1757        1673  3375          DCA     PT
1760        1674  1375          TAD     PT
1761        1675  4445          JMS I   PLIMIT
1762        1676  0240          240
1763        1677  0337          337
1764        1700  2163          NOGOOD
1765        1701  1717          SP
1766        1702  1021          TAD     LP
1767        1703  7650          SNA CLA
1770        1704  5314          JMP     LT
1771        1705  1375          TAD     PT
1772        1706  6661          LSD
1773        1707  5306          JMP     .-1
1774        1710  6652          LCF
1775        1711  6654          LLB
1776        1712  7200          CLA
1777        1713  5672          JMP I   PUTC
2000                    /
2001                    /
2002                    /
2003        1714  1375  LT,     TAD     PT
2004        1715  4365          JMS     LTT
2005        1716  5672          JMP I   PUTC
2006                    /
2007                    /
2010                    EJECT
```

```
2011                    /
2012                    /
2013        1717  1375  SP,       TAD      PT
2014        1720  1062            TAD      MCARET
2015        1721  7640            SZA CLA                  /IS IT CAR RET?
2016        1722  5672            JMP I    PUTC            /NO = IGNORE
2017        1723  7300            CLA CLL
2020        1724  2033            ISZ      LINE            /YES = NEW LINE
2021        1725  5331            JMP      REG
2022        1726  1065            TAD      MLPAGE
2023        1727  3033            DCA      LINE
2024        1730  7120            CLL CML
2025        1731  1021  REG,      TAD      LP
2026        1732  7650            SNA CLA
2027        1733  5345            JMP      LE
2030        1734  1374            TAD      P10
2031        1735  7430            SZL                      /NEW PAGE?
2032        1736  1057            TAD      P7              /YES = MAKE EJECT COMMAND
2033        1737  6661            LSD
2034        1740  5337            JMP      .-1
2035        1741  6652            LCF
2036        1742  6664            LPR
2037        1743  7200            CLA
2040        1744  5672            JMP I    PUTC
2041                    /
2042        1745  1060  LE,       TAD      CARRET
2043        1746  4365            JMS      LTT
2044        1747  1061            TAD      LINFED
2045        1750  4365            JMS      LTT
2046        1751  7420            SNL                      /PAGE?
2047        1752  5672            JMP I    PUTC            /NO
2050        1753  1022            TAD      LISTSW
2051        1754  7640            SZA CLA                  /LISTING?
2052        1755  5672            JMP I    PUTC            /YES
2053        1756  1373            TAD      M3A
2054        1757  3376            DCA      LCOUNT
2055        1760  1061  LELP,     TAD      LINFED
2056        1761  4365            JMS      LTT
2057        1762  2376            ISZ      LCOUNT
2060        1763  5360            JMP      LELP
2061        1764  5672            JMP I    PUTC
2062                    /
2063        1765  0000  LTT,      0
2064        1766  6041            TSF
2065        1767  5366            JMP      .-1
2066        1770  6046            TLS
2067        1771  7200            CLA
2070        1772  5765            JMP I    LTT
2071                    /
2072                    /
2073        1773  7775  M3A,      -3
2074        1774  0010  P10,      10
2075        1775  0000  PT,       0
2076        1776  0000  LCOUNT,   0
2077                    /
2100                    EJECT
-
```

```
2101                    /
2102                            PAGE
2103                    /
2104                    /       DUMP THE CROSS REFERENCE TABLE
2105                    /
2106    2000    7200    DUMP,   CLA
2107    2001    3022            DCA     LISTSW
2110    2002    1021            TAD     LP
2111    2003    7650            SNA CLA
2112    2004    5216            JMP     DTYPE
2113    2005    1065            TAD     MLPAGE
2114    2006    3033            DCA     LINE
2115    2007    1066            TAD     EJCOM
2116    2010    6661            LSD                     /WAIT FOR PRINTER
2117    2011    5210            JMP     .-1
2120    2012    6652            LCF
2121    2013    6664            LPR
2122    2014    7200            CLA
2123    2015    5221            JMP     DMPGO
2124    2016    4441    DTYPE,  JMS I   PCRLF
2125    2017    4441            JMS I   PCRLF
2126    2020    4441            JMS I   PCRLF
2127    2021    1025    DMPGO,  TAD     START
2130    2022    3024            DCA     TEMP
2131    2023    4441    DNAME,  JMS I   PCRLF
2132    2024    5263    ONCE,   JMP     NOWHDR          /FIRST TIME,FORCE A HEADER
2133    2025    1033            TAD     LINE
2134    2026    1064            TAD     LPPAGE
2135    2027    7640            SZA CLA                 /TOP OF PAGE?
2136    2030    5236            JMP     DSYM            /NO
2137    2031    4442    DOHDR,  JMS I   PTTY            /YES = PRINT HEADER
2140    2032    2214            CRFHDR
2141    2033    2033            ISZ     LINE
2142    2034    4441            JMS I   PCRLF
2143    2035    4441            JMS I   PCRLF
2144    2036    4347    DSYM,   JMS     DSET
2145    2037    2024            ISZ     TEMP
2146    2040    5266            JMP     ND
2147    2041    1021            TAD     LP              /PRINTER?
2150    2042    7640            SZA CLA
2151    2043    5252            JMP     EJOUT           /YES=EXIT WITH EJECT
2152    2044    1374            TAD     M12             /NO-EXIT WITH CRLF
2153    2045    3016            DCA     AUTO3
2154    2046    4441            JMS I   PCRLF
2155    2047    2016            ISZ     AUTO3
2156    2050    5246            JMP     .-2
2157    2051    5455            JMP I   BOOT
2160                    /
2161    2052    6661    EJOUT,  LSD                     /WAIT
2162    2053    5252            JMP     .-1
2163    2054    6652            LCF
2164    2055    1066            TAD     EJCOM
2165    2056    6664            LPR                     /EJECT
2166    2057    6661            LSD
2167    2060    5257            JMP     .-1
2170    2061    6652            LCF
2171    2062    5455            JMP I   BOOT            /EXIT
2172                    /
2173    2063    1200    NOWHDR, TAD     DUMP            /PICK UP CLA INSTR
2174    2064    3224            DCA     ONCE            /NOP THE JMP TO HERE
2175    2065    5231            JMP     DOHDR           /FORCE HEADER THE FIRST TIME
2176                    /
2177                            EJECT
```

```
2200                    /
2201                    /
2202    2066    4443    ND,     JMS I   PGETLIN          /GET A LINE FROM SYMBOL TABLE
2203    2067    2163            NOGOOD                  /SHOULDNT HAPPEN
2204    2070    1431            TAD I   LPOINT          /GET FIRST CHAR OF LINE
2205    2071    4445            JMS I   PLIMIT          /CHECK VALIDITY
2206    2072    0301            301
2207    2073    0332            332                     /ALPHA ONLY
2210    2074    2163            NOGOOD
2211    2075    2066            ND                      /IN CASE OF GARBAGE
2212    2076    3745            DCA I   SYMEND          /STOP AFTER SYMBOL
2213    2077    3746            DCA I   VALEND          /AND AFTER VALUE
2214    2100    4442            JMS I   PTTY            /PRINT SYMBOL
2215    2101    2312            CURLIN
2216    2102    4442            JMS I   PTTY            /TWO SPACES
2217    2103    2211            NB
2220    2104    4442            JMS I   PTTY            /PRINT VALUE
2221    2105    2321            CURLIN+7
2222    2106    4442            JMS I   PTTY            /TWO SPACES
2223    2107    2211            NB
2224    2110    7325            CLA STL IAC RAL         /CONSTANT THREE
2225    2111    1024            TAD     TEMP            /BUMP TEMP OVER NAME
2226    2112    3024            DCA     TEMP
2227    2113    4356            JMS     GTEMP           /DEFINITION LINE
2230    2114    4452            JMS I   PPOCTAL
2231    2115    4442            JMS I   PTTY            /TWO SPACES
2232    2116    2211            NB
2233    2117    2024    NNLOOP, ISZ     TEMP
2234    2120    4356            JMS     GTEMP           /GET A REFERENCE
2235    2121    7450            SNA                     /USED?
2236    2122    5223            JMP     DNAME           /NO = END OF REFS TO THIS SYMBOL
2237    2123    4452            JMS I   PPOCTAL         /YES = PRINT IT
2240    2124    4442            JMS I   PTTY            /SPACE ONCE
2241    2125    2212            NB+1
2242    2126    2376            ISZ     NREST           /MORE ROOM ON LINE?
2243    2127    5317            JMP     NNLOOP          /YES = GET NEXT REF
2244    2130    2024            ISZ     TEMP            /NO
2245    2131    4356            JMS     GTEMP           /IS THERE ANOTHER REF?
2246    2132    7650            SNA CLA
2247    2133    5223            JMP     DNAME           /NO = GO TO NEXT SYMBOL
2250    2134    4441            JMS I   PCRLF           /YES = NEW LINE
2251    2135    4347            JMS     DSET            /SET LIMIT
2252    2136    1374            TAD     M12             /SPACE OVER BY 20
2253    2137    3014            DCA     AUTO1
2254    2140    4442            JMS I   PTTY
2255    2141    2211            NB
2256    2142    2014            ISZ     AUTO1           /SPACE TO REF FIELD
2257    2143    5340            JMP     .-3
2260    2144    5320            JMP     NNLOOP+1
2261                    /
2262    2145    2320    SYMEND, CURLIN+6
2263    2146    2325    VALEND, CURLIN+13
2264                    /
2265                    /
2266                            EJECT
-
```

```
2267                    /
2270                    /
2271    2147  0000  DSET,   Ø
2272    2150  1021          TAD     LP
2273    2151  7640          SZA CLA
2274    2152  1375          TAD     P12M26
2275    2153  1374          TAD     M12
2276    2154  3376          DCA     NREST
2277    2155  5747          JMP I   DSET
2300                    /
2301                    /
2302    2156  0000  GTEMP,  Ø
2303    2157  6201          CDF     Ø
2304    2160  1424          TAD I   TEMP
2305    2161  6211          CDF     10
2306    2162  5756          JMP I   GTEMP
2307                    /
2310                    /
2311                    /
2312                    /
2313    2163  4441  NOGOOD, JMS I   PCRLF          /FOUND A ZERO
2314    2164  4441          JMS I   PCRLF          /IN INPUT
2315    2165  4441          JMS I   PCRLF          /WHERE NOT EXPECTED
2316    2166  4442          JMS I   PTTY
2317    2167  2177          BADINPUT
2320    2170  4441          JMS I   PCRLF
2321    2171  4441          JMS I   PCRLF
2322    2172  4441          JMS I   PCRLF
2323    2173  5455          JMP I   BOOT
2324                    /
2325    2174  7766  M12,    -12
2326    2175  7764  P12M26, 12=26
2327                    /
2330                    /
2331                    /
2332    2176  0000  NREST,  Ø
2333                    /
2334                    /
2335                    LCB=6662
2336                    LCF=6652
2337                    LLB=6654
2340                    LPR=6664
2341                    LSD=6661
2342                    /
2343                    /
2344                    /
2345                            EJECT
```

```
2346                    /
2347                    /
2350                    /       MESSAGES
2351                    /
2352                    /
2353        2177  0302  BADINPUT,302     /B
2354        2200  0301          301       /A
2355        2201  0304          304       /D
2356        2202  0240          240       /
2357        2203  0311          311       /I
2360        2204  0316          316       /N
2361        2205  0320          320       /P
2362        2206  0325          325       /U
2363        2207  0324          324       /T
2364        2210  0000          0
2365                    /
2366                    /
2367                    /
2370        2211  0240  NB,       240
2371        2212  0240            240
2372        2213  0000            0         /TWO BLANKS
2373                    /
2374                    /
2375        2214  0323  CRFHDR,   323       /S
2376        2215  0331            331       /Y
2377        2216  0315            315       /M
2400        2217  0302            302       /B
2401        2220  0317            317       /O
2402        2221  0314            314       /L
2403        2222  0240            240
2404        2223  0240            240
2405        2224  0326            326       /V
2406        2225  0301            301       /A
2407        2226  0314            314       /L
2410        2227  0325            325       /U
2411        2230  0305            305       /E
2412        2231  0240            240
2413        2232  0240            240
2414        2233  0304            304       /D
2415        2234  0305            305       /E
2416        2235  0306            306       /F
2417        2236  0240            240
2420        2237  0240            240
2421        2240  0322            322       /R
2422        2241  0305            305       /E
2423        2242  0306            306       /F
2424        2243  0305            305       /E
2425        2244  0322            322       /R
2426        2245  0305            305       /E
2427        2246  0316            316       /N
2430        2247  0303            303       /C
2431        2250  0305            305       /E
2432        2251  0323            323       /S
2433        2252  0000            0
2434                    /
2435                            EJECT
```

```
2436                        /
2437        2253    0215    MESS1,  215     /CAR RET
2440        2254    0212            212     /LINE FEED
2441        2255    0303            303     /C
2442        2256    0317            317     /O
2443        2257    0322            322     /R
2444        2260    0305            305     /E
2445        2261    0240            240     /
2446        2262    0317            317     /O
2447        2263    0326            326     /V
2450        2264    0305            305     /E
2451        2265    0322            322     /R
2452        2266    0306            306     /F
2453        2267    0314            314     /L
2454        2270    0317            317     /O
2455        2271    0327            327     /W
2456        2272    0305            305     /E
2457        2273    0304            304     /D
2460        2274    0240            240     /
2461        2275    0301            301     /A
2462        2276    0324            324     /T
2463        2277    0240            240     /
2464        2300    0314            314     /L
2465        2301    0311            311     /I
2466        2302    0316            316     /N
2467        2303    0305            305     /E
2470        2304    0240            240     /
2471        2305    0316            316     /N
2472        2306    0317            317     /O
2473        2307    0256            256     /.
2474        2310    0240            240     /
2475        2311    0000            0
2476                        /
2477                        /
2500                        CURLIN=.                /CURRENT LINE OF LISTING STARTS HERE
2501                        /
2502                        /
2503        2312    0325    INIT,   325     /U
2504        2313    0316            316     /N
2505        2314    0311            311     /I
2506        2315    0324            324     /T
2507        2316    0240            240     /
2510        2317    0243            243     /
2511        2320    0277            277     /?
2512        2321    0000            0
2513                        /
2514        2322    0314    LST,    314     /L
2515        2323    0311            311     /I
2516        2324    0323            323     /S
2517        2325    0324            324     /T
2520        2326    0311            311     /I
2521        2327    0316            316     /N
2522        2330    0307            307     /G
2523        2331    0333            333     /[
2524        2332    0331            331     /Y
2525        2333    0240            240     /
2526        2334    0317            317     /O
2527        2335    0322            322     /R
2530        2336    0240            240     /
2531        2337    0316            316     /N
2532        2340    0335            335     /]
2533        2341    0277            277     /?
2534        2342    0000            0
-
```

```
2535                    /
2536                    /
2537        2343  0320  PRT,      320       /P
2540        2344  0322            322       /R
2541        2345  0311            311       /I
2542        2346  0316            316       /N
2543        2347  0324            324       /T
2544        2350  0305            305       /E
2545        2351  0322            322       /R
2546        2352  0333            333       /[
2547        2353  0331            331       /Y
2550        2354  0240            240       /
2551        2355  0317            317       /O
2552        2356  0322            322       /R
2553        2357  0240            240       /
2554        2360  0316            316       /N
2555        2361  0335            335       /]
2556        2362  0277            277       /?
2557        2363  0000            0
2560                    /
2561                    /
2562                    /
2563                    /         END OF CREF12
2564                    /
2565                    /
2566                    /
2567                    /
2570                              LISTAPE 7
```

NO ERRORS

```
SYMBOL   VALUE  DEF   REFERENCES

ASSY     0743   0715  0641 0644
AUTO1    0014   0020  0335 0347 0415 0426 0563 0570 1001 1016 1063 1076 1234 1250 1273 1307 1474 1506 1521 2253 2256
AUTO2    0015   0021  0346 0350 0417 0427 0565 0617 0621 1065 1104 1111 1243 1251 1300 1311
AUTO3    0016   0022  0337 0353 1232 1244 1252 1305 1312 2153 2155
AUTO4    0017   0023
BADINP   2177   2356  2317
BCOUNT   1570   1631  1425 1622
BLOCK    1432   1440  0070 1430 1432
BOOT     0055   0074  2157 2171 2323
BOPOUT   0527   0465  0442
BOPRST   0535   0473  0477
BOPUP    0524   0462  0464 0743
BPOINT   1567   1630  1427 1476 1571 1613 1620
BP1      0734   0677  0675 0703
BUFFER   3000   0115  1445
BUFLOC   0026   0116  1437
C        1667   1747  1744
CARRET   0060   0100  2042
CHAR     0027   0036  0176 0203 0217 0235 0257 0260 0262 0544 0567 0605 0636 0756 0760 1013 1137 1155 1513 1515 1541 1617 1621 1625
CHRMSK   1571   1632  1614
CNMCY    0326   0272  0223 0241
COUNT    0026   0035
CRFHDR   2214   2375  2140
CRLF     1663   1742  0055 1745
CURLIN   2312   2500  0040 1633 1634 2215 2221 2262 2263
CZERO    1641   1711  1657 1667 1677 1703
DMPGO    2021   2127  2123
DNAME    2023   2131  2236 2247
DOHDR    2031   2137  2175
DSET     2147   2271  2144 2251 2277
DSYM     2036   2144  2136
DTYPE    2016   2124  2112
DUMP     2000   2106  0476 0524 1170 2173
EDGE     1147   1206  1175
EIGHT    1436   1446  1431
EJCOM    0066   0106  0245 1560 2115 2164
EJOUT    2052   2161  2151
ENDLEN   0453   0367  0336
ENDLST   0415   0327  0063 0317 0331 0333 0352
ENDLUP   0435   0347  0354
ENDMES   0444   0360  0334 0367
ENDRET   0454   0371  0332 0355
EOLTST   1474   1515  1512
EQMCOM   0757   0734  0642
GETBLK   1400   1404  0067 1433 1624
GETC     0766   0753  0060 0540 0576 0761
GETDEL   1112   1144  1141
GETLIN   1443   1464  0057 1466 1470 1522
GETTTY   0310   0252  0162 0215 0233 0263
GTEMP    2156   2302  2227 2234 2245 2306
HIGH     1324   1371  1340 1353
IMCDF1   1253   1306  1270 1313
IMCDF2   1255   1310  1275
IMGET    1263   1320  1267 1272 1274 1277 1301 1323
IMOVE    1232   1265  0065 1303 1315 1321 1322
INIT     2312   2503  0160
IPLP     1224   1250  1253
IPUSH    1200   1224  0064 1226 1227 1235 1236 1246 1255
ISNLP    1005   1002  1017
ISNUM    1000   0775  0741 1020 1021
```

```
SYMBOL   VALUE  DEF   REFERENCES

IZERO    1027   1034  0742 1042 1044 1046 1047 1120
LCB      6662   2335
LCF      6652   2336  1563 1774 2035 2120 2163 2170
LCOUNT   1776   2076  2054 2057
LE       1745   2042  2027
LELP     1760   2055  2060
LEND     1325   1372  1343 1351
LFMCR    1547   1604  1502 1536 1575
LIMIT    1267   1331  0061 1333 1334 1336 1337 1341 1342 1344 1345 1363
LINE     0033   0042  1552 1557 2020 2023 2114 2133 2141
LINENO   0030   0037  0467 0702 0722 0777 1010 1015
LINFED   0061   0101  2044 2055
LISTSW   0022   0031  0516 1510 1527 2050 2107
LLB      6654   2337  1775
LLEN     0032   0041  0526 1172 1475 1507
LNO      1326   1373  1346 1355 1362
LOW      1323   1370  1335 1356
LP       0021   0030  0155 0244 1547 1766 2025 2110 2147 2272
LPOINT   0031   0040  0340 0345 0405 0534 0535 0755 0757 1176 1177 1472 2204
LPPAGE   0064   0104  1553 2134
LPR      6664   2340  0246 1564 2036 2121 2165
LSD      6661   2341  1561 1772 2033 2116 2161 2166
LST      2322   2514  0214
LSTNUL   1516   1547  1531
LSTREQ   0023   0032  0154 0226 0515
LSTSET   0255   0213  0225
LT       1714   2003  1770
LTEMP    1322   1367  1332 1347 1360
LTT      1765   2063  1606 2004 2043 2045 2056 2070
MAIN     0400   0306  0267
MAJOR    0605   0521  0530 0532 0543 0550 1204
MARGIN   0755   0732  0533
MBT      0473   0421  0430
MBUFLN   1434   1444  1424
MCARET   0062   0102  0204 1142 1156 2014
MCN      0325   0271  0220 0236
MEDGE    1146   1205  1171
MEQ      0756   0733  0637
MESS1    2253   2437  0466
MLINFD   0063   0103  1477 1516 1533 1572
MLOOP    0410   0315  0321
MLPAGE   0065   0105  1556 2022 2113
MMARGI   0754   0731  0525
MSLASH   0760   0735  0541
MTEXT    0067   0110  0651 0655 0661
MZERO    1026   1024  1014
M12      2174   2325  2152 2252 2275
M3       1104   1126  1064
M3A      1773   2073  2053
M4       1025   1023  1000
NAME     0034   0043  0416 0434 0435 0450 0557 0561 0562 0564 0650 0654 0660 1125
NB       2211   2370  2217 2223 2232 2241 2255
NBAD     1071   1111  1103
ND       2066   2202  2146 2211
NEGN     0455   0372  0341
NLOOP    1047   1062  1122
NLOOP2   1053   1067  1105
NNLOOP   2117   2233  2243 2260
NOGOOD   2163   2313  0316 0474 0522 0602 0611 1006 1166 1764 2203 2210
NOWHDR   2063   2173  2132
NREST    2176   2332  2242 2276
```

```
SYMBOL  VALUE  DEF   REFERENCES

NSERCH  1043   1055  0740 1071 1106 1107 1117 1121
NULLIN  1502   1527  1501 1504
NXTCHR  1551   1611  1505 1532 1567 1623 1626
NXTONE  1464   1505  1520 1542 1600
ONCE    2024   2132  2174
PART2   0600   0512  0404
PBLOCK  0054   0070  0305 0513
PBOPUP  0764   0743  0672
PBUFF   1435   1445  1426
PCRLF   0041   0055  0156 0216 0234 0303 0471 0472 2124 2125 2126 2131 2142 2143 2154 2250 2313 2314 2315 2320 2321 2322
PCURL   1573   1634  1471 1473
PENDLS  0047   0063  0475 0523 1167
PGETBL  0053   0067  0306 0514
PGETC   0044   0060  0423 1002 1145 1151
PGETLI  0043   0057  0315 0403 0473 0521 1165 2202
PIMOVE  0051   0065  0446
PIPUSH  0050   0064  0443 0676
PISNUM  0762   0741  0531
PIZERO  0763   0742  0670
PLIMIT  0045   0061  0163 0406 0545 0577 0606 1003 1761 2205
PLTT    1550   1606  1570
PMAIN   0323   0267  0240 0247
PNAME   1103   1125  1062
PNSERC  0761   0740  0664 0715
POCTAL  1600   1647  0066 1707
POINTE  1430   1436  0266 1415
PPOCTA  0052   0066  0470 2230 2237
PPOINT  0322   0266  0161 0170 0200
PPUTC   0046   0062  0261 1514
PRT     2343   2537  0232
PRTSET  0271   0231  0222 0243
PT      1775   2075  1757 1760 1771 2003 2013
PTEXT   0765   0744  0663
PTTY    0042   0056  0157 0213 0231 0465 2137 2214 2216 2220 2222 2231 2240 2254 2316
PUTC    1672   1756  0062 1734 1777 2005 2016 2040 2047 2052 2061
P10     1774   2074  2030
P12M26  2175   2326  2274
P17     0324   0270  0177
P5      0542   0502  0436
P7      0057   0077  1656 1666 1676 1702 2032
P7750   1441   1453  1407 1420
P7751   1442   1454  1411 1422
READ    0056   0075  1414
REG     1731   2025  2021
RESTAR  0222   0153  0166 0173 0206
SAVREF  0721   0664  0653 0657
SCAN    0622   0540  0551 0665 0705 0716 0725
SOUNE   0676   0636  0612
SEND    0670   0615  0604
SKPNUL  1505   1532  1535 1540 1555 1565
SLOOP   0652   0574  0623
SOK     0650   0567  0620
SP      1717   2013  1765
START   0025   0034  0310 1057 1231 1233 1240 1241 1242 2127
SYMBUI  0456   0403  0320 0411 0412 0454
SYMEND  2145   2262  2212
SYSCOU  0020   0027  0312 0437 0440 0463
S7750   1437   1450  1410 1417
S7751   1440   1451  1412 1421
TEMP    0024   0033  0666 0667 0674 0720 0723 1037 1045 1060 1067 1073 1114 1115 2130 2145 2225 2226 2233 2244 2304
TL      1654   1730  1735
```

```
SYMBOL   VALUE  DEF   REFERENCES

TLOOP    0231   0162  0201
TMAJOR   1145   1204  1154
TTY      1647   1723  0056 1705 1725 1727 1733 1743
TXTEND   1144   1203  1147 1152
TXTLIN   1127   1164  1144 1160 1174 1200
TXTLP    1116   1151  1161
TXTMOD   1105   1137  0744
TYPNUL   1535   1567  1551 1574 1577
TYTEMP   1662   1737  1726 1730 1731
USET     0251   0203  0167
VALEND   2146   2263  2213
WRONG    1024   1021  1007
W1       1642   1713  1674 1701 1704 1706
W2       1643   1714  1664 1671 1675 1700
W3       1644   1715  1654 1661 1665 1670
W4       1645   1716  1650 1651 1655 1660
ZERET    1574   1636  1467 1616
```

HOW TO OBTAIN SOFTWARE INFORMATION

Announcements for new and revised software, as well as programming notes, software problems, and documentation corrections are published by Software Information Service in the following newsletters.

Digital Software News for the PDP-8 Family
Digital Software News for the PDP-9/15 Family
PDP-6/PDP-10 Software Bulletin

These newsletters contain information applicable to software available from Digital's Program Library.

Please complete the card below to place your name on the newsletter mailing list.

Questions or problems concerning DEC Software should be reported to the Software Specialist at your nearest DEC regional or district sales office. In cases where no Software Specialist is available, please send a Software Trouble Report form with details of the problem to:

Software Information Service
Digital Equipment Corporation
146 Main Street, Bldg. 3-5
Maynard, Massachusetts 01754

These forms, which are available without charge from the Program Library, should be fully filled out and accompanied by teletype output as well as listings or tapes of the user program to facilitate a complete investigation. An answer will be sent to the individual and appropriate topics of general interest will be printed in the newsletter.

New and revised software and manuals, Software Trouble Report forms, and cumulative Software Manual Updates are available from the Program Library. When ordering, include the document number and a brief description of the program or manual requested. Revisions of programs and documents will be announced in the newsletters and a price list will be included twice yearly. Direct all inquiries and requests to:

Program Library
Digital Equipment Corporation
146 Main Street, Bldg. 3-5
Maynard, Massachusetts 01754

Digital Equipment Computer Users Society (DECUS) maintains a user Library and publishes a catalog of programs as well as the DECUSCOPE magazine for its members and non-members who request it. For further information please write to:

DECUS
Digital Equipment Corporation
146 Main Street
Maynard, Massachusetts 01754

Send Digital's software newsletters to:

Name_____
Company Name_____
Address_____
_____
(zip code)

My computer is a

PDP-8/I ☐		PDP-8/L ☐	
LINC-8 ☐		PDP-12 ☐	
PDP-9 ☐		PDP-15 ☐	Please specify
PDP-10 ☐		OTHER ☐	_____

My system serial number is_____ (if known)

..... Fold Here .....

..... Do Not Tear - Fold Here and Staple .....

FIRST CLASS
PERMIT NO. 33
MAYNARD, MASS.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by:

digital

Digital Equipment Corporation
Software Information Services
146 Main Street, Bldg. 3-5
Maynard, Massachusetts 01754

CREF12

READER'S COMMENTS

DEC-12-FRZA-D

Digital Equipment Corporation maintains a continuous effort to improve the quality and usefulness of its publications. To do this effectively we need user feedback – your critical evaluation of this manual.

Please comment on this manual's completeness, accuracy, organization, usability, and readability.

_____

_____

_____

_____

_____

Did you find errors in this manual? _____

_____

_____

_____

_____

How can this manual be improved? _____

_____

_____

_____

_____

_____

DEC also strives to keep its customers informed of current DEC software and publications. Thus, the following periodically distributed publications are available upon request. Please check the appropriate boxes for a current issue of the publication(s) desired.

☐ Software Manual Update, a quarterly collection of revisions to current software manuals.

☐ User's Bookshelf, a bibliography of current software manuals.

☐ Program Library Price List, a list of currently available software programs and manuals.

Please describe your position. _____

Name _____ Organization _____

Street _____ Department _____

City _____ State _____ Zip or Country _____

— Fold Here —

— Do Not Tear - Fold Here and Staple —

FIRST CLASS
PERMIT NO. 33
MAYNARD, MASS.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by:

digital

Digital Equipment Corporation
Software Information Services
146 Main Street, Bldg. 3-5
Maynard, Massachusetts 01754

Digital Equipment Corporation
Maynard, Massachusetts

digital

printed in U.S.A.