Atomic Energy of Canada Limited

PAL8

A PROGRAM TO ASSEMBLE PROGRAMS FOR THE PDP-8 COMPUTER

by

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Chalk River Nuclear Laboratories

Chalk River, Ontario

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ABSTRACT

PAL8 is a program, written to run on a CDC 6600 computer, to assemble PAL III, PAL D and PAL 8 code for a PDP-8 computer. The program produces assembly listings with the necessary cross-reference tables and a binary object code paper tape. Included in this report is both a general description of the assembler and specific examples of its use at the CRNL Computing Centre.

This report supersedes the information previously reported in Atomic Energy of Canada Limited report AECL-4128, May 1972.

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PAL 8: programme d'assemblage de programmes pour l'ordinateur PDP-8

par

D.G. Goulding

Résumé

PAL 8 est un programme conçu pour fonctionner sur un ordinateur CDC 6600, afin d'assembler les codes PAL III, PAL D et PAL 8 pour un ordinateur PDP-8. Ce programme produit des listes d'assemblage avec tableaux de renvoi et les résultats sont donnés binairement sur une bande de papier. On trouvera, dans ce rapport, une description générale de l'assembleur et des exemples spécifiques de son utilisation au centre de calculs de Chalk River.

Ce rapport est une version révisée du rapport à CL-4128 (mai 1972).

L'Energie Atomique du Canada, Limitée
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PAL8

A PROGRAM TO ASSEMBLE PROGRAMS FOR THE PDP-8 COMPUTER

by

D.B. Goulding

1. INTRODUCTION

Experience with the PDP8A assembler (AECL-4128)[1] established the usefulness of a CDC 6600 program to assemble PDP-8 code. However, to take full advantage of the 6600's resources as well as to handle PAL-8 code, the assembler has been upgraded. So extensive were the necessary modifications that an essentially new assembler has resulted, which was added to the CRNL[2] CDC 6600 system under the name PAL8. The main features that distinguish PAL8 from its predecessor, PDP8A, include the ability:

(a) To handle literals and linkages to off-page references, along with the resulting cross-reference table.
(b) To assemble multi-field programs.
(c) To assemble programs containing conditional code.

All of the above features have been introduced without a noticeable loss in assembler efficiency or speed.

It should be noted that, as with the PDP8A assembler, the advantages of using the large computer assembler are realized for very large programs, for sections of systems which are most conveniently maintained with large computer file-handling utilities, and when it is inconvenient or undesirable to dedicate a PDP-8 to other than its main function for an extended period of time.

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[1]AECL - Atomic Energy of Canada Limited

[2]CRNL - Chalk River Nuclear Laboratories

2. GENERAL SPECIFICATIONS

Title:	PAL8
Author:	D.B. Goulding
Version:	G
Installation Date:	11 June 1973
Computer:	CDC 6600
Compiled Under:	FORTRAN Extended 3.0, OPT=1
Core Loading Requirements:	55000_8
Speed:	Approximately 85 statements per CP second.
Assembly Languages:	PAL III, PAL-D, PAL-8
Acceptable Input Sources:	Cards Magnetic tape written in SUCCESS or PS/8 format (via the support packages described in Appendix I). UPDATE utility file Paper tape (via the support package described in Appendix I).
Available Output:	Assembly listing Binary object paper tape.

3. PROGRAM DESCRIPTION

The assembly run begins with an inspection of the job control card by READCC for any user parameters (a full description of the available parameters is found in Appendix B) so that the operating flags may be set to their 'run' values. The assembler now prepares itself to read and assemble the first program by assigning a program identification letter, clearing the program title array, calling INHASH to clear the symbol table of all values save the operation and pseudo operation codes and setting the reference table pointers to their base positions. PASS1 is now called to read the source file.

Immediately upon entry, PASS1 calls SRPL to set the page limit pointers to their base values. The source file (TAPE5) is now read and GETFLD is called to crack each record. The assembly run terminates when an end-of-file is encountered; no attempt is made by the assembler to determine if this termination is correct. As each element is passed from GETFLD, it is routed to the appropriate handling code by the value of TYPE. In most cases, the element will simply be flagged with its element type and stored for future handling by PASS2. Symbols are placed in the symbol and cross-reference tables as they are encountered. If a FIELD pseudo operation code is encountered, SRPL is again called to store and reset the page limit pointers. When the end-of-line is reached (the assembler considers itself to be at the end of a line when it encounters a semicolon, a conditional pseudo operation code opening bracket or and end-of-record), DECODE is called to calculate the value of any PASS1 statements such as definitions, origin settings, etc. If necessary, the location counter is updated and a check is made to see if it still is in bounds. If the conditional assembly flag is set, the above end-of-line code is not executed. If this is the first statement of the record, the source record is formatted for output and written to the file, TAPE10. If there are any elements to be decoded by PASS2, they are written to the file TAPE20. Before returning for the

next line, the conditional assembly flag is updated. When the end-of-program symbol ($) is encountered, PASS1 is terminated by calling SRPL to store the final page limit pointer values. Control is now passed to PASS2.

PASS2 also begins by calling SRPL to set the page limit pointers to their correct values. Throughout the execution of PASS2, control is determined by the contents of the file, TAPE10. As each output record is read from the file, the second element is inspected for routing information. If the value of this element is greater or equal to zero, no further work is necessary except to write the source line to the output file, TAPE6. If negative, the next record is read from the file, TAPE20, and DECODE is called to assemble the statement before the source line is written to the output file. If necessary, CALCL is called to calculate the linkages to off-page references and make the necessary entries in the cross-reference table. If a FIELD change is encountered, LSAC is called to form and output a linkage and literal cross-reference table and SRPL is called to make the necessary changes to the page limit pointers. As each line is sent to the output file, a check is made to see if the line has been flagged as containing a fatal error; if found, the error count is incremented by one. If requested by the user, a binary object paper tape will be created by the assembler during the execution of PASS2. When an end-of-file is encountered on TAPE10, SAP and LSAC are called to form and write the appropriate cross-reference tables to the output file.

When PASS2 terminates, a check is made of the error count; if errors have been generated, a dayfile message is issued to the job dayfile by the routine SENDM. The assembler now loops back to begin processing the next program.

4. NOTES

Throughout the program description, routines were referred to without explanation. These routines are described in Appendix D.

Although PAL8 has been fully tested using many examples of PAL-8 code, the author makes no claim that the object code produced will be exactly the same as that produced on a PDP-8 using the actual PAL-8 assembler.

APPENDIX A

CHARACTER CODES

ANSCII-1		6600		
Character	Code	Character	Code	Hollerith
A	301	A	01	12-1
B	302	B	02	12-2
C	303	C	03	12-3
D	304	D	04	12-4
E	305	E	05	12-5
F	306	F	06	12-6
G	307	G	07	12-7
H	310	H	10	12-8
I	311	I	11	12-9
J	312	J	12	11-1
K	313	K	13	11-2
L	314	L	14	11-3
M	315	M	15	11-4
N	316	N	16	11-5
O	317	O	17	11-6
P	320	P	20	11-7
Q	321	Q	21	11-8
R	322	R	22	11-9
S	323	S	23	0-2
T	324	T	24	0-3
U	325	U	25	0-4
V	326	V	26	0-5
W	327	W	27	0-6
X	330	X	30	0-7
Y	331	Y	31	0-8
Z	332	Z	32	0-9
0	260	0	33	0
1	261	1	34	1
2	262	2	35	2
3	263	3	36	3

CHARACTER CODES (Continued)

ANSCII-1		6600		
Character	Code	Character	Code	Hollerith
4	264	4	37	4
5	265	5	40	5
6	266	6	41	6
7	267	7	42	7
8	270	8	43	8
9	271	9	44	9
!	241	↓	71	11-8-6
"	242	∧	67	0-8-7
#	243	≠	64	8-4
$	244	$	53	11-8-3
%	245	≤	74	8-5
&	246	≡	60	0-8-6
'	247	∨	66	11-8-2
(	250	(	51	0-8-4
)	251	)	52	12-8-4
*	252	*	47	11-8-4
+	253	+	45	12
,	254	,	56	0-8-3
-	255	-	46	11
.	256	.	57	12-8-3
/	257	/	50	0-1
:	272	:	63	8-2
;	273	;	77	12-8-7
<	274	<	72	12-8-2
=	275	=	54	8-3
>	276	>	73	11-8-7
?	277	¬	76	12-8-6
@	300	Space	55	
[	333	[	61	8-7
\	334	≥	75	12-8-5
]	335	]	62	0-8-2
↑	336	↑	70	11-8-5

CHARACTER CODES (Continued)

ANSCII-1		6600		
Character	Code	Character	Code	Hollerith
←	337	→	65	0-8-5
Leader/ Trailer	200	Ignored on input		
Line Feed	212	Ignored on input		
Carriage Return	215	Assumed to be end of line		
Space	240	Space	55	
Rubout	377	Ignored on input		
Blank	000	Ignored on input		
Bell	207	Ignored on input		
Tab	211	Space	55	
Form	214	Ignored on input		

APPENDIX B

ASSEMBLER CALLING SEQUENCES

The control card sequences given in this appendix illustrate the assembler's use in the CDC 6600 system at CRNL.

The following notes apply to each example presented.

(a) The first card is the job control card which should be punched on a purple striped card, provided for that purpose. The JOBNAME may be one to seven alphanumeric characters. The B*** parameter represents the Computing Centre assigned branch code. The MT parameter gives the total number of tape mounts required.

(b) The XXXXXX on REQUEST cards represents the reel number of the datatape the user wishes mounted.

(c) End of job (6-7-8-9 cards) are punched on brown cards.

(d) Two forms of the assembler control card are acceptable:
PAL8. - calls the assembler and uses the default values for all the input parameters.
PAL8(parameters) - calls the assembler and uses the user's input parameters, which may be any of the following in any order:

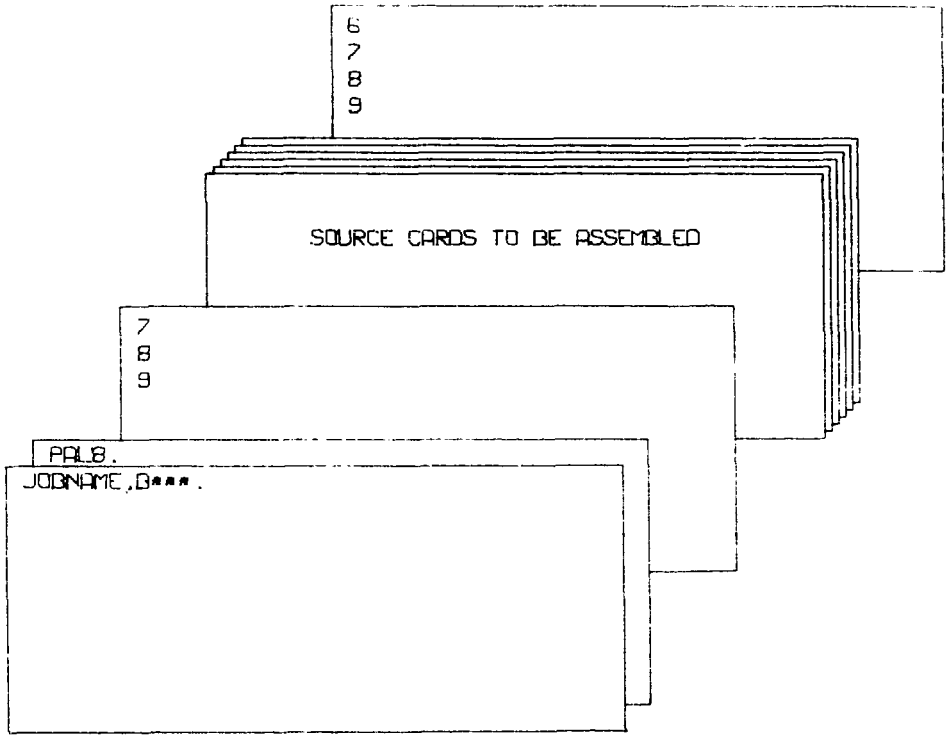
Parameter	Meaning	Default (if missing)
E=XXXX	Electronics Branch identification is XXXX (maximum 20 characters and must not be) or ,).	Electronics Branch identification is blank.
I=XXX	Source data found on a file named XXX (maximum of seven alphanumeric characters).	Source data found on the file named INPUT.
L=YYY	Listing written to file named YYY (maximum of seven alphanumeric characters).	Listing written to file named OUTPUT.
P	Punch binary object code paper tape.	No paper tape produced.
T	Titles started in column 20 of listing.	Titles started in column 40 of listing.
U	List UPDATE identifiers.	Do not list UPDATE parameters.

Should any errors be encountered while cracking this control card, the message

PAL8 - CONTROL CARD ERROR

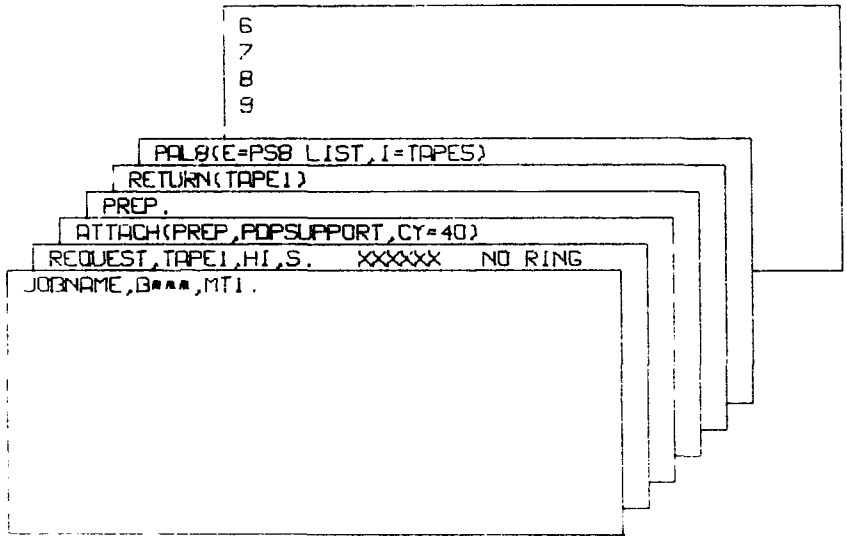
is written into the dayfile and the job is terminated.

EXAMPLE 1



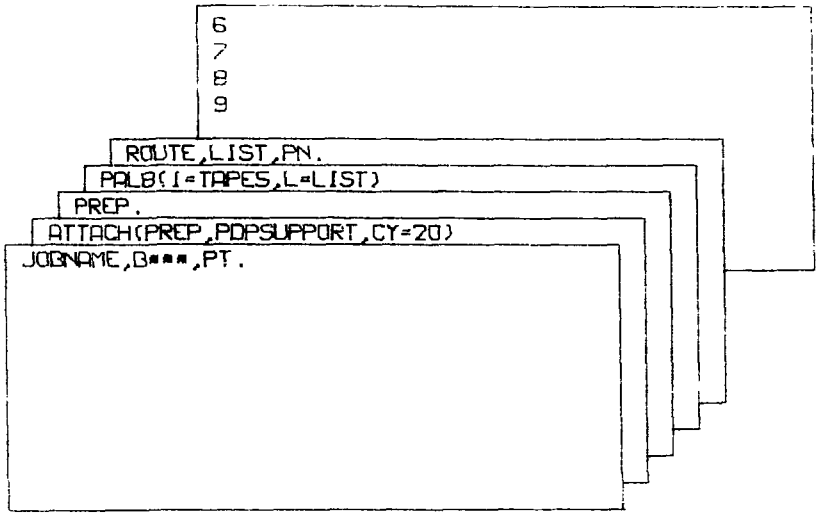
Example 1 illustrates the basic assembler call using cards as the input source.

EXAMPLE 2



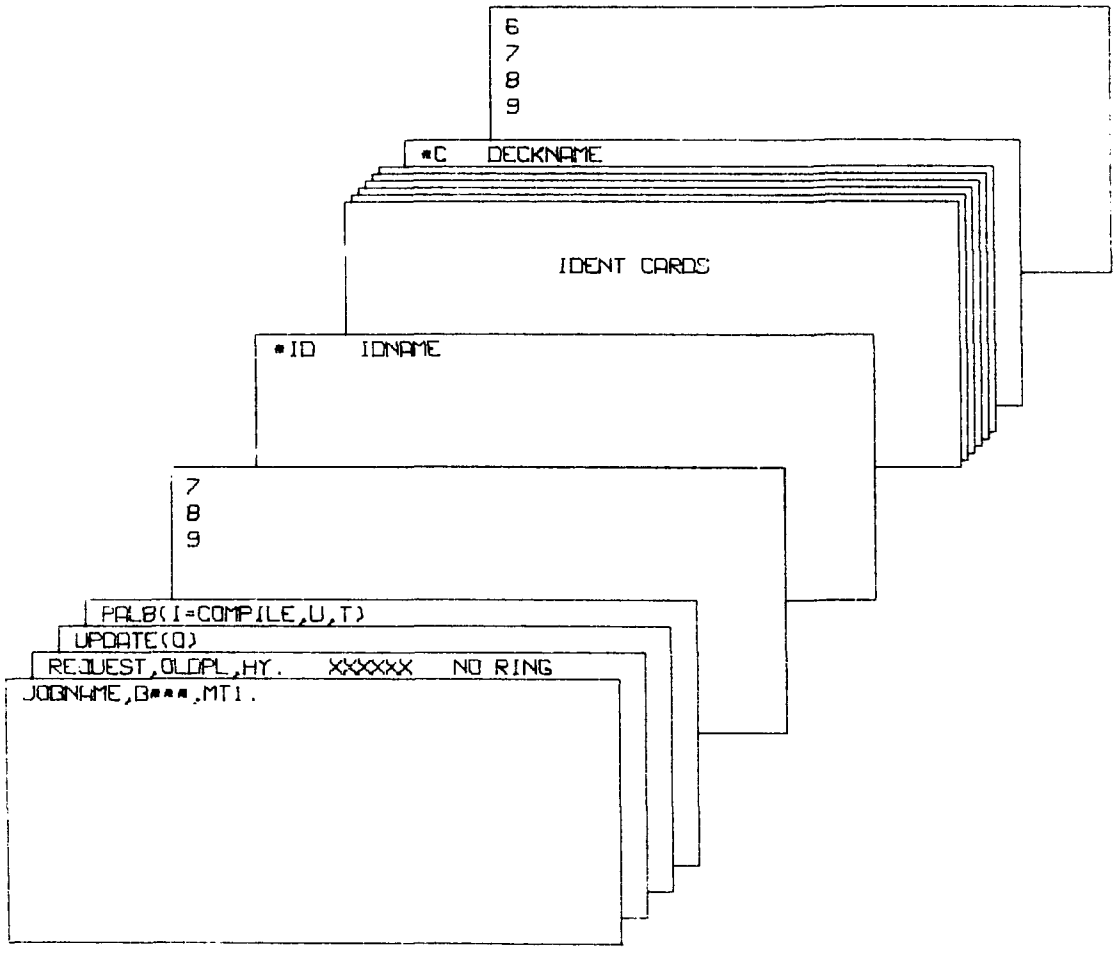
Example 2 illustrates the control cards necessary to assemble PAL code written on a magnetic tape in PS/8 format. A description of the support program used is found in Appendix I.

EXAMPLE 3



Example 3 illustrates a series of control cards necessary to assemble PAL code found on an ASCII paper tape. A description of the support program used is found in Appendix I. The ROUTE card is used here to have the assembly listing printed on narrow paper.

EXAMPLE 4



Example 4 illustrates the assembler's use in conjunction with the UPDATE utility. A complete description of UPDATE is found in the CDC UPDATE Reference Manual (Publication No. 60342500).

APPENDIX C

PAL8 ASSEMBLER PSEUDO OPERATION CODES

The following PAL pseudo operation codes are recognized by the PAL8 assembler:

Code	Action Taken by the Assembler
DECIMAL	All numbers in the source code, following this pseudo operation code, assumed to be decimal.
DEVICE	Sets device name (1 to 4 alphanumeric characters with zero fill).
DTORG	Outputs a two-frame DECTAPE block number to the binary object tape file.
EJECT	Assembly listing is continued on the next output page.
ENPUNCH	Assembler resumes sending binary output to the paper tape punch file (has no effect if user has not requested a binary object code paper tape).
EXPUNGE	Ignored by the assembler and flagged *II*.
FIELD	Outputs the indicated field punch to the binary object tape file. A cross-reference table of all off-page references and literals for the previous field written to output file.
FILENAME	Sets file name (1 to 6 alphanumeric characters, 1 or 2 alphanumeric characters in the extension; both with zero fill).
FIXMRI	Ignored by the assembler and flagged *II*.
FIXTAB	Ignored by the assembler and flagged *II*.
I	Sets the indirect bit in the instruction in which it appears.
IFDEF	Assembles code between conditional brackets if the symbol that follows is defined.
IFNDEF	Assembles code between conditional brackets if the symbol that follows is undefined.
IFNZRO	Assembles code between conditional brackets if the expression that follows is not equal to zero.

Code	Action Taken by the Assembler
IFZERO	Assembles code between conditional brackets if the expression that follows is equal to zero.
NOPUNCH	Assembler ceases sending binary output to the paper tape punch file (has no effect if user has not requested a binary object code paper tape).
OCTAL	All numbers in the source code, following this pseudo-operation code, assumed to be octal. This is the default radix setting.
PAGE	Current location counter set to the beginning of the indicated page number. If no page number is given, the current location counter is set to the beginning of the next page.
PAUSE	Ignored by the assembler and flagged *II*.
TEXT	The delimited character string that follows is assembled in 6-bit ASCII, two characters per word.
XLIST	Ignored by the assembler and flagged *II*.
Z	Sets the page indicator to zero in the instruction in which it appears.
ZBLOCK	Generates a block of zeroed words. The value of the expression that follows gives the number of words to be zeroed.
$	Terminates PASS1 of the assembly.

APPENDIX D

PAL8 SUBROUTINES

CALCL	Calculates an off-page reference linkage. Called by PASS1, PASS2, and DECODE.
DECODE	Evaluates the instruction field, returning the value in LINE(2). Called by PASS1 and PASS2.
GETFLD	Cracks the input record, returning one element per call along with its type index. Called by PASS1.
HASH	Searches for or adds a symbol to the symbol table. Called by PASS1, CALCL and DECODE.
HEAD	Writes the page heading to the output file. Called by PASS2, LINK, LSAC and SAP.
INHASH	Clears the symbol table then adds all the operation and pseudo operation codes. Called by PAL8.
LINK	Performs all the operations on the cross-reference table including adding and searching for references. Called by HASH, LSAC and SAP.
LSAC	Formulates and writes a literal and off-page linkage cross-reference table to the output file. Called by PASS2.
PACKA	Decodes character strings into 6-bit ASCII and packs them two characters to a word. Called by PASS1.
PACKI	Packs binary words into an output array to be written onto the binary object code file. Called by PASS2 and LSAC.
PASS1	Controls the reading and cracking of the source input file. Called by PAL8.
PASS2	Performs the actual assembly of the code read by PASS1. Called by PAL8.
PTPUN	Fills the binary object code paper tape file. Called by PACKI.
SAP	Formulates and writes a symbol cross-reference table to the output file. Called by PASS2.
SET	Contains the constant lists. Called by PAL8.
SENDM	Writes the assembly error message to the job dayfile. Called by PAL8.

SORTIT	Sorts symbol lists. Called by LSAC and SAP.
SRPL	Saves and restores page limit pointers. Called by PASS1 and PASS2.
READCC	Reads and decodes the PAL8 control card and sets the run parameters. Called by PAL8.

APPENDIX E

DIAGNOSTIC CODES

Code		Meaning and Action
BE	F	Error in literal. Rest of record treated as a comment.
DT	F	Label used more than once. The second defininition is ignored.
IC	F	Illegal character(s) found in the source statement. Rest of record treated as a comment.
II	I	Pseudo operation code ignored by the assembler.
IO	F	Evaluation of expression resulted in the origin being set outside the core limits. Statement ignored.
IP	F	The location address counter calculated by the PAGE pseudo operation code was greater than $7600. The location counter is set to the calculated value to be corrected later.
IR	F	Value of an expression greater than $7777. Binary code set to $7000 (a NOP instruction).
PE	F	Space for current page literals and off-page linkages exceeded. Binary code set to $7000 (a NOP instruction).
PH	F	Error in conditional code bracketing. Rest of record treated as a comment.
PO	F	Location address found to be greater than $7777. Location address counter set to $7777.
RD	I	Symbol is was re-defined.
UA	F	Undefined symbol used in defining another or value calculated by expression greater than $7777. The new symbol is not added to the symbol table.
ZE	F	Space for page zero literals and off-page linkages exceeded. Binary code set to $7000 (a NOP instruction).

Diagnostic codes flagged with an I are only informative and are not represented in the error count. Those flagged with an F are fatal and if one or more are encountered during assembly the message

PAL8 - nnn ERRORS IN PROGRAM x

is written to the job dayfile, where nnn is the number of fatal errors and x is the program identification letter.

APPENDIX F

PROGRAM LISTING

```
      OVERLAY(PAL8,0,0)                                                 PAL8    2
      PROGRAM PAL8(INPUT,OUTPUT,TAPE5=INPUT,TAPE6=OUTPUT,               PAL8    3
     *TAPE10=2018,TAPE20=2013,TAPE30=10408)                             PAL8    4
C                                                                       PAL8    5
C     POP-8 ASSEMBLER COMMON                                            PAL8    6
C                                                                       PAL8    7
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    8
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    9
     *             ERRC,CSM,FNP,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8   10
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8   11
      COMMON/PARAMS/ICARD,UP),ITFLAG,NEB(3),DANDT(2)                    MIS008  1
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8   13
     *              IWPE,IWBE,IWPH                                      PAL8   14
      COMMON/USERM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8   15
      COMMON/CONST/IN,OUT,ASR,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8   16
     *             INDPC(106),IO(106),STYPES(11)                        PAL8   17
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(15,32,2),SORTT(1900),     PAL8   18
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8   19
C                                                                       PAL8   20
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8   21
     *        RADIX,UP),REFTAB,REFP,OUT,ASR,BOUT,VERN,ASKII,            PAL8   22
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNP,POI,       PAL8   23
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8   24
C                                                                       PAL8   25
C                                                                       PAL8   26
    1 FORMAT (*1*//////////17X,*PAL-8 ASSEMBLER -- VERSION  *,A10,      PAL8   27
     **  --*)                                                          PAL8   28
C                                                                       PAL8   29
      CALL READCC(ICAR))                                                PAL8   30
      CALL DATE(DANDT(1))                                               MIS008  2
      CALL TIME(DANDT(2))                                               MIS008  3
      WRITE(OUT,1) VERN                                                 PAL8   31
      PROGN = 0                                                         PAL8   32
  275 CALL INHASH                                                       PAL8   33
      PROGN = PROGN + 1                                                 PAL8   34
      IF (PROGN.GT.1RZ) PROGN = 1RA                                     PAL8   35
      DO 300 I = 1,6                                                    PAL8   36
  300 IPROG(I) = 10H                                                    PAL8   37
      REFP = ERRC = LSP = 0                                             PAL8   38
      REFLP = 4096                                                      PAL8   39
      CALL PASS1                                                        PAL8   40
      CALL PASS2                                                        PAL8   41
      REWIND ASR                                                        PAL8   42
      REWIND IT                                                         PAL8   43
      IF (ERRC.GT.0) CALL SFNDM(PROGN,ERRC)                             PAL8   44
      GO TO 275                                                         PAL8   45
      END                                                               PAL8   46
```

```
      SUBROUTINE PASS1                                                  PAL8      47
C                                                                       PAL8      48
C     PDP-8 ASSEMBLER COMMON                                            PAL8      49
C                                                                       PAL8      50
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8      51
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8      52
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8      53
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8      54
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8      55
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRO,IWOA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8      56
     *              IWPE,IWBE,IWPH                                      PAL8      57
      COMMON/USEDN/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8      58
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8      59
     *             INOPC(106),IO(106),STYPES(11)                        PAL8      60
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8      61
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8      62
C                                                                       PAL8      63
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8      64
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8      65
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8      66
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8      67
C                                                                       PAL8      68
C                                                                       PAL8      69
      INTEGER CST,DFLAG,STC,CCT,PASS1F                                  PAL8      70
      INTEGER CONAC,CONAO,CONACH                                        PAL8      71
C                                                                       PAL8      72
 1    FORMAT (86R1)                                                     PAL8      73
 10   FORMAT (5X,*PARITY ERROR ON DISK - JOB ABORTED*)                  PAL8      74
C                                                                       PAL8      75
      PASS = 1                                                          PAL8      76
      FNB = 0                                                           PAL8      77
      CALL SRPL(0)                                                      PAL8      78
      ECODE = RADIX = NEB(3) = IFORD = CCT = 0                          PAL8      79
      CONAC = CONAO = CONA = CONACH = 0                                 PAL8      80
C                                                                       PAL8      81
 50   READ(IN,1) (IMAGE(J),J=1,UPD)                                    PAL8      82
      IF (EOF(IN)) 9000,60                                              PAL8      83
 60   LP = CST = 0                                                      PAL8      84
      CCT = CCT + 1                                                     PAL8      85
 70   DO 65 I=1,15                                                      PAL8      86
 65   LINE(I) = 0                                                       PAL8      87
      FLOC = SFLAG = STC = DFLAG = LABF = ITC = PASS1F = LASTB = 0       PAL8      88
      LINK = 1                                                          PAL8      89
      OPT(1) = LOC                                                      PAL8      90
      CONA = CONA + CONACH                                              PAL8      91
      CONACH = 0                                                        PAL8      92
 80   CALL GETFLD                                                       PAL8      93
      GO TO (100,200,300,400,500,800,600,800,900,700),ITYPE             PAL8      94
C                                                                       PAL8      95
C     SET NEW ORIGIN                                                    PAL8      96
C                                                                       PAL8      97
 100  PASS1F = 1                                                        PAL8      98
      SFLAG = -7778                                                     PAL8      99
      GO TO 80                                                          PAL8     100
C                                                                       PAL8     101
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      C     LABEL                                                          PAL8   102
      C                                                                    PAL8   103
       200  LABF = 1                                                       PAL8   104
            CALL HASH(2,SYMB)                                            PAL8   105
 60         IF (HASHF.EQ.2) LINE(1) = IHOT                                 PAL8   106
            GO TO 80                                                     PAL8   107
      C                                                                    PAL8   108
      C     COMMENT                                                        PAL8   109
      C                                                                    PAL8   110
 65    300  L = LP + 1                                                     PAL8   111
            IF (CONAC.EQ.0) GO TO 308                                    PAL8   112
            DO 315 LP = L,72                                             PAL8   113
            IF (IMAGE(LP).EQ.1R ) GO TO 680                              PAL8   114
       305  CONTINUE                                                       PAL8   115
 70    308  LL = L + 2                                                     PAL8   116
            IF ((CCT.GT.1).OR.(FLOC.GT.1)) GO TO 1000                    PAL8   117
            DO 310 K = L,LL                                              PAL8   118
            IF ((IMAGE(K).LT.338).OR.(IMAGE(K).GT.448)) GO TO 315        PAL8   119
       310  NEB(3) = SHIFT(NEB(3),6).OR.IMAGE(K)                           PAL8   120
 75         GO TO 320                                                    PAL8   121
       315  L = LL - K + 1                                                 PAL8   122
            DO 318 K = 1,L                                               PAL8   123
       318  NEB(3) = SHIFT(NEB(3),6).OR.55B                                PAL8   124
       320  DO 330 K = 1,6                                                 PAL8   125
 80         IPROG(K) = 0                                                 PAL8   126
            DO 330 L = 1,10                                              PAL8   127
            LP = LP + 1                                                  PAL8   128
            IDUM = 1R                                                    PAL8   129
            IF (LP.LE.72) IDUM = IMAGE(LP)                               PAL8   130
 85    330  IPROG(K) = SHIFT(IPROG(K),6).OR.IDUM                          PAL8   131
            GO TO 1000                                                   PAL8   132
      C                                                                    PAL8   133
      C     NUMBER                                                         PAL8   134
      C                                                                    PAL8   135
 90    400  IFLA = 010000000000008                                         PAL8   136
            SYMB = SYMB.AND.7777B                                        PAL8   137
       401  SFLAG = SFLAG + 1                                              PAL8   138
            OFLAG = 0                                                    PAL8   139
            STC = STC + 1                                                PAL8   140
 95         OPT(STC+1) = SYMB.OR.IFLA                                      PAL8   141
            IF (EOS.EQ.0) 80,1000                                        PAL8   142
      C                                                                    PAL8   143
      C     SYMBOL                                                         PAL8   144
      C                                                                    PAL8   145
100    500  CALL HASH(3,SYMB)                                             PAL8   146
            GO TO (510,520,595),HASHF                                    PAL8   147
      C     SYMBOL ADDED OR ALREADY THERE                                  PAL8   148
       510  IFLA = 200000000000B                                           PAL8   149
            GO TO 401                                                    PAL8   150
105   C     PSEUDO OPERATION CODES                                         PAL8   151
      C        ************************************************************PAL8   152
      C        * VAL = 1 - OCTAL          VAL = 2 - DECIMAL          *    PAL8   153
      C        * VAL = 3 - FIELD          VAL = 4 - Z                *    PAL8   154
      C        * VAL = 5 - I              VAL = 6 - EJECT            *    PAL8   155
110   C        * VAL = 7 - PAGE           VAL = 8 - TEXT             *    PAL8   156
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C        * VAL = 9 - PAUSE, $, EXPUNGE, FIXTAB, FIXMRI, OR XLIST *
C        * VAL = 10 - ZBLOCK          VAL = 11 - IFDEF           *
C        * VAL = 12 - IFNDEF          VAL = 13 - IFZERO          *
C        * VAL = 14 - IFNZRO          VAL = 15 - DTORG           *
C        * VAL = 16 - DEVICE          VAL = 17 - FILENAME        *
C        * VAL = 18 - NOPUNCH         VAL = 19 - ENPUNCH         *
C        ***************************************************
 520  GO TO (521,521,523,524,524,535,575,550,535,6000,6050,6100,6150,
     *6200,6250,6300,6350,535,535),VAL
C     RADIX
 521  CONTINUE
      IF (FLOC.GT.1) GO TO 6400
      RADIX = VAL - 1
      GO TO 540
C     FIELD
 523  CONTINUE
      IF ((FLOC.GT.1).OR.(EOS.GT.0)) GO TO 6400
      IF (IFORD.EQ.15) GO TO 6400
      IFORD = 3
      CALL GETFLD
      SYMB = SYMB.AND.77778
      IF ((TYPE.NE.4).OR.(SYMB.GT.7)) GO TO 800
      FNB = SYMB
      OPT(2) = 600000000003B
      OPT(3) = SHIFT(SYMB,3).OR.3008
      STC = 2
      CALL GETFLD
      IF (EOS.EQ.0) GO TO 800
      CALL SRPL(1)
      IF (TYPE.EQ.3) 300,1000
C     I OR Z
 524  SYMB = (VAL - 4)*400B
      IFLA = 500000000000B
      GO TO 401
C     OTHERS
 535  CONTINUE
      IF (FLOC.GT.1) GO TO 6400
 540  STC = STC + 1
      OPT(2) = VAL.OR.600000000000B
 545  CALL GETFLD
      IF (TYPE.EQ.3) GO TO 300
      IF (EOS.GT.0) 1000,800
C     TEXT
 550  LP = LP + 1
      IF ((EOS.GT.0).OR.(STC.GT.0)) GO TO 6400
 551  LP = LP + 1
      IF (LP.GT.72) GO TO 6400
      ITSW = IMAGE(LP)
      IF (ITSW.EQ.1R ) GO TO 551
      OPT(2) = 060000000010B
      OPT(3) = 1
      OPT(4) = ITC = 0
      SFLAG = SFLAG + 1
      STC = 3
 552  LP = LP + 1
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PAL8  157
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                IF (LP.GT.72) GO TO 6400                                    PAL8  212
                IF (IMAGE(LP).EQ.ITSW) GO TO 560                            PAL8  213
                IF (IMAGE(LP).EQ.1R;) GO TO 800                             PAL8  214
                ITC = ITC + 1                                               PAL8  215
170             IF (ITC.EQ.1) GO TO 554                                     PAL8  216
                OPT(STC+1) = SHIFT(OPT(STC+1),6)                            PAL8  217
                ITC = 0                                                     PAL8  218
 554            OPT(STC+1) = OPT(STC+1).OR.(ASKII(IMAGE(LP)).AND.77B)       PAL8  219
                IF (ITC.GT.0) GO TO 552                                     PAL8  220
175             STC = STC + 1                                               PAL8  221
                OPT(3) = OPT(3) + 1                                         PAL8  222
                OPT(STC+1) = 0                                              PAL8  223
                GO TO 552                                                   PAL8  224
 560            ITC = ITC + 1                                               PAL8  225
180             IF (ITC.EQ.2) OPT(STC+1) = SHIFT(OPT(STC+1),6)              PAL8  226
                GO TO 545                                                   PAL8  227
C       PAGE                                                                PAL8  228
 575            PASSLF = 2                                                  PAL8  229
                IF (FLOC.NE.1) GO TO 6400                                   PAL8  230
185             IF (EOS.GT.0) 1000,80                                       PAL8  231
C       XBLOCK                                                              PAL8  232
 6000           PASSLF = 3                                                  PAL8  233
                IF (STC.GT.0) GO TO 6400                                    PAL8  234
                IF (EOS.GT.0) 1000,80                                       PAL8  235
190 C       IFDEF                                                           PAL8  236
 6050           OPT(1) = 0                                                  PAL8  237
                GO TO 6110                                                  PAL8  238
C       IFNDEF                                                              PAL8  239
 6100           OPT(1) = 77777B                                             PAL8  240
195  6110       CALL GETFLD                                                 PAL8  241
                IF ((TYPE.NE.5).OR.(NSP.NE.1)) GO TO 6400                   PAL8  242
                CALL HASH(1,SYMB)                                           PAL8  243
                IF ((HASHF.LT.6).OR.(HASHF.GT.9)) GO TO 6400                PAL8  244
                PASSLF = 5                                                  PAL8  245
200             OPT(2) = 0                                                  PAL8  246
                IF (HASHF.GT.7) OPT(2) = 77777B                             PAL8  247
                STC = 1                                                     PAL8  248
                IF (EOS.GT.0) 6400,80                                       PAL8  249
C       IFZERO                                                              PAL8  250
205  6150       OPT(1) = 0                                                  PAL8  251
                GO TO 6210                                                  PAL8  252
C       IFNZRO                                                              PAL8  253
 6200           OPT(1) = 77777B                                             PAL8  254
 6210           OPT(2) = LOC                                                PAL8  255
210             STC = 1                                                     PAL8  256
                PASSLF = 6                                                  PAL8  257
                SFLAG = -7777B                                              PAL8  258
                IF (EOS.GT.0) 6400,80                                       PAL8  259
C       OTORG                                                               PAL8  260
215  6250       PASSLF = 4                                                  PAL8  261
                IF (STC.GT.0) GO TO 6400                                    PAL8  262
                IF (IFORG.EQ.3) GO TO 6400                                  PAL8  263
                IFORG = 15                                                  PAL8  264
                SFLAG = -7777                                               PAL8  265
220             IF (EOS.GT.0) 6400,80                                       PAL8  266
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      C     DEVICE                                                          PAL8    267
       6300 CONTINUE                                                        PAL8    268
            IF (STC.GT.3) GO TO 6400                                        PAL8    269
            CALL GETFLD                                                     PAL8    270
225         IF ((TYPE.LT.4).OR.(TYPE.GT.6)) GO TO 6400                      PAL8    271
            OPT(2) = 0600000000000208                                       PAL8    272
            OPT(3) = ITC = 2                                                PAL8    273
            SFLAG = SFLAG + 1                                               PAL8    274
            STC = 4                                                         PAL8    275
230         CALL PACKA(4,4)                                                 PAL8    276
            GO TO 545                                                       PAL8    277
      C     FILENAME                                                        PAL8    278
       6350 CONTINUE                                                        PAL8    279
            IF (STC.GT.0) GO TO 6400                                        PAL8    280
235         CALL GETFLD                                                     PAL8    281
            IF ((TYPE.LT.4).OR.(TYPE.GT.6)) GO TO 6401                      PAL8    282
            OPT(2) = 0600000000000218                                       PAL8    283
            OPT(3) = ITC = 4                                                PAL8    284
            SFLAG = SFLAG + 1                                               PAL8    285
240         STC = 5                                                         PAL8    286
            CALL PACKA(4,6)                                                 PAL8    287
            CALL GETFLD                                                     PAL8    288
            IF ((TYPE.EQ.3).OR.(TYPE.EQ.10)) GO TO 6375                     PAL8    289
            IF (NSP.GT.0) GO TO 6400                                        PAL8    290
245         IF ((TYPE.NE.7).OR.(IMAGE(LP).NE.1R.)) GO TO 800                PAL8    291
            CALL GETFLD                                                     PAL8    292
            IF (NSP.GT.1) GO TO 6400                                        PAL8    293
            IF ((TYPE.LT.4).OR.(TYPE.GT.6)) GO TO 6400                      PAL8    294
       6375 CALL PACKA(7,2)                                                 PAL8    295
250         IF (TYPE.EQ.3) 300,545                                          PAL8    296
       6400 LINE(1) = IWIP                                                  PAL8    297
            GO TO 805                                                       PAL8    298
      C     OPERATION CODES                                                 PAL8    299
        595 IFLA = 7000000000000B                                           PAL8    300
255         GO TO 401                                                       PAL8    301
      C                                                                     PAL8    302
      C     SPECIAL CHARACTER                                               PAL8    303
      C                                                                     PAL8    304
        600 SYMB = IMAGE(LP)                                                PAL8    305
260         IF (SYMB.EQ.1R.) GO TO 620                                      PAL8    306
            IF (SYMB.EQ.1R() GO TO 630                                      PAL8    307
            IF (SYMB.EQ.1R)) GO TO 660                                      PAL8    308
            IF (SYMB.EQ.1R[) GO TO 650                                      PAL8    309
            IF (SYMB.EQ.1R]) GO TO 660                                      PAL8    310
265         IF (SYMB.EQ.1R<) GO TO 670                                      PAL8    311
            IF (SYMB.EQ.1R>) GO TO 680                                      PAL8    312
            IF (SYMB.EQ.1R^) GO TO 690                                      PAL8    313
        610 IFLA = 3000000000000B                                           PAL8    314
            GO TO 401                                                       PAL8    315
270     620 IFLA = 4000000000000B                                           PAL8    316
            SYMB = LOC                                                      PAL8    317
            GO TO 401                                                       PAL8    318
      C     OPEN CURRENT PAGE LITERAL                                       PAL8    319
        630 LAST3 = 1R)                                                     PAL8    320
275         SYM3 = LOC                                                      PAL8    321
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                      GO TO 655                                                 PAL8    322
                C     OPEN PAGE ZERO LITERAL                                    PAL8    323
                 650  LASTB = 1RI                                               PAL8    324
                      SYMB = 1008                                               PAL8    325
280              655  LINKL = SHIFT(LINKL,6)                                    PAL8    326
                      IF ((LINKL.AND.77B).NE.0) GO TO 663                       PAL8    327
                      LINKL = LINKL.OR.((STC+2).AND.77B)                        PAL8    328
                      GO TO 668                                                 PAL8    329
                C     CLOSE LITERAL                                             PAL8    330
285              660  CONTINUE                                                  PAL8    331
                      IF (SYMB.EQ.LASTB) GO TO 665                              PAL8    332
                 663  LINE(1) = 14BE                                            PAL8    333
                      GO TO 805                                                 PAL8    334
                 665  SYMB = LASTB = 0                                          PAL8    335
290              668  IFLA = 1100C00000000B                                     PAL8    336
                      GO TO 401                                                 PAL8    337
                 670  CONAC = CONAC + 1                                         PAL8    338
                      IF (CONA.GT.J) GO TO 70                                   PAL8    339
                      IF (PASS1F.EQ.5) GO TO 672                                PAL8    340
295                   IF (PASS1F.NE.6) GO TO 705                                PAL8    341
                      K = 2                                                     PAL8    342
                      STC = STC + 1                                             PAL8    343
                      CALL DECODE(K,STC),RETURNS(705,705,705)                   PAL8    344
                      IF (LINE(2).GT.0) LINE(2) = 77777B                        PAL8    345
300                   OPT(2) = LINE(2)                                          PAL8    346
                 672  CONTINUE                                                  PAL8    347
                      IF (OPT(1).EQ.OPT(2)) GO TO 70                            PAL8    348
                      CONAC = CONAC                                             PAL8    349
                      CONACH = 1                                                PAL8    350
305                   GO TO 70                                                  PAL8    351
                 680  CONTINUE                                                  PAL8    352
                      IF (CONAC.EQ.0) GO TO 705                                 PAL8    353
                      IF (CONAC.NE.CONAC) GO TO 682                             PAL8    354
                      CONACH = -1                                               PAL8    355
310                   CONAC = 0                                                 PAL8    356
                 682  CONAC = CONAC - 1                                         PAL8    357
                      EOS = 1                                                   PAL8    358
                      GO TO 1000                                                PAL8    359
                C     ANSCII CODE GENERATION                                    PAL8    360
315              690  LP = LP + 1                                               PAL8    361
                      IF (LP.GT.72) GO TO 800                                   PAL8    362
                      SYMB = ASKII(IMAGE(LP))                                   PAL8    363
                 692  LP = LP + 1                                               PAL8    364
                      IF (LP.LE.72) GO TO (800,800,800,800,800,698,698,696,800,800,692),  PAL8    365
320                  *IC(IMAGE(LP))                                             PAL8    366
                      EOS = 2                                                   PAL8    367
                      GO TO 400                                                 PAL8    368
                 696  EOS = 1                                                   PAL8    369
                      GO TO 400                                                 PAL8    370
325              698  LP = LP - 1                                               PAL8    371
                      GO TO 400                                                 PAL8    372
                C                                                               PAL8    373
                C     END OF ASSEMBLY CODE                                      PAL8    374
                C                                                               PAL8    375
330              700  CONTINUE                                                  PAL8    376
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                IF (ECODE.EQ.0) GO TO 1000                                      PAL8    377
                IF (CONAC.EQ.0) GO TO 1000                                      PAL8    378
             705  LINE(1) = IWPH                                                PAL8    379
                GO TO 805                                                       PAL8    380
335         C                                                                   PAL8    381
            C       ILLEGAL CHARACTER                                           PAL8    382
            C                                                                   PAL8    383
             800  LINE(1) = IWIC                                                PAL8    384
            C       TURN OFF ALL FLAGS AND TREAT THIS CARD LIKE A COMMENT       PAL8    385
340          805  OFLAG = SFLAG = STC = PASS1F = LINKL = 0                      PAL8    386
                EOS = 2                                                         PAL8    387
                GO TO 1020                                                      PAL8    388
            C                                                                   PAL8    389
            C       DEFINITION                                                  PAL8    390
345         C                                                                   PAL8    391
             900  OFLAG = OFLAG + 1                                             PAL8    392
                IF ((OFLAG.GT.2).OR.(OFLAG.NE.FLOC)) GO TO 800                  PAL8    393
                STC = STC + 1                                                   PAL8    394
                OPT(STC+1) = SYMB.OR.1000000000000B                             PAL8    395
350          920  SFLAG = -7778                                                 PAL8    396
                GO TO 80                                                        PAL8    397
            C                                                                   PAL8    398
            C                                                                   PAL8    399
            C       WRITE LINE AND/OR TABLE ON DISK                             PAL8    400
355         C                                                                   PAL8    401
             1000 CONTINUE                                                      PAL8    402
                IF (OFLAG.GT.0) GO TO 800                                       PAL8    403
                IF (CONA.GT.0) STC = SFLAG = PASS1F = 0                         PAL8    404
                IF (PASS1F.GT.0) GO TO 4000                                     PAL8    405
360             IF (SFLAG) 3000,1020,1025                                       PAL8    406
             1025 CONTINUE                                                      PAL8    407
                IF (LOC.LE.7777B) GO TO 1015                                    PAL8    408
                LOC = 77777B                                                    PAL8    409
                LINE(1) = IWPO                                                  PAL8    410
365          1015 LINE(1) = LINE(1).OR.LOC                                      PAL8    411
                CPAGEN = SHIFT((LOC.AND.7600B),-7)                              PAL8    412
                IF (ITC.GT.0) LOC = LOC + OPT(3) - 1                            PAL8    413
                K = 31                                                          PAL8    414
                IF (LOC.LE.7777B) K = SHIFT((LOC.AND.7600B),-7)                 PAL8    415
370          1027 CONTINUE                                                      PAL8    416
                IF (CPAGEN.EQ.K) GO TO 1029                                     PAL8    417
                IF (CPAGEN.EQ.0) ZPAGE(1) = 1778                                PAL8    418
                IF (CPAGEN.GT.0) PAGER(CPAGEN,1) = 2000B*CPAGEN + 1778          PAL8    419
                CPAGEN = CPAGEN + 1                                             PAL8    420
375             GO TO 1027                                                      PAL8    421
             1029 CONTINUE                                                      PAL8    422
                IF (CPAGEN.GT.0) GO TO 1022                                     PAL8    423
                IF (LOC.GT.ZPAGE(1)) ZPAGE(1) = LOC                             PAL8    424
                GO TO 1028                                                      PAL8    425
380          1022 CONTINUE                                                      PAL8    426
                IF (LOC.GT.PAGER(CPAGEN,1)) PAGER(CPAGEN,1) = LOC               PAL8    427
             1028 LOC = LOC + 1                                                 PAL8    428
            C                                                                   PAL8    429
             1020 CST = CST + 1                                                 PAL8    430
385             IF (STC.GT.0) LINE(2) = -LINKL                                  PAL8    431
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                IF (CST.EQ.1) GO TO 1035                                  PAL8   432
                IF (STC.EQ.0) GO TO 1210                                  PAL8   433
                LIM = 2                                                   PAL8   434
                GO TO 1195                                                PAL8   435
390         1035 DO 1030 I = 1,72                                         PAL8   436
                IF (IMAGE(I).NE.1R ) GO TO 1040                           PAL8   437
            1030 CONTINUE                                                 PAL8   438
            1040 K = I                                                    PAL8   439
                LIM = 3                                                   PAL8   440
395             IF (LABF.EQ.0) GO TO 1070                                 PAL8   441
            1045 CONTINUE                                                 PAL8   442
                IF (IMAGE(I).EQ.1R,) GO TO 1060                           PAL8   443
                K = K + 1                                                 PAL8   444
                IF (K.LE.10) GO TO 1050                                   PAL8   445
400             LIM = LIM + 1                                             PAL8   446
                K = 1                                                     PAL8   447
            1050 LINE(LIM) = SHIFT(LINE(LIM),6).OR.IMAGE(I)               PAL8   448
                I = I + 1                                                 PAL8   449
                IF (I.GT.72) 1100,1045                                    PAL8   450
405         1060 K = K + 1                                                PAL8   451
                LINE(LIM) = SHIFT(LINE(LIM),6).OR.1R,                     PAL8   452
                M = (10-K)*6                                              PAL8   453
                LINE(LIM) = SHIFT(LINE(LIM),M)                            PAL8   454
                I = I + 1                                                 PAL8   455
410             DO 1065 K = I,72                                          PAL8   456
                IF (IMAGE(K).NE.1R ) GO TO 1068                           PAL8   457
            1065 CONTINUE                                                 PAL8   458
                GO TO 1150                                                PAL8   459
            1068 I = K                                                    PAL8   460
415         1070 LIM = LIM + 1                                            PAL8   461
                K = 1                                                     PAL8   462
                I = I - 1                                                 PAL8   463
            1075 I = I + 1                                                PAL8   464
                IF (I.GT.72) GO TO 1100                                   PAL8   465
420             IF (IMAGE(I).EQ.1R/) GO TO 1500                           PAL8   466
                K = K + 1                                                 PAL8   467
                IF (K.LE.10) GO TO 1080                                   PAL8   468
                LIM = LIM + 1                                             PAL8   469
                K = 1                                                     PAL8   470
425         1080 LINE(LIM) = SHIFT(LINE(LIM),6).OR.IMAGE(I)               PAL8   471
                GO TO 1075                                                PAL8   472
            1500 CONTINUE                                                 PAL8   473
                IF (K.EQ.0) GO TO 1550                                    PAL8   474
                IF (K.EQ.10) GO TO 1549                                   PAL8   475
430             M = (10-K)*6                                              PAL8   476
                LINE(LIM) = SHIFT(LINE(LIM),M)                            PAL8   477
            1549 LIM = LIM + 1                                            PAL8   478
            1550 CONTINUE                                                 PAL8   479
                IF (LIM.EQ.5) LIM = 6                                     PAL8   480
435             IF ((ITFLAG.NE.1RT).AND.(LIM.LT.6)) LIM = 6               PAL8   481
                K = 1                                                     PAL8   482
                LINE(LIM) = IMAGE(I)                                      PAL8   483
                IF (LIM.NE.8) GO TO 1560                                  PAL8   484
                LINE(LIM) = 0                                             PAL8   485
440             GO TO 1600                                                PAL8   486
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      1560 I = I + 1                                                    PAL8    487
           IF (I.GT.72) GO TO 1100                                      PAL8    488
      1565 K = K + 1                                                    PAL8    489
           IF (K.LE.10) GO TO 1570                                      PAL8    490
445        LIM = LIM + 1                                               PAL8    491
           K = 1                                                        PAL8    492
           IF (LIM.EQ.8) GO TO 1600                                     PAL8    493
      1570 LINE(LIM) = SHIFT(LINE(LIM),6).OR.IMAGE(I)                   PAL8    494
           GO TO 1560                                                   PAL8    495
450   1600 CONTINUE                                                     PAL8    496
           IF ((I+9).GE.72) GO TO 1560                                  PAL8    497
           KK = I + 9                                                   PAL8    498
           DO 1610 KKK = I,KK                                           PAL8    499
           LL = KK - KKK + I                                            PAL8    500
455        IF (IMAGE(LL).EQ.1R ) GO TO 1620                             PAL8    501
      1610 CONTINUE                                                     PAL8    502
           K = J                                                        PAL8    503
           GO TO 1565                                                   PAL8    504
      1620 DO 1630 KK = I,LL                                            PAL8    505
460   1630 LINE(LIM) = SHIFT(LINE(LIM),6).OR.IMAGE(KK)                  PAL8    506
           M = (10-(LL-I+1))*6                                          PAL8    507
           LINE(LIM) = SHIFT(LINE(LIM),M)                               PAL8    508
           I = LL                                                       PAL8    509
           LIM = LIM + 1                                                PAL8    510
465        K = J                                                        PAL8    511
           GO TO 1560                                                   PAL8    512
         C                                                              PAL8    513
      1100 CONTINUE                                                     PAL8    514
           IF ((K.EQ.0).OR.(K.EQ.10)) GO TO 1120                        PAL8    515
470        M = 10 - K                                                   PAL8    516
           DO 1110 I=1,M                                                PAL8    517
      1110 LINE(LIM) = SHIFT(LINE(LIM),6).OR.1R                         PAL8    518
      1120 K = LIM                                                      PAL8    519
           DO 1125 I=1,K                                                PAL8    520
475        KK = K-I+1                                                   PAL8    521
           IF (LINE(KK).NE.10H          ) GO TO 1150                    PAL8    522
      1125 LIM = LIM - 1                                                PAL8    523
      1150 ITA = ITB = 0                                                PAL8    524
           IF (UPD.EQ.72) GO TO 1168                                    PAL8    525
480        DO 1160 I = 73,82                                            PAL8    526
      1160 ITA = SHIFT(ITA,6).OR.IMAGE(I)                               PAL8    527
           DO 1165 I = 83,86                                            PAL8    528
      1165 ITB = SHIFT(ITB,6).OR.IMAGE(I)                               PAL8    529
           ITB = SHIFT(ITB,36)                                          PAL8    530
485   1168 CONTINUE                                                     PAL8    531
           IF (LIM.GT.8) GO TO 1170                                     PAL8    532
           LIM = 10                                                     PAL8    533
           GO TO 1190                                                   PAL8    534
      1170 I = LIM                                                      PAL8    535
490   1175 K = I + 2                                                    PAL8    536
           LINE(K) = LINE(I)                                            PAL8    537
           I = I - 1                                                    PAL8    538
           IF (I.GT.8) GO TO 1175                                       PAL8    539
           LIM = LIM + 2                                                PAL8    540
495   1190 LINE(9) = ITA                                                PAL8    541
```

```
      LINE(10) = ITB
 1195 WRITE(ASB) LIM
      WRITE(ASB) (LINE(LL),LL=1,LIM)
C
 1200 CONTINUE
      IF (STC.EQ.0) GO TO 1210
      STC = STC + 1
      WRITE(IT) STC
      WRITE(IT) (OPT(LL),LL=1,STC)
 1210 CONTINUE
      IF (ECODE.GT.0) GO TO 9500
      GO TO (70,50),EOS
C
 9999 WRITE(OUT,10)
C     SOMETHING REALLY WRONG - QUIT HERE
 9000 CALL EXIT
C
 9500 CALL SRPL(1)
      REWIND ASB
      RETURN
C
 3000 CONTINUE
      IF (STC.EQ.0) GO TO 1020
      K = 2
      IDEFA = OPT(2).AND.MASKV
      IDEFB = 0
      IF ((OPT(3).AND.77000000000000B).NE.10000000000000B) GO TO 3100
      IDEFB = OPT(3).AND.MASKV
      K = 3
 3100 STC = STC + 1
      OPT(K) = OPT(1)
      DO 3120 I = 1,10
      M = LINKL.AND.77B
      IF (M.LT.K) M = K
      IF ((M+1).GT.STC) GO TO 3155
 3110 CALL DECODE(M,STC),RETURNS(3155,3155,3155)
      IF (M.EQ.K) GO TO 3130
      CALL CALCL(OPT(M),LINE(2),5)
      IF (VAL.EQ.0) GO TO 3155
      OPT(M) = 01000000000000B.OR.VAL
 3120 LINKL = SHIFT(LINKL,-6)
      GO TO 3155
 3130 VAL = LINE(2)
      LINE(2) = STC = 0
      CALL HASH(4,IDEFA)
      GO TO (3160,3170),HASHF
 3170 LINE(1) = IWRD
 3160 IF (IDEFB.EQ.0) GO TO 1020
      CALL HASH(4,IDEFB)
      GO TO (1020,3190),HASHF
 3190 LINE(1) = IWRD
      GO TO 1020
 3155 LINE(1) = IWUA
      LINE(2) = STC = 0
      GO TO 1020
```

```
      C                                                                 PAL8  597
       4000 CONTINUE                                                    PAL8  598
            IF (STC.GT.0) GO TO 4050                                    PAL8  599
            GO TO (4010,4015,4020,4025,4025,4025),PASS1F                PAL8  600
555         4010 LINE(1) = IWIO                                         PAL8  601
            GO TO 4999                                                  PAL8  602
            4015 LOC = (LOC.AND.7600B) + 200B                           PAL8  603
            IF (LOC.GT.7600B) 4025,4225                                 PAL8  604
            4020 LINE(1) = IWII                                         PAL8  605
560         GO TO 4999                                                  PAL8  606
            4025 LINE(1) = IWIP                                         PAL8  607
            4999 LINE(2) = 0                                            PAL8  608
            GO TO 1020                                                  PAL8  609
            4050 STC = STC + 1                                          PAL8  610
565         DO 4070 I = 1,10                                            PAL8  611
            M = LINKL.AND.77B                                           PAL8  612
            IF ((M+1).GT.STC) GO TO 4025                                PAL8  613
            4060 CALL DECODE(M,STC),RETURNS(4025,4025,4025)             PAL8  614
            IF (M.EQ.1) GO TO 4080                                      PAL8  615
570         CALL CALCL(OPT(M),LINE(2),5)                                PAL8  616
            IF (VAL.EQ.0) GO TO 4025                                    PAL8  617
            OPT(M) = 0100000000000000B.OR.VAL                           PAL8  618
            4070 LINKL = SHIFT(LINKL,-6)                                PAL8  619
            GO TO 4025                                                  PAL8  620
575         4080 STC = 0                                                PAL8  621
            GO TO (4100,4200,4300,4400,4025,4025),PASS1F                PAL8  622
            4100 LOC = LINE(2)                                          PAL8  623
            GO TO 1020                                                  PAL8  624
            4200 CONTINUE                                               PAL8  625
580         IF (LINE(2).GT.37B) GO TO 4275                              PAL8  626
            LOC = SHIFT(LINE(2),7)                                      PAL8  627
            4225 LINE(2) = LOC                                          PAL8  628
            GO TO 1025                                                  PAL8  629
            4275 LOC = OPT(1)                                           PAL8  630
585         GO TO 4025                                                  PAL8  631
            4300 CONTINUE                                               PAL8  632
            IF (LINE(2).EQ.0) GO TO 4020                                PAL8  633
            ITC = LINE(2)                                               PAL8  634
            OPT(2) = 0600000000000128                                   PAL8  635
590         OPT(3) = ITC                                                PAL8  636
            STC = 2                                                     PAL8  637
            GO TO 1025                                                  PAL8  638
            4400 OPT(2) = 0601000000000178                              PAL8  639
            OPT(3) = SHIFT((LINE(2).AND.7700B),-6)                      PAL8  640
595         OPT(3) = OPT(3).OR.3000B                                    PAL8  641
            OPT(4) = LINE(2).AND.77B                                    PAL8  642
            STC = 3                                                     PAL8  643
            GO TO 1020                                                  PAL8  644
      C                                                                 PAL8  645
600         END                                                         PAL8  646
```

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      SUBROUTINE PASS2                                                  PAL8    647
C                                                                       PAL8    648
C        PDP-8 ASSEMBLER COMMON                                         PAL8    649
C                                                                       PAL8    650
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    651
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    652
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    653
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    654
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    655
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    656
     *              IWPE,IWBE,IWPH                                      PAL8    657
      COMMON/USEUM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    658
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    659
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    660
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    661
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    662
C                                                                       PAL8    663
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    664
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    665
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    666
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    667
C                                                                       PAL8    668
C                                                                       PAL8    669
      INTEGER TS,PQUEST                                                 PAL8    670
C                                                                       PAL8    671
    2 FORMAT (A5,O4,2X,O4,2X,A8,5A10,5X,A10,A4)                         PAL8    672
    3 FORMAT (A5,12X,A8,5A10,5X,A10,A4)                                 PAL8    673
    4 FORMAT (5X,*PARITY ERROR ON DISK - JOB ABORTED*)                  PAL8    674
    7 FORMAT (46X,3A10)                                                 PAL8    675
C                                                                       PAL8    676
      PASS = 2                                                          PAL8    677
      REWIND IT                                                         PAL8    678
      PAGE = SFLAG = PQUEST = LINE(1) = FNB = POI = BIC = CSM = 0       PAL8    679
      CONA = LSP = 0                                                    PAL8    680
      CALL SRPL(2)                                                      PAL8    681
      ILH = IRH = 2200B                                                 PAL8    682
      DO 25 I = 1,15                                                    PAL8    683
   25 CALL PACKI(0,2,ILH,IRH)                                           PAL8    684
      T[illegible] = 01028                                              PAL8    685
      [illegible]RH = 00008                                             PAL8    686
      CALL PACKI(1,2,ILH,IRH)                                           PAL8    687
   50 CALL HEAD                                                         PAL8    688
  100 LINE(1) = LINE(1).AND.MASKE                                       PAL8    689
      IF (LINE(1).EQ.0) GO TO 105                                       PAL8    690
      IF ((LINE(1).NE.IWII).AND.(LINE(1).NE.IWRD)) ERRC = ERRC + 1      PAL8    691
  105 IEJ = 1                                                           PAL8    692
      IF (LINC.GT.53) CALL HEAD                                         PAL8    693
      READ(ASB) LIM                                                     PAL8    694
      IF (EOF(ASB)) 9000,200                                            PAL8    695
  200 READ(ASB) (LINE(KK),KK=1,LIM)                                     PAL8    696
      LL = 13                                                           PAL8    697
      IF (LIM.LT.13) LL = LIM                                           PAL8    698
      IF (LINE(2)) 500,1000,225                                         PAL8    699
  225 CONTINUE                                                          PAL8    700
      IF (PQUEST.GT.0) GO TO 1000                                       PAL8    701
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                ILH = SHIFT((LINE(2).AND.77700B),-6).OR.100B                    PAL8    702
                IRH = LINE(2).AND.77B                                           PAL8    703
                CALL PACKI(1,2,ILH,IRH)                                         PAL8    704
                GO TO 1000                                                      PAL8    705
 60     500     READ(IT) LIM                                                    PAL8    706
                IF (EOF(IT)) 100,600                                            PAL8    707
        600     READ(IT) (OPT(KK),KK=1,LIM)                                     PAL8    708
                LLL = LIM                                                       PAL8    709
                LINKL = -LINE(2)                                                PAL8    710
 65             LOC = LINE(1).AND.MASKL                                         PAL8    711
                DO 650 I = 1,10                                                 PAL8    712
                TS = LINKL.AND.77B                                              PAL8    713
                IF ((TS+1).GT.LLL) GO TO 675                                    PAL8    714
                CALL DECODE(TS,LLL),RETURNS(200,700,630)                        PAL8    715
 70             IF (TS.EQ.1) GO TO 800                                          PAL8    716
                CALL CALCL(OPT(TS),LINE(2),5)                                   PAL8    717
                IF (VAL.GT.0) GO TO 640                                         PAL8    718
                IF (CPAGEN.EQ.0) GO TO 612                                      PAL8    719
        602     LINE(1) = (LINE(1).AND.MASKL).OR.IWPE                           PAL8    720
 75             GO TO 750                                                       PAL8    721
        612     LINE(1) = (LINE(1).AND.MASKL).OR.IWZE                           PAL8    722
                GO TO 750                                                       PAL8    723
        640     OPT(TS) = 0100000000000000B.OR.VAL                              PAL8    724
        650     LINKL = SHIFT(LINKL,-6)                                         PAL8    725
 80     675     LINE(1) = (LINE(1).AND.MASKL).OR.IWBE                           PAL8    726
                GO TO 750                                                       PAL8    727
        690     CONTINUE                                                        PAL8    728
                IF (CPAGEN) 602,612                                             PAL8    729
        700     LINE(1) = (LINE(1).AND.MASKL).OR.IWIR                           PAL8    730
 85     750     LINE(2) = 7000B                                                 PAL8    731
        800     K = LL                                                          PAL8    732
                IF (LL.GT.10) K = 10                                            PAL8    733
                WRITE(OUT,2) LINE(1),(LINE(J),J=1,K)                            PAL8    734
                LINC = LINC + 1                                                 PAL8    735
 90             IF (LL.LE.10) GO TO 850                                         PAL8    736
                WRITE(OUT,7) (LINE(J),J=11,LL)                                  PAL8    737
                LINC = LINC + 1                                                 PAL8    738
        850     CONTINUE                                                        PAL8    739
                IF (PQUEST.GT.0) GO TO 880                                      PAL8    740
 95             ILH = SHIFT((LINE(2).AND.77700B),-6)                            PAL8    741
                IRH = LINE(2).AND.77B                                           PAL8    742
                CALL PACKI(1,2,ILH,IRH)                                         PAL8    743
        880     CONTINUE                                                        PAL8    744
                IF (IEC.EQ.0) GO TO 100                                         PAL8    745
100             LOC = LINE(1).AND.77777B                                        PAL8    746
                LINE(1) = LINE(1).AND.MASKE                                     PAL8    747
                IF (LINE(1).EQ.0) GO TO 885                                     PAL8    748
                IF ((LINE(1).NE.IWII).AND.(LINE(1).NE.IWRD)) ERRC = ERRC + 1    PAL8    749
        885     CONTINUE                                                        PAL8    750
105             DO 875 I = 1,IEC                                                PAL8    751
                IF (LINC.GT.53) CALL HEAD                                       PAL8    752
        900     LINE(1) = LOC = LOC + 1                                         PAL8    753
                IF (LOC.LE.77777B) GO TO 905                                    PAL8    754
                LOC = 77777B                                                    PAL8    755
110             LINE(1) = IWPO.OR.LOC                                           PAL8    756
```

```
      ERRC = ERRC + 1
  905 GO TO (910,920),IET
  910 LINE(2) = 0
      GO TO 925
  920 LINE(2) = OPT(I+4).AND.MASKL
  925 WRITE(OUT,2) LINE(1),LINE(1),LINE(2)
      LINC = LINC + 1
      IF (PQUEST.GT.0) GO TO 875
      ILH = SHIFT(LINE(2).AND.77000B,-6)
      IRH = LINE(2).AND.77B
      CALL PACKI(1,2,ILH,IRH)
  875 CONTINUE
      GO TO 105
C
 1000 K = LL
      IF (LL.GT.13) K = 10
      WRITE(OUT,3) LINE(1),(LINE(J),J=3,K)
      LINC = LINC + 1
      IF (LL.LE.10) GO TO 100
      WRITE(OUT,7) (LINE(J),J=11,LL)
      LINC = LINC + 1
      GO TO 100
C
 2000 LINE(1) = 0
      GO TO (1000,1000,2005,2050,2050,2100,2050,2300,2050,2400,2050,
     *2050,2050,2050,2010,2300,2300,2200,2225),VAL
 2005 CALL LSAC
      FNB = SHIFT(OPT(3),-3).AND.7B
      CALL SRPL(2)
      IF (LINC.GT.0) CALL HEAD
      IF (PQUEST.GT.0) GO TO 1000
      CALL PACKI(0,1,OPT(3),OPT(4))
      GO TO 1000
 2010 CONTINUE
      IF (PQUEST.GT.0) GO TO 1000
      CALL PACKI(1,2,OPT(3),OPT(4))
      GO TO 1000
 2050 LINE(1) = IWII
      GO TO 1000
 2100 K = LL
      IF (LL.GT.13) K = 10
      WRITE(OUT,3) LINE(1),(LINE(J),J=3,K)
      IF (LL.LE.13) GO TO 50
      WRITE(OUT,7) (LINE(J),J=11,LL)
      GO TO 50
 2200 PQUEST = 1
      GO TO 1000
 2225 PQUEST = 0
      GO TO 1000
 2300 IET = 2
      LINE(2) = OPT(4).AND.MASKL
      GO TO 2450
 2400 IET = 1
      LINE(2) = 0
 2450 LINE(1) = OPT(1)
```

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PAL8  757
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PAL8  810
PAL8  811
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      IEC = OPT(3) - 1
      GO TO 800
C
 8000 WRITE(OUT,4)
C     SOMETHING REALLY WRONG - QUIT HERE
      CALL EXIT
C
 9000 CALL LSAC
      CALL SAP
      ILH = SHIFT((CSM.AND.7700B),-6)
      IRH = CSM.AND.77B
      CALL PACKI(0,2,ILH,IRH)
      ILH = IRH = 0200B
      DO 5025 I = 1,10
 5025 CALL PACKI(0,2,ILH,IRH)
      ILH = IRH = 0000B
      K = 0
      IF (BIC.GT.0) K = 5 - BIC
      K = K + (20 - POI)*5
      IF (K.LT.20) K = K + 100
      IF ((K.AND.1).GT.0) CALL PACKI(0,1,ILH,IRH)
      K = SHIFT(K,-1)
      DO 5050 I = 1,K
 5050 CALL PACKI(0,2,ILH,IRH)
      RETURN
      END
```

```
      SUBROUTINE CALCL(IL,IV,IHT)                                       PAL8    838
C                                                                       PAL8    839
C        PDP-8 ASSEMBLER COMMON                                         PAL8    840
C                                                                       PAL8    841
      COMMON/LINKS/SYMB,EOS,NCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    842
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    843
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    844
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    845
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NE8(3)                             PAL8    846
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    847
     *              IWPE,IW8E,IWPH                                      PAL8    848
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    849
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    850
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    851
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    852
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    853
C                                                                       PAL8    854
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    855
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    856
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    857
     *        CONA,PROGN,STYPES,NCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    858
C                                                                       PAL8    859
C                                                                       PAL8    860
      CPAGEN = SHIFT((IL.AND.76000B),-7)                                PAL8    861
      I = SHIFT(IV,6).OR.CPAGEN                                         PAL8    862
      IF (CPAGEN.EQ.0) GO TO 50                                         PAL8    863
      VAL = PAGER(CPAGEN,2) - 1                                         PAL8    864
      IF (PAGER(CPAGEN,1).GE.VAL) VAL = 0                               PAL8    865
      CALL HASH(IHT,I)                                                  PAL8    866
      IF (VAL.EQ.0) RETURN                                              PAL8    867
      IF (VAL.EQ.(PAGER(CPAGEN,2)-1)) PAGER(CPAGEN,2) = VAL             PAL8    868
      RETURN                                                            PAL8    869
   50 VAL = ZPAGE(2) - 1                                                PAL8    870
      IF (ZPAGE(1).GE.VAL) VAL = 0                                      PAL8    871
      CALL HASH(IHT,I)                                                  PAL8    872
      IF (VAL.EQ.0) RETURN                                              PAL8    873
      IF (VAL.EQ.(ZPAGE(2)-1)) ZPAGE(2) = VAL                           PAL8    874
      RETURN                                                            PAL8    875
      END                                                               PAL8    876
```

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      SUBROUTINE DECODE(J,L),RETURNS(MM,NN,OO)                          PAL8     877
C                                                                       PAL8     878
C        PDP-8 ASSEMBLER COMMON                                         PAL8     879
C                                                                       PAL8     880
      COMMON/LINKS/SYMB,EOS,MCC,TYPE,FLOC,LP,MASHF,LOC,VAL,TP,ECODE,NSP, PAL8     881
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8     882
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8     883
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8     884
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8     885
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8     886
     *              IWPE,IWBE,IWPH                                      PAL8     887
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8     888
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8     889
     *             INOPC(106),IO(106),STYPES(11)                        PAL8     890
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8     891
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8     892
C                                                                       PAL8     893
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8     894
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8     895
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8     896
     *        CONA,PROGN,STYPES,MCC,ECODE,SORTT,STP,REFLP,PASS          PAL8     897
C                                                                       PAL8     898
C                                                                       PAL8     899
      INTEGER THISL,G1,G2,OT                                            PAL8     900
C                                                                       PAL8     901
      LINE(2) = MRII = INB = G1 = G2 = OT = 0                           PAL8     902
      IPM = 1                                                           PAL8     903
      THISL = OPT(J).AND.7777B                                          PAL8     904
      JJ = J + 1                                                        PAL8     905
      DO 1100 I = JJ,L                                                  PAL8     906
      ICODE = SHIFT((OPT(I).AND.7700000000000000B),24)                  PAL8     907
      IF (ICODE.EQ.0) GO TO 1000                                        PAL8     908
      GO TO (100,200,300,400,500,600,700,1000,4000),ICODE               PAL8     909
C                                                                       PAL8     910
C     NUMBER                                                            PAL8     911
C                                                                       PAL8     912
  100 VAL = OPT(I).AND.MASKL                                            PAL8     913
      GO TO 2000                                                        PAL8     914
C                                                                       PAL8     915
C     SYMBOL                                                            PAL8     916
C                                                                       PAL8     917
  200 IWORD = OPT(I).AND.MASKV                                          PAL8     918
      CALL HASH(1,IWORD)                                                PAL8     919
      IF (HASHF.GT.7) RETURN NN                                         PAL8     920
      IF (HASHF.EQ.5) RETURN MM                                         PAL8     921
      GO TO 2000                                                        PAL8     922
C                                                                       PAL8     923
C     SPECIAL SYMBOL                                                    PAL8     924
C                                                                       PAL8     925
  300 ISC = OPT(I).AND.77B                                              PAL8     926
      IF (ISC.EQ.1R+) IPM = 5                                           PAL8     927
      IF (ISC.EQ.1R+) IPM = 2                                           PAL8     928
      IF (ISC.EQ.1R-) IPM = 3                                           PAL8     929
      IF (ISC.EQ.1R=) IPM = 4                                           PAL8     930
      IF (ISC.EQ.1R*) IPM = 6                                           PAL8     931
```

```
                      IF (ISC.EQ.IRS) IPM = 7                                   PAL8    932
                      GO TO 999                                                 PAL8    933
                C                                                               PAL8    934
                C     THIS LOCATION (.)                                         PAL8    935
 60             C                                                               PAL8    936
                 400  VAL = OPT(I).AND.MASKL                                    PAL8    937
                      GO TO 2000                                                PAL8    938
                C                                                               PAL8    939
                C     I OR Z                                                    PAL8    940
 65             C                                                               PAL8    941
                 500  IF ((OPT(I).AND.7778).GT.0) INS = 4000                    PAL8    942
                      GO TO 999                                                 PAL8    943
                C                                                               PAL8    944
                C     PSUEDO OP CODE                                            PAL8    945
 70             C                                                               PAL8    946
                 600  VAL = OPT(I).AND.778                                      PAL8    947
                      IF (VAL.GT.19) RETURN NN                                  PAL8    948
                      RETURN MM                                                 PAL8    949
                C                                                               PAL8    950
 75             C     LITERALS                                                  PAL8    951
                C                                                               PAL8    952
                 4001 CONTINUE                                                  PAL8    953
                      IF ((OPT(I).AND.MASKL).EQ.0) OPT(I) = 0                   PAL8    954
                      GO TO 1001                                                PAL8    955
 80             C                                                               PAL8    956
                C     OP CODE                                                   PAL8    957
                C                                                               PAL8    958
                 700  IWORD = OPT(I).AND.MASKV                                  PAL8    959
                      CALL HASH(1,IWORD)                                        PAL8    960
 85                   GO TO (750,800,850,900),HASHF                             PAL8    961
                C     MEMORY REF OR FLOATING POINT INSTRUCTION                  PAL8    962
                 750  INS = VAL                                                 PAL8    963
                      IF (I.GT.JJ) RETURN NN                                    PAL8    964
                      MRII = 1                                                  PAL8    965
 90                   IPM = 5                                                   PAL8    966
                      GO TO 999                                                 PAL8    967
                C     GROUP 1 INSTRUCTIONS                                      PAL8    968
                 800  CONTINUE                                                  PAL8    969
                      IF (I.EQ.JJ) GO TO 825                                    PAL8    970
 95                   IF ((VAL.EQ.7200B).AND.(G2.GT.0)) GO TO 840               PAL8    971
                 825  G1 = 1                                                    PAL8    972
                      IF((G1.EQ.0).OR.(G2.GT.0).OR.(OT.GT.0)) RETURN NN         PAL8    973
                      IF ((VAL.AND.16B).EQ.0) GO TO 2000                        PAL8    974
                      IF ((LINE(2).AND.16B).GT.0) RETURN NN                     PAL8    975
100                   GO TO 2000                                                PAL8    976
                 840  VAL = 7600B                                               PAL8    977
                C     GROUP 2 INSTRUCTIONS                                      PAL8    978
                 850  IF (I.EQ.JJ) G2 = 1                                       PAL8    979
                      IF ((G1.GT.0).AND.(LINE(2).EQ.7200B)) GO TO 860           PAL8    980
105                   IF ((G1.GT.0).OR.(G2.EQ.0).OR.(OT.GT.0)) RETURN NN        PAL8    981
                      GO TO 870                                                 PAL8    982
                 860  G1 = 1                                                    PAL8    983
                      G2 = 1                                                    PAL8    984
                      LINE(2) = 7600B                                           PAL8    985
110              870  CONTINUE                                                  PAL8    986
```

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                K = VAL.AND.1700B                                       PAL8     987
                IF (K.EQ.0) GO TO 2000                                  PAL8     988
                IF ((K.EQ.100B).AND.((LINE(2).AND.1700B).EQ.0)) GO TO 2000  PAL8  989
                IF ((LINE(2).AND.1700B).EQ.100B) RETURN NN              PAL8     990
115             IF ((LINE(2).AND.1600B).EQ.0) GO TO 2000                PAL8     991
                IF ((LINE(2).AND.100B).NE.(VAL.AND.100B)) RETURN NN     PAL8     992
                GO TO 2000                                              PAL8     993
              C OTHERS                                                  PAL8     994
              900 CONTINUE                                              PAL8     995
120             IF ((I-JJ).NE.OT) RETURN NN                             PAL8     996
                OT = OT + 1                                             PAL8     997
                IF (OT.EQ.1) GO TO 2000                                 PAL8     998
                IF ((LINE(2).AND.77700B).NE.(VAL.AND.77700B)) RETURN NN PAL8     999
              C                                                         PAL8    1000
125           2000 GO TO (2100,2200,2300,2400,2150,2600,2700),IPM       PAL8    1001
              2300 VAL = 100000B - VAL                                  PAL8    1002
                GO TO 2200                                              PAL8    1003
              2100 CONTINUE                                             PAL8    1004
                IF (NRII.GT.0) RETURN NN                                PAL8    1005
130           2150 LINE(2) = LINE(2).OR.VAL                             PAL8    1006
                GO TO 2500                                              PAL8    1007
              2200 LINE(2) = (LINE(2) + VAL).AND.MASKL                  PAL8    1008
                GO TO 2500                                              PAL8    1009
              2400 LINE(2) = LINE(2).AND.VAL                            PAL8    1010
135             GO TO 2500                                              PAL8    1011
              2600 LINE(2) = (LINE(2) * VAL).AND.MASKL                  PAL8    1012
                GO TO 2500                                              PAL8    1013
              2700 LINE(2) = (LINE(2)/VAL).AND.MASKL                    PAL8    1014
              2500 IPM = 1                                              PAL8    1015
140           999 OPT(I) = 0                                            PAL8    1016
              1000 CONTINUE                                             PAL8    1017
              1001 CONTINUE                                             PAL8    1018
                IF (LINE(2).GT.77777B) RETURN NN                        PAL8    1019
                IF (NRII.EQ.0) RETURN                                   PAL8    1020
145             I = LINE(2).AND.1778                                    PAL8    1021
                IF ((LINE(2).AND.76000B).EQ.0) GO TO 1100               PAL8    1022
                IF ((THISL.AND.76000B).EQ.(LINE(2).AND.76000B)) GO TO 1075  PAL8  1023
                IF (INB.GT.0) RETURN NN                                 PAL8    1024
                CALL CALCL(THISL,LINE(2),6)                             PAL8    1025
150             IF (VAL.EQ.0) RETURN 00                                 PAL8    1026
              1050 INB = 4000B                                          PAL8    1027
                I = VAL.AND.1778                                        PAL8    1028
              1075 I = I.OR.2000B                                       PAL8    1029
              1100 I = I.OR.INB                                         PAL8    1030
155             LINE(2) = INS.OR.I                                      PAL8    1031
                RETURN                                                  PAL8    1032
                END                                                     PAL8    1033
```

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      SUBROUTINE GETFLD                                                 PAL8    1034
C                                                                       PAL8    1035
C       PDP-8 ASSEMBLER COMMON                                          PAL8    1036
C                                                                       PAL8    1037
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1038
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    1039
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    1040
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    1041
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    1042
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    1043
     *              IWPE,IWBE,IWPH                                      PAL8    1044
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    1045
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    1046
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    1047
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    1048
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    1049
C                                                                       PAL8    1050
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    1051
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    1052
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    1053
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    1054
C                                                                       PAL8    1055
C                                                                       PAL8    1056
C     ************************************************************      PAL8    1057
C     * VALUES OF TYPE UPON EXIT                                 *      PAL8    1058
C     *                                                          *      PAL8    1059
C     *    1 = ORIGIN                                            *      PAL8    1060
C     *    2 = LABEL                                             *      PAL8    1061
C     *    3 = COMMENT                                           *      PAL8    1062
C     *    4 = NUMERIC FIELD (RETURNED IN THE CORRECT BASE)      *      PAL8    1063
C     *    5 = SYMBOL                                            *      PAL8    1064
C     *    6 = SYMBOL (BEGINNING WITH A NUMERIC CHARACTER)       *      PAL8    1065
C     *    7 = SPECIAL CHARACTER                                 *      PAL8    1066
C     *    8 = ILLEGAL CHARACTER                                 *      PAL8    1067
C     *    9 = DEFINITION                                        *      PAL8    1068
C     *   10 = TERMINATOR                                        *      PAL8    1069
C     ************************************************************      PAL8    1070
C                                                                       PAL8    1071
      FLOC = FLOC + 1                                                   PAL8    1072
      SYMB = EOS = NUMB = TYPE = NSP = 0                                PAL8    1073
  100 LP = LP + 1                                                       PAL8    1074
      IF (LP.GT.72) GO TO 8000                                          PAL8    1075
      GO TO (9000,1000,2000,9000,9000,3000,3100,8100,3050,3150,125),    PAL8    1076
     *IC(IMAGE(LP))                                                     PAL8    1077
  125 NSP = NSP + 1                                                     PAL8    1078
      GO TO 100                                                         PAL8    1079
C                                                                       PAL8    1080
 1000 TYPE = 5                                                          PAL8    1081
      SYMB = IMAGE(LP)                                                  PAL8    1082
      WCC = 1                                                           PAL8    1083
 1050 LP = LP + 1                                                       PAL8    1084
      IF (LP.GT.72) GO TO 8000                                          PAL8    1085
      GO TO (9000,1075,1075,1510,1520,1535,1535,1535,9000,9000,1535),   PAL8    1086
     *IC(IMAGE(LP))                                                     PAL8    1087
 1075 CONTINUE                                                          PAL8    1088
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                IF (WCC.EQ.6) GO TO 1050                                    PAL8    1089
                WCC = WCC + 1                                               PAL8    1090
             1080 SYMB = SHIFT(SYMB,6).OR.IMAGE(LP)                         PAL8    1091
                GO TO 1050                                                  PAL8    1092
60           C                                                              PAL8    1093
             1510 CONTINUE                                                  PAL8    1094
                IF (FLOC.NE.1) GO TO 9000                                   PAL8    1095
                TYPE = 2                                                    PAL8    1096
                RETURN                                                      PAL8    1097
65           1520 CONTINUE                                                  PAL8    1098
                IF (TYPE.NE.5) GO TO 9000                                   PAL8    1099
                TYPE = 9                                                    PAL8    1100
                RETURN                                                      PAL8    1101
             1530 SYMB = SHIFT(SYMB,12).OR.NUMB                             PAL8    1102
70           1535 LP = LP - 1                                               PAL8    1103
                RETURN                                                      PAL8    1104
             C                                                              PAL8    1105
             2000 NUMB = IMAGE(LP) - 33B                                    PAL8    1106
                SYMB = IMAGE(LP)                                            PAL8    1107
75              WCC = 1                                                     PAL8    1108
                IF ((RADIX.EQ.8).AND.((IMAGE(LP)-33B).GT.7)) GO TO 2100     PAL8    1109
                TYPE = 4                                                    PAL8    1110
             2050 CONTINUE                                                  PAL8    1111
                IF (NUMB.GT.77777B) GO TO 2100                              PAL8    1112
80              LP = LP + 1                                                 PAL8    1113
                IF (LP.GT.72) GO TO 8000                                    PAL8    1114
                GO TO (9000,2125,2060,9000,9000,1530,1530,1530,9000,9000,1530),  PAL8    1115
               *IC(IMAGE(LP))                                               PAL8    1116
             2060 WCC = WCC + 1                                             PAL8    1117
85              IF (WCC.GT.4) GO TO 2150                                    PAL8    1118
                IF ((RADIX.EQ.8).AND.((IMAGE(LP)-33B).GT.7)) GO TO 2150     PAL8    1119
                SYMB = SHIFT(SYMB,6).OR.IMAGE(LP)                           PAL8    1120
                IF (RADIX.GT.8) GO TO 2075                                  PAL8    1121
                NUMB = NUMB*8 + (IMAGE(LP)-33B)                             PAL8    1122
90              GO TO 2050                                                  PAL8    1123
             2075 NUMB = NUMB*10 + (IMAGE(LP)-33B)                          PAL8    1124
                GO TO 2050                                                  PAL8    1125
             2100 TYPE = 6                                                  PAL8    1126
                GO TO 1050                                                  PAL8    1127
95           2125 WCC = WCC + 1                                             PAL8    1128
             2150 TYPE = 6                                                  PAL8    1129
                GO TO 1080                                                  PAL8    1130
             C                                                              PAL8    1131
             3000 TYPE = 7                                                  PAL8    1132
100             RETURN                                                      PAL8    1133
             3050 TYPE = 1                                                  PAL8    1134
                RETURN                                                      PAL8    1135
             3100 TYPE = 3                                                  PAL8    1136
                GO TO 8000                                                  PAL8    1137
105          3150 ECODE = 1                                                 PAL8    1138
             C                                                              PAL8    1139
             8000 EOS = 1                                                   PAL8    1140
             8100 EOS = EOS + 1                                             PAL8    1141
                IF (TYPE.EQ.0) TYPE = 10                                    PAL8    1142
110             RETURN                                                      PAL8    1143
```

```
C
      BOOL TYPE = 8
      RETURN
C
115   END
```

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PAL8    1144
PAL8    1145
PAL8    1146
PAL8    1147
PAL8    1148
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      SUBROUTINE HASH(IE,SYMN)                                          PAL8    1149
C                                                                       PAL8    1150
C       PDP-8 ASSEMBLER COMMON                                          PAL8    1151
C                                                                       PAL8    1152
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1153
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    1154
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    1155
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    1156
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    1157
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    1158
     *              IWPE,IWBE,IWPH                                      PAL8    1159
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    1160
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    1161
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    1162
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    1163
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    1164
C                                                                       PAL8    1165
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    1166
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    1167
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    1168
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    1169
C                                                                       PAL8    1170
C                                                                       PAL8    1171
      INTEGER SS,SYMN                                                   PAL8    1172
C                                                                       PAL8    1173
    1 FORMAT (5X,*SYMBOL TABLE FULL - JOB ABORTED*)                     PAL8    1174
C                                                                       PAL8    1175
C     ***************************************************************   PAL8    1176
C     * IF IE = 1  -  TABLE LOOK-UP                                 *   PAL8    1177
C     * IF IE = 2  -  ADD LABEL + LOCATION                          *   PAL8    1178
C     * IF IE = 3  -  ADD SYMBOL + LOCATION                         *   PAL8    1179
C     * IF IE = 4  -  ADD DEFINITION + VALUE                        *   PAL8    1180
C     * IF IE = 5  -  ADD LITERAL + LOCATION                        *   PAL8    1181
C     * IF IE = 6  -  ADD OFF-PAGE REFERENCE + LOCATION             *   PAL8    1182
C     * VALUES OF HASHF UPON EXIT                                   *   PAL8    1183
C     *    (IE = 1)  1 = MEM. REF. OR FLTING. POINT INSTRUCTION     *   PAL8    1184
C     *              2 = GROUP 1 INSTRUCTION                        *   PAL8    1185
C     *              3 = GROUP 2 INSTRUCTION                        *   PAL8    1186
C     *              4 = OTHER OP CODES                             *   PAL8    1187
C     *              5 = PSEUDO OP CODE                             *   PAL8    1188
C     *              6 = LABEL                                      *   PAL8    1189
C     *              7 = SYMBOL                                     *   PAL8    1190
C     *              8 = UNDEFINED SYMBOL                           *   PAL8    1191
C     *              9 = NOT FOUND                                  *   PAL8    1192
C     *    (IE = 2)  1 = LABEL ADDED                                *   PAL8    1193
C     *              2 = ALREADY USED                               *   PAL8    1194
C     *    (IE = 3)  1 = SYMBOL ADDED                               *   PAL8    1195
C     *              2 = PSUEDO OP CODE                             *   PAL8    1196
C     *              3 = OP CODE                                    *   PAL8    1197
C     *    (IE = 4)  1 = DEFINITION ADDED                           *   PAL8    1198
C     *              2 = REDEFINITION                               *   PAL8    1199
C     *    (IE = 5)  1 = LITERAL ADDED                              *   PAL8    1200
C     *    (IE = 6)  1 = REFERENCE ADDED                            *   PAL8    1201
C     ***************************************************************   PAL8    1202
C                                                                       PAL8    1203
```

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                SS = SHIFT(SYMN,24)                                          PAL8    1204
                RS = SYMN                                                    PAL8    1205
                ID = RS/1741.0                                               PAL8    1206
                IQ = ID*1741                                                 PAL8    1207
 60             IRR = SYMN-IQ+1                                              PAL8    1208
                GO TO (100,900,900,950,950,950),IE                           PAL8    1209
            100 IR = IRR                                                     PAL8    1210
                IF ((TABLE(IR,1).AND.MASKS).EQ.SS) GO TO 200                 PAL8    1211
                IRR = TABLE(IR,2).AND.MASKL                                  PAL8    1212
 65 *           IF (IRR.GT.0) GO TO 100                                      PAL8    1213
                HASHF = 9                                                    PAL8    1214
                RETURN                                                       PAL8    1215
            200 VAL = TABLE(IR,1).AND.MASKL                                  PAL8    1216
                ITP = TABLE(IR,1).AND.MASKT                                  PAL8    1217
 70             HASHF = 9                                                    PAL8    1218
                IF (ITP.EQ.STYPES(4)) HASHF = 7                              PAL8    1219
                IF (ITP.EQ.STYPES(2)) HASHF = 6                              PAL8    1220
                IF (ITP.EQ.STYPES(3)) HASHF = 8                              PAL8    1221
                IF (ITP.EQ.STYPES(7)) HASHF = 5                              PAL8    1222
 75             IF (ITP.EQ.STYPES(8)) HASHF = 1                              PAL8    1223
                IF (ITP.EQ.STYPES(9)) HASHF = 2                              PAL8    1224
                IF (ITP.EQ.STYPES(10)) HASHF = 3                             PAL8    1225
                IF (ITP.EQ.STYPES(11)) HASHF = 4                             PAL8    1226
                RETURN                                                       PAL8    1227
 80           C                                                              PAL8    1228
            900 IHVAL = LOC                                                  PAL8    1229
                GO TO 1000                                                   PAL8    1230
            950 IHVAL = VAL                                                  PAL8    1231
           1000 IHVAL = IHVAL.OR.SHIFT(FNB,21).OR.SHIFT(PASS,18)             PAL8    1232
 85             IF (CONA.GT.0) GO TO 1175                                    PAL8    1233
           1010 IR = IRR                                                     PAL8    1234
                IF (TABLE(IR,1).EQ.0) GO TO 1500                             PAL8    1235
                IF ((TABLE(IR,1).AND.MASKS).EQ.SS) GO TO 2000                PAL8    1236
           1025 IRR = TABLE(IR,2).AND.MASKL                                  PAL8    1237
 90             IF (IRR.GT.0) GO TO 1010                                     PAL8    1238
           1050 TP = TP - 1                                                  PAL8    1239
                IF (TP.LT.1) GO TO 3000                                      PAL8    1240
                IF (TABLE(TP,1).NE.0) GO TO 1050                             PAL8    1241
           1100 TABLE(TP,1) = SS.OR.STYPES(IE).OR.IHVAL                      PAL8    1242
 95             TABLE(IR,2) = TABLE(IR,2).OR.TP                              PAL8    1243
                TABLE(TP,2) = SHIFT(IR,12)                                   PAL8    1244
                IF (SFLAG.GE.0) CALL LINK(TP,1,IE)                           PAL8    1245
           1175 HASHF = 1                                                    PAL8    1246
                RETURN                                                       PAL8    1247
100             2000 ITP = TABLE(IR,1).AND.MASKT                             PAL8    1248
                IF (IE.GE.5) GO TO 2200                                      PAL8    1249
                IF (IE.EQ.4) GO TO 2050                                      PAL8    1250
                IF (ITP.EQ.STYPES(7)) GO TO 2110                             PAL8    1251
                DO 2100 I = 8,11                                             PAL8    1252
105             IF (ITP.EQ.STYPES(I)) GO TO 2100                             PAL8    1253
            2100 CONTINUE                                                    PAL8    1254
                IF (ITP.EQ.STYPES(5)) GO TO 1025                             PAL8    1255
                IF (ITP.EQ.STYPES(6)) GO TO 1025                             PAL8    1256
                IF (SFLAG.GE.0) CALL LINK(IR,2,IE)                           PAL8    1257
110             IF (IE.EQ.3) GO TO 1175                                      PAL8    1258
```

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                      IF (ITP.NE.STYPES(3)) GO TO 2025                          PAL8    1259
                      TABLE(IR,1) = SS.OR.STYPES(2).OR.IHVAL                    PAL8    1260
                      GO TO 1175                                                PAL8    1261
                 2025 HASHF = 2                                                 PAL8    1262
115                   RETURN                                                    PAL8    1263
                 2100 HASHF = 3                                                 PAL8    1264
                      IF (IE.EQ.2) GO TO 2025                                   PAL8    1265
                      RETURN                                                    PAL8    1266
                 2110 VAL = TABLE(IR,1).AND.77B                                 PAL8    1267
120                   GO TO 2025                                                PAL8    1268
                 2050 CONTINUE                                                  PAL8    1269
                      IF (ITP.NE.STYPES(3)) GO TO 2051                          PAL8    1270
                      TABLE(IR,1) = SS.OR.STYPES(4).OR.IHVAL                    PAL8    1271
                      GO TO 1175                                                PAL8    1272
125              2051 TABLE(IR,1) = (TABLE(IR,1).AND.MASKE).OR.VAL              PAL8    1273
                      GO TO 2025                                                PAL8    1274
                 2200 CONTINUE                                                  PAL8    1275
                      IF (SHIFT(FNB,21).NE.(TABLE(IR,1).AND.700000008)) GO TO 1025  PAL8    1276
                      IF (ITP.NE.STYPES(IE)) GO TO 1025                         PAL8    1277
130                   VAL = TABLE(IR,1).AND.MASKL                               PAL8    1278
                      CALL LINK(IR,2,IE)                                        PAL8    1279
                      GO TO 1175                                                PAL8    1280
                 1500 TABLE(IR,1) = SS.OR.STYPES(IE).OR.IHVAL                   PAL8    1281
                      IF (SFLAG.GE.0) CALL LINK(IR,1,IE)                        PAL8    1282
135                   GO TO 1175                                                PAL8    1283
                 3000 WRITE(OUT,1)                                              PAL8    1284
                      CALL EXIT                                                 PAL8    1285
                      END                                                       PAL8    1286
```

```
      SUBROUTINE HEAD                                                    PAL8    1287
C                                                                        PAL8    1288
C        PDP-8 ASSEMBLER COMMON                                          PAL8    1289
C                                                                        PAL8    1290
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1291
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,       PAL8    1292
     *             ERRC,OSM,FNB,IFORD,IFN,PPOGN,LSP,STP,REFLP,PASS       PAL8    1293
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)          PAL8    1294
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3),DANDT(2)                     MIS008     4
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRO,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,   PAL8    1296
     *              IWPE,IWRE,IWPH                                       PAL8    1297
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                         PAL8    1298
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),             PAL8    1299
     *             INOPC(106),TO(106),STYPES(11)                         PAL8    1300
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),      PAL8    1301
     *             IMAGE(96),OPT(63),LINE(15)                            PAL8    1302
C                                                                        PAL8    1303
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VALUE,OPT,                  PAL8    1304
     *          RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,           PAL8    1305
     *          BIC,PAGE,SFLAG,ZPAGE,PAGEP,CPAGEN,ERRC,OSM,FNB,POI,      PAL8    1306
     *          CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS         PAL8    1307
C                                                                        PAL8    1308
C                                                                        PAL8    1309
    1 FORMAT (*1*,* PAL-8 ASSEMBLER - *,A10,24X,2A10)                    MIS008     5
    2 FORMAT (2X,6A10,2X,*PAGE *,R1,I4/1X,74(*-*)//)                     PAL8    1311
    3 FORMAT (2X,2A10,23)                                                PAL8    1312
C                                                                        PAL8    1313
      PAGE = PAGE + 1                                                    PAL8    1314
      WRITE(OUT,1) VERN,DANDT                                            MIS008     6
      IF (NEB(1).NE.104           ) WRITE(OUT,3) NEB                     PAL8    1316
      WRITE(OUT,2) IPROG,PROGN,PAGE                                      PAL8    1317
      LINC = 0                                                           PAL8    1318
      RETURN                                                             PAL8    1319
      END                                                                PAL8    1320
```

```
      SUBROUTINE INHASH                                                 PAL8    1321
C                                                                       PAL8    1322
C        PDP-8 ASSEMBLER COMMON                                         PAL8    1323
C                                                                       PAL8    1324
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1325
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    1326
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    1327
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    1328
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    1329
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    1330
     *              IWPE,IWBE,IWPH                                      PAL8    1331
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    1332
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    1333
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    1334
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    1335
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    1336
C                                                                       PAL8    1337
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    1338
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    1339
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    1340
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    1341
C                                                                       PAL8    1342
C                                                                       PAL8    1343
      INTEGER SS                                                        PAL8    1344
C                                                                       PAL8    1345
    1 FORMAT (5X,5H*****,*WARNING SYMBOL TABLE CONFLICT *,R6,5H*****)   PAL8    1346
C                                                                       PAL8    1347
      TP = 2001                                                         PAL8    1348
      DO 50 I=1,2000                                                    PAL8    1349
   50 TABLE(I,1) = TABLE(I,2) = 0                                       PAL8    1350
      DO 100 I = 1,106                                                  PAL8    1351
      SS = SHIFT(INOPC(I),24)                                           PAL8    1352
      RS = INOPC(I)                                                     PAL8    1353
      ID = RS/1741.0                                                    PAL8    1354
      IQ = ID*1741                                                      PAL8    1355
      IR = INOPC(I)-IQ+1                                                PAL8    1356
      IF (TABLE(IR,1).NE.0) WRITE(OUT,1) INOPC(I)                       PAL8    1357
      IF ((IO(I).AND.MASKT).EQ.0) GO TO 100                             PAL8    1358
      TABLE(IR,1) = SS.OR.IO(I)                                         PAL8    1359
  100 CONTINUE                                                          PAL8    1360
      RETURN                                                            PAL8    1361
      END                                                               PAL8    1362
```

```
      SUBROUTINE LINK(IR,IE,VT)                                          PAL8    1363
C                                                                        PAL8    1364
C     PDP-8 ASSEMBLER COMMON                                             PAL8    1365
C                                                                        PAL8    1366
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1367
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,       PAL8    1368
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS       PAL8    1369
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)          PAL8    1370
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                              PAL8    1371
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,   PAL8    1372
     *              IWPE,IWBE,IWPH                                       PAL8    1373
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                         PAL8    1374
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),             PAL8    1375
     *             INOPC(106),IO(106),STYPES(11)                         PAL8    1376
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),      PAL8    1377
     *             IMAGE(86),OPT(63),LINE(15)                            PAL8    1378
C                                                                        PAL8    1379
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                 PAL8    1380
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,             PAL8    1381
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,        PAL8    1382
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS           PAL8    1383
C                                                                        PAL8    1384
C                                                                        PAL8    1385
      INTEGER RLIST(150),VT,PP                                           PAL8    1386
      EQUIVALENCE (RLIST(1),IMAGE(1))                                    PAL8    1387
C                                                                        PAL8    1388
C     ***************************************                            PAL8    1389
C     * IF IE = 1 THEN ADD NEW SYMBOL       *                            PAL8    1390
C     * IF IE = 2 THEN ADD NEW REFERENCE    *                            PAL8    1391
C     * IF IE = 3 THEN SEARCH FOR REFERENCES *                           PAL8    1392
C     ***************************************                            PAL8    1393
C                                                                        PAL8    1394
    1 FORMAT (10X,*REFERENCE TABLE FULL*)                                PAL8    1395
    2 FORMAT (3X,A6,6X,O4)                                               PAL8    1396
    3 FORMAT (R1,24X,8(O4,2X))                                           PAL8    1397
    4 FORMAT (3X,A6,5X,*UNDEF.*)                                         PAL8    1398
    5 FORMAT (25X,3H***,*EXCESS REFERENCES NOT LISTED*,3H***)            PAL8    1399
    7 FORMAT (4X,O4,R1,4X,O1,1X,O4)                                      PAL8    1400
C                                                                        PAL8    1401
      IOP = LOC                                                          PAL8    1402
      IF (IOP.GT.7777B) IOP = 7777B                                      PAL8    1403
      GO TO (100,1000,2000),IE                                           PAL8    1404
C                                                                        PAL8    1405
  100 CONTINUE                                                           PAL8    1406
      IF (VT.GE.5) PP = REFLP = REFLP - 1                                PAL8    1407
      IF (VT.LT.5) PP = REFP = REFP + 1                                  PAL8    1408
      IF (REFP.LT.REFLP) GO TO 110                                       PAL8    1409
   99 WRITE(OUT,1)                                                       PAL8    1410
      RETURN                                                             PAL8    1411
  110 TABLE(IR,2) = TABLE(IR,2).OR.SHIFT(PP,27).OR.3000000000B           PAL8    1412
      REFTAB(PP) = SHIFT(IOP,36)                                         PAL8    1413
      RETURN                                                             PAL8    1414
C                                                                        PAL8    1415
 1000 IRP = SHIFT(TABLE(IR,2),33).AND.MASKL                              PAL8    1416
      IF (IRP.EQ.0) GO TO 100                                            PAL8    1417
```

```
      1010 NL = SHIFT(REFTAB(IRP),12)                                          PAL8    1418
           IF ((NL.AND.MASKL).EQ.0) GO TO 1100                                 PAL8    1419
           IRP = NL.AND.MASKL                                                  PAL8    1420
           GO TO 1010                                                          PAL8    1421
 60    1100 NPOS = SHIFT(TABLE(IR,2),36).AND.78                                 PAL8    1422
           IF (NPOS.EQ.0) GO TO 1200                                           PAL8    1423
           NPOS = NPOS - 1                                                     PAL8    1424
      1111 M = NPOS*12                                                         PAL8    1425
           REFTAB(IRP) = REFTAB(IRP).OR.SHIFT(IOP,M)                           PAL8    1426
 65        TABLE(IR,2) = (TABLE(IR,2).AND.77770777777778).OR.SHIFT(NPOS,24)    PAL8    1427
           RETURN                                                              PAL8    1428
      1200 CONTINUE                                                            PAL8    1429
           IF (VT.GE.5) PP = REFLP = REFLP - 1                                 PAL8    1430
           IF (VT.LT.5) PP = REFP = REFP + 1                                   PAL8    1431
 70        REFTAB(IRP) = REFTAB(IRP).OR.SHIFT(PP,48)                           PAL8    1432
           IRP = PP                                                            PAL8    1433
           REFTAB(IRP) = 0                                                     PAL8    1434
           NPOS = 3                                                            PAL8    1435
           GO TO 1111                                                          PAL8    1436
 75      C                                                                     PAL8    1437
      2000 M = SHIFT(TABLE(IR,2),33)                                           PAL8    1438
           IRP = M.AND.MASKL                                                   PAL8    1439
           NPOS = SHIFT(M,3).AND.78                                            PAL8    1440
           II = 0                                                              PAL8    1441
 80        IF (IRP.EQ.0) GO TO 2160                                            PAL8    1442
      2025 IWORD = SHIFT(REFTAB(IRP),12)                                       PAL8    1443
           NL = IWORD.AND.MASKL                                                PAL8    1444
           IF (NL.EQ.0) GO TO 2100                                             PAL8    1445
           DO 2050 I = 1,4                                                     PAL8    1446
 85        IWORD = SHIFT(IWORD,12)                                             PAL8    1447
           II = II + 1                                                         PAL8    1448
           IF (II.GT.150) GO TO 2160                                           PAL8    1449
      2050 RLIST(II) = IWORD.AND.MASKL                                         PAL8    1450
           IRP = NL                                                            PAL8    1451
 90        GO TO 2025                                                          PAL8    1452
      2100 J = 4 - NPOS                                                        PAL8    1453
           DO 2150 I = 1,J                                                     PAL8    1454
           IWORD = SHIFT(IWORD,12)                                             PAL8    1455
           II = II + 1                                                         PAL8    1456
 95        IF (II.GT.150) GO TO 2160                                           PAL8    1457
      2150 RLIST(II) = IWORD.AND.MASKL                                         PAL8    1458
      2160 IST = 1                                                             PAL8    1459
           IEND = 8                                                            PAL8    1460
           IF (II.LT.8) IEND = II                                              PAL8    1461
100        IF ((TABLE(IR,1).AND.MASKT).EQ.STYPES(6)) GO TO 2180                PAL8    1462
           IF ((TABLE(IR,1).AND.MASKT).EQ.STYPES(5)) GO TO 2185                PAL8    1463
           IF ((TABLE(IR,1).AND.MASKT).NE.STYPES(3)) GO TO 2175                PAL8    1464
           WRITE(OUT,4) TABLE(IR,1)                                            PAL8    1465
           GO TO 2200                                                          PAL8    1466
105        2175 WRITE(OUT,2) TABLE(IR,1),TABLE(IR,1)                           PAL8    1467
           GO TO 2200                                                          PAL8    1468
      2180 IOP = 1R#                                                           PAL8    1469
           GO TO 2188                                                          PAL8    1470
      2185 IOP = 1R                                                            PAL8    1471
110        2188 VAL = SHIFT(TABLE(IR,1),30)                                    PAL8    1472
```

```
                IFN = SHIFT(TABLE(IR,1),39)                                  PAL8    1473
                IF ((TABLE(IR,1).AND.77777B).EQ.0) GO TO 2189                PAL8    1474
                WRITE(OUT,7) VAL,IOP,IFN,TABLE(IR,1)                         PAL8    1475
                GO TO 2200                                                   PAL8    1476
115          2189 WRITE(OUT,7) VAL,IOP,IFN                                   PAL8    1477
             2200 IOP = 1R+                                                  PAL8    1478
                IF (IEND.EQ.0) GO TO 2250                                    PAL8    1479
                GO TO 2275                                                   PAL8    1480
             2250 LINC = LINC + 1                                            PAL8    1481
120             IF (LINC.GE.52) CALL HEAD                                    PAL8    1482
                IF (IEND.EQ.II) RETURN                                       PAL8    1483
                IF (IEND.EQ.150) GO TO 2300                                  PAL8    1484
                IST = IST + 8                                                PAL8    1485
             2275 IEND = IST + 7                                             PAL8    1486
125             IF (II.LT.IEND) IEND = II                                    PAL8    1487
                IF (IEND.GT.150) IEND = 150                                  PAL8    1488
                WRITE(OUT,3) IOP,(RLIST(J),J=IST,IEND)                       PAL8    1489
                IOP = 1R                                                     PAL8    1490
                GO TO 2250                                                   PAL8    1491
130          C                                                               PAL8    1492
             2300 WRITE(OUT,5)                                               PAL8    1493
                LINC = LINC + 1                                              PAL8    1494
                IF (LINC.GE.52) CALL HEAD                                    PAL8    1495
                RETURN                                                       PAL8    1496
135          C                                                               PAL8    1497
                END                                                          PAL8    1498
```

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      SUBROUTINE LSAC                                                    PAL8    1499
C                                                                        PAL8    1560
C        PDP-8 ASSEMBLER COMMON                                          PAL8    1561
C                                                                        PAL8    1562
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1503
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,       PAL8    1504
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS       PAL8    1505
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)          PAL8    1506
      COMMON/PARAMS/ICARD,UPO,IFFLAG,NEB(3)                              PAL8    1507
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,   PAL8    1508
     *              IWPE,IWBE,IWPH                                       PAL8    1509
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                         PAL8    1510
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),             PAL8    1511
     *             INOPC(106),IO(106),STYPES(11)                         PAL8    1512
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),      PAL8    1513
     *             IMAGE(86),OPT(63),LINE(15)                            PAL8    1514
C                                                                        PAL8    1515
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                 PAL8    1516
     *        RADIX,UPO,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,             PAL8    1517
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,        PAL8    1518
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS           PAL8    1519
C                                                                        PAL8    1520
C                                                                        PAL8    1521
      INTEGER BACK,FORW                                                  PAL8    1522
C                                                                        PAL8    1523
    1 FORMAT (4X,*VALUE*,4X,*LOCATION*,4X,*REFERENCES*/)                 PAL8    1524
C                                                                        PAL8    1525
      STP = 0                                                            PAL8    1526
      DO 1000 I = 1,2000                                                 PAL8    1527
      ITP = TABLE(I,1).AND.MASKT                                         PAL8    1528
      IF ((ITP.NE.STYPES(5)).AND.(ITP.NE.STYPES(6))) GO TO 1000          PAL8    1529
      IF (SHIFT(FNB,21).NE.(TABLE(I,1).AND.700000008)) GO TO 1000        PAL8    1530
      STP = STP + 1                                                      PAL8    1531
      SORTT(STP) = (TABLE(I,1).AND.MASKL).OR.SHIFT(I,42)                 PAL8    1532
 1000 CONTINUE                                                           PAL8    1533
      IF (STP.EQ.0) RETURN                                               PAL8    1534
      CALL SORTIT                                                        PAL8    1535
      IF (LINC.GT.0) CALL HEAD                                           PAL8    1536
      WRITE(OUT,1)                                                       PAL8    1537
      LINC = 2                                                           PAL8    1538
      NLINK = 0                                                          PAL8    1539
      DO 1100 I = 1,STP                                                  PAL8    1540
      K = SHIFT(SORTT(I),-42)                                            PAL8    1541
      CALL LINK(K,3,0)                                                   PAL8    1542
      VAL = TABLE(K,1).AND.MASKL                                         PAL8    1543
      IF (VAL.EQ.0) GO TO 1090                                           PAL8    1544
      IF (NLINK.EQ.VAL) GO TO 1075                                       PAL8    1545
      ILH = SHIFT((VAL.AND.77000B),-6)                                   PAL8    1546
      IRH = VAL.AND.77B                                                  PAL8    1547
      CALL PACKI(1,2,ILH,IRH)                                            PAL8    1548
 1075 NLINK = VAL + 1                                                    PAL8    1549
      VAL = SHIFT(TABLE(K,1),27)                                         PAL8    1550
      ILH = SHIFT((VAL.AND.77000B),-6)                                   PAL8    1551
      IRH = VAL.AND.77B                                                  PAL8    1552
      CALL PACKI(1,2,ILH,IRH)                                            PAL8    1553
```

```
      1090 BACK = SHIFT((TABLE(K,2).AND.7777000000B),-12)                PAL8   1554
           FORW = TABLE(K,2).AND.MASKL                                   PAL8   1555
           IF ((TABLE(K,1).AND.700000B).EQ.100000B) GO TO 1100           PAL8   1556
           IF (BACK.GT.0) TABLE(BACK,2) = (TABLE(BACK,2).AND.            PAL8   1557
     60   *777777777777777700000B).OR.FORW                              PAL8   1558
           IF (FORW.GT.0) TABLE(FORW,2) = (TABLE(FORW,2).AND.            PAL8   1559
          *777777777777000077777B).OR.SHIFT(BACK,12)                     PAL8   1560
           IF (K.GT.TP) TP = K                                           PAL8   1561
           TABLE(K,1) = TABLE(K,2) = 0                                   PAL8   1562
     65    1100 CONTINUE                                                 PAL8   1563
           REFLP = 4096                                                  PAL8   1564
           RETURN                                                        PAL8   1565
           END                                                           PAL8   1566
```

```
      SUBROUTINE PACKA(IST,INU)                                          PAL8    1567
C                                                                        PAL8    1568
C        PDP-8 ASSEMBLER COMMON                                          PAL8    1569
C                                                                        PAL8    1570
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1571
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,       PAL8    1572
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS       PAL8    1573
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)          PAL8    1574
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                              PAL8    1575
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,   PAL8    1576
     *              IWPE,IWBE,IWPH                                       PAL8    1577
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                         PAL8    1578
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),             PAL8    1579
     *             INOPC(106),IO(106),STYPES(11)                         PAL8    1580
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),      PAL8    1581
     *             IMAGE(86),OPT(63),LINE(15)                            PAL8    1582
C                                                                        PAL8    1583
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                 PAL8    1584
     *          RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,           PAL8    1585
     *          BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,      PAL8    1586
     *          CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS         PAL8    1587
C                                                                        PAL8    1588
C                                                                        PAL8    1589
      L = SHIFT(INU,-1) + IST - 1                                        PAL8    1590
      DO 100 I = IST,L                                                   PAL8    1591
  100 OPT(I) = 0                                                         PAL8    1592
      IF (SYMB.EQ.0) RETURN                                              PAL8    1593
      IF (TYPE.EQ.4) SYMB = SHIFT(SYMB,-12)                              PAL8    1594
      L = (6 - WCC)*6 + 24                                               PAL8    1595
      SYMB = SHIFT(SYMB,L)                                               PAL8    1596
      L = 1                                                              PAL8    1597
      DO 200 I = 1,INU                                                   PAL8    1598
      K = 1                                                              PAL8    1599
      IF (I.GT.WCC) GO TO 175                                            PAL8    1600
      SYMB = SHIFT(SYMB,6)                                               PAL8    1601
      K = ASKII(SYMB.AND.77B).AND.77B                                    PAL8    1602
      IF ((I.AND.1).GT.0) K = SHIFT(K,6)                                 PAL8    1603
  175 OPT(IST+L) = OPT(IST+L).OR.K                                       PAL8    1604
      IF ((I.AND.1).EQ.0) L = L + 1                                      PAL8    1605
  200 CONTINUE                                                           PAL8    1606
      RETURN                                                             PAL8    1607
      END                                                                PAL8    1608
```

```
      SUBROUTINE PACKI(IAC,NOF,ILH,IRH)                                 PAL8    1609
C                                                                       PAL8    1610
C     PDP-8 ASSEMBLER COMMON                                            PAL8    1611
C                                                                       PAL8    1612
      COMMON/LINKS/SYMB,EOS,MCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,EC  ',NSP, PAL8    1613
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    1614
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    1615
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    1616
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    1617
      COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    1618
     *              IWPE,IWBE,IWPH                                      PAL8    1619
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    1620
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    1621
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    1622
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    1623
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    1624
C                                                                       PAL8    1625
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    1626
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    1627
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    1628
     *        CONA,PROGN,STYPES,MCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    1629
C                                                                       PAL8    1630
C                                                                       PAL8    1631
      IF (NOF.EQ.0) RETURN                                              PAL8    1632
      IF (ICARD.NE.1RP) RETURN                                          PAL8    1633
      IFRAME = ILH                                                      PAL8    1634
      K = NOF                                                           PAL8    1635
   20 K = K - 1                                                         PAL8    1636
      IF (POI.GT.0) GO TO 30                                            PAL8    1637
      POI = 1                                                           PAL8    1638
      IKI(POI) = 0                                                      PAL8    1639
   30 BIC = BIC + 1                                                     PAL8    1640
      IKI(POI) = SHIFT(IKI(POI),12).OR.IFRAME                           PAL8    1641
      IF (IAC.GT.0) CSM = CSM + IFRAME                                  PAL8    1642
      IF (BIC.LT.5) GO TO 50                                            PAL8    1643
      BIC = 0                                                           PAL8    1644
      POI = POI + 1                                                     PAL8    1645
      IF (POI.LE.20) GO TO 50                                           PAL8    1646
      CALL PTPUN(BOUT,IKI,20)                                           PAL8    1647
      POI = 0                                                           PAL8    1648
   50 CONTINUE                                                          PAL8    1649
      IF ((BIC.EQ.0).AND.(POI.GT.0)) IKI(POI) = 0                       PAL8    1650
      IF (K.EQ.0) RETURN                                                PAL8    1651
      IFRAME = IRH                                                      PAL8    1652
      GO TO 20                                                          PAL8    1653
      END                                                               PAL8    1654
```

```
      SUBROUTINE SAP                                                    PAL8    1655
C                                                                       PAL8    1656
C       PDP-8 ASSEMBLER COMMON                                          PAL8    1657
C                                                                       PAL8    1658
      COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1659
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    1660
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    1661
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    1662
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    1663
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    1664
     *              IWPE,IWBE,IWPH                                      PAL8    1665
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    1666
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    1667
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    1668
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    1669
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    1670
C                                                                       PAL8    1671
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    1672
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    1673
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    1674
     *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    1675
C                                                                       PAL8    1676
C                                                                       PAL8    1677
    3 FORMAT (3X,*SYMBOL*,5X,*VALUE*,6X,*REFERENCES*/)                  PAL8    1678
C                                                                       PAL8    1679
      STP = 0                                                           PAL8    1680
      DO 100 I=1,2000                                                   PAL8    1681
      ITP = TABLE(I,1).AND.MASKT                                        PAL8    1682
      IF (ITP.EQ.STYPES(3)) GO TO 80                                    PAL8    1683
      IF ((ITP.NE.STYPES(2)).AND.(ITP.NE.STYPES(4))) GO TO 100          PAL8    1684
   80 STP = STP + 1                                                     PAL8    1685
      SORTT(STP) = TABLE(I,1).AND.MASKS                                 PAL8    1686
  150 CONTINUE                                                          PAL8    1687
      IF ((SORTT(STP).AND.77000000000000000038).NE.0) GO TO 200         PAL8    1688
      SORTT(STP) = SHIFT(SORTT(STP),6)                                  PAL8    1689
      GO TO 150                                                         PAL8    1690
  200 SORTT(STP) = SHIFT(SORTT(STP),36).OR.SHIFT(I,42)                  PAL8    1691
  100 CONTINUE                                                          PAL8    1692
      IF (STP.EQ.0) RETURN                                              PAL8    1693
      CALL SORTIT                                                       PAL8    1694
      IF (LINC.GT.0) CALL HEAD                                          PAL8    1695
      WRITE(OUT,3)                                                      PAL8    1696
      LINC = 2                                                          PAL8    1697
      DO 300 I=1,STP                                                    PAL8    1698
      ITP = SHIFT(SORTT(I),-42)                                         PAL8    1699
      CALL LINK(ITP,3,0)                                                PAL8    1700
  300 CONTINUE                                                          PAL8    1701
      RETURN                                                            PAL8    1702
      END                                                               PAL8    1703
```

```
      SUBROUTINE SORTIT                                                 PAL8    1704
C                                                                       PAL8    1705
C        PDP-8 ASSEMBLER COMMON                                         PAL8    1706
C                                                                       PAL8    1707
      COMMON/LINKS/SYMB,EOS,MCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8    1708
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,      PAL8    1709
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS      PAL8    1710
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)         PAL8    1711
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                             PAL8    1712
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,  PAL8    1713
     *              IWPE,IWBE,IWPM                                      PAL8    1714
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                        PAL8    1715
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),            PAL8    1716
     *             INOPC(106),IO(106),STYPES(11)                        PAL8    1717
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),     PAL8    1718
     *             IMAGE(86),OPT(63),LINE(15)                           PAL8    1719
C                                                                       PAL8    1720
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                PAL8    1721
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,            PAL8    1722
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,       PAL8    1723
     *        CONA,PROGN,STYPES,MCC,ECODE,SORTT,STP,REFLP,PASS          PAL8    1724
C                                                                       PAL8    1725
C                                                                       PAL8    1726
      INTEGER IU(16),IL(16),T,TT,A(1900)                                PAL8    1727
      EQUIVALENCE (IU(1),IMAGE(1))                                      PAL8    1728
      EQUIVALENCE (IL(1),IMAGE(16))                                     PAL8    1729
      EQUIVALENCE (A(1),SORTT(1))                                       PAL8    1730
C                                                                       PAL8    1731
    2 I = M = 1                                                         PAL8    1732
      J = STP                                                           PAL8    1733
    5 IF (I .GE. J) GO TO 70                                            PAL8    1734
   10 K=I                                                               PAL8    1735
      IJ=(J+I)*.5                                                       PAL8    1736
      T=A(IJ)                                                           PAL8    1737
      IF ((A(I).AND.MASKV).LE.(T.AND.MASKV)) GO TO 20                   PAL8    1738
      A(IJ)=A(I)                                                        PAL8    1739
      A(I)=T                                                            PAL8    1740
      T=A(IJ)                                                           PAL8    1741
   20 L=J                                                               PAL8    1742
      IF ((A(J).AND.MASKV).GE.(T.AND.MASKV)) GO TO 40                   PAL8    1743
      A(IJ)=A(J)                                                        PAL8    1744
      A(J)=T                                                            PAL8    1745
      T=A(IJ)                                                           PAL8    1746
      IF ((A(I).AND.MASKV).LE.(T.AND.MASKV)) GO TO 40                   PAL8    1747
      A(IJ)=A(I)                                                        PAL8    1748
      A(I)=T                                                            PAL8    1749
      T=A(IJ)                                                           PAL8    1750
      GO TO 40                                                          PAL8    1751
   30 A(L)=A(K)                                                         PAL8    1752
      A(K)=TT                                                           PAL8    1753
   40 L=L-1                                                             PAL8    1754
      IF ((A(L).AND.MASKV).GT.(T.AND.MASKV)) GO TO 40                   PAL8    1755
      TT=A(L)                                                           PAL8    1756
   50 K=K+1                                                             PAL8    1757
      IF ((A(K).AND.MASKV).LT.(T.AND.MASKV)) GO TO 50                   PAL8    1758
```

```
      IF (K .LE. L) GO TO 30                                          PAL8    1759
      IF (J-I .LE. J-K) GO TO 60                                      PAL8    1760
      IL(M)=I                                                         PAL8    1761
      IU(M)=L                                                         PAL8    1762
60    I=K                                                             PAL8    1763
      M=M+1                                                           PAL8    1764
      GO TO 80                                                        PAL8    1765
   60 IL(M)=K                                                         PAL8    1766
      IU(M)=J                                                         PAL8    1767
65    J=L                                                             PAL8    1768
      M=M+1                                                           PAL8    1769
      GO TO 80                                                        PAL8    1770
   70 M=M-1                                                           PAL8    1771
      IF (M.EQ.0) GO TO 130                                           PAL8    1772
70    I=IL(M)                                                         PAL8    1773
      J=IU(M)                                                         PAL8    1774
   80 IF (J-I .GE. 11) GO TO 10                                       PAL8    1775
      IF (I.EQ.1) GO TO 5                                             PAL8    1776
      I=I-1                                                           PAL8    1777
75    90 I=I+1                                                        PAL8    1778
      IF(I .EQ. J) GO TO 70                                           PAL8    1779
      T=A(I+1)                                                        PAL8    1780
      IF ((A(I).AND.MASKV).LE.(T.AND.MASKV)) GO TO 90                 PAL8    1781
      K=I                                                             PAL8    1782
80    100 A(K+1)=A(K)                                                 PAL8    1783
      K=K-1                                                           PAL8    1784
      IF ((T.AND.MASKV).LT.(A(K).AND.MASKV)) GO TO 100                PAL8    1785
      A(K+1)=T                                                        PAL8    1786
      GO TO 90                                                        PAL8    1787
85    130 RETURN                                                      PAL8    1788
      END                                                             PAL8    1789
```

```
      SUBROUTINE SRPL(IE)                                                PAL8  1790
C                                                                        PAL8  1791
C     PDP-8 ASSEMBLER COMMON                                             PAL8  1792
C                                                                        PAL8  1793
      COMMON/LINKS/SYMB,EOS,MCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP, PAL8  1794
     *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,       PAL8  1795
     *             ERRC,CSM,FNB,IFORD,IFN,PROGN,LSP,STP,REFLP,PASS       PAL8  1796
      COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)          PAL8  1797
      COMMON/PARAMS/ICARD,UPD,ITFLAG,NEB(3)                              PAL8  1798
      COMMON/ERRORS/IWIC,IWDT,IWPO,IWRO,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,   PAL8  1799
     *              IWPE,IWBE,IWPH                                       PAL8  1800
      COMMON/USEDM/MASKE,MASKV,MASKL,MASKS,MASKT                         PAL8  1801
      COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),             PAL8  1802
     *             INOPC(106),IO(106),STYPES(11)                         PAL8  1803
      COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(16,32,2),SORTT(1900),      PAL8  1804
     *             IMAGE(86),OPT(63),LINE(15)                            PAL8  1805
C                                                                        PAL8  1806
      INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                 PAL8  1807
     *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,             PAL8  1808
     *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,        PAL8  1809
     *        CONA,PROGN,STYPES,MCC,ECODE,SORTT,STP,REFLP,PASS           PAL8  1810
C                                                                        PAL8  1811
C                                                                        PAL8  1812
    9 FORMAT (5X,*FIELD CHANGE TABLE FULL - JOB ABORTED*)                PAL8  1813
C                                                                        PAL8  1814
      IF (IE.EQ.0) GO TO 300                                             PAL8  1815
      LSP = LSP + 1                                                      PAL8  1816
      IF (LSP.LE.16) GO TO (100,200),IE                                  PAL8  1817
      WRITE(OUT,9)                                                       PAL8  1818
      CALL EXIT                                                          PAL8  1819
C                                                                        PAL8  1820
  100 DO 150 I = 1,2                                                     PAL8  1821
      LSAVE(LSP,1,I) = ZPAGE(I)                                          PAL8  1822
      DO 150 J = 1,31                                                    PAL8  1823
  150 LSAVE(LSP,J+1,I) = PAGER(J,I)                                      PAL8  1824
      GO TO 300                                                          PAL8  1825
C                                                                        PAL8  1826
  200 DO 250 I = 1,2                                                     PAL8  1827
      ZPAGE(I) = LSAVE(LSP,1,I)                                          PAL8  1828
      DO 250 J = 1,31                                                    PAL8  1829
  250 PAGER(J,I) = LSAVE(LSP,J+1,I)                                      PAL8  1830
      RETURN                                                             PAL8  1831
C                                                                        PAL8  1832
  300 ZPAGE(1) = 178                                                     PAL8  1833
      ZPAGE(2) = 2008                                                    PAL8  1834
      PAGER(1,1) = 2778                                                  PAL8  1835
      PAGER(1,2) = 4008                                                  PAL8  1836
      DO 350 I = 2,31                                                    PAL8  1837
      DO 350 J = 1,2                                                     PAL8  1838
  350 PAGER(I,J) = PAGER(I-1,J) + 2008                                   PAL8  1839
      LOC = 2008                                                         PAL8  1840
      RETURN                                                             PAL8  1841
      END                                                                PAL8  1842
```

```
                BLOCK DATA SET                                                  PAL8    1843
      C                                                                         PAL8    1844
      C         INITIALIZE ALL STANDARD CONSTANTS                               PAL8    1845
      C                                                                         PAL8    1846
      C                                                                         PAL8    1847
      C         PDP-8 ASSEMBLER COMMON                                          PAL8    1848
      C                                                                         PAL8    1849
            COMMON/LINKS/SYMB,EOS,WCC,TYPE,FLOC,LP,HASHF,LOC,VAL,TP,ECODE,NSP,  PAL8    1850
           *             RADIX,SFLAG,REFP,BIC,PAGE,LINC,POI,CONA,CPAGEN,        PAL8    1851
           *             ERRC,CSM,FNB,IFORD,IFN,PROGN,_SP,STP,REFLP,PASS        PAL8    1852
            COMMON/HARRAY/TABLE(2000,2),IPROG(6),REFTAB(4095),IKI(20)           PAL8    1853
            COMMON/PARAMS/ICARD,UPD,ITFLAG,NER(3)                               PAL8    1854
            COMMON/ERRORS/IWIC,IWOT,IWPO,IWRD,IWUA,IWII,IWIP,IWIR,IWIO,IWZE,    PAL8    1855
           *              IWPE,IW95,IWPH                                        PAL8    1856
            COMMON/USEOM/MASKE,MASKV,MASKL,MASKS,MASKT                          PAL8    1857
            COMMON/CONST/IN,OUT,ASB,IT,BOUT,VERN,ASKII(63),IC(63),              PAL8    1858
           *             INDPC(106),IO(106),STYPES(11)                          PAL8    1859
            COMMON/SPACE/ZPAGE(2),PAGER(31,2),LSAVE(15,32,2),SORTT(1900),       PAL8    1860
           *             IMAGE(96),OPT(63),LINE(15)                             PAL8    1861
      C                                                                         PAL8    1862
            INTEGER SYMB,EOS,TYPE,FLOC,TABLE,HASHF,VAL,TP,OPT,                  PAL8    1863
           *        RADIX,UPD,REFTAB,REFP,OUT,ASB,BOUT,VERN,ASKII,              PAL8    1864
           *        BIC,PAGE,SFLAG,ZPAGE,PAGER,CPAGEN,ERRC,CSM,FNB,POI,         PAL8    1865
           *        CONA,PROGN,STYPES,WCC,ECODE,SORTT,STP,REFLP,PASS            PAL8    1866
      C                                                                         PAL8    1867
      C                                                                         PAL8    1868
            DATA VERN/10HG 11/06/73/                                            MIS008     7
      C                                                                         PAL8    1870
      C         *****                                                           PAL8    1871
      C         * TAPE5 = SOURCE DATA INPUT                                     PAL8    1872
      C         * TAPE6 = PRINT OUTPUT                                          PAL8    1873
      C         * TAPE10 = SOURCE LINES                                         PAL8    1874
      C         * TAPE20 = OPERATION FIELDS                                     PAL8    1875
      C         * TAPE30 = BINARY OUTPUT                                        PAL8    1876
      C         *****                                                           PAL8    1877
      C                                                                         PAL8    1878
            DATA IN/5/                                                          PAL8    1879
            DATA OUT/6/                                                         PAL8    1880
            DATA ASB/10/                                                        PAL8    1881
            DATA IT/20/                                                         PAL8    1882
            DATA BOUT/30/                                                       PAL8    1883
      C                                                                         PAL8    1884
      C         *****                                                           PAL8    1885
      C         * IC - ILLEGAL CHARACTER OR WORD IN STATEMENT                   PAL8    1886
      C         * DT - LABEL USED MORE THAN ONCE                               PAL8    1887
      C         * PD - LOCATION ADDRESS GREATER THAN 87777                      PAL8    1888
      C         * RD - REDEFINITION                                            PAL8    1889
      C         * UA - UNDEFINED ADDRESS                                       PAL8    1890
      C         * II - INSTRUCTION IGNORED                                     PAL8    1891
      C         * IP - ILLEGAL PAGE REFERENCE                                  PAL8    1892
      C         * IR - ILLEGAL REFERENCE                                       PAL8    1893
      C         * IO - ILLEGAL ORIGIN SETTING                                  PAL8    1894
      C         * ZF - PAGE ZERO EXCEEDED                                      PAL8    1895
      C         * PE - CURRENT PAGE EXCEEDED                                   PAL8    1896
      C         * BE - ERROR IN LITERAL                                        PAL8    1897
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      C        * PH - PHASE ERROR                                                    PAL8    1898
      C        *****                                                                 PAL8    1899
      C                                                                              PAL8    1900
            DATA IWIC/5547110347555555000008/                                        PAL8    1901
   60       DATA IWDT/5547042447555555000008/                                        PAL8    1902
            DATA IWPO/5547201747555555000008/                                        PAL8    1903
            DATA IWRD/5547220447555555000008/                                        PAL8    1904
            DATA IWUA/5547250147555555000008/                                        PAL8    1905
            DATA IWII/5547111147555555000008/                                        PAL8    1906
   65       DATA IWIP/5547112047555555000008/                                        PAL8    1907
            DATA IWIR/5547112247555555000008/                                        PAL8    1908
            DATA IWIO/5547111747555555000008/                                        PAL8    1909
            DATA IWZE/5547320547555555000008/                                        PAL8    1910
            DATA IWPE/5547200547555555000008/                                        PAL8    1911
   70       DATA IWBE/5547620547555555000008/                                        PAL8    1912
            DATA IWPH/5547201047555555000008/                                        PAL8    1913
      C                                                                              PAL8    1914
      C        ASKII CODE CONVERSION TABLE                                           PAL8    1915
      C                                                                              PAL8    1916
   75       DATA ASKII/3018,3028,3038,3048,3058,3068,3078,3108,3118,3128,3138,      PAL8    1917
           *           3148,3158,3168,3178,3208,3218,3228,3238,3248,3258,3268,      PAL8    1918
           *           3278,3308,3318,3328,2608,2618,2628,2638,2648,2658,2668,      PAL8    1919
           *           2678,2708,2718,2538,2558,2528,2578,2508,2518,2448,2758,      PAL8    1920
           *           2408,2548,2568,2468,3338,3358,2728,2438,3378,2478,2428,      PAL8    1921
   80      *           3368,2418,2748,2768,2458,3348,2778,2738/                     PAL8    1922
      C                                                                              PAL8    1923
      C        *****                                                                 PAL8    1924
      C        * CODES                                                              PAL8    1925
      C        *    1 = ILLEGAL CHARACTER  ¤ ¢ ↗ ∨ ≥ ¬                              PAL8    1926
   85 C        *    2 = ALPHABETIC CHARACTER                                        PAL8    1927
      C        *    3 = NUMERIC CHARACTER                                           PAL8    1928
      C        *    4 = SPECIAL CHARACTER  ,                                        PAL8    1929
      C        *    5 = SPECIAL CHARACTER  =                                        PAL8    1930
      C        *    6 = SPECIAL CHARACTER  + - , Ξ ↓ ↑ ≤ ( ) [ ] < > ^              PAL8    1931
   90 C        *    7 = SPECIAL CHARACTER  /                                        PAL8    1932
      C        *    8 = SPECIAL CHARACTER  ;                                        PAL8    1933
      C        *    9 = SPECIAL CHARACTER  *                                        PAL8    1934
      C        *    10 = SPECIAL CHARACTER  $                                       PAL8    1935
      C        *    11 = SPECIAL CHARACTER  A BLANK                                 PAL8    1936
   95 C        *****                                                                 PAL8    1937
      C                                                                              PAL8    1938
            DATA IC/26*2,10*3,2*6,9,7,2*6,10,5,11,4,4*6,4*1,6*6,2*1,8/               PAL8    1939
      C                                                                              PAL8    1940
            DATA MASKE/7777777777777777700008/                                       PAL8    1941
  100       DATA MASKV/777777777778/                                                 PAL8    1942
            DATA MASKL/77778/                                                        PAL8    1943
            DATA MASKS/7777777777770000000008/                                       PAL8    1944
            DATA MASKT/7700008/                                                      PAL8    1945
      C                                                                              PAL8    1946
  105       DATA STYPES/0000008,1400008,2300008,0400008,3200008,1700008,           PAL8    1947
           *           2000008,1500008,0100008,0200008,2200008/                     PAL8    1948
      C                                                                              PAL8    1949
      C        *****                                                                 PAL8    1950
      C        * PERMANENT SYMBOL TABLE                                             PAL8    1951
  110 C        *                                                                     PAL8    1952
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      C     *   AND   0000   LOGICAL AND                                  PAL8   1953
      C     *   TAD   1000   TWO S COMPLEMENT ADD                         PAL8   1954
      C     *   ISZ   2000   INCREMENT AND SKIP IF ZERO                   PAL8   1955
      C     *   DCA   3000   DEPOSIT AND CLEAR AC                         PAL8   1956
115   C     *   JMS   4000   JUMP TO SUBROUTINE                           PAL8   1957
      C     *   JMP   5000   JUMP                                         PAL8   1958
      C     *   FEXT  0000   FLOATING EXIT  (1)                           PAL8   1959
      C     *   FADD  1000   FLOATING ADD  (1)                            PAL8   1960
      C     *   FSUB  2000   FLOATING SUBTRACTION  (1)                    PAL8   1961
120   C     *   FMPY  3000   FLOATING MULTIPLY  (1)                       PAL8   1962
      C     *   FDIV  4000   FLOATING DIVIDE  (1)                         PAL8   1963
      C     *   FGET  5000   FLOATING GET  (1)                            PAL8   1964
      C     *   FPUT  6000   FLOATING PUT  (1)                            PAL8   1965
      C     *   FNOR  7000   FLOATING NORMALIZE  (1)                      PAL8   1966
125   C     *   OPR   7000   NO OPERATION  (2)                            PAL8   1967
      C     *   NOP   7000   NO OPERATION                                 PAL8   1968
      C     *   IAC   7001   INCREMENT AC                                 PAL8   1969
      C     *   RAL   7004   ROTATE AC AND LINK LEFT ONE                  PAL8   1970
      C     *   RTL   7006   ROTATE AC AND LINK LEFT TWO                  PAL8   1971
130   C     *   RAR   7010   ROTATE AC AND LINK RIGHT ONE                 PAL8   1972
      C     *   RTR   7012   ROTATE AC AND LINK RIGHT TWO                 PAL8   1973
      C     *   CML   7020   COMPLEMENT LINK                              PAL8   1974
      C     *   CMA   7040   COMPLEMENT AC                                PAL8   1975
      C     *   CLL   7100   CLEAR LINK                                   PAL8   1976
135   C     *   CLA   7200   CLEAR AC                                     PAL8   1977
      C     *   HLT   7402   HALTS THE COMPUTER                           PAL8   1978
      C     *   OSR   7404   INCLUSIVE OR SR WITH AC                      PAL8   1979
      C     *   SKP   7410   SKIP UNCONDITIONALLY                         PAL8   1980
      C     *   SNL   7420   SKIP ON NONZERO LINK                         PAL8   1981
140   C     *   SZL   7430   SKIP ON ZERO LINK                            PAL8   1982
      C     *   SZA   7440   SKIP ON ZERO AC                              PAL8   1983
      C     *   SNA   7450   SKIP ON NONZERO AC                           PAL8   1984
      C     *   SMA   7500   SKIP ON MINUS AC                             PAL8   1985
      C     *   SPA   7510   SKIP ON ZERO OR POSITIVE AC                  PAL8   1986
145   C     *   CIA   7041   COMPLEMENT AND INCREMENT AC                  PAL8   1987
      C     *   STL   7120   SET LINK TO 1                                PAL8   1988
      C     *   GLK   7204   GET LINK, PUT LINK IN AC, BIT 11             PAL8   1989
      C     *   STA   7240   SET AC TO -1                                 PAL8   1990
      C     *   LAS   7604   LOAD AC WITH SR                              PAL8   1991
150   C     *   IOT   6000     (2)                                        PAL8   1992
      C     *   ION   6001   TURN INTERRUPT PROCESSOR ON                  PAL8   1993
      C     *   IOF   6002   DISABLE INTERRUPT PROCESSOR                  PAL8   1994
      C     *   KSF   6031   SKIP ON KEYBOARD FLAG                        PAL8   1995
      C     *   KCC   6032   CLEAR KEYBOARD FLAG AND AC                   PAL8   1996
155   C     *   KRS   6034   READ KEYBOARD BUFFER - STATIC                PAL8   1997
      C     *   KRB   6036   READ KEYBOARD BUFFER - DYNAMIC               PAL8   1998
      C     *   TSF   6041   SKIP ON TELEPRINTER FLAG                     PAL8   1999
      C     *   TCF   6042   CLEAR TELEPRINTER FLAG                       PAL8   2000
      C     *   TPC   6044   LOAD TELEPRINTER AND PRINT                   PAL8   2001
160   C     *   TLS   6046   LOAD TELEPRINTER SEQUENCE                    PAL8   2002
      C     *   RSF   6011   SKIP ON READER FLAG                          PAL8   2003
      C     *   RRB   6012   READ READER BUFFER AND CLEAR READER FLAG     PAL8   2004
      C     *   RFC   6014   READER FETCH CHARACTER                       PAL8   2005
      C     *   PSF   6021   SKIP ON PUNCH FLAG                           PAL8   2006
165   C     *   PCF   6022   CLEAR ON PUNCH FLAG                          PAL8   2007
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                C       *   PPC     6024    LOAD PUNCH BUFFER AND PUNCH CHARACTER          PAL8    2058
                C       *   PLS     6026    LOAD PUNCH BUFFER SEQUENCE                     PAL8    2059
                C       *   DTRA    6761    CONTENTS OF STATUS REGISTER IS ORED INTO AC    PAL8    2010
                C       *                   BITS 0 - 9                                     PAL8    2011
            170 C       *   DTCA    6762    CLEAR STATUS REG. A, ALL FLAGS UNDISTURBED     PAL8    2012
                C       *   DTXA    6764    STATUS REGISTER A LOADED BY EXCLUSIVE OR       PAL8    2013
                C       *                   FROM AC, IF AC BIT 10 = 0, CLEAR ERROR         PAL8    2014
                C       *                   FLAGS, IF AC BIT 11 = 0, DEC-TAPE CONTROL      PAL8    2015
                C       *                   FLAG IS CLEARED                                PAL8    2016
            175 C       *   DTLA    6766    COMBINATION OF DTCA AND DTXA  (3)              PAL8    2017
                C       *   DTSF    6771    SKIP IF ERROR FLAG OR DEC-TAPE CONTROL         PAL8    2018
                C       *                   FLAG IS 1                                      PAL8    2019
                C       *   DTRB    6772    CONTENTS OF STATUS REGISTER B IS ORED INTO     PAL8    2020
                C       *                   AC                                             PAL8    2021
            180 C       *   DTLB    6774    MEMORY FIELD PORTION OF STATUS REGISTER B      PAL8    2022
                C       *                   LOADED FROM AC BITS 6 - 8                      PAL8    2023
                C       *   DCMA    6601    CLEAR DISK MEMORY REQUEST AND INTERRUPT        PAL8    2024
                C       *                   FLAGS                                          PAL8    2025
                C       *   DMAR    6603    LOAD DISK FROM AC, CLEAR AC READ INTO CORE,    PAL8    2026
            185 C       *                   CLEAR INTERRUPT FLAG                           PAL8    2027
                C       *   DMAW    6605    LOAD DISK FROM AC, WRITE ONTO DISK FROM        PAL8    2028
                C       *                   CORE, CLEAR INTERRUPT FLAG                     PAL8    2029
                C       *   DCEA    6611    CLEAR DISK EXTENDED ADDRESS AND MEMORY         PAL8    2030
                C       *                   ADDRESS EXTENSION REGISTER                     PAL8    2031
            190 C       *   DSAC    6612    SKIP IF ADDRESS CONFIRMED FLAG = 1             PAL8    2032
                C       *   DEAL    6615    CLEAR DISK EXTENDED ADDRESS AND MEMORY         PAL8    2033
                C       *                   ADDRESS EXTENSION REGISTER AND LOAD SAME       PAL8    2034
                C       *                   FROM AC                                        PAL8    2035
                C       *   DEAC    6616    CLEAR AC, LOAD AC FROM DISK EXTENDED           PAL8    2036
            195 C       *                   ADDRESS REGISTER, SKIP IF ADDRESS              PAL8    2037
                C       *                   CONFIRMED FLAG = 1                             PAL8    2038
                C       *   DFSE    6621    SKIP IF PARITY ERROR, DATA REQUEST LATE,       PAL8    2039
                C       *                   OR WRITE LOCK SWITCH FLAG = 0 - NO ERROR       PAL8    2040
                C       *   DFSC    6622    SKIP IF COMPLETION FLAG = 1                    PAL8    2041
            200 C       *   DMAC    6626    CLEAR AC, LOAD AC FROM DISK MEMORY ADDRESS     PAL8    2042
                C       *                   REGISTER                                       PAL8    2043
                C       *   CDF     6201    CHANGE TO DATA FIELD N                         PAL8    2044
                C       *   CIF     6202    CHANGE TO INSTRUCTION FIELD N                  PAL8    2045
                C       *   RDF     6214    READ DATA FIELD                                PAL8    2046
            205 C       *   RIF     6224    READ INSTRUCTION FIELD                         PAL8    2047
                C       *   RIB     6234    READ INTERRUPT BUFFER                          PAL8    2048
                C       *   RMF     6244    RESTORE MEMORY FIELD                           PAL8    2049
                C       *   SMP     6101    SKIP IF MEMORY PARITY ERROR FLAG = 0  (3)      PAL8    2050
                C       *   CMP     6104    CLEAR MEMORY PARITY ERROR FLAG  (3)            PAL8    2051
            210 C       *                                                                  PAL8    2052
                C       *   DECIMAL   2     SET DECIMAL RADIX                              PAL8    2053
                C       *   OCTAL     1     SET OCTAL RADIX                                PAL8    2054
                C       *   FIELD     3     LOAD INTO FIELD N                              PAL8    2055
                C       *   PAUSE     9     PAUSE  (4)                                     PAL8    2056
            215 C       *   I         5     INDIRECT REFERENCE                             PAL8    2057
                C       *   Z         4     PAGE ZERO REFERENCE                            PAL8    2058
                C       *   $         9     END OF PROGRAM INDICATOR                       PAL8    2059
                C       *   EXPUNGE   9     DELETE PERMANENT SYMBOL TABLE EXCEPT           PAL8    2060
                C       *                   PSUEDO OP. CODES  (4)                          PAL8    2061
            220 C       *   FIXTAB    9     APPEND ALL DEFINED SYMBOLS TO PERMANENT        PAL8    2062
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                C       *                       SYMBOL TABLE  (4)                                      PAL8    2063
                C       *       FIXMRI    9     FIX MEMORY REFERENCE INSTRUCTION  (4) (3)            PAL8    2064
                C       *       EJECT     6     CONTINUE SOURCE LISTING ON NEXT PAGE                  PAL8    2065
                C       *       PAGE      7     SET ORIGIN TO BEGINNING OF PAGE N  (2)                PAL8    2066
    225         C       *       XLIST     9     DO NOT LIST THIS PART OF SOURCE  (4) (2)              PAL8    2067
                C       *       TEXT      8     ASSEMBLE CHARACTER STRING  (2)                        PAL8    2068
                C       *       ZBLOCK    10    RESERVE N WORDS OF MEMORY CONTAINING                  PAL8    2069
                C       *                       ZEROS  (5)                                            PAL8    2070
                C       *       IFDEF     11    ASSEMBLE CODE IF SYMBOL DEFINED  (5)                  PAL8    2071
    230         C       *       IFNDEF    12    ASSEMBLE CODE IF SYMBOL NOT DEFINED  (5)              PAL8    2072
                C       *       IFZERO    13    ASSEMBLE CODE IF EXPRESSION = 0  (5)                  PAL8    2073
                C       *       IFNZRO    14    ASSEMBLE CODE IF EXPRESSION ≠ 0  (5)                  PAL8    2074
                C       *       OTORG     15    OUTPUT TWO FRAME OCTAPE BLOCK NUMBER                  PAL8    2075
                C       *                       ON THE BINARY TAPE  (5)                               PAL8    2076
    235         C       *       DEVICE    16    NAME DEVICE  (5)                                      PAL8    2077
                C       *       FILENAME  17    NAME FILE  (5)                                        PAL8    2078
                C       *       NOPUNCH   18    CEASE BINARY OUTPUT  (5)                              PAL8    2079
                C       *       ENPUNCH   19    CLEAR NOPUNCH CONDITION  (5)                          PAL8    2080
                C       *                                                                             PAL8    2081
    240         C       *       (1)  -  NOT PRESENT IN 4K PAL-D                                       PAL8    2082
                C       *               (DEACTIVATED IN THIS ASSEMBLER)                               PAL8    2083
                C       *       (2)  -  NOT PRESENT IN PAL III                                        PAL8    2084
                C       *       (3)  -  NOT PRESENT IN 4K OR 8K PAL-D                                 PAL8    2085
                C       *       (4)  -  IGNORED BY THIS ASSEMBLER                                     PAL8    2086
    245         C       *       (5)  -  NOT PRESENT IN 4K ASSEMBLERS                                  PAL8    2087
                C       *****                                                                         PAL8    2088
                C                                                                                     PAL8    2089
                      DATA INOPC/3RAND,3RTAD,3RISZ,3RDCA,3RJMS,3RJMP,4RFEXT,4RFADD,                   PAL8    2090
                     *            4RFSUB,4RFMPY,4RFDIV,4RFGET,4RFPUT,4RFNOR,                          PAL8    2091
    250              *            3ROPR,3RNOP,3RIAC,3RRAL,3RRTL,3RRAR,3RRTR,3RCML,3RCMA,              PAL8    2092
                     *            3RCLL,3RCLA,                                                        PAL8    2093
                     *            3RHLT,3ROSR,3RSKP,3RSNL,3RSZL,3RSZA,3RSNA,3RSMA,3RSPA,              PAL8    2094
                     *            3RCIA,3RSTL,3RGLK,3RSTA,3RLAS,                                      PAL8    2095
                     *            3RIOT,3RION,3RIOF,3RKSF,3RKCC,3RKRS,3RKRB,3RTSF,3RTCF,              PAL8    2096
    255              *            3RTPC,3RTLS,3RRSF,3RRRB,3RRFC,3RPSF,3RPCF,3RPPC,3RPLS,              PAL8    2097
                     *            4RDTRA,4RDTCA,4RDTXA,4RDTLA,4RDTSF,4RDTRB,4RDTLB,                   PAL8    2098
                     *            4RDCMA,4RDMAR,4RDMAW,4RDCEA,4RDSAC,4RDEAL,4RDEAC,                   PAL8    2099
                     *            4RDFSE,4RDFSC,4RDMAC,3RCDF,3RCIF,3RRDF,3RRIF,3RRIB,                 PAL8    2100
                     *            3RRMF,3RSMP,3RCMP,                                                  PAL8    2101
    260              *            6RDECIMA,5ROCTAL,5RFIELD,5RPAUSE,1RI,1RZ,1RS,6REXPUNC,              PAL8    2102
                     *            6RFIXTAB,6RFIXMRI,5REJECT,4RPAGE,5RXLIST,4RTEXT,                    PAL8    2103
                     *            6RZBLOCK,5RIFDEF,6RIFNDEF,6RIFZERO,6RIFNZRO,5RDTORG,                PAL8    2104
                     *            6RDEVICE,6RFILENA,6RNOPUNC,6RENPUNC/                                PAL8    2105
                C                                                                                     PAL8    2106
    265               DATA IO/1500008,1510008,1520008,1530008,1540008,1550008,0600008,                  PAL8    2107
                     *       0610008,0620008,0630008,0640008,0650008,0660008,0670008,                   PAL8    2108
                     *       0170008,0170008,0170018,0170048,0170068,0170108,0170128,                   PAL8    2109
                     *       0170208,0170408,0171008,0172008,0274028,0274048,0274108,                   PAL8    2110
                     *       0274208,0274308,0274408,0274508,0275008,0275108,                           PAL8    2111
    270              *       0170418,0171208,0172048,0172408,0276048,                                   PAL8    2112
                     *       2260008,2260018,2260028,2260318,2260328,2260348,2260368,                   PAL8    2113
                     *       2260418,2260428,2260448,2260468,2260118,2260128,2260148,                   PAL8    2114
                     *       2260218,2260228,2260248,2260268,2267618,2267628,2267648,                   PAL8    2115
                     *       2267668,2267718,2267728,2267748,                                           PAL8    2116
    275              *       2266018,2266038,2266058,2266118,                                           PAL8    2117
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                     *       2266128,2266158,2266168,2266218,2266228,2266268,2262018,    PAL8    2118
                     *       2262028,2262148,2262248,2262348,2262448,2261018,2261048,    PAL8    2119
                     *       2000028,2000018,2000038,2000118,2000058,2000048,2000118,    PAL8    2120
                     *       2000118,2000118,2000118,2000068,2000078,2000118,2000108,    PAL8    2121
                     *       2000128,2000138,2000148,2000158,2000168,2000178,2000208,    PAL8    2122
280                  *       2000218,2000228,2000238/                                    PAL8    2123
                                                                                         PAL8    2124
                C                                                                        PAL8    2125
                      END
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                                       IDENT    PTPUN                                            PAL8   2126
                     000063    PROGRAM LENGTH

                               BLOCKS

           000000    000063    PROGRAM*   LOCAL

                               ENTRY POINTS

                                  000002 PTPUN

                               EXTERNAL SYMBOLS

                               CPC        GETBA

                                       ENTRY    PTPUN                                            PAL8   2127
                      0001000  LENBUF  EQU      512                                              PAL8   2128
  000000  00000000000000000000  AZERO  DATA     0                                                PAL8   2129
  000001  20242025160000000002 + TRACE. VFD     42/0LPTPUN,18/PTPUN                              PAL8   2130
  000002  00000000000000000000  PTPUN  DATA     0                                                PAL8   2131
  000003  74600                        SX6      A0                                               PAL8   2132
             5160000000 +              SA6      AZERO          SAVE A0                           PAL8   2133
                      54210            SA2      A1                                               PAL8   2134
  000004  63120                        SB1      X2             B1 = ADDRESS OF FILE NAME         PAL8   2135
             5021000001                SA2      A1+1                                             PAL8   2136
                      73620            SX6      X2                                               PAL8   2137
  000005  5160000056 +                 SA6      FWA            FWA OF USERS ARRAY                PAL8   2138
                 5021000002            SA2      A1+2                                             PAL8   2139
  000006  53320                        SA3      X2                                               PAL8   2140
             73730                     SX7      X3                                               PAL8   2141
                 5170000060 +          SA7      NWDS           NUMBER OF WORDS TO BE TRANSFERRED PAL8   2142
  000007  0100000013 +                 RJ       INITTP                                           PAL8   2143
  000010  0100000030 +                 RJ       FILBUF                                           PAL8   2144
  000011  5110000000 +         EXIT    SA1      AZERO                                            PAL8   2145
                 53010                 SA0      X1             RESTORE A0                        PAL8   2146
  000012  0400000002 +                 EQ       PTPUN                                            PAL8   2147
  000013  00000000000000000000  INITTP DATA     0                                                PAL8   2148
  000014  67201                        SB2      -B1            COMPILEMENT ADDRESS OF FILE NAME  PAL8   2149
             0100000000 X              RJ       =XGETBA                                          PAL8   2150
  000015  0720000011 +                 NG       B2,EXIT        ERROR, IF NOT FOUND               PAL8   2151
                 76620                 SX6      B2                                               PAL8   2152
  000016  5160000057 +                 SA6      FET            STORE FET ADDRESS                 PAL8   2153
                 56020                 SA0      B2                                               PAL8   2154
                      43063            MX0      60-9                                             PAL8   2155
  000017  54200                        SA2      A0                                               PAL8   2156
             15620                     BX6      -X0*X2                                           PAL8   2157
                 0316000013 +          NZ       X6,INITTP      EXIT, IF NOT THE FIRST TIME CALLED PAL8  2158
  000020  5010000001                   SA1      A0+1                                             PAL8   2159
                 43260                 MX2      48                                               PAL8   2160
                      20230            LX2      24                                               PAL8   2161
  000021  11312                        BX3      X1*X2                                            PAL8   2162
             5120000052 +              SA2      T30PAR                                           PAL8   2163
                      12632            BX6      X3+X2                                            PAL8   2164
  000022  5060000001                   SA6      A0+1                                             PAL8   2165
                 43600                 MX6      0                                                PAL8   2166
  000023  5060000007                   SA6      A0+7           PUT ZERO IN FET+7                 PAL8   2167
                 54100                 SA1      A0                                               PAL8   2168
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                43062              MX0    2                                    PAL8
000024 20602                       LX0    2                                    PAL8
          12610                    BX6    X1+X0                                PAL8
             54600                 SA6    A0         SET BITS 0+1 IN FET       PAL8
                54100              SA1    A0                                   PAL8
000025 0100000000 X                RJ     =XCPC                                PAL8
000026 00000420000000000144        VFD    18/4,2/1,22/0,18/144B                PAL8
000027 0400000013 +                EQ     INITTP                               PAL8
000030 00000000000000000000 FILBUF DATA   0                                    PAL8
000031 56220                       SA2    B2                                   PAL8
          43072                    MX0    60-2                                 PAL8
             16720                 BX7    -X0*X2     SET BINARY AND NOT BUSY   PAL8
                54720              SA7    A2                                   PAL8
000032 6170000001                  SB7    1                                    PAL8
             66300                 SB3    B0         ZERO WDCT                 PAL8
000033 5150000056 +         FILMO  SA5    FWA                                  PAL8
             53050                 SA0    X5                                   PAL8
000034 5110000057 +                SA1    FET                                  PAL8
             53217                 SA2    X1+B7      LOAD *FIRST*              PAL8
                63120              SB1    X2                                   PAL8
000035 6161001000                  SB6    B1+LENBUF  LIMIT                     PAL8
             54327                 SA3    A2+B7                                PAL8
                63530              SB5    X3         *IN*                      PAL8
000036 5140000060 +                SA4    NWDS                                 PAL8
             63440                 SB4    X4         NWDS                      PAL8
000037 0434000054 +                EQ     B3,B4,ALLIN                          PAL8
000040 54403                LTRANS SA4    A0+B3      LOAD NEXT WORD            PAL8
          10644                    BX6    X4                                   PAL8
             56650                 SA6    B5                                   PAL8
                66337              SB3    B3+B7      INCREMENT WDCT            PAL8
000041 66557                       SB5    B5+B7      INCREMENT *IN*            PAL8
          0465000043 +             EQ     B6,B5,BFULL                          PAL8
000042 0434000054 +                EQ     B3,B4,ALLIN                          PAL8
             0400000040 +          EQ     LTRANS     GET NEXT WORD             PAL8
000043 76630                BFULL  SX6    B3                                   PAL8
          5160000061 +             SA6    SWDCT      SAVE WDCT                 PAL8
000044 5120000057 +                SA2    FET                                  PAL8
             76750                 SX7    B5                                   PAL8
000045 5272000002                  SA7    X2+2       SET *IN* TO FIRST+LENBUF  PAL8
             53120                 SA1    X2                                   PAL8
000046 0100000000 X                RJ     =XCPC                                PAL8
000047 00000220000000000014        VFD    18/2,2/1,34/0,6/14B                  PAL8
000050 6170000001                  SB7    1                                    PAL8
             5150000057 +          SA5    FET                                  PAL8
000051 53357                       SA3    X5+B7      LOAD *FIRST*              PAL8
          10633                    BX6    X3                                   PAL8
             54637                 SA6    A3+B7      *IN* = *FIRST*            PAL8
                54667              SA6    A6+B7      *OUT* = *FIRST*           PAL8
000052 5120000061 +                SA2    SWDCT                                PAL8
             63320                 SB3    X2         RESTORE WDCT              PAL8
000053 0400000033 +                EQ     FILMO                                PAL8
000054 5150000057 +         ALLIN  SA5    FET                                  PAL8
             76650                 SX6    B5                                   PAL8
000055 5265000002                  SA6    X5+2       UPDATE *IN*               PAL8
             0400000030 +          EQ     FILBUF     EXIT                      PAL8
000056 00000000000000000000 FWA    DATA   0                                    PAL8
000057 00000000000000000000 FET    DATA   0                                    PAL8
```

VER 1.1 PTPJN

```
000050  0000000000000000.000    NWDS    DATA    6                          PAL8    2226
000051  0000000000000000.000    SWDCT   DATA    1                          PAL8    2227
000052  0000000023000000.000    T3OPAR  VFD     24/0,12/00238,24/0         PAL8    2228
000053                          END                                        PAL8    2229

                        123171  UNUSED STORAGE      164 STATEMENTS    18  SYMBOLS
```

```
                               IDENT     READCC
                    000210   PROGRAM LENGTH

                             BLOCKS

          000000    000210   PROGRAM*  LOCAL

                             ENTRY POINTS

                               000001 READCC

                             EXTERNAL SYMBOLS

                             GETBA     CPC

                                       ENTRY     READCC                                   PAL8
000030  2265010403630000000C1 +  TRACE.    VFD       42/0LREADCC,18/READCC                  PAL8
000031  00000000000000000000     READCC    DATA      0                                      PAL8
000032  54210                            SA2       A1                                     PAL8
             10622                       BX5       X2                                     PAL8
                  5160000200 +           SA6       LISTH      SAVE PARAMETER LIST HEAD    PAL8
                                 *                                                        PAL8
000003                                   MESSAGE   70B        PUT CONTROL CARD IN THE DAYFILE  PAL8
                                 *                                                        PAL8
000035  43006                            MX0       6                                      PAL8
             20006                       LX0       6          (X0) = CHARACTER MASK       PAL8
                  66300                  SB3       B0         (B3) = CC WORD INDEX        PAL8
000036  6140000006                       SB4       6          (B4) = WORD POSITION INDEX  PAL8
                  6160000010             SB6       8                                      PAL8
000037  6170000001                       SB7       1                                      PAL8
                  5123000070             SA2       70B+B3                                 PAL8
000010  20236                            LX2       30                                     PAL8
             11320                       BX3       X2*X0                                  PAL8
                  7150000057             SX5       1R.                                    PAL8
000011  37553                            IX5       X5-X3                                  PAL8
             0305000157 +                ZR        X5,CLOSE   JUMP IF ONLY DEFAULT PARAMETERS  PAL8
000012  7150000051                       SX5       1R(                                    PAL8
                  37553                  IX5       X5-X3                                  PAL8
000013  0315000153 +                     NZ        X5,ERROR   THERE MUST BE A ( HERE      PAL8
                                 *                                                        PAL8
000014  0100000101 +             SHIFTA  RJ        GETNC                                  PAL8
000015  5140000172 +                     SA4       POSSABLE                               PAL8
                  6150000010             SB5       8                                      PAL8
000016  0100000106 +                     RJ        MATCH                                  PAL8
000017  0250000020 +                     JP        LISTA+B5                               PAL8
000020  0400000153 +             LISTA   EQ        ERROR                                  PAL8
000021  0400000157 +             +       EQ        CLOSE      )                           PAL8
000022  0400000014 +             +       EQ        SHIFTA     SPACE                       PAL8
000023  0400000031 +             +       EQ        FOUNDT     T                           PAL8
000024  0400000033 +             +       EQ        FOUNDI     I                           PAL8
000025  0400000036 +             +       EQ        FOUNDL     L                           PAL8
000026  0400000042 +             +       EQ        FOUNDP     P                           PAL8
000027  0400000044 +             +       EQ        FOUNDU     U                           PAL8
000030  0400000055 +             +       EQ        FOUNDE     E                           PAL8
000031  73630                    FOUNDT  SX6       X3                                     PAL8
             5160000205 +                SA6       TITLEF     SET TITLES FLAG             PAL8
000032  0400000045 +                     EQ        CHECKT                                 PAL8
```

```
000033  01000000124 +           FOUNDI  RJ      GETLFN                                  PAL8    2273
000034  6110000173 +                    SB1     INLFN                                   PAL8    2274
                  0133000141 +           RJ      SETLFN          CHANGE NAME OF INPUT FILE PAL8  2275
000035  0400000040 +                    EQ      CHECKC                                  PAL8    2276
000036  0100000124 +           FOUNDL  RJ      GETLFN                                  PAL8    2277
000037  6110000174 +                    SB1     OUTLFN                                  PAL8    2278
                  0100000141 +           RJ      SETLFN          CHANGE NAME OF OUTPUT FILE PAL8 2279
000040  11320                  CHECKC  BX3     X2*X0                                   PAL8    2280
          7150000052                    SX5     1R)                                     PAL8    2281
                    37335               IX3     X3-X5                                   PAL8    2282
000041  0313000014 +                    NZ      X3,SHIFTA       WAS IT TERMINATED BY A ) PAL8   2283
                  0400000157 +           EQ      CLOSE           YES                     PAL8    2284
000042  10633                  FOUNDP  BX6     X3                                      PAL8    2285
          5160000203 +                  SA6     PUNFILE         SET PUNCH PT REQUEST FLAG PAL8  2286
000043  0400000045 +                    EQ      CHECKT                                  PAL8    2287
000044  7160000126             FOUNDU  SX6     86                                      PAL8    2288
                  5161000204 +           SA6     LINEL           SET LINE LENGTH FOR UPDATE PAL8 2289
000045  0100000101 +           CHECKT  RJ      GETNC                                   PAL8    2290
000046  5140000172 +                    SA4     POSSABLE                                PAL8    2291
                    20444               LX4     36                                      PAL8    2292
000047  6150000003                      SB5     3                                       PAL8    2293
                  0133000106 +           RJ      MATCH                                   PAL8    2294
000050  0250000051 +                    JP      LISTT+B5                                PAL8    2295
000051  0400000153 +           LISTT   EQ      ERROR                                   PAL8    2296
000052  0400000014 +                   +EQ      SHIFTA          ,                       PAL8    2297
000053  0400000157 +                   +EQ      CLOSE           )                       PAL8    2298
000054  0400000045 +                   +EQ      CHECKT          SPACE                   PAL8    2299
000055  43600                  FOUNDE  MX6     0                                       PAL8    2300
          43700                         MX7     C                                       PAL8    2301
                  6113000012            SB1     10                                      PAL8    2302
000056  6120000012                      SB2     12                                      PAL8    2303
                  0100000112 +           RJ      EQUAL                                   PAL8    2304
000057  0100000101 +           ENDEF   RJ      GETNC                                   PAL8    2305
000060  5140000172 +                    SA4     POSSIBLE                                PAL8    2306
                    20452               LX4     42                                      PAL8    2307
000061  6150000002                      SB5     2                                       PAL8    2308
                  0100000106 +           RJ      MATCH                                   PAL8    2309
000062  0250000063 +                    JP      LISTF+B5                                PAL8    2310
000063  0400000066 +           LISTF   EQ      PUTE                                    PAL8    2311
000064  0400000072 +                   +EQ      ENDE            ,                       PAL8    2312
000065  0400000072 +                   +EQ      ENDE            )                       PAL8    2313
000066  0410000070 +           PUTE    EQ      B1,B0,FILLX7                            PAL8    2314
                  67117                 SB1     B1-B7                                   PAL8    2315
                    20606               LX6     6                                       PAL8    2316
000067  12663                          BX6     X6+X3                                   PAL8    2317
          0400000057 +                  EQ      ENDEF                                   PAL8    2318
000070  0420000057 +           FILLX7  EQ      B2,B0,ENDEF                             PAL8    2319
                  67227                 SB2     B2-B7                                   PAL8    2320
                    20706               LX7     6                                       PAL8    2321
000071  12773                          BX7     X7+X3                                   PAL8    2322
          0400000057 +                  EQ      ENDEF                                   PAL8    2323
000072  7130000055             ENDE    SX3     1R                                      PAL8    2324
                  0410000075 +           EQ      B1,B0,SHX7                              PAL8    2325
000073  67117                          SB1     B1-B7                                   PAL8    2326
          20606                         LX6     6                                       PAL8    2327
                    12563               BX6     X6+X3                                   PAL8    2328
000074  0400000072 +                    EQ      ENDE                                    PAL8    2329
```

```
000075  0420000077 +          SHX7    EQ      B2,B0,WRIE                              PAL8    2330
                 67227                  SB2     B2-B7                                   PAL8    2331
                      20746             LX7     6                                       PAL8    2332
000076  12773                          BX7     X7+X3                                   PAL8    2333
             0400000075 +               EQ      SHX7                                    PAL8    2334
000077  5160000206 +          WRIE    SA5     EID             SET ELECTRONICS ID      PAL8    2335
             5170000207 +               SA7     EID+1                                   PAL8    2336
000100  0400000040 +                   EQ      CHECKC                                  PAL8    2337
                                       *                                               PAL8    2338
000101  0000000000000000000000 GETNC   DATA    0               GET NEXT CHARACTER      PAL8    2339
000102  67447                          SB4     B4-B7                                   PAL8    2340
             0540000135 +              NE      B4,B0,NCGOT                             PAL8    2341
                      66337             SB3     B3+B7                                   PAL8    2342
000103  0636000153 +                   GE      B3,B6,ERROR     EXIT IF CARD FULLY READ PAL8    2343
                 6140000012             SB4     10                                      PAL8    2344
000104  5123000070                     SA2     70B+B3                                  PAL8    2345
000105  20206                  NCGOT   LX2     6                                       PAL8    2346
             11320                     BX3     X2*X0           (X3) = NEXT CHARACTER   PAL8    2347
                  0400000101 +         EQ      GETNC                                   PAL8    2348
                                       *                                               PAL8    2349
000106  0000000000000000000000 MATCH   DATA    0               MATCH CHARACTERS        PAL8    2350
000107  20406                  LOOPM   LX4     6                                       PAL8    2351
             11540                     BX5     X4*X0                                   PAL8    2352
                  37553                IX5     X5-X3                                   PAL8    2353
000110  0305000106 +                   ZR      X5,MATCH        RETURN IF MATCH FOUND   PAL8    2354
                 67557                  SB5     B5-B7                                   PAL8    2355
000111  0450000106 +                   EQ      B5,B0,MATCH     RETURN IF NOTHING MORE TO CHECK PAL8    2356
                 0400000107 +          EQ      LOOPM                                   PAL8    2357
                                       *                                               PAL8    2358
000112  0000000000000000000000 EQUAL   DATA    0               SEARCH FOR AN EQUAL SIGN PAL8   2359
000113  0100000101 +           LOOPE   RJ      GETNC                                   PAL8    2360
000114  5140000172 +                   SA4     POSSABLE                                PAL8    2361
                 20444                  LX4     36                                      PAL8    2362
000115  6150000004                     SB5     4                                       PAL8    2363
                 0100000106 +          RJ      MATCH                                   PAL8    2364
000116  0250000117 +                   JP      LISTE+B5                                PAL8    2365
000117  0400000153 +           LISTE   EQ      ERROR                                   PAL8    2366
000120  0400000112 +           +       EQ      EQUAL           =                       PAL8    2367
000121  0400000153 +           +       EQ      ERROR           ,                       PAL8    2368
000122  0400000153 +           +       EQ      ERROR           )                       PAL8    2369
000123  0400000113 +           +       EQ      LOOPE           SPACE                   PAL8    2370
                                       *                                               PAL8    2371
000124  0000000000000000000000 GETLFN  DATA    0               GET LOCAL FILE NAME     PAL8    2372
000125  43600                          MX6     0                                       PAL8    2373
             66200                     SB2     B0                                      PAL8    2374
                  0100000112 +         RJ      EQUAL                                   PAL8    2375
000126  0100000101 +           LFNLA   RJ      GETNC                                   PAL8    2376
000127  5140000172 +                   SA4     POSSABLE                                PAL8    2377
                 20444                  LX4     36                                      PAL8    2378
000130  6150000004                     SB5     4                                       PAL8    2379
                 0100000106 +          RJ      MATCH                                   PAL8    2380
000131  0250000132 +                   JP      LISTLB+B5                               PAL8    2381
000132  0400000137 +           LISTLB  EQ      LFNLB                                   PAL8    2382
000133  0400000153 +           +       EQ      ERROR           =                       PAL8    2383
000134  0400000124 +           +       EQ      GETLFN          ,                       PAL8    2384
000135  0400000124 +           +       EQ      GETLFN          )                       PAL8    2385
000136  0400000126 +           +       EQ      LFNLA           SPACE                   PAL8    2386
```

```
000137  66227                   LFNLB   SB2     B2+B7                                           PAL8    2387
              0426000153 +              EQ      B2,B6,ERROR                                     PAL8    2388
                    20606               LX6     6                                               PAL8    2389
000140  12363                           BX6     X6+X3                                           PAL8    2390
              0400000125 +              EQ      LFNLA                                           PAL8    2391
                                *                                                               PAL8    2392
000141  0000000000000000000000  SETLFN  DATA    0               PUT LFN IN FET                  PAL8    2393
000142  0326000153 +                      ZR      X6,ERROR                                        PAL8    2394
                    6150000012          SB5     10                                              PAL8    2395
000143  20606                   LOOPL   LX6     6                                               PAL8    2396
              66227                     SB2     B2+B7                                           PAL8    2397
                    0425000145 +        EQ      B2,B5,FINDIO                                    PAL8    2398
000144  0400000143 +                      EQ      LOOPL                                           PAL8    2399
000145  5160000201 +             FINDIO  SA6     NEWNAME                                         PAL8    2400
                    67201               SB2     -B1                                             PAL8    2401
                          10622         BX6     X2                                              PAL8    2402
000146  5160000202 +                      SA6     SAVEX2                                          PAL8    2403
                    0110000000 X        RJ      =XGETBA                                         PAL8    2404
000147  56420                           SA4     B2                                              PAL8    2405
              43522                     MX5     18                                              PAL8    2406
                    20522               LX5     18                                              PAL8    2407
                          11445         BX4     X4*X5                                           PAL8    2408
000150  5150000201 +                      SA5     NEWNAME                                         PAL8    2409
                    12654               BX6     X5+X4                                           PAL8    2410
                          56620         SA6     B2                                              PAL8    2411
000151  5120000202 +                      SA2     SAVEX2                                          PAL8    2412
                    43005               MX0     6                                               PAL8    2413
                          20006         LX0     6                                               PAL8    2414
000152  0400000141 +                      EQ      SETLFN                                          PAL8    2415
                                *                                                               PAL8    2416
000153                          ERROR   MESSAGE CCMSG           SEND DIAGNOSTIC MESSAGE TO DAYFILE  PAL8    2417
000155                                  ABORT                   ABORT JOB                       PAL8    2418
                                *                                                               PAL8    2419
000157  5120000200 +            CLOSE   SA2     LISTH                                           PAL8    2420
                    5150000203 +        SA5     PUNFILE                                         PAL8    2421
000161  10655                           BX6     X5                                              PAL8    2422
              53620                     SA0     X2              SET ICARD                       PAL8    2423
                    5150000204 +        SA5     LINEL                                           PAL8    2424
000161  10655                           BX6     X5                                              PAL8    2425
              5066000001                SA6     A6+1            SET UPO                         PAL8    2426
000162  5150000205 +                      SA5     TITLEF                                          PAL8    2427
                    10655               BX6     X5                                              PAL8    2428
000163  5066000001                      SA6     A6+1            SET ITFLAG                      PAL8    2429
                    5150000206 +        SA5     EID                                             PAL8    2430
000164  10655                           BX6     X5                                              PAL8    2431
              5066000001                SA6     A6+1            SET NEB(1)                      PAL8    2432
000165  5150000207 +                      SA5     EID+1                                           PAL8    2433
                    10655               BX6     X5                                              PAL8    2434
000166  5066000001                      SA6     A6+1            SET NEB(2)                      PAL8    2435
                    6110000174 +        SB1     OUTLFN                                          PAL8    2436
000167  67201                           SB2     -B1                                             PAL8    2437
              0100000000 X              RJ      =XGETBA                                         PAL8    2438
000170  43622                           MX6     18                                              PAL8    2439
              20622                     LX6     18                                              PAL8    2440
                    5162000017          SA6     B2+15           SET LC TO 777777B               PAL8    2441
000171  0400000000 +                      EQ      READCC                                          PAL8    2442
                                *                                                               PAL8    2443
```

```
VER 1.1      READCC                                                                                   23/08/73     PAGE NO.      5

   000172  05252014112455525654   POSSABLE  DATA    05252014112455525654B                                      PAL8     2444
   000173  11162025240000000000   INLFN     VFD     60/5LINPUT                                                 PAL8     2445
   000174  17252420252400000000   OUTLFN    VFD     60/6LOUTPUT                                                PAL8     2446
   000175  20011443554655031716   CCMSG     DIS     ,*PAL8 - CONTROL CARD ERROR*                               PAL8     2447
   000200  00000000000000000000   LISTH     DATA    0                                                          PAL8     2448
   000201  00000000000000000000   NEWNAME   DATA    0                                                          PAL8     2449
   000202  00000000000000000000   SAVEX2    DATA    0                                                          PAL8     2450
   000203  00000000000000000000   PUNFILE   DATA    0                                                          PAL8     2451
   000204  00000000000000000110   LINEL     DATA    72                                                         PAL8     2452
   000205  00000000000000000000   TITLEF    DATA    0                                                          PAL8     2453
   000206  55555555555555555555   EID       DATA    10H                                                        PAL8     2454
   000207  55555555555555555555             DATA    10H                                                        PAL8     2455
                                  *                                                                            PAL8     2456
   000210                                   END                                                                PAL8     2457

                          023151    UNUSED STORAGE         249 STATEMENTS       51  SYMBOLS
```

```
                                IDENT    SENDM                                                    PAL8     2458
                     000031     PROGRAM LENGTH

                                BLOCKS

                000000  000031  PROGRAM*  LOCAL

                                ENTRY POINTS

                                   000001 SENDM

                                EXTERNAL SYMBOLS

                                CPC

                                ENTRY    SENDM                                                    PAL8     2459
000000  23051604150000000001 +  TRACE.   VFD      42/0LSENDM,18/SENDM                              PAL8     2460
000001  0000000000000000000     SENDM    DATA     0                                                PAL8     2461
000002  54210                            SA2      A1                                               PAL8     2462
            53220                        SA2      X2          (X2) = PROGRAM LETTER                PAL8     2463
000003  5130000027 +             PNOK     SA3      ERRM+2                                           PAL8     2464
                43406                    MX4      54                                               PAL8     2465
                    11334                BX3      X3*X4                                            PAL8     2466
000004  12623                            BX6      X2+X3                                            PAL8     2467
            5160000027 +                 SA6      ERRM+2      PUT PROGRAM LETTER IN THE MESSAGE    PAL8     2468
000005  5021000001                       SA2      A1+1                                             PAL8     2469
                53321                    SA3      X2          (X3) = ERROR COUNT                   PAL8     2470
                    43100                MX1      0                                                PAL8     2471
000006  7120001001                       SX2      1                                                PAL8     2472
                    7140000144           SX4      100                                              PAL8     2473
000007  37334                    LOOPA    IX3      X3-X4                                            PAL8     2474
            0333000011 +                 NG       X3,ENDA                                          PAL8     2475
                    36112                IX1      X1+X2                                            PAL8     2476
000010  1400000007 +                     EQ       LOOPA                                            PAL8     2477
000011  36334                    ENDA     IX3      X3+X4                                            PAL8     2478
            7140000012                   SX4      10                                               PAL8     2479
                    37514                IX5      X1-X4                                            PAL8     2480
000012  0335000013 +                     NG       X5,INBOUND                                       PAL8     2481
                7110000014               SX1      1R*-1R0                                          PAL8     2482
000013  20106                    INBOUND  LX1      6                                                PAL8     2483
000014  37334                    LOOPB    IX3      X3-X4                                            PAL8     2484
            0333000015 +                 NG       X3,ENDB                                          PAL8     2485
                    36112                IX1      X1+X2                                            PAL8     2486
000015  1400000014 +                     EQ       LOOPB                                            PAL8     2487
000016  36334                    ENDB     IX3      X3+X4                                            PAL8     2488
            20106                        LX1      6                                                PAL8     2489
                    36113                IX1      X1+X3                                            PAL8     2490
000017  7140333333                       SX4      3R000                                            PAL8     2491
                    36114                IX1      X1+X4                                            PAL8     2492
000020  5120000025 +                     SA2      ERRM                                             PAL8     2493
                43362                    MX3      42                                               PAL8     2494
                    11223                BX2      X2*X3                                            PAL8     2495
000021  12612                            BX6      X1+X2                                            PAL8     2496
            5160000025 +                 SA6      ERRM        PUT ERROR COUNT IN THE MESSAGE       PAL8     2497
                                *                                                                  PAL8     2498
                                MESSAGE  ERRM                                                      PAL8     2499
                                *                                                                  PAL8     2500
```

```
000024  0400000001 *
000025  2001144355465555555      *       EQ      SENDM
000031                           ERRM    DIS     ,*PAL8 - ERRORS IN PROGRAM *
                                 *       END
                        023172  UNUSED STORAGE

                                57 STATEMENTS   12 SYMBOLS
```

PAL8 2501
PAL8 2502
PAL8 2503
PAL8 2504
PAL8 2505

APPENDIX G

SAMPLE OUTPUT LISTING

```
                        /PAL8 EXAMPLE OUTPUT
0200  7402  BADEX,  HLT
0201  7000  HVMSB,  7000              /MS BYTE OF PRODUCT
0202  7000  HVLSB,  7000
0203  7000  ONE,    7000
0204  7000  TWO,    7000              /LS BYTE OF PRODUCT
                    PAGE
0400  7000  HVCR,   7000
                    IFNZRO 400-HVCR <JMP BADEX >
0401  3251          DCA ADDRS         /ADDRESS OF HTSV MSBYTE
0402  6214          RDF               /FIELD OF HTSV DATA
0403  1177          TAD [6201
0404  3224          DCA DFLD1
0405  1651          TAD I ADDRS
0406  3777          DCA HVMSB         /SAVE HIGH ORDER HTSV
0407  2251          ISZ ADDRS
0410  1551          TAD I ADDRS
0411  3776          DCA HVLSB         /SAVE LOW ORDER HTSV BYTE
0412  6211          CDF 10
0413  4564          JMS I 164         /ROT CORRECTION FACTOR
0414  7000  CORLSB, 7000
0415  3775          DCA ONE
0416  1214          TAD CORLSB
0417  3774          DCA TWO
0420  4571          JMS I 171         /D.P. MULTIPLY (HTSV)(BETA)(1+
                                       ALPHA*T)
0421  7040          CMA
0422  1251          TAD ADDRS         /RETURN ADDRESS TO MS BYTE
0423  3251          DCA ADDRS         /IN CALLING TASK
0424  7000  DFLD1,  7000              /CHANGE DATA FIELD TO CALLING
                                       PROGRAM
0425  1775          TAD ONE
0426  7004          RAL
0427  3775          DCA ONE
0430  1776          TAD HVLSB
0431  7004          RAL
0432  3776          DCA HVLSB
0433  1777          TAD HVMSB
0434  7004          RAL               /MULTIPLY FINAL PRODUCT BY 2
0435  3777          DCA HVMSB
0436  1775          TAD ONE
0437  7004          RAL
0440  7200          CLA
0441  1776          TAD HVLSB
0442  7004          RAL
0443  3776          DCA HVLSB
0444  1777          TAD HVMSB
0445  7004          RAL
0446  3651          DCA I ADDRS       /STORE MS BYTE OF HTSV
0447  1776          TAD HVLSB
0450  5500          JMP I HVCR        /RETURN TO ENG. CONVERSION
0451  6670  ADDRS,  6670
                    $
```

VALUE	LOCATION	REFERENCES					
6201	J 0177	0403					
0204*	J 0574	0417					
0203*	D 0575	0415	0425	0427	0436		
0202*	J 0576	0411	0430	0432	0441	0443	0447
0201*	D 0577	0406	0433	0435	0444		

SYMBOL	VALUE	REFERENCES							
ADDRS	0451	0401	0405	0407	0410	0422	0423	0446	0451
BADEX	0200	0200							
CORLSB	0414	0414	0416						
OFLO1	0424	0404	0424						
HVCR	0400	0400	0450						
HVLSB	0202	0202	0411	0430	0432	0441	0443	0447	
HVMSB	0201	0201	0406	0433	0435	0444			
ONE	0203	0203	0415	0425	0427	0436			
TWO	0204	0204	0417						

APPENDIX H

SUPPORT PROGRAMS

The following programs are available on the CDC 6600 system for the users of the PAL8 assembler at the CRNL Computing Centre.

ASKPT - Read ASCII Paper Tapes

This program reads and converts ASCII paper tapes into 6600 display code on the file TAPE5. The program terminates when the end of tape is encountered. It may be accessed by attaching cycle 20 of the permanent file, PDPSUPPORT.

ASKPR - Read MAGNET Format Datatapes

This program reads and converts datatapes written using the MAGNET utility into 6600 display code on the file TAPE5. The program terminates when a double end-of-file is encountered. It may be accessed by attaching cycle 30 of the permanent file, PDPSUPPORT.

ASKPS - Read PS/8 Format Datatapes

This program reads and converts datatapes written in PS/8 format into 6600 display code on the file TAPE5. The program terminates when a double end of file is encountered. It may be accessed by attaching cycle 40 of the permanent file, PDPSUPPORT.

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