

M9312

M9312/1144 UBI BOOT
CZM9BD0

AH-E058D-MC

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IDENTIFICATION

PRODUCT CODE: AC-E057D-MC
PRODUCT NAME: CZM9BD0 M9312/1144 JBI BOOT
DATE: OCT 1979
MAINTAINER: DIAGNOSTIC ENGINEERING

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HISTORY SECTION

PBRDA0 WAS RELEASED MARCH, 1978.
PBRDB0 WAS RELEASED JUNE, 1978.
PBRD440 WAS RELEASED JANUARY, 1979
PBRD800 WAS RELEASED OCTOBER 1979

REVISION B WAS CREATED TO PROVIDE THE FOLLOWING ENHANCEMENTS:

1. PROPERLY CHECK THE BOOT ROM'S ALPHABETIC SEQUENCE AND, IF NOT IN CORRECT SEQUENCE, PRINT THE CORRECT SEQUENCE AS AN ERROR MESSAGE. ALSO CHECK FOR NO HOLES AND CHECK FOR ROM IN SOCKET #2 IF 11/60 AND ONLY ONE ROM EXISTS, ELSE PRINT THE CORRECT SEQUENCE.
2. THE DIAGNOSTIC CANNOT DETERMINE THE DEVICE CODE FOR A CONTINUATION ROM. THEREFORE, CONTINUATION ROMS ARE TREATED AS EXTENSIONS OF THE PRECEDING DEVICE CODE ROM. ILLEGAL PLACEMENT OF CONTINUATION ROMS ARE REPORTED IN ERROR MESSAGES. A DUPLICATE DEVICE ROM IS ALSO REPORTED IN AN ERROR MESSAGE.

COMMENT FIELDS BEGINNING WITH THE CHARACTERS ':'*'
IDENTIFY ALL LINES ADDED OR MODIFIED BY REV B0.

REVISION C WAS CREATED TO PROVIDE THE FOLLOWING ENHANCEMENTS:

1. TO UPDATE THE DIAGNOSTIC BASED ON FAULT INSERTION OF THE M9312 MODULE.
2. TO ADD A ' NO ROMS FOUND ' MESSAGE.
3. TO SIZE FOR A FALSE ERROR CAUSED BY A REAL FAILURE TO FIND THE POWER FAIL VECTOR WHEN ONLY THE CPU ROM IS PRESENT. THIS SHOULD NOT BE TREATED AS A FATAL ERROR (WHICH IT WAS IN REV. B) PREVIOUSLY, APT WOULD NOT RUN IN PRINTING MODE DISABLED DUE TO THIS ERROR.

COMMENT FIELDS BEGINNING WITH THE CHARACTERS ':'-'
IDENTIFY ALL LINES ADDED OR MODIFIED BY REV. C.

REVISION D WAS CREATED TO ACCOMODATE TESTING OF 11/44 UBI MODULE.
THE UBI MODULE HAS LOGIC WHICH IS FUNCTIONALLY EQUIVALENT TO THE M9312.

1. SINCE THE DIAGNOSTIC CALLS OUT E NUMBERS REFERENCING THE 4 BOOTSTRAP & 1 BOOT DIAGNOSTIC ROM IC'S, USE MFPT INSTRUCTION TO DETERMINE IF CPU IS 11/44. IF IT IS THEN USE SET OF E NUMBERS CONSISTENT WITH UBI MODULE.

COMMENT FIELDS BEGINNING WITH THE CHARACTERS ':'*'
IDENTIFY ALL LINES ADDED OR MODIFIED BY REV. D.

1.0 ABSTRACT

THIS PROGRAM VERIFIES THE ROM INFORMATION FOR THE M9312 BOOTSTRAP TERMINATOR OR 11/44 UBI TERMINATOR. IT HAS TWO MODES OF OPERATION; STAND-ALONE MODE WHICH REQUIRES OPERATOR INTERVENTION AND APT-MODE.

2.0 REQUIREMENTS

2.1 HARDWARE

ANY PDP-11 UNIBUS PROCESSOR WITH CONSOLE TERMINAL AND/OR HARDWARE SWITCH REGISTER
M9312 BOOT STRAP TERMINATOR
4K MEMORY

NOTE: IF 11/44 (P), M9312 BOOTSTRAP TERMINATOR IS NOT NEEDED

2.2 SOFTWARE

THIS PROGRAM REQUIRES THAT THE CORRECT OPERATION OF THE PROCESSOR, MEMORY AND CONSOLE TERMINAL HAVE BEEN VERIFIED BY THE APPROPRIATE DIAGNOSTICS.

3.0 LOADING AND STARTING PROCEDURES

3.1 LOAD THE PROGRAM BY ANY OF THE STANDARD PROCEDURES FOR ABSOLUTE PROGRAM FORMATS.

3.2 STARTING ADDRESS

200- DO CRC VERIFICATION AND SIZING

3.3 RESTART ADDRESS

204- RESTART WITHOUT SIZING

3.4 SPECIAL ENVIRONMENTS

THIS PROGRAM IS APT COMPATIBLE SEE SECTION FOR ETABLE SET-UP.
FOLLOW STANDARD APT PROCEDURES FOR LOADING AND STARTING.

4.0 OPERATING PROCEDURES

4.1 OPERATIONAL SWITCH SETTINGS

THE PROGRAM IS DESIGNED TO USE THE HARDWARE SWITCH REGISTER, HOWEVER IF THIS REGISTER IS NOT AVAILABLE THE PROGRAM WILL USE LOCATION 176 AS THE SWITCH REGISTER.

SW 15=1 OR UP-- HALT ON ERROR
 SW 13=1 OR UP-- INHIBIT ERROR TYPEOUTS
 SW 10=1 OR UP-- BELL ON ERROR

4.2 EXECUTION TIMES

EXECUTION TIME IS DEPENDENT ON THE CONSOLE TERMINAL DURING THE FIRST PASS. ALL OTHER PASSES TAKE LESS THEN 1 SECOND.

4.3 APT PROCEDURES

THERE ARE TWO CHOICES WHEN RUNNING UNDER APT. IF THE SIZE BIT (BIT 7-\$ENVN) IS CLEAR THE PROGRAM WILL OPEATE IN NORMAL STAND-ALONE MODE. IF THE SIZE BIT IS SET THE PROGRAM WILL COMPARE PARAMETERS FROM THE BOARD TO THE CONTENTS OF THE ETABLE. TO USE THE APT COMPARSION FEATURE THE ETABLE MUST BE SET UP IN THIS ORDER;

\$ENV:	DON'T CARE
\$ENVN:	200 OR 240
\$SWREG:	DON'T CARE
\$USWR:	NOT USED
\$CPUOP:	NOT USED
\$MAMS1:	NOT USED
\$MTYP1:	NOT USED
\$MADR1:	NOT USED
\$MAMS2:	NOT USED
\$MTYP2:	NOT USED
\$MADR2:	NOT USED
\$MAMS3:	NOT USED
\$MTYP3:	NOT USED
\$MADR3:	NOT USED
\$MAMS4:	NOT USED
\$MAMS4:	NOT USED
\$MTYP4:	NOT USED
\$MADR4:	NOT USED
\$VECT1:	NOT USED
\$VECT2:	NOT USED
\$BASE:	PSEUDO POWER-FAIL VECTOR ADDRESS
\$DEVN:	NOT USED
\$CDW1:	CONTENTS OF ADDRESS IN \$BASE
\$CDW2:	NOT USED
\$DDWO:	DEVICE CODES EXPECTED
	FIRST LETTER/SECOND LETTER
DDW15:	

NOTE: THE ORDER FOR LOADING \$DDWO IS IMPORTANT. THE FIRST

VALUE SHOULD BE FOR THE DIAGNOSTIC / CPU ROM, FOLLOWED
BY THE APPROPRIATE OCTAL VALUES FOR THE BOOT ROMS PRESENT.
SOME OCTAL VALUES USED ARE:

OCTAL DATA	MNEMONIC	PIN LABELING
040480-----	A0-----	248FT-----
04160	B0	233F1
041460	C0	
042113	DK	756A9
042114	DL	751A9
042130	DX	753A9
046524	MT	757A9

5.0 SUBROUTINE ABSTRACTS

5.1 NOROMS

THIS ROUTINE IS CALLED ONLY IF NO ROMS WERE FOUND DURING SIZING
IT DOES A READ OF ALL BOOTSTRAP ROM ADDRESSES AND COMPARES THE
CONTENTS TO A KNOWN EXPECTED VALUE.

5.2 CHECKS

THIS ROUTINE SETS UP THE FIRST, LAST AND EXCEPTION ADDRESSES FOR
THE 'CALSUM' SUBROUTINE. IT RECEIVES THE CALCULATED CHECKSUM FROM
'CALSUM' AND COMPARES IT AGAINST THE GOOD CHECKSUM TO DETERMINE
CRC ERRORS.

5.3 CALSUM

THIS ROUTINE CALCULATES THE CRC16 CHECKSUM OF EACH ROM. IT
RECEIVES THE FIRST ADDRESS TO BE CHECKED (FIRSTA), THE LAST
ADDRESS TO BE CHECKED (LASTAD) AND THE EXCEPTION ADDRESS (EXCADD)
FROM THE 'CHECKS' MODULE AND RETURNS TO IT THE CHECKSUM IN R4.

5.4 PROMP

THIS ROUTINE PROCESSES THE ROM PARAMETERS. IT CHECKS THE SIZE/
DON'T SIZE BIT IN THE APT ETABLE AND EITHER FORMATS THE SIZING
MESSAGES OR COMPARES THE SIZING INFORMATION TO THE APT ETABLE
DATA.

5.5 DEVCOD

THIS ROUTINE LOCATES EACH DEVICE CODE AND PASSES IT AND THE
ADDRESS IN WHICH IT WAS FOUND BACK TO THE 'PROMP' MODULE.

5.6 PPFVAR

THIS ROUTINE DETERMINES THE PSEUDO POWER-FAIL VECTOR ADDRESS AND PASSES IT AND ITS CONTENTS TO THE 'PROMP' MODULE

5.7 PUTMES

THIS ROUTINE FORMATS THE PARAMETER AND POWER-FAIL ADDRESS MESSAGE.

5.8 ERRHAN

THIS ROUTINE FORMATS ALL ERROR MESSAGES AND CALLS THE TYPE ROUTINE TO OUTPUT THEM. IT ALSO USES THE OPERATIONAL SWITCHES TO DETERMINE WHETHER TO OUTPUT THE MESSAGE, OR HALT.

5.9 FILBUF

THIS ROUTINE FILLS THE MESSAGE BUFFER WITH ASCII CHARACTERS. IT RECEIVES THE ADDRESS OF THE ASCII IN R5.

5.10 OCASC

THIS ROUTINE TAKES A SIXTEEN BIT BINARY NUMBER AND CONVERTS IT TO 6 ASCII CHARACTERS.

5.11 OCADD

THIS ROUTINE IS USED BY THE 'PUTMES' MODULE WHEN THE DATA IN R3 IS NOT IN THE RIGHT MODE TO BE HANDLED BY THE 'OCASC' MODULE. IT MOVES THE ADDRESSING MODE OF R3 UP ONE LEVEL OF DEFEMENT.

6.0 RELIABILITY//AVAILABILITY//SERVICEABILITY

WHEN RUNNING IN ANY ENVIRONMENT BUT APT THERE IS ONLY ONE ERROR DETECTED BY THE PROGRAM. THIS ERROR IS A CHECKSUM ERROR. THE MESSAGE WILL BE:

CRC ERROR IN ROM EXX

THE FOLLOWING ERROR MESSAGES WERE ADDED IN REV B0:

1. A CONTINUATION ROM IS INCORRECTLY LOCATED IN ROM X(Exx)
2. A CONTINUATION ROM IS MISSING FOR DEVICE CODE XX
3. THERE IS A DUPLICATE ROM WITH DEVICE CODE XX
4. ROM SEQUENCE IS INCORRECT AS PER INSTALLATION PROCEDURE.

SEQUENCE SHOULD BE:

ROM 1(E35)	XX
ROM 2(E33)	XX
ROM 3(E34)	XX
ROM 4(E32)	XX

WHEN RUNNING IN THE APT ENVIRONMENT THREE OTHER ERRORS MAY OCCUR.

1. AN ERROR WILL OCCUR WHEN THE DEVICE CODES IN THE ETABLE DO NOT MATCH THE DEVICE CODES FOUND IN THE ROMS. THE ERROR MESSAGE WILL BE EITHER:

1. COULD NOT FIND DEVICE CODE XX.
2. FOUND UNEXPECTED DEVICE CODE XX.

THE FIRST MESSAGE WILL BE PASSED TO APT IF A DEVICE CODE LISTED IN THE ETABLE CANNOT BE FOUND IN THE EXISTING ROMS. THE SECOND MESSAGE WILL BE SENT IF A DEVICE CODE NOT LISTED IN THE ETABLE IS FOUND IN A ROM.

2. THE SECOND ERROR WILL BE IF THE PSEUDO POWER-FAIL VECTOR ADDRESS IN THE ETABLE DOES NOT MATCH THE ADDRESS DETERMINED BY THE PROGRAM. TO BE IN THE BOARDS' SWITCHES. THE MESSAGE WILL BE:

POWER-FAIL VECTOR	
EXPECTED	RECEIVED
-----	-----

WHERE EXPECTED IS THE CONTENTS OF THE ETABLE AND RECEIVED IS THE VALUE FOUND BY THE PROGRAM.

3. THE THIRD ERROR WILL BE IF THE CONTENTS OF BOARD'S PSEUDO POWER-FAIL VECTOR ADDRESS DOES NOT MATCH THE VALUE EXPECTED FROM THE ETABLE. THE MESSAGE WILL BE:

POWER-FAIL DATA ERROR	
EXPECTED	RECEIVED
-----	-----

7.0 NOTE: DIAGNOSTIC COVERAGE

THIS DIAGNOSTIC DOES NOT PERFORM ANY EXAMINATION OF THE BOOT CIRCUITRY ON THE M9312. IF YOU WISH TO CHECK THIS CIRCUITRY YOU MUST FIRST, DETERMINE WHICH DEVICE YOU WILL BOOT AND SECOND, YOU MUST SET THE SWITCHES ON THE M9312 TO THE APPROPRIATE SETTINGS. YOU MAY NOW ATTEMPT TO BOOT

THE M9312 . IF THE DEVICE DOES BOOT THIS SHOULD BE
EVIDENT FROM THE CONSOLE TERMINAL, IF PRESENT, OR FROM THE RUN
LIGHT ON THE FRONT PANEL, WHICH SHOULD BE "LIT".

```
408
409 000000      .ENABLE ABS
410              .LIST ME
411              .NLIST MC,MD,CND
412
413
414
415
419
423
424
425      .MCALL  .$ASTAT,.$SAVE,.$SCATCH,.$CMTAG,.$SETUP,.$EOP,.$TYPE
426      .MCALL  STARS,.$EQUATE,.$APTHDR,.$APTBL,.$APTYPE
427      .MCALL  .SACT11,.$HEADER,.$SWRHI,REPORT,TYPNAM,PUSH,POP,.$STRAP
428      .MCALL  .SREAD,.$TYPOCT
429      .MCALL  .EQUIV
430      .TITLE  C7M9BD0 M9312/1144 UBI BOOT
      ;*COPYRIGHT (C) 1978
      ;*DIGITAL EQUIPMENT CORP.
      ;*MAYNARD, MASS. 01754
      ;*
      ;*PROGRAM BY BARRY G. IRRGANG
      ;*
      ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
      ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
      ;*
      $TN=1
      $SWR=160000      ;;HALT ON ERROR, LOOP ON TEST, INHIBIT ERROR TYPOUT
431      .SBTTL  OPERATIONAL SWITCH SETTINGS
      ;*
      ;*      SWITCH                      USE
      ;*      -----
      ;*      15                      HALT ON ERROR
      ;*      14                      LOOP ON TEST
      ;*      13                      INHIBIT ERROR TYPEOUTS
432      .SBTTL  BASIC DEFINITIONS
      ;*INITIAL ADDRESS OF THE STACK POINTER *** 1 00 ***
      STACK= 1100
      ERROR=EMT
      SCOPE=IOT
      ;*MISCELLANEOUS DEFINITIONS
      HT= 11          ;;CODE FOR HORIZONTAL TAB
      LF= 12          ;;CODE FOR LINE FEED
      CR= 15          ;;CODE FOR CARRIAGE RETURN
      CRLF= 200       ;;CODE FOR CARRIAGE RETURN-LINE FEED
      PS= 177776      ;;PROCESSOR STATUS WORD
      PSW=PS
      STKLMT= 177774   ;;STACK LIMIT REGISTER
      PIRQ= 177772     ;;PROGRAM INTERRUPT REQUEST REGISTER
      DSWR= 177570     ;;HARDWARE SWITCH REGISTER
      DDISP= 177570   ;;HARDWARE DISPLAY REGISTER
      ;*GENERAL PURPOSE REGISTER DEFINITIONS
      R0= %0          ;;GENERAL REGISTER
      R1= %1          ;;GENERAL REGISTER
```

000002	R2=	%2	::GENERAL REGISTER
000003	R3=	%3	::GENERAL REGISTER
000004	R4=	%4	::GENERAL REGISTER
000005	R5=	%5	::GENERAL REGISTER
000006	R6=	%6	::GENERAL REGISTER
000007	R7=	%7	::GENERAL REGISTER
000006	SP=	%6	::STACK POINTER
000007	PC=	%7	::PROGRAM COUNTER

;*PRIORITY LEVEL DEFINITIONS

000000	PR0=	0	::PRIORITY LEVEL 0
000040	PR1=	40	::PRIORITY LEVEL 1
000100	PR2=	100	::PRIORITY LEVEL 2
000140	PR3=	140	::PRIORITY LEVEL 3
000200	PR4=	200	::PRIORITY LEVEL 4
000240	PR5=	240	::PRIORITY LEVEL 5
000300	PR6=	300	::PRIORITY LEVEL 6
000340	PR7=	340	::PRIORITY LEVEL 7

;*SWITCH REGISTER SWITCH DEFINITIONS

100000	SW15=	100000
040000	SW14=	40000
020000	SW13=	20000
010000	SW12=	10000
004000	SW11=	4000
002000	SW10=	2000
001000	SW09=	1000
000400	SW08=	400
000200	SW07=	200
000100	SW06=	100
000040	SW05=	40
000020	SW04=	20
000010	SW03=	10
000004	SW02=	4
000002	SW01=	2
000001	SW00=	1
001000	SW9=	SW09
000400	SW8=	SW08
000200	SW7=	SW07
000100	SW6=	SW06
000040	SW5=	SW05
000020	SW4=	SW04
000010	SW3=	SW03
000004	SW2=	SW02
000002	SW1=	SW01
000001	SW0=	SW00

;*DATA BIT DEFINITIONS (BIT00 TO BIT15)

100000	BIT15=	100000
040000	BIT14=	40000
020000	BIT13=	20000
010000	BIT12=	10000
004000	BIT11=	4000
002000	BIT10=	2000
001000	BIT09=	1000
000400	BIT08=	400
000200	BIT07=	200

000100	BIT06=	100
000040	BIT05=	40
000020	BIT04=	20
000010	BIT03=	10
000004	BIT02=	4
000002	BIT01=	2
000001	BIT00=	1
001000	BIT9=BIT09	
000400	BIT8=BIT08	
000200	BIT7=BIT07	
000100	BIT6=BIT06	
000040	BIT5=BIT05	
000020	BIT4=BIT04	
000010	BIT3=BIT03	
000004	BIT2=BIT02	
000002	BIT1=BIT01	
000001	BIT0=BIT00	

000004	ERRVEC= 4	::TIME OUT AND OTHER ERRORS
000010	RESVEC= 10	::RESERVED AND ILLEGAL INSTRUCTIONS
000014	TBITVEC=14	::'T' BIT
000014	TRTVEC= 14	::TRACE TRAP
000014	BPTVEC= 14	::BREAKPOINT TRAP (BPT)
000020	IOTVEC= 20	::INPUT/OUTPUT TRAP (IOT) **SCOPE**
000024	PWRVEC= 24	::POWER FAIL
000030	EMTVEC= 30	::EMULATOR TRAP (EMT) **ERROR**
000034	TRAPVEC=34	::'TRAP' TRAP
000060	TKVEC= 60	::TTY KEYBOARD VECTOR
000064	TPVEC= 64	::TTY PRINTER VECTOR
000240	PIRVEC=240	::PROGRAM INTERRUPT REQUEST VECTOR

PROGRAM EQUATES

000001	APTER1 = 1
000002	APTER2 = 2
000004	APTER3 = 4
000010	APTER4 = 10
000020	CRCERR = 20
000040	PFERR = 40
000100	NOROME =100
000200	SEQERR =200
000400	CONONE =400
001000	CONTWO=1000
002000	DUPERR=2000

.=0
.SB:TL TRAP CATCHER

000000

.=0
;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ''+2,HAL''
;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS

000174	000174
000174	000000
000176	000000

DISPREG:	.WORD 0	::SOFTWARE DISPLAY REGISTER
SWREG:	.WORD 0	::SOFTWARE SWITCH REGISTER
.SB:TL	STARTING ADDRESS(ES)	

451 000200 000137 001400 JMP @START ;; JUMP TO STARTING ADDRESS OF PROGRAM
452 000204 000204 . = 204
453 000204 000167 001730 JMP RSTART
454

.SBTTL ACT11 HOOKS

;; HOOKS REQUIRED BY ACT11

000210 \$SVPC=.; ; SAVE PC
000046 000046 . = 46
000052 002246 \$ENDAD .;; 1) SET LOC.46 TO ADDRESS OF \$ENDAD IN .SEOP
000052 000052 . = 52
000000 .WORD 0 .;; 2) SET LOC.52 TO ZERO
000210 . \$SVPC .;; RESTORE PC

455
456 001100 . = 1100
457 001100 000 \$AUTOB: .BYTE 0
458 001101 000 \$INTAG: .BYTE 0
459 001102 000000 .WORD 0
460 001104 177570 SWR: .WORD DSWR
461 001106 177570 DISPLAY: .WORD DDISP
462 001110 000000 ROMERR: 0
463 001112 000000 MESSAG: 0
464 001114 173000 FIRSTB: 173000
465 001116 000000 ROMFIN: 0
466 001120 000000 ERRCNT: 0
467
468

.SBTTL APT PARAMETER BLOCK

;; SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT

001122 . \$X=.; ; SAVE CURRENT LOCATION
000024 000024 . = 24 .;; SET POWER FAIL TO POINT TO START OF PROGRAM
000024 000200 200 .;; FOR APT START UP
000044 000044 . = 44 .;; POINT TO APT INDIRECT ADDRESS PNTR.
000044 001122 \$APTHDR .;; POINT TO APT HEADER BLOCK
001122 . = \$X .;; RESET LOCATION COUNTER

;; SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
;; INTERFACE SPEC.

001122 \$APTHD:
001122 000000 \$HIBTS: .WORD 0 .;; TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
001124 001136 \$MBADR: .WORD \$MAIL .;; ADDRESS OF APT MAILBOX (BITS 0-15)
001126 000002 \$TSTM: .WORD 2. .;; RUN TIME OF LONGEST TEST
001130 000002 \$PASTM: .WORD 2. .;; RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
001132 000000 \$UNITM: .WORD 0 .;; ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
001134 000052 .WORD \$ETEND-\$MAIL/2 .;; LENGTH MAILBOX-ETABLE (WORDS)
469 .SBTTL APT MAILBOX-ETABLE

.EVEN

001136 \$MAIL: .;; APT MAILBOX
001136 000000 \$MSGTY: .WORD AMSGTY .;; MESSAGE TYPE CODE
001140 000000 \$FATAL: .WORD AFATAL .;; FATAL ERROR NUMBER
001142 000000 \$TESTN: .WORD ATESTN .;; TEST NUMBER

001144	000000	\$PASS:	.WORD	APASS	::PASS COUNT
001146	000000	\$DEVCT:	.WORD	ADEVCT	::DEVICE COUNT
001150	000000	\$UNIT:	.WORD	AUNIT	::I/O UNIT NUMBER
001152	000000	\$MSGAD:	.WORD	AMSGAD	::MESSAGE ADDRESS
001154	000000	\$MSGLG:	.WORD	AMSGLG	::MESSAGE LENGTH
001156		\$ETABLE:			::APT ENVIRONMENT TABLE
001156	000	\$ENV:	.BYTE	AENV	::ENVIRONMENT BYTE
001157	000	\$ENVM:	.BYTE	AENVM	::ENVIRONMENT MODE BITS
001160	000000	\$SWREG:	.WORD	ASWREG	::APT SWITCH REGISTER
001162	000000	\$USWR:	.WORD	AUSWR	::USER SWITCHES
001164	000000	\$CPUOP:	.WORD	ACPUOP	::CPU TYPE,OPTIONS
		*			BITS 15-11=CPU TYPE
		*			11/04=01,11/05=02,11/20=03,11/40=04,11/45=05
		*			11/70=06,PDQ=07,Q=10
		*			BIT 10=REAL TIME CLOCK
		*			BIT 9=FLOATING POINT PROCESSOR
		*			BIT 8=MEMORY MANAGEMENT
001166	000	\$MAMS1:	.BYTE	AMAMS1	::HIGH ADDRESS,M.S. BYTE
001167	000	\$MTYP1:	.BYTE	AMTYP1	::MEM. TYPE,BLK#1
		*			MEM.TYPE BYTE -- (HIGH BYTE)
		*			900 NSEC CORE=001
		*			300 NSEC BIPOLAR=002
		*			500 NSEC MOS=003
001170	000000	\$MADR1:	.WORD	AMADR1	::HIGH ADDRESS,BLK#1
		*			MEM.LAST ADDR.=3 BYTES,THIS WORD AND LOW OF 'TYPE' ABOVE
001172	000	\$MAMS2:	.BYTE	AMAMS2	::HIGH ADDRESS,M.S. BYTE
001173	000	\$MTYP2:	.BYTE	AMTYP2	::MEM. TYPE,BLK#2
001174	000000	\$MADR2:	.WORD	AMADR2	::MEM.LAST ADDRESS,BLK#2
001176	000	\$MAMS3:	.BYTE	AMAMS3	::HIGH ADDRESS,M.S.BYTE
001177	000	\$MTYP3:	.BYTE	AMTYP3	::MEM. TYPE,BLK#3
001200	000000	\$MADR3:	.WORD	AMADR3	::MEM.LAST ADDRESS,BLK#3
001202	000	\$MAMS4:	.BYTE	AMAMS4	::HIGH ADDRESS,M.S.BYTE
001203	000	\$MTYP4:	.BYTE	AMTYP4	::MEM. TYPE,BLK#4
001204	000000	\$MADR4:	.WORD	AMADR4	::MEM.LAST ADDRESS,BLK#4
001206	000000	\$VECT1:	.WORD	AVECT1	::INTERRUPT VECTOR#1,BUS PRIORITY#1
001210	000000	\$VECT2:	.WORD	AVECT2	::INTERRUPT VECTOR#2BUS PRIORITY#2
001212	000000	\$BASE:	.WORD	ABASE	::BASE ADDRESS OF EQUIPMENT UNDER TEST
001214	000000	\$DEVN:	.WORD	ADEVN	::DEVICE MAP
001216	000000	\$CDW1:	.WORD	ACDW1	::CONTROLLER DESCRIPTION WORD#1
001220	000000	\$CDW2:	.WORD	ACDW2	::CONTROLLER DESCRIPTION WORD#2
001222	000000	\$DDW0:	.WORD	ADDW0	::DEVICE DESCRIPTOR WORD#0
001224	000000	\$DDW1:	.WORD	ADDW1	::DEVICE DESCRIPTOR WORD#1
001226	000000	\$DDW2:	.WORD	ADDW2	::DEVICE DESCRIPTOR WORD#2
001230	000000	\$DDW3:	.WORD	ADDW3	::DEVICE DESCRIPTOR WORD#3
001232	000000	\$DDW4:	.WORD	ADDW4	::DEVICE DESCRIPTOR WORD#4
001234	000000	\$DDW5:	.WORD	ADDW5	::DEVICE DESCRIPTOR WORD#5
001236	000000	\$DDW6:	.WORD	ADDW6	::DEVICE DESCRIPTOR WORD#6
001240	000000	\$DDW7:	.WORD	ADDW7	::DEVICE DESCRIPTOR WORD#7
001242	000000	\$DDW8:	.WORD	ADDW8	::DEVICE DESCRIPTOR WORD#8
001244	000000	\$DDW9:	.WORD	ADDW9	::DEVICE DESCRIPTOR WORD#9
001246	000000	\$DDW10:	.WORD	ADDW10	::DEVICE DESCRIPTOR WORD#10
001250	000000	\$DDW11:	.WORD	ADDW11	::DEVICE DESCRIPTOR WORD#11
001252	000000	\$DDW12:	.WORD	ADDW12	::DEVICE DESCRIPTOR WORD#12
001254	000000	\$DDW13:	.WORD	ADDW13	::DEVICE DESCRIPTOR WORD#13
001256	000000	\$DDW14:	.WORD	ADDW14	::DEVICE DESCRIPTOR WORD#14
001260	000000	\$DDW15:	.WORD	ADDW15	::DEVICE DESCRIPTOR WORD#15

```
001262          SETEND:
470          000007          MFPT=000007
471          001400          .=1400
472 001400          START:
          .SBTTL  INITIALIZE THE COMMON TAGS
          MOV      #STACK,SP          ;;SETUP THE STACK POINTER
          ;;INITIALIZE A FEW VECTORS
          MOV      #TRAP,@TRAPVEC    ;;TRAP VECTOR FOR TRAP CALLS
          MOV      #340,@TRAPVEC+2  ;;LEVEL 7
          CLR      $PASS              ;;CLEAR THE PASS COUNT
          MOV      $ENDCT,$EOPCT     ;;SETUP END-OF-PROGRAM COUNTER
          ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
          ;;EQUAL TO A '-1', SETUP FOR A SOFTWARE SWITCH REGISTER.
          MOV      @ERRVEC,-(SP)      ;;SAVE ERROR VECTOR
          MOV      #64$,@ERRVEC      ;;SET UP ERROR VECTOR
          MOV      #DSWR,SWR         ;;SETUP FOR A HARDWARE SWICH REGISTER
          MOV      #DDISP,DISPLAY    ;;AND A HARDWARE DISPLAY REGISTER
          CMP      #-1,@SWR          ;;TRY TO REFERENCE HARDWARE SWR
          BNE      66$              ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
          ;;AND THE HARDWARE SWR IS NOT -1
          BR       65$              ;;BRANCH IF NO TIMEOUT
          MOV      #65$,(SP)         ;;SET UP FOR TRAP RETURN
          RTI
          MOV      #SWREG,SWR        ;;POINT TO SOFTWARE SWR
          MOV      #DISPREG,DISPLA
          MOV      (SP)+,@ERRVEC    ;;RESTORE ERROR VECTOR
          CLR      $PASS              ;;CLEAR PASS COUNT
          BITB     #APTSIZE,$ENVM    ;;TEST USER SIZE UNDER APT
          BEQ      67$              ;;YES,USE NON-APT SWITCH
          MOV      #SSWREG,SWR      ;;NO,USE APT SWITCH REGISTER
          67$:
          .SBTTL  TYPE PROGRAM NAME
          ;;TYPE THE NAME OF THE PROGRAM IF FIRST PASS
          INCL     #-1              ;;FIRST TIME?
          BNE      68$              ;;BRANCH IF NO
          CMP      #SENDAD,@42      ;;ACT-11?
          BEQ      68$              ;;BRANCH IF YES
          TYPE     ,69$            ;;TYPE ASCII STRING
          .SBTTL  GET VALUE FOR SOFTWARE SWITCH REGISTER
          TST      @42              ;;ARE WE RUNNING UNDER XXDP/ACT?
          BNE      70$              ;;BRANCH IF YES
          CMPB     $ENV,#1          ;;ARE WE RUNNING UNDER APT?
          BEQ      70$              ;;BRANCH IF YES
          CMP      SWR,#SWREG       ;;SOFTWARE SWITCH REC SELECTED?
          BNE      71$              ;;BRANCH IF NO
          GTSWR                    ;;GET SOFT-SWR SETTINGS
          BR       71$
          MOV      #1,$AUTOB        ;;SET AUTO-MODE INDICATOR
          BR       68$              ;;GET OVER THE ASCII
          .ASCII   <CRLF>*CZM98D0 M9312/1144 UBI BOOT*<CRLF>
          68$:
          MOV      @10,-(SP)         ;;** SAVE VECTOR ON STACK
          MOV      #10$,@10          ;;** SET ERROR VECTOR
```


[illegible]

```

;*INCREMENT THE PASS NUMBER ($PASS)
;*TYPE 'END PASS'
;*IF THERES A MONITOR GO TO IT
;*IF THERE ISN'T JUMP TO RSTART
;*IF IT IS DESIRED TO HAVE A BELL INDICATE THE 'END OF PASS' LOCATION
;*SENDMG CAN BE CHANGED TO 7.

```

002176				\$EOP:	NOP		
002176	000240				INC	\$PASS	:: INCREMENT THE PASS NUMBER
002200	005267	176740			BIC	#100000,\$PASS	:: DON'T ALLOW A NEG. NUMBER
002204	042767	100000	176732		DEC	(PC)+	:: LOOP?
002212	005327			\$EOPCT:	.WORD	1	
002214	000001				BGT	\$DOAGN	:: YES
002216	003017				MOV	(PC)+,a(PC)+	:: RESTORE COUNTER
002220	012737			\$ENDCT:	.WORD	1	
002222	000001				\$EOPCT		
002224	002214				TYPE	,\$SENDMG	:: TYPE 'END PASS'
002226	104401	002265			TYPE	,\$ENULL	:: TYPE A NULL CHARACTER
002232	104401	002262		\$GET42:	MOV	a42,R0	:: GET MONITOR ADDRESS
002236	013700	000042			BEQ	\$DOAGN	:: BRANCH IF NO MONITOR
002242	001405				RESET		:: CLEAR THE WORLD
002244	000005			\$ENDAD:	JSR	PC,(R0)	:: GO TO MONITOR
002246	004710				NOP		:: SAVE ROOM
002250	000240				NOP		:: FOR
002252	000240				NOP		:: ACT11
002254	000240			\$DOAGN:			
002256					JMP	a(PC)+	:: RETURN
002256	000137			\$RTNAD:	.WORD	RSTART	
002260	002140			\$ENULL:	.BYTE	-1,-1,0	:: NULL CHARACTER STRING
002262	377	377	000	\$ENDMG:	.ASCIIZ	<15><12>/END PASS/	
002265	015	012	105				
002270	116	104	040				
002273	120	101	123				
002276	123	000					

```

;NO ROMS TEST
;THIS ROUTINE IS CALLED ONLY IF NO ROMS WERE FOUND
;DURING SIZING. IT DOES A READ OF ALL BOOTSTRAP ROM
;ADDRESSES AND COMPARES THE CONTENTS TO A KNOWN
;EXPECTED VALUE.

```

531							
532							
533							
534							
535							
536							
537							
538							
539							
540	002300	104401	006700	NOROMS:	TYPE	MNORM	
541	002304	012703	172000		MOV	#172000,	R3
542	002310	013704	002364	1\$:	MOV	a4NODATA,	R4
543	002314	121304			CMPE	(R3),	R4
544	002316	001406			BEQ	2\$	
545	002320	011304			MOV	(R3), R4	
546	002322	052737	000100		BIS	#NOROME,	a4ROMERR
547	002330	004767	001506		JSR	PC,	ERRHAN
548	002334	062703	000002	2\$:	ADD	#2,	R3
549	002340	022703	173024		CMP	#173024,	R3
550	002344	001773			BEQ	2\$	
551	002346	022703	173224		CMP	#173224,	R3
552	002352	001770			BEQ	2\$	
553	002354	022703	174000		CMP	#174000,	R3

```

;- TYPE MESSAGE THAT NOROMS FOUND
; GET FIRST ADDRESS TO BE READ
; GET ADDRESS OF EXPECTED VALUE
;+DOES RECIEVED VALUE EQUAL EXPECTED
; IF YES CONTINUE TESTING
;+GET BAD VALUE
; IF NO SET ERROR INDICATER
;REPORT ERROR
;+GET TO NEXT EVEN ADDRESS
;+AT A VECTOR ADDRESS?
;+BRANCH IF YES
;+AT A VECTOR ADDRESS?
;+BRANCH IF YES
;HAVE ALL ADDRESSES BEEN TESTED

```

```

554 002360 003353          BGT 1$          ;IF NO GO TEST THIS ADDRESS
555 002362 000207          RTS PC
556
557 002364 000777          NODATA: .WORD 777      ;+A HOLE LOOKS LIKE XXX777
558
559
560
561
562          ;CHECKSUM ROMS MODULE
563          ;THIS ROUTINE DOES A CHECKSUM OF ALL ROMS PRESENT
564
565 002366 012737 000001 002602 CHECKS: MOV #1, @#ROMCNT      ;INITIALIZE ROM COUNTER
566 002374 033737 002602 001116      BIT @#ROMCNT, @#ROMFIN      ;IS DIAGNOSTIC ROM PRESENT
567 002402 001424          BEQ 1$          ;IF NO GO CHECKSUM BOOT ROMS
568 002404 012737 165775 002700      MOV #165775, @#LASTAD      ;SET UP LAST ADDRESS TO BE SUMMED
569 002412 012737 000000 002676      MOV #0, @#EXCADD      ;SET UP EXCEPTION ADDRESS
570 002420 012737 165000 002674      MOV #165000, @#FIRSTA      ;SET UP FIRST ADDRESS TO BE SUMMED
571 002426 004767 000152          JSR PC, CALSUM      ;GO CALCULATE CHECKSUM
572 002432 013703 165776          MOV @#165776, R3      ;GET EXPECTED CHECKSUM
573 002436 020304          CMP R3, R4      ;COMPARE CHECKSUMS
574 002440 001405          BEQ 1$          ;IF CHECKSUMS COMPARE CONTINUE
575 002442 052737 000020 001110      BIS #CRCERR, @#ROMERR      ;IF ERROR SET INDICATOR
576 002450 004767 001366          JSR PC, ERRHAN      ;REPORT ERROR
577 002454 012737 173000 002674 1$: MOV #173000, @#FIRSTA      ;SET UP FIRST ADDRESS TO BE SUMMED
578 002462 012737 173024 002676      MOV #173024, @#EXCADD      ;SET UP EXCEPTION ADDRESS
579 002470 012737 173175 002700      MOV #173175, @#LASTAD      ;SET UP LAST ADDRESS TO BE SUMMED
580 002476 012702 173176          MOV #173176, R2      ;GET ADDRESS OF GOOD DATA
581 002502 006137 002602          2$: ROL @#ROMCNT      ;UPDATE ROM COUNTER
582 002506 033737 002602 001116      BIT @#ROMCNT, @#ROMFIN      ;IS ROM PRESENT
583 002514 001412          BEQ 3$          ;IF NO, GO UPDATE TO NEXT ROM
584 002516 004767 000062          JSR PC, CALSUM      ;IF YES GO CALCULATE CHECKSUM
585 002522 011203          MOV (R2), R3      ;GET EXPECTED CHECKSUM
586 002524 020304          CMP R3, R4      ;COMPARE CHECKSUMS
587 002526 001405          BEQ 3$          ;IF CHECKSUMS EQUAL CONTINUE
588 002530 052737 000020 001110      BIS #CRCERR, @#ROMERR      ;IF ERROR SET INDICATOR
589 002536 004767 001300          JSR PC, ERRHAN      ;REPORT ERROR
590 002542 062737 000200 002674 3$: ADD #200, @#FIRSTA      ;UPDATE FIRST ADDRESS
591 002550 062737 000200 002676      ADD #200, @#EXCADD      ;UPDATE EXCEPTION ADDRESS
592 002556 062737 000200 002700      ADD #200, @#LASTAD      ;UPDATE LAST ADDRESS
593 002564 062702 000200          ADD #200, R2      ;UPDATE ADDRESS OF GOOD DATA
594 002570 022737 174000 002674      CMP #174000, @#FIRSTA      ;HAVE ALL ROMS BEEN CHECKED
595 002576 001341          BNE 2$          ;IF NO GO CHECKSUM NEXT ONE
596 002600 000207          RTS PC      ;IF YES RETURN
597
598 002602 000000          ROMCNT: 0
599
600
601          ;CALCULATE CHECKSUMS MODULE
602          ;THIS ROUTINE CALCULATES THE CRC16 CHECKSUM OF THE CONTENTS
603          ;OF EVERY LOCATION EXCEPT THE EXCEPTION ADDRESS AND LAST ADDRESS
604          ;OF EVERY ROM
605
606
607 002604 010246          CALSUM: MOV R2, -(SP)      ;SAVE R2
608 002606 013700 002674      MOV @#FIRSTA, R0      ;GET STARTING ADDRESS
609 002612 005004          CLR R4      ;INITIALIZE CRC WORD
610 002614 012005          LOOP: MOV (R0)+, R5      ;GET A BYTE

```

```

611 002616 012702 000020          MOV      #16.,      R2          ;SET BYTE COUNT
612 002622 000241          CRCLOP: CLC                     ;THE NEXT NINE LINES
613 002624 006004          ROR      R4                     ;DO THE MATH CALCULATIONS
614 002626 006005          ROR      R5
615 002630 102006          BVC      1$
616 002632 012701 120001          MOV      #120001.,    R1
617 002636 040401          BJC      R4.,      R1
618 002640 042704 120001          BIC      #120001.,    R4
619 002644 050104          BIS      R1.,      R4
620 002646 005302          1$: DEC      R2
621 002650 003364          BGT      CRCLOP
622 002652 020037 002676          CMP      R0.,      @#EXCADD      ;IS NEXT ADDRESS AN EXCEPTION ADDRESS
623 002656 001001          BNE      2$                     ;IF NO TEST IT
624 002660 005720          TST      (R0)+              ;IF YES SKIP ADDRESS
625 002662 020037 002700          2$: CMP      R0.,      @#LASTAD      ;HAVE ALL LOCATIONS BEEN SUMMED
626 002666 101752          BLOS     LOOP
627 002670 012602          MOV      (SP)+,    R2          ;IF NO CONTINUE
628 002672 000207          RTS      PC                  ;RESTORE R2
629                                     ;IF YES RETURN
630 002674 000000          FIRSTA: 0
631 002676 000000          EXCADD: 0
632 002700 000000          LASTAD: 0
633
634
635
636
637
638
639
640
641
642
643 002702 105737 001157          PROMP: TSTB     @#SENVN      ;IF BIT IS CLEAR SIZE
644 002706 100424          BMI      1$                     ;IF BIT IS SET DON'T SIZE.
645 002710 004767 000250          JSR      PC.,      DEVCOD      ;CALL DEVICE CODE MODULE
646 002714 004767 000570          JSR      PC.,      PUTMES      ;FORMAT PARAMETER MESSAGE
647 002720 010016          MES1
648 002722 004767 000452          JSR      PC.,      PPFVAR      ;GO GET PSEUDO POWER-FAIL VECTOR ADDRESS
649 002726 032737 000040 001110          BIT      #PFERR.,    @#ROMERR      ;WAS THERE AN ERR
650 002734 001403          BEQ      10$                     ;IF NO GO FORMAT MESSAGE
651 002736 004767 001100          JSR      PC.,      ERRHAN      ;IF YES GO REPORT MESSAGE
652 002742 000507          BR       9$
653 002744 004767 000540          10$: JSR      PC.,      PUTMES      ;FORMAT PSEUDO POWER-FAIL VECTOR
654 002750 010416          MES2                                ;ADDRESS MESSAGE
655 002752 005237 001112          INC      @#MESSAG      ;SET MESSAGE INDICATOR
656 002756 000501          BR       9$                     ;GO TO EXIT
657 002760 004767 000200          1$: JSR      PC.,      DEVCOD      ;CALL GET DEVICE CODE MODULE
658 002764 012703 007722          MOV      #BUF1.,    R3          ;GET BOARD DEVICE CODES
659 002770 012704 001222          2$: MOV      #SDDW0.,    R4          ;GET ETABLE DEVICE CODE PARAMETERS
660 002774 062703 000002          ADD      #2.,      R3          ;GET TO BOARD DEVICE CODE
661 003000 012402          3$: MOV      (R4)+,    R2          ;GET ETABLE DEVICE CODE
662 003002 020213          CMP      R2.,      (R3)          ;DO THE TWO DEVICE CODES COMPARE
663 003004 001407          BEQ      4$                     ;IF YES GET NEXT BOARD DEVICE CODE
664 003006 005714          TST      (R4)                  ;IF NO HAVE WE CHECKED THE WHOLE ETABLE
665 003010 001373          BNE      3$                     ;IF WE HAVEN'T CHECK NEXT ETABLE ENTRY
666 003012 052737 000001 001110          BIS      #APTER1.,    @#ROMERR      ;IF WE HAVE THEN DEVICE CODE ON BOARD
667 003020 004767 001016          JSR      PC.,      ERRHAN      ;DOES NOT EXIST IN ETABLE

```

```

668 003024 062703 000002      4$:  ADD    #2,      R3      ;UPDATE TO NEXT ADDRESS
669 003030 005713              TST    (R3)      ;IF CONTENTS EQUALS ZERO WE'RE DONE
670 003032 001356              BNE     2$        ;IF CONTENTS NO EQUAL ZERO CONTINUE
671 003034 012703 001222      MOV     #SDDW0,    R3      ;GET BOARD DEVICE CODES
672 003040 012704 007720      5$:  MOV     #BUF1-2,    R4      ;GET ETABLE DEVICE CODES
673 003044 062704 000004      6$:  ADD     #4,      R4      ;GET BOARD DEVICE CODE
674 003050 021314              CMP     (R3),    (R4)    ;DO THE TWO DEVICE CODES COMPARE
675 003052 001407              BEQ     7$        ;IF YES GET NEXT ETABLE DEVICE CODE
676 003054 005714              TST     (R4)      ;IF NO HAVE WE CHECKED ALL THE BOARD
677 003056 001372              BNE     6$        ;DEVICE CODES, IF NO CONTINUE
678 003060 052737 000002 001110  BIS     #APTER2,    @#ROMERR ;IF YES ETABLE DEVICE CODE NOT
679 003066 004767 000750              JSR     PC,      ERRHAN ;NOT ON BOARD
680
681 003072 062703 000002      7$:  ADD     #2,      R3      ;IF CONTENTS EQUAL ZERO-DONE
682 003076 005713              TST     (R3)      ;IF CONTENTS NO EQUAL ZERO-CONTINUE
683 003100 001357              BNE     5$        ;IF CONTENTS NO EQUAL ZERO-CONTINUE
684 003102 004767 000272      JSR     PC,      PPFVAR ;GO GET PSEUDO POWER-FAIL VECTOR ADDRESS
685 003106 013704 001212      MOV     @#BASE,    R4      ;GET ETABLE PPFVA
686 003112 013703 010002      MOV     @#BUF2,    R3      ;GET BOARD PPFVA
687 003116 020403              CMP     R4,      R3      ;DO THE TWO PARAMETERS COMPARE
688 003120 001405              BEQ     8$        ;IF YES CONTINUE
689 003122 052737 000004 001110  BIS     #APTER3,    @#ROMERR ;SET APT ERROR INDICATOR
690 003130 004767 000706              JSR     PC,      ERRHAN ;GO TO ERROR ROUTINE
691 003134 013704 001216      8$:  MOV     @#SCDW1,    R4      ;GET ETABLE DATA
692 003140 013703 010004      MOV     @#BUF2+2,    R3      ;GET BOARD DATA
693 003144 020403              CMP     R4,      R3      ;DO THE TWO PARAMETER COMPARE
694 003146 001405              BEQ     9$        ;IF YES THEN DONE
695 003150 052737 000010 001110  BIS     #APTER4,    @#ROMERR ;SET APT ERROR INDICATOR
696 003156 004767 000660              JSR     PC,      ERRHAN ;GO TO ERROR ROUTINE
697 003162 000207      9$:  RTS     PC
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724

```

;GET DEVICE CODES MODULE
;THIS SUBROUTINE LOCATES EACH DEVICE CODE AND PASSES IT AND THE
;ADDRESS IN WHICH IT WAS FOUND BACK TO THE CALLING ROUTINE.
;DATA IS STORED IN BUFFER 'BUF1' IN THIS FORMAT:

```

BUF1:  ADDRESS OF FIRST DEVICE CODE
        DEVICE CODE
        ADDRESS OF SECOND DEVICE CODE
        DEVICE CODE
        .
        .
        .
        ADDRESS OF NTH DEVICE CODE
        DEVICE CODE

```

+CONTINUATION ROM DATA IS STORED IN 'BUF1' AS FOLLOWS:

```

        .
        .
        CONTINUATION CHIP IDENTIFIER (ALWAYS A +1)
        DEVICE CODE (PREVIOUS ROM'S DEVICE CODE,OR -1 IF ILLEGAL ROM)
        .
        .

```

;IF DIAGNOSTIC ROM PRESENT IT WILL BE THE FIRST DEVICE CODE.

```
725      ;THERE IS ROOM FOR UP TO 12 DEVICE CODES IN TEMP
726 003164 012700 007722      DEVGOD: MOV #BUF1, R0
727 003170 012701 000001      MOV #1, R1
728 003174 030137 001116      BIT R1, @#ROMFIN      ;INITIALIZE ROM POINTER
729 003200 001411              BEQ 1$              ;IS DIAGNOSTIC ROM PRESENT
730 003202 012737 165774 003374      MOV #165774, @#TESTAD      ;IF NO GO TEST BOOT ROMS
731 003210 013720 003374      MOV @#TESTAD, (R0)+      ;GET ADDRESS OF DIAG. ROM DEVICE CODE.
732 003214 017720 000154      MOV @#TESTAD, (R0)+      ;STORE ADDRESS OF DEVICE CODE
733 003220 005037 003376      CLR @#DATAFLAG      ;STORE DEVICE CODE
734 003224 013737 001114 003374 1$: MOV @#FIRSTB, @#TESTAD      ;CLR DATA TYPE FLAG
735 003232 006101              ROL R1              ;GET ADDRESS OF FIRST BOOT ROM
736 003234 030167 007054      3$: BIT R1, DEVF IN      ;UPDATE POINTER TO NEXT ROM
737 003240 001007              BNE 4$              ;+IS DEVICE ROM PRESENT
738 003242 004767 005666      JSR PC, CON1          ;IF YES GO GET PARAMETERS
739 003246 062737 000200 003374      ADD #200, @#TESTAD      ;+CHECK FOR CONTINUATION CHIP
740 003254 006101              ROL R1              ;IF NO UPDATE TEST ADDRESS
741 003256 000441              BR 9$              ;UPDATE POINTER TO NEXT ROM
742 003260 005737 003376      4$: TST @#DATAFLAG      ;GO SEE IF ALL ROM CHECKED
743 003264 001010              BNF 5$              ;IF DATAFLAG=0 THEN DATA IS DEVICE CODE
744 003266 013720 003374      MOV @#TESTAD, (R0)+      ;IF DATAFLAG=1 THE DATA IS OFFSET TO NEXT
745 003272 017720 000076      MOV @#TESTAD, (R0)+      ;STORE ADDRESS OF DEVICE CODE
746 003276 062737 000002 003374      ADD #2, @#TESTAD      ;STORE DEVICE CODE
747 003304 000424              BR 8$              ;UPDATE TEST ADDRESS
748 003306 013702 003374      5$: MOV @#TESTAD, R2      ;GET OVER SOME CODE
749 003312 067737 000056 003374      ADD @#TESTAD, @#TESTAD      ;SAVE OLD TEST ADDRESS
750 003320 013703 003374      MOV @#TESTAD, R3      ;UPDATE TO NEW TEST ADDRESS
751 003324 042702 170177      BIC #170177, R2      ;GET THE NEW ADDRESS
752 003330 042703 170177      BIC #170177, R3      ;+SAVE ONLY BITS 7,8,9,10,11
753 003334 160203              SUB R2, R3          ;+IN R3 ALSO
754 003336 005703      6$: TST R3              ;CALCULATE DISTANCE BETWEEN ADD
755 003340 001406              BEQ 8$              ;IS R3 EQUAL TO 0
756 003342 162703 000200      SUB #200, R3          ;IF YES THEN DONE
757 003346 006101              ROL R1              ;IF NO THEN MOVE POINTER
758 003350 004767 005606      JSR PC, CON2          ;ONE BIT FOR EVERY 200
759 003354 000770              BR 6$              ;+CHECK FOR CONTINUATION CHIP
760 003356 005137 003376      8$: COM @#DATAFLAG      ;CHANGE DATA FLAG TO RIGHT DATA TYPE
761 003362 023727 003374 174000 9$: CMP @#TESTAD, #174000      ;HAVE WE CHECKED ALL THE ROM
762 003370 002721              BLT 3$              ;IF NO CONTINUE
763 003372 000207              RTS PC              ;IF YES RETURN
764
765 003374 000000      TESTAD: 0
766 003376 000000      DATAFLAG: 0
767
768      ;GET PSEUDO POWER-FAIL VECTOR ADDRESS ROUTINE
769      ;THIS SUBROUTINE TESTS LOCATIONS 173024 AND 173224 TO DETERMINE
770      ;WHICH VECTOR WILL BE USED IF POWER-FAIL OPTION ENABLED ON THE
771      ;BOARD. THE OPTION MUST BE ENABLED AND AT LEAST ONE ADDRESS
772      ;SWITCH MUST BE 'ON' OR AN ERROR WILL BE DETECTED.
773      ;THE DATA WILL BE RETURNED IN 'BUF2' IN THE FORMAT.
774      :
775      :      BUF2: PSEUDO POWER-FAIL VECTOR ADDRESS
776      :      :      CONTENTS OF VECTOR ADDRESS
777      :
778 003400 022737 173000 173024 PPFVAR: CMP #173000, @#173024      ;- TEST IF LOCATION 173024 SELECTED
779 003406 001414              BEQ 1$              ;IF NOT THEN GO TEST LOCATION 173224
780 003410 012767 003440 006670      MOV #1$, RETURN      ;+SET UP AN ALTERNATE RETURN
781 003416 004767 005604      JSR PC, HOLCK1        ;+CHECK FOR A HOLE
```

```

782 003422 012737 173024 010002      MOV      #173024,      @#BUF2      ;IF IT IS THEN STORE ADDRESS
783 003430 013737 173024 010004      MOV      @#173024,      @#BUF2+2      ;STORE CONTENTS OF LOCATION 173024
784 003436 000423                      BR        3$              ;GO TO RETURN
785 003440 022737 173000 173224 1$:    CMP      #173000,      @#173224      ;-TEST IF LOCATION 173224 SELECTED
786 003446 001414                      BEQ      2$              ;IF NOT THEN SET ERROR INDICATOR
787 003450 012767 003500 006630      MOV      #2$,      RETURN      ;+SET UP AN ALTERNATE RETURN
788 003456 004767 005556                      JSR      PC,      HOLCK2      ;+CHECK FOR A HOLE
789 003462 012737 173224 010002      MOV      #173224,      @#BUF2      ;IF IT IS THEN STORE ADDRESS
790 003470 013737 173224 010004      MOV      @#173224,      @#BUF2+2      ;STORE CONTENTS OF VECTOR
791 003476 000403                      BR        3$              ;GET OVER ERROR
792 003500 052737 000040 001110 2$:    BIS      #PFERR,      @#ROMERR      ;SET ERROR INDICATOR
793 003506 000207                      3$:    RTS      PC

```

;PUT MESSAGE IN BUFFER ROUTINE
;THIS SUBROUTINE FORMATS THE PARAMETER AND POWER-FAIL MESSAGES.

```

800
801 003510 017604 000000      PUTMES: MOV      @#(R6),      R4      ;GET MESSAGE BUFFER ADDRESS
802 003514 005737 004040      TST      @#TIMES      ;IS THIS FIRST TIME THROUGH
803 003520 001110      BNE      3$              ;IF NOT FIRST TIME THEN FORMAT POWER-
804                                     ;FAIL MESSAGE
805 003522 005237 004040      INC      @#TIMES      ;TOGGLE WATCHDOG
806 003526 012703 007722      MOV      #BUF1,      R3      ;GET DATA BUFFER ADDRESS
807 003532 022713 165774      CMP      #165774,      (R3)      ;IS DIAGNOSTIC ROM PRESENT
808 003536 001012      BNE      1$              ;IF NOT DON'T FORMAT DIAG. ROM MESSAGE
809 003540 012705 006754      MOV      #DRHEAD,      R5      ;IF IT IS GET DIAG. ROM MESSAGE HEADER
810 003544 004767 000714      JSR      PC,      FILBUF      ;GO PUT HEADER IN MESSAGE BUFFER
811 003550 000015      CR
812 003552 062703 000002      ADD      #2,      R3      ;SKIP OVER ADDRESS OF ASCII
813 003556 000313      SWAB      (R3)      ;FORMAT ASCII FOR MESSAGE
814 003560 112324      MOV      (R3)+,      (R4)+      ;PUT ASCII IN MESSAGE BUFFER
815 003562 112324      MOV      (R3)+,      (R4)+
816 003564 012705 007021      1$:    MOV      #BRHEAD,      R5
817 003570 004767 000670      JSR      PC,      FILBUF      ;GO PUT BOOT ROM HEADER IN MESS. BUF.
818 003574 000015      CR
819 003576 012701 000001      MOV      #1,      R1      ;+POINT TO DIAGNOSTIC ROM
820 003602 013702 012326      MOV      @#MESSPT,      R2      ;+POINT TO MSG TABLE
821 003606 012767 003622 006472      MOV      #2$,      RETURN      ;+SET UP AN ALTERNATE RETURN
822 003614 012767 004006 006502      MOV      #5$,      FINISH      ;+SET UP ANOTHER ALTERNATE RETURN
823 003622 112724 000015      2$:    MOV      #CR,      (R4)+      ;PUT A CR/LF HERE
824 003626 112724 000012      MOV      #LF,      (R4)+
825 003632 004767 005440      JSR      PC,      ROMTYP      ;+FIND THE ROM TYPE
826 003636 062713 000004      ADD      #4,      (R3)      ;GET FIRST ENTRY POINT
827 003642 004767 000764      JSR      PC,      OCADD      ;GO CONVERT OCTAL TO ASCII
828 003646 004767 000612      JSR      PC,      FILBUF      ;GO PUT ENTRY POINT IN MESSAGE BUF
829 003652 000011      HT
830 003654 112724 000040      MOV      #40,      (R4)+
831 003660 112724 000040      MOV      #40,      (R4)+
832 003664 112724 000040      MOV      #40,      (R4)+
833 003670 062713 000002      ADD      #2,      (R3)      ;GET SECOND ENTRY POINT
834 003674 004767 000732      JSR      PC,      OCADD      ;GO CONVERT OCTAL TO ASCII
835 003700 004767 000560      JSR      PC,      FILBUF      ;GO PUT ENTRY POINT IN MESSAGE BUF.
836 003704 000011      HT
837 003706 112724 0000'0      MOV      #40,      (R4)+
838 003712 112724 000040      MOV      #40,      (R4)+

```



```
839 003716 112724 000040      MOVB    #40,      (R4)+
840 003722 112724 000011      MOVB    #HT,      (R4)+      ;PUT TAB IN HERE
841 003726 062703 000002      ADD     #2,      R3      ;UPDATE DATA BUFFER ADDRESS
842 003732 000313              SWAB    (R3)      ;FORMAT ASCII FOR MESSAGE
843 003734 112324              MOVB    (R3)+,    (R4)+      ;MOV ASCII TO MES1
844 003736 112324              MOVB    (R3)+,    (R4)+
845 003740 000730              BR      2$      ;GO BACK TO START OF LOOP
846 003742 012703 010002      3$:  MOV    #BUF2,    R3      ;GET DATA BUFFER ADDRESS
847 003746 012705 007156      MOV    #PFHEAD,  R5      ;GET POWER-FAIL HEADER ADDRESS
848 003752 004767 000506      JSR     PC,      FILBUF      ;GO PUT POWER-FAIL HEADER IN MESSAGE BUF.
849 003756 000015              CR
850 003760 022703 010006      4$:  CMP     #BUF2+4,  R3      ;ARE WE DONE
851 003764 001410              BEQ     5$      ;IF YES THEN GO RETURN
852 003766 004767 000640      JSR     PC,      0CADD      ;GO CONVERT OCTAL TO ASCII
853 003772 004767 000466      JSR     PC,      FILBUF
854 003776 000011              HT
855 004000 062703 000002      ADD     #2,      R3      ;UPDATE DATA BUFFER ADDRESS
856 004004 000765              BR      4$      ;GO BACK TO START OF LOOP
857 004006 112724 000015      5$:  MOVB    #CR,      (R4)+      ;PUT A CR/LF AT END OF MESSAGE
858 004012 112724 000012      MOVB    #LF,      (R4)+
859 004016 105024              CLRB    (R4)+      ;PUT ZERO TERMINATOR AT END OF MESSAGE
860 004020 017667 000000 000002  MOV     @ (R6),    6$      ;GET MESSAGE BUFFER ADDRESS
861 004026 104401              TYPE
862 004030 000000      6$:  .WORD    0
863 004032 062716 000002      ADD     #2,      (R6)      ;GET OVER MESSAGE BUFFER ADDRESS
864 004036 000207      RTS     PC
865 004040 000000      TIMES:  0
```

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;ERROR HANDLER ROUTINE
;THIS SUBROUTINE FORMATS THE ERROR MESSAGES THE TYPES THEM
;OUT.

```
878 004042 104411      ERRHAN: SAVREG
879 004044 012704 010516      MOV     #ERRMSG,    R4
880 004050 005237 001120      INC     @ERRCNT      ;INCREMENT ERROR COUNTER
881 004054 032777 002000 175022  BIT     #BIT10,    @SWR      ;BELL ON ERROR
882 004062 001402              BEQ     1$      ;BRANCH IF NO
883 004064 104401              TYPE
884 004066 006674              BELL
885 004070 032777 020000 175006 1$:  BIT     #BIT13,    @SWR      ;INHIBIT ERROR TYPEOUT
886 004076 001402              BEQ     OVER1      ;NO GO THROUGH
887 004100 000167 000310      JMP     OVER10
888 004104 013700 001110      OVER1: MOV     @WROMERR,  R0      ;GET ERROR CODE
889 004110 013767 001110 000264  MOV     @WROMERR,  OVER9      ;SAVE ERROR CODE FOR APT
890 004116 012701 004436      MOV     #EHEADT,  R1      ;GET ERROR HEADER TABLE
891 004122 000241              CLC
892 004124 006000      2$:  ROR     R0      ;C-BIT USED TO STOP STEPPING THROUGH TABLE
893 004126 103403              BCS     3$      ;ROTATE ERROR CODES
894 004130 062701 000002      ADD     #2,      R1      ;IF C-BIT SET STOP STEPPING
895 004134 000773              BR      2$      ;IF C-BIT CLEAR STEP TO NEXT HEADER
                                ;GO STEP
```

```

896 004136 011105      3$:  MOV      (R1),      R5      ;PUT HEADER ADDRESS IN REGISTER.
897 004140 004767 000320  JSR      PC,      FILBUF  ;GO PUT HEADER IN ERROR MESSAGE BUF.
898 004144 000015      CR
899 004146 032767 000040 174734  BIT      #PFERR, ROMERR  ;+IS IT A 'PPFVAR' ERROR?
900 004154 001063      BNE      8$
901 004156 032767 003600 174724  BIT      #3600, ROMERR  ;+BRANCH IF YES
902 004164 001411      BEQ      14$
903 004166 016767 006126 000010  MOV      ARG2, 13$
904 004174 016705 006116  MOV      ARG1,  R5
905 004200 004767 000260      JSR      PC,      FILBUF  ;+IS IT A 'SEQTST' ERROR?
906 004204 000000      13$:  .WORD  0
907 004206 000446      BR      8$
908 004210 032737 000023 001110 14$:  BIT      #23,      @#ROMERR  ;+BRANCH IF NO
909 004216 001424      BEQ      7$
910 004220 032737 000020 001110  BIT      #20,      @#ROMERR  ;+PUT #CR OR #HT AT 13$
911 004226 001415      BEQ      6$
912 004230 013700 002602      MOV      @#ROMCNT, R0
913 004234 013701 006646      MOV      @#ROMPTR, R1  ;+ARG1 CONTAINS ADR. OF MSG
914 004240 000241      CLC
915 004242 006000      4$:  ROR      R0
916 004244 103403      BCS      5$
917 004246 062701 000002      ADD      #2,      R1
918 004252 000773      BR      4$
919 004254 112124      5$:  MOVB     (R1)+,  (R4)+
920 004256 112124      MOVB     (R1)+,  (R4)+
921 004260 000421      BR      8$
922 004262 112324      6$:  MOVB     (R3)+,  (R4)+
923 004264 112324      MOVB     (R3)+,  (R4)+
924 004266 000416      BR      8$
925 004270 016603 000006      7$:  MOV      6(R6),  R3
926 004274 004767 000226      JSR      PC,      OCASC
927 004300 004767 000160      JSR      PC,      FILBUF  ;GO TO END OF ROUTINE
928 004304 000011      HT
929 004306 016603 000010      MOV      10(R6), R3
930 004312 004767 000210      JSR      PC,      OCASC
931 004316 004767 000142      JSR      PC,      FILBUF  ;PUT BAD DEVICE CODE IN ERROR MESS. BUF.
932 004322 000011      HT
933 004324 112724 000015      8$:  MOVB     #CR,      (R4)+
934 004330 112724 000012      MOVB     #LF,      (R4)+
935 004334 112724 000000      MOVB     #0,      (R4)+
936 004340 005767 174612      TST      $ENV
937 004344 001002      BNE      OVER2
938 004346 000167 000034      JMP      OVER11
939 004352 022737 000001 001116 OVER2: CMP      #1,      @#ROMFIN
940 004360 001005      BNE      AROUND
941 004362 032737 000040 001110  BIT      #PFERR , @#ROMERR  ;GO COVERT OCTAL TO ASCII
942
943 004370 001401      BEQ      AROUND
944 004372 000405      BR      OVER11
945 004374 004767 000614      AROUND: JSR      PC,      $ATY1
946 004400 010516      ERRMSG
947 004402 000000      OVER9: .WORD  0
948 004404 000000      HALT
949 004406 004767 000610      OVER11: JSR      PC,      $ATY3
950 004412 010516      ERRMSG
951 004414 032777 100000 174462 OVER10: BIT      #BIT15, @SWR
952 004422 001401      BEQ      12$

```

```
953 004424 000000
954 004426 005037 001110      12$: HALT
955 004432 104412              CLR      @WROMERR      ;CLEAR ERROR FLAGS
956 004434 000207              RESREG
957                                RTS      PC
958
959 004436 007257      EHEADT: ER1MSG
960 004440 007223              ER2MSG
961 004442 007315              ER3MSG
962 004444 007373              ER4MSG
963 004446 007447              CRCMSG
964 004450 007473              PFMSG
965 004452 007551              NOROMM
966 004454 007627              SEQMSG      ;+
967 004456 012376              ERMES1      ;+
968 004460 012455              ERMES2      ;+
969 004462 012535              ERMES3      ;+
970
971
972
973      ;FILL BUFFER ROUTINE
974      ;THIS SUBROUTINE FILLS THE MESSAGE BUFFER WILL ASCII
975      ;CHARACTERS.
976
977 004464 022776 000011 000000 FILBUF: CMP      #HT,      @ (R6)      ;IS FIRST CHARACTER A TAB OR CR
978 004472 001003              BNE      1$      ;IF CR THEN GO PUT CR/LF IN BUFFER
979 004474 112724 000011              MOVB     #HT,      (R4)+      ;IF TAB THEN PUT TAB IN BUFFER
980 004500 000404              BR      2$      ;GET OVER NEXT LINE
981 004502 112724 000015      1$:  MOVB     #CR,      (R4)+      ;MOV CR/LF TO BUFFER
982 004506 112724 000012              MOVB     #LF,      (R4)+
983 004512 112524              2$:  MOVB     (R5)+,      (R4)+      ;PUT A CHARACTER IN MESSAGE BUFFER
984 004514 105715              TSTB     (R5)      ;IS NEXT CHARACTER ZERO
985 004516 001375              BNE      2$      ;IF NOT PUT IT IN MESSAGE BUFFER AND GET NEX
986 004520 062716 000002              ADD      #2,      (R6)      ;UPDATE RETURN POINTER TO GET OVER CHARACTER
987 004524 000207              RTS      PC      ;THEN RETURN
988
989
990
991
992      ;OCTAL TO ASCII CONVERSION ROUTINE
993      ;THIS SUBROUTINE TAKES A SIXTEEN BIT OCTAL NUMBER AND
994      ;CONVERTS IT TO 6 ASCII CHARACTERS
995
996 004526 012700 010006      OCASC: MOV      #OCTBUF,      R0      ;GET BUFFER ADDRESS
997 004532 005020              CLR      (R0)+      ;CLEAR BUFFER
998 004534 005020              CLR      (R0)+
999 004536 005020              CLR      (R0)+
1000 004540 005020              CLR      (R0)+
1001 004542 012700 010006      MOV      #OCTBUF,      R0      ;GET BUFFER ADDRESS
1002 004546 010337 004630      MOV      R3,      @TEMP      ;GET OCTAL NUMBER
1003 004552 000241              CLC      ;CLEAR CARRY
1004 004554 006137 004630      ROL      @TEMP      ;ROTATE BIT INTO CARRY BIT
1005 004560 006110              ROL      (R0)      ;ROTATE CARRY BIT INTO BUFFER
1006 004562 152710 000060      1$:  BISB     #60,      (R0)      ;MAKE IT ASCII
1007 004566 005200              INC      R0      ;UPDATE BUFFER ADDRESS
1008 004570 020027 010014      CMP      R0,      #OCTBUF+6      ;HAVE WE CONVERTED ALL THE NUMBER
1009 004574 001003              BNE      2$      ;IF NO CONTINUE
```

```
1010 004576 012705 010006      MOV    #OCTBUF,      R5      ;IF YES PUT BUFFER ADDRESS IN REGISTER
1011 004602 000207              RTS      PC              ;RETURN
1012 004604 006137 004630      2$:    ROL     @TEMP      ;ROTATE BIT INTO CARRY BIT
1013 004610 106110              ROLB    (R0)             ;ROTATE CARRY BIT INTO BUFFER
1014 004612 006137 004630      ROL     @TEMP      ;
1015 004616 106110              ROLB    (R0)             ;
1016 004620 006137 004630      ROL     @TEMP      ;
1017 004624 106110              ROLB    (R0)             ;
1018 004626 000755              BR      1$              ;GO TO START OF LOOP
1019 004630 000000      TEMP:    0
```

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1026 004632 010346
1027 004634 011303
1028 004636 004767 177664
1029 004642 012603
1030 004644 000207
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;THIS ROUTINE IS CALLED BY THE PUT MESSAGE ROUTINE TO GET THE RIGHT
;VALUE IN R3 SO THE OCTAL TO ASCII ROUTINE GETS THE RIGHT NUMBER.

```
OCADD:  MOV    R3,      -(R6)      ;SAVE THE VALUE OF R3
        MOV    (R3),    R3         ;PUT THE DATA TO BE CONVERTED IN R3
        JSR    PC,      OCASC      ;GO CONVERT OCTAL TO ASCII
        MOV    (R6)+,    R3        ;RESTORE R3
        RTS     PC                ;RETURN
```

.SBTTL TYPE ROUTINE

```
*****
*ROUTINE TO TYPE ASCII MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
*NOTE1:      $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
*NOTE2:      $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
*NOTE3:      $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
*
*CALL:
*1) USING A TRAP INSTRUCTION
*      TYPE    ,MESADR      ;;MESADR IS FIRST ADDRESS OF AN ASCII STRING
*OR
*      TYPE    MESADR
*
```

```
004646 105767 000335      $TYPE:  TSTB    $TPFLG      ;;IS THERE A TERMINAL?
004652 100002              BPL     1$              ;;BR IF YES
004654 000000              HALT    ;HALT HERE IF NO TERMINAL
004656 000430              BR      3$              ;;LEAVE
004660 010046      1$:    MOV     R0,-(SP)           ;;SAVE R0
004662 017600 000002      MOV     @2(SP),R0        ;;GET ADDRESS OF ASCII STRING
004666 122767 000001 174262  CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
004674 001011      BNE     62$                    ;;NO,GO CHECK FOR APT CONSOLE
004676 132767 000100 174253  BITB    #APTSPOOL,$ENVM  ;;SPOOL MESSAGE TO APT
004704 001405      BEQ     62$                    ;;NO,GO CHECK FOR CONSOLE
004706 010067 000004      MOV     R0,61$           ;;SETUP MESSAGE ADDRESS FOR APT
004712 004767 000304      JSR     PC,$ATY3         ;;SPOOL MESSAGE TO APT
004716 000000      61$:    .WORD    0              ;;MESSAGE ADDRESS
004720 132767 000040 174231 62$:    BITB    #APTCSUP,$ENVM ;;APT CONSOLE SUPPRESSED
```

```

004726 001003      BNE      60$      ;;YES,SKIP TYPE OUT
004730 112046      2$:      MOVB      (R0)+,-(SP)      ;;PUSH CHARACTER TO BE TYPED ONTO STACK
004732 001005      BNE      4$      ;;BR IF IT ISN'T THE TERMINATOR
004734 005726      TST      (SP)+      ;;IF TERMINATOR POP IT OFF THE STACK
004736 012600      60$:      MOV      (SP)+,R0      ;;RESTORE R0
004740 062716 000002 3$:      ADD      #2,(SP)      ;;ADJUST RETURN PC
004744 000002      RTI      ;;RETURN
004746 122716 000011 4$:      CMPB      #HT,(SP)      ;;BRANCH IF <HT>
004752 001430      BEQ      8$      ;;BRANCH IF NOT <CRLF>
004754 122716 000200      CMPB      #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
004760 001006      BNE      5$      ;;BRANCH IF NOT <CRLF>
004762 005726      TST      (SP)+      ;;POP <CR><LF> EQUIV
004764 104701      TYPE      ;;TYPE A CR AND LF
004766 005211      $CRLF      ;;TYPE A CR AND LF
004770 105067 000200      CLRB      $CHARCNT      ;;CLEAR CHARACTER COUNT
004774 000755      BR      2$      ;;GET NEXT CHARACTER
004776 004767 000056 5$:      JSR      PC,$TYPEPC      ;;GO TYPE THIS CHARACTER
005002 126726 000200 6$:      CMPB      $FILLC,(SP)+      ;;IS IT TIME FOR FILLER CHARS.?
005006 001350      BNE      2$      ;;IF NO GO GET NEXT CHAR.
005010 016746 000170      MOV      $NULL,-(SP)      ;;GET # OF FILLER CHARS. NEEDED
                                ;;AND THE NULL CHAR.
005014 105366 000001 7$:      DECB      1(SP)      ;;DOES A NULL NEED TO BE TYPED?
005020 002770      BLT      6$      ;;BR IF NO--GO POP THE NULL OFF OF STACK
005022 004767 000032      JSR      PC,$TYPEPC      ;;GO TYPE A NULL
005026 105367 000142      DECB      $CHARCNT      ;;DO NOT COUNT AS A COUNT
005032 000770      BR      7$      ;;LOOP

```

;HORIZONTAL TAB PROCESSOR

```

005034 112716 000040      8$:      MOVB      #'',(SP)      ;;REPLACE TAB WITH SPACE
005040 004767 000014      9$:      JSR      PC,$TYPEPC      ;;TYPE A SPACE
005044 132767 000007 000122      BITB      #7,$CHARCNT      ;;BRANCH IF NOT AT
005052 001372      BNE      9$      ;;TAB STOP
005054 005726      TST      (SP)+      ;;POP SPACE OFF STACK
005056 000724      BR      2$      ;;GET NEXT CHARACTER
005060 105777 000114      $TYPEPC: TSTB      @STPS      ;;WAIT UNTIL PRINTER IS READY
005064 100375      BPL      $TYPEPC
005066 116677 000002 000106      MOVB      2(SP),@STPB      ;;LOAD CHAR TO BE TYPED INTO DATA REG.
005074 105777 000362      TSTB      @STKS      ;;SEE IF KEYBOARD IS TALKING.
005100 100021      BPL      2$      ;;BRANCH IF IT ISN'T.
005102 017746 000356      MOV      @STKB,-(SP)      ;;PUSH CHARACTER ONTO STACK.
005106 042716 177600      BIC      #177600,(SP)      ;;BIT CLEAR TOP BYTE AND PARITY BIT.
005112 005726 000023      CMP      #23,(SP)+      ;;SEE IF THIS IS A ^S.
005116 001012      BNE      2$      ;;BRANCH TO CONTINUE IF IT ISN'T.
005120 105777 000336 3$:      TSTB      @STKS      ;;WAIT FOR ANOTHER INPUT.
005124 100375      BPL      3$      ;;BRANCH BACK IF NOT READY.
005126 017746 000332      MOV      @STKB,-(SP)      ;;PUSH NEXT CHARACTER ON STACK.
005132 042716 177600      BIC      #177600,(SP)      ;;BIT CLEAR TOP BYTE AND PARITY BIT.
005136 022726 000021      CMP      #21,(SP)+      ;;SEE IF THIS IS A ^Q.
005142 001366      BNE      3$      ;;BRANCH BACK FOR MORE WAIT IF NOT.
005144 122766 000015 000002 2$:      CMPB      #CR,2(SP)      ;;IS CHARACTER A CARRIAGE RETURN?
005152 001003      BNE      1$      ;;BRANCH IF NO
005154 105067 000014      CLRB      $CHARCNT      ;;YES--CLEAR CHARACTER COUNT
005160 000406      BR      $TYPEPC      ;;EXIT
005162 122766 000012 000002 1$:      CMPB      #LF,2(SP)      ;;IS CHARACTER A LINE FEED?
005170 001402      BEQ      $TYPEPC      ;;BRANCH IF YES
005172 105227      INCB      (PC)+      ;;COUNT THE CHARACTER

```

005174	000000			\$CHARCNT: .WORD	0		:: CHARACTER COUNT STORAGE
005176	000207			\$TYPEX: RTS	PC		
005200	177564			\$TPS: .WORD	177564		:: TTY PRINTER STATUS REG. ADDRESS
005202	177566			\$TPB: .WORD	177566		:: TTY PRINTER BUFFER REG. ADDRESS
005204	000			\$NULL: .BYTE	0		:: CONTAINS NULL CHARACTER FOR FILLS
005205	002			\$FILLS: .BYTE	2		:: CONTAINS # OF FILLER CHARACTERS REQUIRED
005206	012			\$FILLC: .BYTE	12		:: INSERT FILL CHARS. AFTER A 'LINE FEED'
005207	000			\$TPFLG: .BYTE	0		:: 'TERMINAL AVAILABLE' FLAG (BIT<07>=0=YES)
005210	077			\$QUES: .ASCII	'?'		:: QUESTION MARK
005211	015			\$CRLF: .ASCII	<15>		:: CARRIAGE RETURN
005212	012	000		\$LF: .ASCII	<12>		:: LINEFEED
1037				.SBTTL APT COMMUNICATIONS ROUTINE			

005214	112767	000001	000236	\$ATY1: MOVB	#1,\$FFLG		:: TO REPORT FATAL ERROR
005222	112767	000001	000226	\$ATY3: MOVB	#1,\$MFLG		:: TO TYPE A MESSAGE
005230	000403			BR	\$ATYC		
005232	112767	000001	000220	\$ATY4: MOVB	#1,\$FFLG		:: TO ONLY REPORT FATAL ERROR
005240				\$ATYC:			
005240	010046			MOV	R0,-(SP)		:: PUSH R0 ON STACK
005242	010146			MOV	R1,-(SP)		:: PUSH R1 ON STACK
005244	105767	000206		TSTB	\$MFLG		:: SHOULD TYPE A MESSAGE?
005250	001450			BEQ	\$S		:: IF NOT: BR
005252	122767	000001	173676	CMPEB	#APTENV,\$ENV		:: OPERATING UNDER APT?
005260	001031			BNE	\$S		:: IF NOT: BR
005262	132767	000100	173667	BITB	#APTSPool,\$ENV		:: SHOULD SPOOL MESSAGES?
005270	001425			BEQ	\$S		:: IF NOT: BR
005272	017600	000004		MOV	@4(SP),R0		:: GET MESSAGE ADDR.
005276	062766	000002	000004	ADD	#2,4(SP)		:: BUMP RETURN ADDR.
005304	005767	173626		1\$: TST	\$MSGTYPE		:: SEE IF DONE W/ LAST XMISSION?
005310	001375			BNE	\$S		:: IF NOT: WAIT
005312	010067	173634		MOV	' \$MSGAD		:: PUT ADDR IN MAILBOX
005316	105720			2\$: TSTB	+		:: FIND END OF MESSAGE
005320	001376			BNE	\$S		
005322	166700	173624		SUB	\$MSGAD,R0		:: SUB START OF MESSAGE
005326	006200			ASR	R0		:: GET MESSAGE LGTH IN WORDS
005330	010067	173620		MOV	R0,\$MSGLG		:: PUT LENGTH IN MAILBOX
005334	012767	000004	173574	MOV	#4,\$MSGTYPE		:: TELL APT TO TAKE MSG.
005342	000413			BR	\$S		
005344	017667	000004	000016	3\$: MOV	@4(SP),4\$:: PUT MSG ADDR IN JSR LINKAGE
005352	062766	000002	000004	ADD	#2,4(SP)		:: BUMP RETURN ADDRESS
005360	016746	172412		MOV	177776,-(SP)		:: PUSH 177776 ON STACK
005364	004767	177256		JSR	PC,\$TYPE		:: CALL TYPE MACRO
005370	000000			4\$: .WORD	0		
005372				5\$:			
005372	105767	000062		10\$: TSTB	\$FFLG		:: SHOULD REPORT FATAL ERROR?
005376	001416			BEQ	\$S		:: IF NOT: BR
005400	005767	173552		TST	\$ENV		:: RUNNING UNDER APT?
005404	001413			BEQ	\$S		:: IF NOT: BR
005406	005767	173524		11\$: TST	\$MSGTYPE		:: FINISHED LAST MESSAGE?
005412	001375			BNE	\$S		:: IF NOT: WAIT
005414	017667	000004	173516	MOV	@4(SP),\$FATAL		:: GET ERROR #
005422	062766	000002	000004	ADD	#2,4(SP)		:: BUMP RETURN ADDR.
005430	005267	173502		INC	\$MSGTYPE		:: TELL APT TO TAKE ERROR
005434	105067	000020		12\$: CLRB	\$FFLG		:: CLEAR FATAL FLAG
005440	105067	000013		CLRB	\$LFLG		:: CLEAR LOG FLAG

```

005444 105067 000006      CLR B      $MFLG      ;; CLEAR MESSAGE FLAG
005450 012601      MOV      (SP)+,R1      ;; POP STACK INTO R1
005452 012600      MOV      (SP)+,R0      ;; POP STACK INTO R0
005454 000207      RTS      PC          ;; RETURN
005456      000      $MFLG: .BYTE 0      ;; MESSG. FLAG
005457      000      $LFLG: .BYTE 0      ;; LOG FLAG
005460      000      $FFLG: .BYTE 0      ;; FATAL FLAG
                                .EVEN
                                APTSIZE=200
                                APTENV=001
                                APTSPool=100
                                APTCSUP=040
1038      0000200
            000001
            000100
            000040
            .SBTTL TTY INPUT RC INE

*****
005462 177560      $TKS: .WORD 177560      ;; TTY KBD STATUS
005464 77562      $TKB: .WORD 177562      ;; TTY KBD BUFFER
            .ENABL LSB

*****
*SOFTWARE SWITCH REGISTER CHANGE ROUTINE.
*ROUTINE IS ENTERED FROM THE TRAP HANDLER, AND WILL
*SERVICE THE TEST FOR CHANGE IN SOFTWARE SWITCH REGISTER TRAP CALL
*WHEN OPERATING IN TTY FLAG MODE.
005466 022767 000176 173410 $CKSWR: CMP      #SWREG,SWR      ;; IS THE SOFT-SWR SELECTED?
005474 001074      BNE      15$          ;; BRANCH IF NO
005476 105777 177760      TSTB      @TKS          ;; CHAR THERE?
005502 100071      BPL      15$          ;; IF NO, DON'T WAIT AROUND
005504 117746 177754      MOV B      @TKB,-(SP)      ;; SAVE THE CHAR
005510 042716 177600      BIC      #^C177,(SP)      ;; STRIP-OFF THE ASCII
005514 022726 000007      CMP      #7,(SP)+      ;; IS IT A CONTROL G?
005520 001062      BNE      15$          ;; NO, RETURN TO USER
005522 126727 173352 000001 CMPB      $AUTOB,#1      ;; ARE WE RUNNING IN AUTO-MODE?
005530 001456      BEQ      15$          ;; BRANCH IF YES

005532 104401 006213      TYPE      , $CNTLG      ;; ECHO THE CONTROL-G (^G)
005536 104401 006220      $GTSWR: TYPE      , $MSWR      ;; TYPE CURRENT CONTENTS
005542 016746 172430      MOV      SWREG,-(SP)      ;; SAVE SWREG FOR TYPEOUT
005546 104402      TYPOC      ;; GO TYPE--OCTAL ASCII(ALL DIGITS)
005550 104401 006231      TYPE      , $MNEW      ;; PROMPT FOR NEW SWR
005554 005046      19$: CLR      -(SP)      ;; CLEAR COUNTER
005556 005046      7$: CLR      -(SP)      ;; THE NEW SWR
005560 105777 177676      TSTB      @TKS          ;; CHAR THERE?
005564 100375      BPL      7$          ;; IF NOT TRY AGAIN

005566 117746 177672      MOV B      @TKB,-(SP)      ;; PICK UP CHAR
005572 042716 177600      BIC      #^C177,(SP)      ;; MAKE IT 7-BIT ASCII

005576 021627 000025      9$: CMP      (SP),#25      ;; IS IT A CONTROL-U?
005602 001005      BNE      10$          ;; BRANCH IF NOT
005604 104401 006206      TYPE      , $CNTLU      ;; YES, ECHO CONTROL-U (^U)
005610 062706 000006      20$: ADD      #6,SP      ;; IGNORE PREVIOUS INPUT
005614 000757      BR      19$          ;; LET'S TRY IT AGAIN

```



```
005616 021627 000015      10$: CMP      (SP),#15      ;; IS IT A <CR>?
005622 001022              BNE      16$      ;; BRANCH IF NO
005624 005766 000004      TST      4(SP)      ;; YES, IS IT THE FIRST CHAR?
005630 001403              BEQ      11$      ;; BRANCH IF YES
005632 016677 000002 173244 MOV      2(SP),@SWR      ;; SAVE NEW SWR
005640 062706 000006      11$: ADD      #6,SP      ;; CLEAR UP STACK
005644 104401 005211      14$: TYPE     $CRLF      ;; ECHO <CR> AND <LF>
005650 126727 173225 000001 CMPSB     $INTAG,#1      ;; RE-ENABLE TTY KBD INTERRUPTS?
005656 001003              BNE      15$      ;; BRANCH IF NOT
005660 012777 000100 177574 MOV      #100,@STKS      ;; RE-ENABLE TTY KBD INTERRUPTS
005666 000002      15$: RTI              ;; RETURN
005670 004767 177164      16$: JSR      PC,$TYPEC      ;; ECHO CHAR
005674 021627 000060      CMP      (SP),#60      ;; CHAR < 0?
005700 002420              BLT      18$      ;; BRANCH IF YES
005702 021627 000067      CMP      (SP),#67      ;; CHAR > 7?
005706 003015              BGT      18$      ;; BRANCH IF YES
005710 042726 000060      BIC      #60,(SP)+      ;; STRIP-OFF ASCII
005714 005766 000002      TST      2(SP)      ;; IS THIS THE FIRST CHAR
005720 001103              BEQ      17$      ;; BRANCH IF YES
005722 006316              ASL      (SP)      ;; NO, SHIFT PRESENT
005724 006316              ASL      (SP)      ;; CHAR OVER TO MAKE
005726 006316              ASL      (SP)      ;; ROOM FOR NEW ONE.
005730 005266 000002      17$: INC      2(SP)      ;; KEEP COUNT OF CHAR
005734 056616 177776      BIS      -2(SP),(SP)      ;; SET IN NEW CHAR
005740 000707              BR       7$      ;; GET THE NEXT ONE
005742 104401 005210      18$: TYPE     $QUES      ;; TYPE ?<CR><LF>
005746 000720              BR       20$      ;; SIMULATE CONTROL-U
      .DSABL  LSB
```

```
*****
*THIS ROUTINE WILL INPUT A SINGLE CHARACTER FROM THE TTY
*CALL:
*      RDCHR      ;; INPUT A SINGLE CHARACTER FROM THE TTY
*      RETURN HERE ;; CHARACTER IS ON THE STACK
*                  ;; WITH PARITY BIT STRIPPED OFF
*
```

```
005750 011646      $RDCHR: MOV      (SP),-(SP)      ;; PUSH DOWN THE PC
005752 016666 000004 000002 MOV      4(SP),2(SP)      ;; SAVE THE PS
005760 105777 177476      1$: TSTB     @STKS      ;; WAIT FOR
005764 100375              BPL      1$      ;; A CHARACTER
005766 117766 177472 000004 MOVB     @STKB,4(SP)      ;; READ THE TTY
005774 042766 177600 000004 BIC      #^C<177>,4(SP)      ;; GET RID OF JUNK IF ANY
006002 026627 000004 000023 CMP      4(SP),#23      ;; IS IT A CONTROL-S?
006010 001013              BNE      3$      ;; BRANCH IF NO
006012 105777 177444      2$: TSTB     @STKS      ;; WAIT FOR A CHARACTER
006016 100375              BPL      2$      ;; LOOP UNTIL ITS THERE
006020 117746 177440      MOVB     @STKB,-(SP)      ;; GET CHARACTER
006024 042716 177600      BIC      #^C177,(SP)      ;; MAKE IT 7-BIT ASCII
006030 022627 000021      CMP      (SP)+,#21      ;; IS IT A CONTROL-Q?
006034 001366              BNE      2$      ;; IF NOT DISCARD IT
006036 000750              BR       1$      ;; YES, RESUME
006040 026627 000004 000140 3$: CMP      4(SP),#140      ;; IS IT UPPER CASE?
006046 002407              BLT      4$      ;; BRANCH IF YES
006050 026627 000004 000175      CMP      4(SP),#175      ;; IS IT A SPECIAL CHAR?
006056 003003              BGT      4$      ;; BRANCH IF YES
```

Address	Hex	Dec	Label	Op	Opnd	Comment
006070	010346		\$RDLIN:	MOV	R3, -(SP)	::SAVE R3
006072	012703	006176	1\$:	MOV	#\$TTYIN, R3	::GET ADDRESS
006076	022703	006206	2\$:	CMP	#\$TTYIN+8., R3	::BUFFER FULL?
006102	101405			BLOS	4\$::BR IF YES
006104	104407			RDCHR		::GO READ ONE CHARACTER FROM THE TTY
006106	112613			MOVB	(SP)+, (R3)	::GET CHARACTER
006110	122713	000177	10\$:	CMPS	#177, (R3)	::IS IT A RUBOUT
006114	001003			BNE	3\$::SKIP IF NOT
006116	104401	005210	4\$:	TYPE	, \$QUES	::TYPE A '?'
006122	000763			BR	1\$::CLEAR THE BUFFER AND LOOP
006124	111367	000044	3\$:	MOVB	(R3), 9\$::ECHO THE CHARACTER
006130	104401	006174		TYPE	, 9\$	
006134	122723	000015		CMPS	#15, (R3)+	::CHECK FOR RETURN
006140	0C1356			BNE	2\$::LOOP IF NOT RETURN
006142	105063	177777		CLRB	-1(R3)	::CLEAR RETURN (THE 15)
006146	104401	005212		TYPE	, \$LF	::TYPE A LINE FEED
006152	012603			MOV	(SP)+, R3	::RESTORE R3
006154	011646			MOV	(SP), -(SP)	::ADJUST THE STACK AND PUT ADDRESS OF THE
006156	016666	000004	000002	MOV	4(SP), 2(SP)	::FIRST ASCII CHARACTER ON IT
006164	012766	006176	000004	MOV	#\$TTYIN, 4(SP)	
006172	000002			RTI		::RETURN
006174	000		9\$:	.BYTE	0	::STORAGE FOR ASCII CHAR. TO TYPE
006175	000			.BYTE	0	::TERMINATOR
006176			\$TTYIN:	.BLKB	8.	::RESERVE 8 BYTES FOR TTY INPUT
006206	136	125	015	\$CNTLU:	.ASCIZ /^U/<15><12>	::CONTROL 'U'
006211	012	000				
006213	136	107	015	\$CNTLG:	.ASCIZ /^G/<15><12>	::CONTROL 'G'
006216	012	000				
006220	015	012	123	\$MSWR:	.ASCIZ <15><12>/SWR = /	
006223	127	122	040			
006226	075	040	000			
006231	040	040	116	\$MNEW:	.ASCIZ / NEW = /	
006234	105	127	040			
006237	075	040	000			

1039

.SBTTL BINARY TO OCTAL (ASCII) AND TYPE

[illegible]

```

; *STYPON---ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
; *STYPOS OR STYPOC
; *CALL:
; *      MOV      NUM,-(SP)      ;;NUMBER TO BE TYPED
; *      TYPON                      ;;CALL FOR TYPEOUT
; *
; *STYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
; *CALL:
; *      MOV      NUM,-(SP)      ;;NUMBER TO BE TYPED
; *      TYPOC                      ;;CALL FOR TYPEOUT
; *
006242 017646 000000      STYPOS: MOV      @ (SP),-(SP)      ;;PICKUP THE MODE
006246 116667 000001 000211      MOV      1(SP),SOFILL      ;;LOAD ZERO FILL SWITCH
006254 112667 000207      MOV      (SP)+,SOMODE+1      ;;NUMBER OF DIGITS TO TYPE
006260 062716 000002      ADD      #2,(SP)      ;;ADJUST RETURN ADDRESS
006264 000406      BR      STYPON
006266 112767 000001 000171      STYPOC: MOV      #1,SOFILL      ;;SET THE ZERO FILL SWITCH
006274 112767 000006 000165      MOV      #6,SOMODE+1      ;;SET FOR SIX(6) DIGITS
006302 112767 000005 000154      STYPON: MOV      #5,SOCNT      ;;SET THE ITERATION COUNT
006310 010346      MOV      R3,-(SP)      ;;SAVE R3
006312 010446      MOV      R4,-(SP)      ;;SAVE R4
006314 010546      MOV      R5,-(SP)      ;;SAVE R5
006316 116704 000145      MOV      SOMODE+1,R4      ;;GET THE NUMBER OF DIGITS TO TYPE
006322 005404      NEG      R4
006324 062704 000006      ADD      #6,R4      ;;SUBTRACT IT FOR MAX. ALLOWED
006330 110467 000132      MOV      R4,SOMODE      ;;SAVE IT FOR USE
006334 116704 000125      MOV      SOFILL,R4      ;;GET THE ZERO FILL SWITCH
006340 016605 000012      MOV      12(SP),R5      ;;PICKUP THE INPUT NUMBER
006344 005003      CLR      R3      ;;CLEAR THE OUTPUT WORD
006346 006105      1$: ROL      R5      ;;ROTATE MSB INTO 'C'
006350 000404      BR      3$      ;;GO DO MSB
006352 006105      2$: ROL      R5      ;;FORM THIS DIGIT
006354 006105      ROL      R5
006356 006105      ROL      R5
006360 010503      MOV      R5,R3
006362 006103      3$: ROL      R3      ;;GET LSB OF THIS DIGIT
006364 105367 000076      DECB      SOMODE      ;;TYPE THIS DIGIT?
006370 100016      BPL      7$      ;;BR IF NO
006372 042703 177770      BIC      #177770,R3      ;;GET RID OF JUNK
006376 001002      BNE      4$      ;;TEST FOR 0
006400 005704      TST      R4      ;;SUPPRESS THIS 0?
006402 001403      SEQ      5$      ;;BR IF YES
006404 005204      4$: INC      R4      ;;DON'T SUPPRESS ANYMORE 0'S
006406 052703 000060      BIS      #'0,R3      ;;MAKE THIS DIGIT ASCII
006412 052703 000040      5$: BIS      #' ,R3      ;;MAKE ASCII IF NOT ALREADY
006416 110367 000040      MOV      R3,8$      ;;SAVE FOR TYPING
006422 104401 006462      TYPE      8$      ;;GO TYPE THIS DIGIT
006426 105367 000032      7$: DECB      SOCNT      ;;COUNT BY 1
006432 003347      BGT      2$      ;;BR IF MORE TO DO
006434 002402      BLT      6$      ;;BR IF DONE
006436 005204      INC      R4      ;;INSURE LAST DIGIT ISN'T A BLANK
006440 000744      BR      2$      ;;GO DO THE LAST DIGIT
006442 012605      6$: MOV      (SP)+,R5      ;;RESTORE R5
006444 012604      MOV      (SP)+,R4      ;;RESTORE R4
006446 012603      MOV      (SP)+,R3      ;;RESTORE R3
006450 016666 000002 000004      MOV      2(SP),4(SP)      ;;SET THE STACK FOR RETURNING
006456 012616      MOV      (SP)+,(SP)

```

006460 000002
 006462 000
 006463 000
 006464 000
 006465 000
 006466 000000
 1040

```

      RTI                      ;;RETURN
8$:   .BYTE 0                  ;;STORAGE FOR ASCII DIGIT
      .BYTE 0                  ;;TERMINATOR FOR TYPE ROUTINE
$OCNT: .BYTE 0                 ;;OCTAL DIGIT COUNTER
$OFILL: .BYTE 0                ;;ZERO FILL SWITCH
$OMODE: .WORD 0                ;;NUMBER OF DIGITS TO TYPE
.SBTTL SAVE AND RESTORE R0-R5 ROUTINES

```

```

*****
; *SAVE R0-R5
; *CALL:
; *   SAVREG
; *UPON RETURN FROM $SAVREG THE STACK WILL LOOK LIKE:
; *
; *TOP---(+16)
; * +2---(+18)
; * +4---R5
; * +6---R4
; * +8---R3
; *+10---R2
; *+12---R1
; *+14---R0

```

006470
 006470 010046
 006472 010146
 006474 010246
 006476 010346
 006500 010446
 006502 010546
 006504 016646 000022
 006510 016646 000022
 006514 016646 000022
 006520 016646 000022
 006524 000002

```

$SAVREG:
      MOV R0,-(SP)             ;;PUSH R0 ON STACK
      MOV R1,-(SP)             ;;PUSH R1 ON STACK
      MOV R2,-(SP)             ;;PUSH R2 ON STACK
      MOV R3,-(SP)             ;;PUSH R3 ON STACK
      MOV R4,-(SP)             ;;PUSH R4 ON STACK
      MOV R5,-(SP)             ;;PUSH R5 ON STACK
      MOV 22(SP),-(SP)         ;;SAVE PS OF MAIN FLOW
      MOV 22(SP),-(SP)         ;;SAVE PC OF MAIN FLOW
      MOV 22(SP),-(SP)         ;;SAVE PS OF CALL
      MOV 22(SP),-(SP)         ;;SAVE PC OF CALL
      RTI

```

```

; *RESTORE R0-R5
; *CALL:
; *   RESREG

```

006526
 006526 012666 000022
 006532 012666 000022
 006536 012666 000022
 006542 012666 000022
 006546 012605
 006550 012604
 006552 012603
 006554 012602
 006556 012601
 006560 012600
 006562 000002

```

$RESREG:
      MOV (SP)+,22(SP)         ;;RESTORE PC OF CALL
      MOV (SP)+,22(SP)         ;;RESTORE PS OF CALL
      MOV (SP)+,22(SP)         ;;RESTORE PC OF MAIN FLOW
      MOV (SP)+,22(SP)         ;;RESTORE PS OF MAIN FLOW
      MOV (SP)+,R5              ;;POP STACK INTO R5
      MOV (SP)+,R4              ;;POP STACK INTO R4
      MOV (SP)+,R3              ;;POP STACK INTO R3
      MOV (SP)+,R2              ;;POP STACK INTO R2
      MOV (SP)+,R1              ;;POP STACK INTO R1
      MOV (SP)+,R0              ;;POP STACK INTO R0
      RTI

```

1043

.SBTTL TRAP DECODER

```

*****
; *THIS ROUTINE WILL PICKUP THE LOWER BYTE OF THE 'TRAP' INSTRUCTION
; *AND USE IT TO INDEX THROUGH THE TRAP TABLE FOR THE STARTING ADDRESS
; *OF THE DESIRED ROUTINE. THEN USING THE ADDRESS OBTAINED IT WILL

```

;*GO TO THAT ROUTINE.

006564	010046		\$TRAP:	MOV	R0,-(SP)	::SAVE R0
006566	016600	000002		MOV	2(SP),R0	::GET TRAP ADDRESS
006572	005740			TST	-(R0)	::BACKUP BY 2
006574	111000			MOVB	(R0),R0	::GET RIGHT BYTE OF TRAP
006576	006300			ASL	R0	::POSITION FOR INDEXING
006600	016000	006620		MOV	\$TRPAD(R0),R0	::INDEX TO TABLE
006604	000200			RTS	R0	::GO TO ROUTINE

::THIS IS USE TO HANDLE THE 'GETPRI' MACRO

006606	011646		\$TRAP2:	MOV	(SP),-(SP)	::MOVE THE PC DOWN
006610	016666	000004		MOV	4(SP),2(SP)	::MOVE THE PSW DOWN
006616	000002	000002		RTI		::RESTORE THE PSW

.SBITL TRAP TABLE

;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
;*BY THE 'TRAP' INSTRUCTION.

			:	ROUTINE	
			:	-----	
006620	006606		\$TRPAD:	.WORD	\$TRAP2
006622	004646			\$TYPE	::CALL=TYPE TRAP+1(104401) TTY TYPEOUT ROUTINE
006624	006266			\$TYPOC	::CALL=TYPOC TRAP+2(104402) TYPE OCTAL NUMBER (WITH LEADING ZEROS)
006626	006242			\$TYPOS	::CALL=TYPOS TRAP+3(104403) TYPE OCTAL NUMBER (NO LEADING ZEROS)
006630	006302			\$TYPON	::CALL=TYPON TRAP+4(104404) TYPE OCTAL NUMBER (AS PER LAST CALL)
006632	005536			\$GTSWR	::CALL=GTSWR TRAP+5(104405) GET SOFT-SWR SETTING
006634	005466			\$CKSWR	::CALL=CKSWR TRAP+6(104406) TEST FOR CHANGE IN SOFT-SWR
006636	005750			\$RDCHR	::CALL=RDCHR TRAP+7(104407) TTY TYPEIN CHARACTER ROUTINE
006640	006070			\$RDLIN	::CALL=RDLIN TRAP+10(104410) TTY TYPEIN STRING ROUTINE
006642	006470			\$SAVREG	::CALL=SAVREG TRAP+11(104411) SAVE R0-R5 ROUTINE
006644	006526			\$RESREG	::CALL=RESREG TRAP+12(104412) RESTORE R0-R5 ROUTINE

:MESSAGES

1044				
1045				
1046				
1047				
1048				
1049	006646	006662		
1050	006650	065	070	
1051	006652	064	070	
1052	006654	064	071	
1053	006656	065	060	
1054	006660	065	071	
1055	006662	062	060	
1056	006664	063	065	
1057	006666	063	063	
1058	006670	063	064	
1059	006672	063	062	
1060	006674	207	377	377 BELL: .ASCIIZ <207><377><377>
	006677	000		
1061	006700	012	015	116 MNORM: .ASCIIZ <12><15>/NO ROMS RESPONDED TO THE SIZING ROUTINE/<12><15>
	006703	117	040	122

006706	117	115	123
006711	040	122	105
006714	123	120	117
006717	116	104	105
006722	104	040	124
006725	117	040	124
006730	110	105	040
006733	123	111	132
006736	111	116	107
006741	040	122	117
006744	125	124	111
006747	116	105	012
006752	015	000	

1062

1064
1065 006754 104 111 101 DRHEAD: .ASCIZ /DIAG. ROM (E20) (FOR 11-44 UBI: E58)/ ;**
006757 107 056 040
006762 122 117 115
006765 040 050 105
006770 062 060 051
006773 040 050 106
006776 117 122 040
007001 061 061 055
007004 064 064 040
007007 125 102 111
007012 072 040 105
007015 065 070 051
007020 000
1066 007021 012 102 117 BRHEAD: .ASCII <12>/BOOTSTRAP ROM ENTRY POINTS AND DEVICE CODES/<15><12>
007024 117 124 123
007027 124 122 101
007032 120 040 122
007035 117 115 040
007040 105 116 124
007043 122 131 040
007046 120 117 111
007051 116 124 123
007054 040 101 116
007057 104 040 104
007062 105 126 111
007065 103 105 040
007070 103 117 104
007073 105 123 015
007076 012
1067 007077 114 117 103 .ASCIZ /LOC. NO DIAG. RUN DIAG. DEVICE CODE/
007102 056 040 040
007105 040 040 040
007110 040 040 040
007113 040 040 011
007116 040 116 117
007121 040 104 111
007124 101 107 056
007127 011 122 125
007132 116 040 104
007135 111 101 107
007140 056 011 104
007143 105 126 111
007146 103 105 040
007151 103 117 104
007154 105 000

1069	007156	120	123	105	PFHEAD: .ASCII2 @PSEUDO POWER-FAIL VECTOR ADR./NEW PC@
	007161	125	104	117	
	007164	040	120	117	
	007167	127	105	122	
	007172	055	106	101	
	007175	111	114	040	
	007200	126	105	103	
	007203	124	117	122	
	007206	040	101	104	
	007211	122	056	057	
	007214	116	105	127	
	007217	040	120	103	
	007222	000			
1070	007223	103	117	125	ER2MSG: .ASCII2 /COULD NOT FIND DEVICE CODE /
	007226	114	104	040	
	007231	116	117	124	
	007234	040	106	111	
	007237	116	104	040	
	007242	104	105	126	
	007245	111	103	105	
	007250	040	103	117	
	007253	104	105	040	
	007256	000			
1071	007257	106	117	125	ER1MSG: .ASCII2 /FOUND UNEXPECTED DEVICE CODE /
	007262	116	104	040	
	007265	125	116	105	
	007270	130	120	105	
	007273	103	124	105	
	007276	104	040	104	
	007301	105	126	111	
	007304	103	105	040	
	007307	103	117	104	
	007312	105	040	000	
1072	007315	120	117	127	ER3MSG: .ASCII /POWER-FAIL VECTOR ERROR/<15><12>
	007320	105	122	055	
	007323	106	101	111	
	007326	114	040	126	
	007331	105	103	124	
	007334	117	122	040	
	007337	105	122	122	
	007342	117	122	015	
	007345	012			
1073	007346	011	105	130	.ASCII2 / EXPECTED RECIEVED/<15><12>
	007351	120	105	103	
	007354	124	105	104	
	007357	011	122	105	
	007362	103	111	105	
	007365	126	105	104	
	007370	015	012	000	
1074	007373	120	117	127	ER4MSG: .ASCII /POWER-FAIL DATA ERROR/<15><12>
	007376	105	122	055	
	007401	106	101	111	
	007404	114	040	104	
	007407	101	124	101	
	007412	040	105	122	
	007415	122	117	122	
	007420	015	012		

				.ASCIIZ /	EXPECTED	RECIEVED/<15><12>
1075	007422	011	105	130		
	007425	120	105	103		
	007430	124	105	104		
	007433	011	122	105		
	007436	103	111	105		
	007441	126	105	104		
	007444	015	012	000		
1076	007447	103	122	103	CRCMSG: .ASCIIZ /CRC ERROR IN ROM E-/	
	007452	040	105	122		
	007455	122	117	122		
	007460	040	111	116		
	007463	040	122	117		
	007466	115	040	105		
	007471	055	000			
1077	007473	103	117	125	PFMSG: .ASCIIZ /COULD NOT DETERMINE POWER-FAIL VECTOR ADDRESS/	
	007476	114	104	040		
	007501	116	117	124		
	007504	040	104	105		
	007507	124	105	122		
	007512	115	111	116		
	007515	105	040	120		
	007520	117	127	105		
	007523	122	055	106		
	007526	101	111	114		
	007531	040	126	105		
	007534	103	124	117		
	007537	122	040	101		
	007542	104	104	122		
	007545	105	123	123		
	007550	000				

```
1079 007551      116      117      040  NOROMM: .ASCII  /NO ROMS TEST ERROR/<15><12>
      007554      122      117      115
      007557      123      040      124
      007562      105      123      124
      007565      040      105      122
      007570      122      117      122
      007573      015      012
1080 007575      040      040      040      .ASCIIZ  /      VALUE  ADDRESS/<15><12>
      007600      040      040      040
      007603      040      040      126
      007606      101      114      125
      007611      105      040      040
      007614      040      101      104
      007617      104      122      105
      007622      123      123      015
      007625      012      000
1081 007627      015      012      122  SEQMSG: .ASCII  <15><12>/ROM SEQUENCE IS INCORRECT AS PER /
      007632      117      115      040
      007635      123      105      121
      007640      125      105      116
      007643      103      105      040
      007646      111      123      040
      007651      111      116      103
      007654      117      122      122
      007657      105      103      124
      007662      040      101      123
      007665      040      120      105
      007670      122      040
1082 007672      111      116      123      .ASCIIZ  /INSTALLATION PROCEDURE./
      007675      124      101      114
      007700      114      101      124
      007703      111      117      116
      007706      040      120      122
      007711      117      103      105
      007714      104      125      122
      007717      105      056      000
1083                                     .EVEN
1084
1085
1086                                     ;BUFFERS
1087
1088 007722      000030      BUF1:  .REPT 30
1090 007722      000000      .WORD  0
      007724      000000      .WORD  0
      007726      000000      .WORD  0
      007730      000000      .WORD  0
      007732      000000      .WORD  0
      007734      000000      .WORD  0
      007736      000000      .WORD  0
      007740      000000      .WORD  0
      007742      000000      .WORD  0
      007744      000000      .WORD  0
      007746      000000      .WORD  0
      007750      000000      .WORD  0
      007752      000000      .WORD  0
      007754      000000      .WORD  0
      007756      000000      .WORD  0
```

007760 000000
007762 0000C0
007764 000000
007766 000000
007770 000000
007772 000000
007774 000000
007776 000000
010000 000000
1091 010002 000000
1092 010004 000000

.WORD 0
.WORD 0
.WORD 0
.WORD 0
.WORD 0
.WORD 0
.WORD 0
.WORD 0
.WORD 0
BUF2: .WORD 0
.WORD 0
OCTBUF: .BLKB 10
MES1: .BLKB 400
MES2: .BLKB 100
ERRMSG: .BLKB 400

1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112

```

;+
;+THE FOLLOWING CODE WAS ADDED IN REV B0:
;+
;+'CLEAR' CLEARS THE NEW LABEL AND BUFFER LOCATIONS
;+
;+'CON1' AND 'CON2' FILL 'BUF1' WITH THE CONTINUATION ROM DATA AND
;+SET ERROR FLAGS WHEN NECESSARY
;+
;+'HOLCK1' AND 'HOLCK2' CHECK FOR HOLES TO VERIFY THE POWER FAIL
;+VECTOR ADDRESS; ALSO SET 11/60 INDICATOR WHEN APPLICABLE
;+
;+'ROMTYP' AND 'ROMNM' FILL THE MESSAGE BUFFER WITH A CONTINUATION ROM
;+MESSAGE AND WITH A ROM IDENTIFICATION MESSAGE
;+

```

:

1116	011116	012700	012262	CLEAR:	MOV	#SE0BUF,	R0	;	SET UP TO CLEAR LOCATIONS	
1117	011122	005020		1\$:	CLR	(R0)+		;		
1118	011127	020027	012324		CMP	R0,	#FINISH	;	ALL CLEARED?	
1119	011130	101774			BLOS	1\$;	BRANCH IF NO	
1120	011132	000207			RTS	PC		;		
1121	011134	030167	001152	CON1:	BIT	R1,	CONFIN	;	CONTINUATION CHIP?	
1122	011140	001001			BNE	1\$;	BRANCH IF YES	
1123	011142	000207			RTS	PC		;		
1124	011144	050167	001132	1\$:	BIS	R1,	CONER1	;	CHIP DOES NOT BELONG HERE-SET ERROR FLAG	
1125	011150	012720	000001		MOV	#1,	(R0)+	;	SET CONTINUATION ROM INDICATOR	
1126	011154	012720	177777		MOV	#-1,	(R0)+	;	ILLEGAL ROM'S DEVICE CODE --1	
1127	011160	000207			RTS	PC		;		
1128	011162	005703		CON2:	TST	R3		;	POINTING OVER THIS CHIP?	
1129	011164	001001			BNE	1\$;	BRANCH IF YES	
1130	011166	000207			RTS	PC		;		
1131	011170	030167	001116	1\$:	BIT	R1,	CONFIN	;	CONTINUATION CHIP?	
1132	011174	001005			BNE	2\$;	BRANCH IF YES	
1133	011176	014067	001102		MOV	-(R0),	CONER2	;	CHIP IS MISSING-SAVE DEVICE CODE	
1134	011202	062700	000002		ADD	#2,	R0	;		
1135	011206	000207			RTS	PC		;		
1136	011210	012710	000001	2\$:	MOV	#1,	(R0)	;	SET CONTINUATION CHIP INDICATOR	
1137	011214	014002			MOV	-(R0),	R2	;	GET PREVIOUS DEVICE CODE	
1138	011216	062700	000004		ADD	#4,	R0	;	POINT TO CORRECT LOCATION	
1139	011222	010220			MOV	R2,	(R0)+	;	PUT IN DEVICE CODE	
1140	011224	000207			RTS	PC		;		
1141	011226	032767	000002	167662	HOLCK1:	BIT	#2,	ROMFIN	;	A CHIP IN SOCKET #1?
1142	011234	001415			BEQ	END		;	BRANCH IF NO	
1143	011236	000207			RTS	PC		;		
1144	011240	032767	000004	167650	HOLCK2:	BIT	#4,	ROMFIN	;	A CHIP IN SOCKET #2?
1145	011246	001401			BEQ	1\$;	BRANCH IF NO	
1146	011250	000207			RTS	PC		;		
1147	011252	122737	000777	173224	1\$:	CMPB	#777,	@#173224	;	ARE SWITCHES SET?
1148	011260	001403			BEQ	END		;	BRANCH IF NO	
1149	011262	052767	000002	001020		BIS	#2,	FLAG	;	SET 11/60 INDICATOR
1150	011270	016716	001012	END:	MOV	RETURN,	(R6)	;	SET UP ALTERNATE RETURN	
1151	011274	000207			RTS	PC		;		
1152	011276	005713		ROMTYP:	TST	(R3)		;	ARE WE FINISHED?	
1153	011300	001003			BNE	1\$;	BRANCH IF NO	
1154	011302	016716	001016		MOV	FINISH,	(R6)	;	SET UP ALTERNATE RETURN	
1155	011306	000207			RTS	PC		;		
1156	011310	022713	000001	1\$:	CMP	#1,	(R3)	;	CONTINUATION CHIP?	
1157	011314	001401			BEQ	2\$;	BRANCH IF YES	
1158	011316	000414			BR	ROMNM		;	ITS A DEVICE CHIP-FIND SOCKET #	
1159	011320	004767	000024	2\$:	JSR	PC,	ROMNM	;	FIND SOCKET #	
1160	011324	012705	012350		MOV	#CONMES,	R5	;	LOAD MSG INTO BUFFER	
1161	011330	004767	173130		JSR	PC,	FILBUF	;		
1162	011334	000011			HT			;		
1163	011336	062703	000004		ADD	#4,	R3	;	POP OVER CONTINUATION CHIP DATA	
1164	011342	016716	000740		MOV	RETURN,	(R6)	;	SET UP ALTERNATE RETURN	
1165	011346	000207			RTS	PC		;		
1166	011350	032713	000170	ROMNM:	BIT	#170,	(R3)	;	BEGINNING A NEW ROM?	
1167	011354	001015			BNE	3\$;	BRANCH IF NOT	
1168	011356	000241		1\$:	CLC			;		
1169	011360	006101			ROL	R1		;	POINT TO NEXT SOCKET	
1170	011362	030167	167530		BIT	R1,	RCMFIN	;	IS A ROM THERE?	
1171	011366	001003			BNE	2\$;	BRANCH IF YES	
1172	011370	062702	000002		ADD	#2,	R2	;	POINT TO NEXT MSG	

```
1173 011374 000770
1174 011376 012205
1175 011400 004767 173060
1176 011404 000015
1177 011406 000402
1178 011410 12724 000011
1179 011414 000207
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192 011416 012767 000011 000674
1193 011424 005767 000652
1194 011430 001417
1195 011432 016703 000644
1196 011436 013702 012326
1197 011442 012767 000400 167440
1198 011450 032703 000002
1199 011454 001026
1200 011456 062702 000002
1201 011462 000241
1202 011464 006003
1203 011466 000770
1204 011470 005767 000610
1205 011474 001423
1206 011476 012767 001000 167404
1207 011504 012767 010016 000604
1208 011512 000367 000566
1209 011516 016767 000562 176272
1210 011524 105067 176270
1211 011530 000402
1212 011532 011267 000560
1213 011536 004767 172300
1214 011542 000207
1215
1216
1217
1218
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1221
1222
1223
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1225
1226
1227
1228 011544 012703 012262
1229 011550 012702 173000
```

```
2$: BR 1$ ;+CONTINUE
MOV (R2)+, R5 ;+LOAD ROM ID
JSR PC, FILBUF ;+INTO THE MSG BUFFER
CR ;+
BR 4$ ;+
3$: MOVB #HT, (R4)+ ;+LOAD A TAB
4$: RTS PC ;+

;+SEQUENCE TEST
;+THIS TEST VERIFIES THAT CONTINUATION CHIPS ARE LOCATED WHERE
;+THEY BELONG, THAT THERE ARE NO DUPLICATE DEVICE ROMS,
;+THAT THE ROMS ARE IN ALPHABETICAL ORDER, THAT THERE ARE NO
;+HOLES, AND THAT SOCKET #2 HAS A CHIP IF THE PROCESSOR IS AN 11/60.
;+IF THE ONLY PROBLEM IS ALPHABETICAL ORDER AND/OR HOLES,
;+THEN A CORRECT SEQUENCE IS DETERMINED AND PRINTED OUT.

;+FIRST, CHECK FOR ILLEGAL CONTINUATION ROM ERRORS
;+IF ANY ARE FOUND, PRINT ERROR MSG AND EXIT

SEQTST: MOV #HT, ARG2 ;+SET UP FOR 'ERRHAN'
TST CONER1 ;+WAS THERE AN ERROR?
BEQ 2$ ;+BRANCH IF NO
MOV CONER1, R3 ;+THE BIT IDENTIFIES THE CHIP
MOV #MESSPT, R2 ;+POINT TO MSG TABLE
MOV #CONONE, ROMERR ;+SET ERROR FLAG
1$: BIT #2, R3 ;+IDENTIFY THE ROM FOR PRINTOUT
BNE 3$ ;+BRANCH IF FOUND IT
ADD #2, R2 ;+SET UP FOR NEXT ROM MSG
CLC ;+
ROR R3 ;+SET UP TO IDENTIFY NEXT ROM
BR 1$ ;+
2$: TST CONER2 ;+WAS THERE AN ERROR?
BEQ FILTAB ;+BRANCH IF NO
MOV #CONTWO, ROMERR ;+SET ERROR FLAG
MOV #MES1, ARG1 ;+PASS THIS ADDRESS TO ERRHAN
SWAB CONER2 ;+BUILD THE MSG
MOV CONER2, MES1 ;+
CLRB MES1+2 ;+
BR 4$ ;+REPORT THE ERROR
3$: MOV (R2), ARG1 ;+PASS MSG ADDRESS TO 'ERRHAN'
4$: JSR PC, ERRHAN ;+REPORT ERROR
RTS PC ;+

;+IF THERE WERE NO CONTINUATION ROM ERRORS, BUILD THE FOLLOWING TABLE:
;+
;+ SEQBUF: FIRST DEVICE CODE
;+ # OF CONTINUATION ROMS FOR FIRST DEVICE
;+ SECOND DEVICE CODE
;+ # OF CONTINUATION ROMS FOR SECOND DEVICE
;+
;+
;+ ENDSEQ: FOURTH (LAST) DEVICE CODE
;+
;+FOR A 'HOLE', THE DEVICE CODE WILL BE A 0.

FILTAB: MOV #SEQBUF, R3 ;+SET UP TO FILL A TABLE CALLED 'SEQBUF'
MOV #173000, R2 ;+POINT TO FIRST ROM
```

```
1230 011554 012700 000001      MOV    #1,    R0      ;+
1231 011560 000241      1$:    CLC          ;+
1232 011562 006100      ROL     R0          ;+POINT TO NEXT ROM
1233 011564 030067 167326      BIT     R0,    ROMFIN ;+IS IT A HOLE?
1234 011570 001404      BEQ     3$,          ;+BRANCH IF YES
1235 011572 C30067 000514      2$:    BIT     R0,    CONFIN ;+IS IT A CONTINUATION CHIP?
1236 011576 001011      BNE     4$,          ;+BRANCH IF YES
1237 011600 011213      MOV     (R2), (R3) ;+ITS A DEVICE ROM-PUT DEVICE CODE INTO TABLE
1238 011602 062703 000004      3$:    ADD     #4,    R3      ;+POINT TO NEXT DEVICE CODE LOCATION
1239 011606 062702 000200      5$:    ADD     #200, R2      ;+POINT TO NEXT ROM
1240 011612 030027 000020      BIT     R0,    #20      ;+ALL DONE?
1241 011616 001760      BEQ     1$,          ;+NO-BRANCH
1242 011620 000404      BR      ALPHCK ;+TABLE COMPLETELY BUILT
1243 011622 005243      4$:    INC     -(R3) ;+COUNT ONE CONTINUATION CHIP IN LOCATION
1244 011624 062703 000002      ADD     #2,    R3      ;+POINT TO NEXT DEVICE CODE LOCATION
1245 011630 000766      BR      5$,          ;+
1246
1247      ;+NOW CHECK DEVICE CODES IN 'SEQBUF' FOR ALPHABETICAL ORDER AND
1248      ;+CHECK FOR 'HOLES'. IF THERE IS A DUPLICATE DEVICE CODE, PRINT
1249      ;+AN ERROR MESSAGE AND EXIT. IF DEVICE CODES NEED SORTING
1250      ;+AND/OR HOLES FILLING, DO IT AND SET THE SEQUENCE ERROR
1251      ;+FLAG. ALSO CHECK FOR THE 11/60 SPECIAL CASE.
1252
1253 011632 012703 012262      ALPHCK: MOV    #SEQBUF, R3      ;+SET UP TO CHECK ALPHABETIC SEQUENCE IN 'SEQBUF'
1254 011636 010304      1$:    MOV     R3,    R4      ;+WILL BE COMPARING (R3) TO (R4)
1255 011640 062704 000004      2$:    ADD     #4,    R4      ;+WHERE R3 AND R4 POINT TO DEVICE CODE LOCATIONS
1256 011644 020427 012276      CMP     R4,    #ENDSEQ ;+PAST THE LAST DEVICE CODE?
1257 011650 101010      BHI     3$,          ;+BRANCH IF YES
1258 011652 005713      TST     (R3)      ;+IS THERE A DEVICE CODE HERE?
1259 011654 001446      BEQ     7$,          ;+BRANCH IF NO
1260 011656 005714      TST     (R4)      ;+IS THERE A DEVICE CODE HERE?
1261 011660 001767      BEQ     2$,          ;+BRANCH IF NO
1262 011662 021314      CMP     (R3), (R4) ;+IS THE SEQUENCE CORRECT?
1263 011664 001410      BEQ     4$,          ;+BRANCH IF NO-FOUND A DUPLICATE
1264 011666 003025      BGT     5$,          ;+BRANCH IF NO-NEED TO DO A SHIFT
1265 011670 000763      BR      2$,          ;+YES-CONTINUE
1266 011672 062703 000004      3$:    ADD     #4,    R3      ;+POINT TO NEXT DEVICE CODE
1267 011676 020327 012276      CMP     R3,    #ENDSEQ ;+ALL DONE?
1268 011702 103056      BHI     9$,          ;+BRANCH IF YES
1269 011704 000754      BR      1$,          ;+NOT YET
1270 011706 012767 002000 167174 4$:    MOV     #DUPERR, ROMERR ;+SET ERROR FLAG
1271 011714 012767 010016 000374      MOV     #MES1, ARG1 ;+PASS THIS ADDRESS TO 'ERRHAN'
1272 011722 000314      SWAB    (R4)      ;+BUILD THE MSG
1273 011724 011467 176066      MOV     (R4), MES1 ;+
1274 011730 105067 176064      CLRB   MES1+2 ;+
1275 011734 004767 172102      JSR     PC,    ERRHAN ;+REPORT THE ERROR
1276 011740 000207      RTS     PC ;+
1277 011742 010301      5$:    MOV     R3,    R1      ;+SET UP FOR THE SHUFFLE
1278 011744 010402      MOV     R4,    R2      ;+
1279 011746 011200      6$:    MOV     (R2), R0      ;+SHIFT THE VALUES
1280 011750 011122      MOV     (R1), (R2)+ ;+
1281 011752 010021      MOV     R0,    (R1)+ ;+
1282 011754 011200      MOV     (R2), R0      ;+
1283 011756 011112      MOV     (R1), (R2) ;+
1284 011760 010011      MOV     R0,    (R1) ;+
1285 011762 012767 000200 167120      MOV     #SEQERR, ROMERR ;+SET THE SEQUENCE ERROR FLAG
1286 011770 000723      BR      2$,          ;+CONTINUE SORTING
```

```
1287 011772 010305      7$: MOV R3, R5      ;+SET UP TO SEE IF WE HAVE A 'HOLE'
1288 011774 020527 012276 8$: CMP R5, #ENDSEQ ;+END OF TABLE?
1289 012000 103017      BHIS 9$      ;+YES-THIS WAS NOT A 'HOLE'
1290 012002 062705 000004 ADD #4, R5 ;+NO-POINT TO NEXT DEVICE CODE LOCATION
1291 012006 005715      TST (R5) ;+IS THERE A ROM HERE?
1292 012010 001771      BEQ 8$      ;+BRANCH IF NO
1293 012012 032767 000032 167076 BIT #32, ROMFIN ;+A ROM IN SOCKET #2 ONLY?
1294 012020 001004      BNE 11$     ;+BRANCH IF NO
1295 012022 105737 173224 TSTB #173224 ;+11/60 SPECIAL CASE?
1296 012026 001401      BEQ 11$     ;+BRANCH IF NO
1297 012030 000422      BR 10$      ;+THE ONLY ROM MUST STAY IN SOCKET #2
1298 012032 010301      11$: MOV R3, R1 ;+YES-THERE IS A HOLE THAT CAN BE FILLED
1299 012034 010502      MOV R5, R2 ;+GET READY TO SHIFT THE VALUES
1300 012036 000743      BR 6$       ;+FILL IN THE HOLE
1301 012040 032767 000002 000242 9$: BIT #2, FLAG ;+AN 11/60?
1302 012046 001413      BEQ 10$     ;+BRANCH IF NO
1303 012050 005767 000212      TST SEQBUF+4 ;+IS SOCKET #2 EMPTY?
1304 012054 001366      BNE 11$     ;+BRANCH IF NO
1305 012056 005767 000200      TST SEQBUF ;+IS SOCKET #1 EMPTY?
1306 012062 001405      BEQ 10$     ;+BRANCH IF YES
1307 012064 012701 012262      MOV #SEQBUF, R1 ;+SET UP TO SHIFT
1308 012070 012702 012266      MOV #SEQBUF+4, R2 ;+CHIPS #1 AND #2
1309 012074 000724      BR 6$       ;+DO THE SHIFT
1310 012076 032767 000200 167004 10$: BIT #SEQERR, ROMERR ;+WAS THERE A SEQUENCE ERROR?
1311 012104 001001      BNE OUTTAB ;+BRANCH IF YES
1312 012106 000207      RTS PC      ;+
1313
1314 ;+THE FOLLOWING ROUTINE BUILDS THE CORRECT SEQUENCE MSG TO BE
1315 ;+PRINTED AS AN ERROR MSG BY 'ERRHAN'
1316
1317 012110 012767 010016 000200 OUTTAB: MOV #MES1, ARG1 ;+PASS MSG ADR. TO 'ERRHAN'
1318 012116 012767 000015 000174      MOV #CR, ARG2 ;+PASS THIS TOO
1319 012124 012700 012262      MOV #SEQBUF, R0 ;+
1320 012130 013702 012326      MOV #MESSPT, R2 ;+
1321 012134 012704 010016      MOV #MES1, R4 ;+START BUILDING THE ERROR MSG
1322 012140 012705 012611      MOV #ERMES4, R5 ;+PUT IN THE FIRST PART
1323 012144 004767 172314      JSR PC, FILBUF ;+
1324 012150 000015      CR ;+
1325 012152 005710      TST (R0) ;+IS A ROM IN SOCKET #1?
1326 012154 001004      BNE 1$      ;+BRANCH IF YES
1327 012156 062700 000004      ADD #4, R0 ;+DO SOCKET #2 ONLY
1328 012162 062702 000002      ADD #2, R2 ;+
1329 012166 012767 010416 000126 1$: MOV #MES2, BUILD ;+SET UP THE DEVICE CODE PART
1330 012174 000310      SWAB (R0) ;+
1331 012176 012067 176214      MOV (R0)+, MES2 ;+
1332 012202 105067 176212      C RB MES2+2 ;+
1333 012206 012205      2$: MOV (R2)+, R5 ;+IDENTIFY THE ROM #
1334 012210 004767 172250      JSR PC, FILBUF ;+
1335 012214 000015      CR ;+
1336 012216 016705 000100      MOV BUILD, R5 ;+PUT IN EITHER DEVICE CODE OR CONTINUATION MSG
1337 012222 004767 172236      JSR PC, FILBUF ;+
1338 012226 000011      HI ;+
1339 012230 005720      ST (R0)+ ;+ANY CONTINUATION ROMS?
1340 012232 001405      BEQ 3$      ;+BRANCH IF NO
1341 012234 005340      DEC -(R0) ;+COUNT DOWN ONE ROM
1342 012236 012767 012350 000056      MOV #CONMES, BUILD ;+SET UP FOR CONTINUATION MSG
1343 012244 000760      BR 2$      ;+CONTINUE
```


1344	012246	005710			3\$:	TST	(R0)			;	+ANY MORE DEVICE ROMS?
1345	012250	001346				RNE	1\$;	+BRANCH IF YES
1346	012252	105014				CLRB	(R4)			;	+MUST END WITH 0 BYTE
1347	012254	004767	171562			JSR	PC,	ERRHAN		;	+REPORT THE ERROR
1348	012260	000207				RTS	PC			;	+
1349											
1350											
1351	012262	000000			SEQBUF:	.WORD	0			;	+FIRST DEVICE CODE
1352	012264	000000				.WORD	0			;	+# OF CONTINUATION CHIPS FOR FIRST DEVICE
1353	012266	000000				.WORD	0			;	+SECOND DEVICE CODE, ETC
1354	012270	000000				.WORD	0			;	+
1355	012272	000000				.WORD	0			;	+
1356	012274	000000				.WORD	0			;	+
1357	012276	000000			ENDSEQ:	.WORD	0			;	+FOURTH (LAST) DEVICE CODE
1358	012300	000000				.WORD	0			;	+
1359	012302	000000			CONER1:	.WORD	0			;	+EXTRA CONTINUATION CHIP ERROR FLAG
1360	012304	000000			CONER2:	.WORD	0			;	+MISSING CONTINUATION CHIP FOR THIS DEVICE
1361	012306	000000			RETURN:	.WORD	0			;	+ALTERNATE RETURN ADDRESS
1362	012310	000000			FLAG:	.WORD	0			;	+BIT 1:11/60
1363	012312	000000			CONF IN:	.WORD	0			;	+CONTINUATION ROM FOUND INDICATOR
1364	012314	000000			DEVFIN:	.WORD	0			;	+DEVICE ROM FOUND INDICATOR
1365	012316	000000			ARG1:	.WORD	0			;	+PASSES MSG ADR. TO 'ERRHAN'
1366	012320	000000			ARG2:	.WORD	0			;	+PASSES CR OR HT TO 'ERRHAN'
1367	012322	000000			BUILD:	.WORD	0			;	+
1368	012324	000000			FINISH:	.WORD	0			;	+ALTERNATE RETURN ADDRESS
1369											
1370	012326	012340			MESSPT:	.WORD	MESTAB				
1371	012330	012636			MESS44:	AROM1				;	**
1372	012332	012652				AROM2				;	**
1373	012334	012666				AROM3				;	**
1374	012336	012702				AROM4				;	**
1375	012340	012716			MESTAB:	ROM1				;	+ASCII MSG TABLE
1376	012342	012732				ROM2				;	+
1377	012344	012746				ROM3				;	+
1378	012346	012762				ROM4				;	+
1379	012350	111	123	040	CONMES:	.ASCIIZ	/IS A CONTINUATION ROM/				
	012353	101	040	103							
	012356	117	116	124							
	012361	111	116	125							
	012364	101	124	111							
	012367	117	116	040							
	012372	122	117	115							
	012375	000									
1380	012376	015	012	101	ERMES1:	.ASCIIZ	<15><12>/A CONTINUATION ROM IS INCORRECTLY LOCATED IN/				
	012401	040	103	117							
	012404	116	124	111							
	012407	116	125	101							
	012412	124	111	117							
	012415	116	040	122							
	012420	117	115	040							
	012423	111	123	040							
	012426	111	116	103							
	012431	117	122	122							
	012434	105	103	124							
	012437	114	131	040							
	012442	114	117	103							
	012445	101	124	105							

	012450	104	040	111	
	012453	116	000		
1381	012455	015	012	101	ERMES2: .ASCIZ <15><12>/A CONTINUATION ROM IS MISSING FOR DEVICE CODE/
	012460	040	103	117	
	012463	116	124	111	
	012466	116	125	101	
	012471	124	111	117	
	012474	116	040	122	
	012477	117	115	040	
	012502	111	123	040	
	012505	115	111	123	
	012510	123	111	116	
	012513	107	040	106	
	012516	117	122	040	
	012521	104	105	126	
	012524	111	103	105	
	012527	040	103	117	
1382	012532	104	105	000	
	012535	015	012	124	ERMES3: .ASCIZ <15><12>/THERE IS A DUPLICATE ROM WITH DEVICE CODE/
	012540	110	105	122	
	012543	105	040	111	
	012546	123	040	101	
	012551	040	104	125	
	012554	120	114	111	
	012557	103	101	124	
	012562	105	040	122	
	012565	117	115	040	
	012570	127	111	124	
	012573	110	040	104	
	012576	105	126	111	
	012601	103	105	040	
	012604	103	117	104	
	012607	105	000		
1383	012611	123	105	121	ERMES4: .ASCIZ /SEQUENCE SHOULD BE: /<12>
	012614	125	105	116	
	012617	103	105	040	
	012622	123	110	117	
	012625	125	14	104	
	012630	040	102	105	
	012633	072	012	000	
1384	012636	122	117	115	AROM1: .ASCIZ /ROM 1(E48) / ;**
	012641	040	061	050	
	012644	105	064	070	
	012647	051	040	000	
1385	012652	122	117	115	AROM2: .ASCIZ /ROM 2(E49) / ;**
	012655	040	062	050	
	012660	105	064	071	
	012663	051	040	000	
1386	012666	122	117	115	AROM3: .ASCIZ /ROM 3(E50) / ;**
	012671	040	063	050	
	012674	105	065	060	
	012677	051	040	000	
1387	012702	122	117	115	AROM4: .ASCIZ /ROM 4(E59) / ;**
	012705	040	064	050	
	012710	105	065	071	
	012713	051	040	000	
1388	012716	122	117	115	ROM1: .ASCIZ /ROM 1(E35) /

	012721	040	061	050	
	012724	105	063	065	
	012727	051	040	000	
1389	012732	122	117	115	ROM2: .ASCIIZ /ROM 2(E33) /
	012735	040	062	050	
	012740	105	063	063	
	012743	051	040	000	
1390	012746	122	117	115	ROM3: .ASCIIZ /ROM 3(E34) /
	012751	040	063	050	
	012754	105	063	064	
	012757	051	040	000	
1391	012762	122	117	115	ROM4: .ASCIIZ /ROM 4(E32) /
	012765	040	064	050	
	012770	105	063	062	
	012773	051	040	000	
1392					
1393					
1394	000001				.END

SYMBOL TABLE

SEQ 0047

ABASE = 000000	AROM4 012702	DAFLAG 003376	OVER1 004104	SW02 = 000004
ACDW1 = 000000	AROUND 004374	DDISP = 177570	OVER10 004414	SW03 = 000010
ACDW2 = 000000	ASWREG= 000000	DEVCD 003164	OVER11 004406	SW04 = 000020
ACPUOP= 000000	ATESTN= 000000	DEVFIN 012314	OVER2 004352	SW05 = 000040
ADDW0 = 000000	AUNIT = 000000	DISPLA 001106	OVER9 004402	SW06 = 000100
ADDW1 = 000000	AUSWR = 000000	DISPRE 000174	PFERR = 000040	SW07 = 000200
ADDW10= 000000	AVECT1= 000000	DRHEAD 006754	PFHEAD 007156	SW08 = 000400
ADDW11= 000000	AVECT2= 000000	DSWR = 177570	PFMSG 007473	SW09 = 001000
ADDW12= 000000	BELL 006674	DUPERR= 002000	PIRQ = 177772	SW1 = 000002
ADDW13= 000000	BIT0 = 000001	EHEADT 004436	PIRQVE= 000240	SW10 = 002000
ADDW14= 000000	BIT00 = 000001	EMTVEC= 000030	PPFVAR 003400	SW11 = 004000
ADDW15= 000000	BIT01 = 000002	END 011270	PROMP 002702	SW12 = 010000
ADDW2 = 000000	BIT02 = 000004	ENDSEQ 012276	PR0 = 000000	SW13 = 020000
ADDW3 = 000000	BIT03 = 000010	ERMES1 012376	PR1 = 000040	SW14 = 040000
ADDW4 = 000000	BIT04 = 000020	ERMES2 012455	PR2 = 000100	SW15 = 100000
ADDW5 = 000000	BIT05 = 000040	ERMES3 012535	PR3 = 000140	SW2 = 000004
ADDW6 = 000000	BIT06 = 000100	ERMES4 012611	PR4 = 000200	SW3 = 000010
ADDW7 = 000000	BIT07 = 000200	ERRCNT 001120	PR5 = 000240	SW4 = 000020
ADDW8 = 000000	BIT08 = 000400	ERRHAN 004042	PR6 = 000300	SW5 = 000040
ADDW9 = 000000	BIT09 = 001000	ERRMSG 010516	PR7 = 000340	SW6 = 000100
ADEVCT= 000000	BIT1 = 000002	ERROR = 104000	PS = 177776	SW7 = 000200
ADEVN = 000000	BIT10 = 002000	ERRVEC= 000004	PSW = 177776	SW8 = 000400
AENV = 000000	BIT11 = 004000	ER1MSG 007257	PUTMES 003510	SW9 = 001000
AENVN = 000000	BIT12 = 010000	ER2MSG 007223	PWRVEC= 000024	TBITVE= 000014
AFATAL= 000000	BIT13 = 020000	ER3MSG 007315	RDCHR = 104407	TEMP 004630
ALPHCK 011632	BIT14 = 040000	ER4MSG 007373	RDLIN = 104410	TESTAD 003374
AMADR1= 000000	BIT15 = 100000	EXCADD 002676	RESREG= 104412	TIMES 004040
AMADR2= 000000	BIT2 = 000004	FILBUF 004464	RESVEC= 000010	TKVEC = 000060
AMADR3= 000000	BIT3 = 000010	FILTAB 011544	RETURN 012306	TPVEC = 000064
AMADR4= 000000	BIT4 = 000020	FINISH 012324	ROMCNT 002602	TRAPVE= 000034
AMAMS1= 000000	BIT5 = 000040	FIRSTA 002674	ROMERR 001110	TRTVEC= 000014
AMAMS2= 000000	BIT6 = 000100	FIRSTB 001114	ROMFIN 001116	TYPE = 104401
AMAMS3= 000000	BIT7 = 000200	FLAG 012310	ROMNM 011350	TYPOC = 104402
AMAMS4= 000000	BIT8 = 000400	GTSWR = 104405	ROMNUM 006662	TYPON = 104404
AMSGAD= 000000	BIT9 = 001000	HOLCK1 011226	ROMPTR 006646	TYPOS = 104403
AMSGLG= 000000	BPTVEC= 000014	HOLCK2 011240	ROMTYP 011276	\$APTHD 001122
AMSGTY= 000000	BRHEAD 007021	HI = 000011	ROM1 012716	\$ATYC 005240
AMTYP1= 000000	BUF1 007722	IOTVEC= 000020	ROM2 012732	\$ATY1 005214
AMTYP2= 000000	BUF2 010002	LASTAD 002700	ROM3 012746	\$ATY3 005222
AMTYP3= 000000	BUILD 012322	LF = 000012	ROM4 012762	\$ATY4 005232
AMTYP4= 000000	CALSUM 002604	LOOP 002614	RSTART 002140	\$AUTOB 001100
APASS = 000000	CHECKS 002366	MESSAG 001112	R6 = %000006	\$BASE 001212
APRIOR= 000000	CKSWR = 104406	MESSPT 012326	R7 = %000007	\$CDW1 001216
APTCU= 000040	CLEAR 011116	MESS44 012330	SAVREG= 104411	\$CDW2 001220
AP*ENV= 000001	CONER1 012302	MESTAB 012340	SCOPE = 000004	\$CHARC 005174
APTER1= 000001	CONER2 012304	MES1 010016	SEQBUF 012262	\$CKSWR 005466
APTER2= 000002	CONF IN 012312	MES2 010416	SEQERR= 000200	\$CNTLG 006213
APTER3= 000004	CONMES 012350	MFPT = 000007	SEQMSG 007627	\$CNTLU 006206
APTER4= 000010	CONONE= 000400	MNORM 006700	SEQTST 011416	\$CPUOP 001164
APTSIZ= 000200	CONTWO= 001000	NODATA 002364	STACK = 001100	\$CRLF 005211
APTSP0= 000100	CON1 011134	NOROME= 000100	START 001400	\$DDW0 001222
ARG1 012316	CON2 011162	NOROMM 007551	STKLMT= 177774	\$DDW1 001224
ARG2 012320	CR = 000015	NOROMS 002300	SWR 001104	\$DDW10 001246
AROM 006650	CRCERR= 000020	OCADD 004632	SWREG 000176	\$DDW11 001250
AROM1 012636	CRCLOP 002622	OCASC 004526	SW0 = 000001	\$DDW12 001252
AROM2 012652	CRCMSG 007447	OCTBUF 010006	SW00 = 000001	\$DDW13 001254
AROM3 012666	CRLF = 000200	OUTTAB 012110	SW01 = 000002	\$DDW14 001256

\$DDW15	001260	\$ETABL	001156	\$MAMS3	001176	\$RDCHR	005750	\$TRAP2	006606
\$DDW2	001226	\$ETEND	001262	\$MAMS4	001202	\$RDLIN	006070	\$TRP -	000013
\$DDW3	001230	\$FATAL	001140	\$MEADR	001124	\$RDSZ =	000010	\$TRPAD	006620
\$DDW4	001232	\$FFLG	005460	\$MFLG	005456	\$RESRE	006526	\$TSTM	001126
\$DDW5	001234	\$FILLC	005206	\$MNEW	006231	\$RTNAD	002260	\$TTYIN	006176
\$DDW6	001236	\$FILLS	005205	\$MSGAD	001152	\$SAVRE	006470	\$TYPE	004646
\$DDW7	001240	\$GET42	002236	\$MSGGLG	001154	\$SETUP=	000124	\$TYPEC	005060
\$DDW8	001242	\$GTSWR	005536	\$MSGTY	001136	\$STUP =	177777	\$TYPEX	005176
\$DDW9	001244	\$HD =	000003	\$MSWR	006220	\$SVPC =	000210	\$TYPOC	006266
\$DEVCT	001146	\$HIB	001122	\$MTYP1	001167	\$SWR =	160000	\$TYPON	006302
\$DEVIM	001214	\$INTAG	001101	\$MTYP2	001173	\$SWREG	001160	\$TYPOS	006242
\$DOAGN	002256	\$LF	005212	\$MTYP3	001177	\$TESTN	001142	\$UNIT	001150
\$ENDAD	002246	\$LFLG	005457	\$MTYP4	001203	\$TKB	005464	\$UNITM	001132
\$ENDCT	002222	\$MADR1	001170	\$NULL	005204	\$TKS	005462	\$USWR	001162
\$ENDMG	002265	\$MADR2	001174	\$OCNT	006464	\$TN =	000001	\$VECT1	001206
\$ENULL	002262	\$MADR3	001200	\$OMODE	006466	\$TPB	005202	\$VECT2	001210
\$ENV	001156	\$MADR4	001204	\$PASS	001144	\$TPFLG	005207	\$SGET4=	000000
\$ENVIM	001157	\$MAIL	001136	\$PASTM	001130	\$TPS	005200	\$OFILL	006465
\$EOP	002176	\$MAMS1	001166	\$QUES	005210	\$TRAP	006564	\$.X -	001122
\$EOPCT	002214	\$MAMS2	001172						

. ABS. 012776 000
 000000 001

ERRORS DETECTED: 0

VIRTUAL MEMORY USED: 58280 WORDS (228 PAGES)

DYNAMIC MEMORY: 20434 WORDS (78 PAGES)

ELAPSED TIME: 00:05:20

CZM9BDO,CZM9BDO.SEQ/NL:TOC/CRF/-SP=CZM9BDO.SML,CZM9BDO.P11

SYMBOL	CROSS REFERENCE	VALUE	REFERENCES
ABASE	=	000000	61-469 61-469
ACDW1	=	000000	61-469 61-469
ACDW2	=	000000	61-469 61-469
ACPUOP	=	000000	61-469 61-469
ADDW0	=	000000	61-469 61-469
ADDW1	=	000000	61-469 61-469
ADDW10	=	000000	61-469 61-469
ADDW11	=	000000	61-469 61-469
ADDW12	=	000000	61-469 61-469
ADDW13	=	000000	61-469 61-469
ADDW14	=	000000	61-469 61-469
ADDW15	=	000000	61-469 61-469
ADDW2	=	000000	61-469 61-469
ADDW3	=	000000	61-469 61-469
ADDW4	=	000000	61-469 61-469
ADDW5	=	000000	61-469 61-469
ADDW6	=	000000	61-469 61-469
ADDW7	=	000000	61-469 61-469
ADDW8	=	000000	61-469 61-469
ADDW9	=	000000	61-469 61-469
ADEVCT	=	000000	61-469 61-469
ADEVN	=	000000	61-469 61-469
AENV	=	000000	61-469 61-469
AENVN	=	000000	61-469 61-469
AFATAL	=	000000	61-469 61-469
ALPHCK	=	011632	65-1242 #65-1253
AMADR1	=	000000	61-469 61-469
AMADR2	=	000000	61-469 61-469
AMADR3	=	000000	61-469 61-469
AMADR4	=	000000	61-469 61-469
AMAMS1	=	000000	61-469 61-469
AMAMS2	=	000000	61-469 61-469
AMAMS3	=	000000	61-469 61-469
AMAMS4	=	000000	61-469 61-469
AMSGAD	=	000000	61-469 61-469
AMSGLG	=	000000	61-469 61-469
AMSGTY	=	000000	61-469 61-469
AMTYP1	=	000000	61-469 61-469
AMTYP2	=	000000	61-469 61-469
AMTYP3	=	000000	61-469 61-469
AMTYP4	=	000000	61-469 61-469
APASS	=	000000	61-469 61-469
APRIOR	=	000000	61-469
APTCU	=	000040	61-1036 #61-1037
APTEV	=	000001	61-1036 61-1037 #61-1037
APTER1	=	000001	#61-436 61-666
APTER2	=	000002	#61-437 61-678
APTER3	=	000004	#61-438 61-689
APTER4	=	000010	#61-439 61-695
APTSIZ	=	000200	61-472 #61-1037
APTSPO	=	000100	61-1036 61-1037 #61-1037
ARG1	=	012316	61-904 *65-1207 *65-1212 *65-1271 *65-1317 #65-1365

SYMBOL CROSS REFERENCE

CREF

SYMBOL	VALUE	REFERENCES
ARG2	012320	61-903 *65-1192 *65-1318 #65-1366
AROM	006650	61-480 #61-1050
AROM1	012636	65-1371 #65-1384
AROM2	012652	65-1372 #55-1385
AROM3	012666	65-1373 #65-1386
AROM4	012702	65-1374 #65-1387
AROUND	004374	61-940 61-943 #61-945
ASWREG	= 000000	61-469 61-469
ATESTN	= 000000	61-469 61-469
AUNIT	= 000000	1-469 61-469
AUSWR	= 000000	61-469 61-469
AVECT1	= 000000	61-469 61-469
AVECT2	= 000000	61-469 61-469
BELL	006674	61-884 #61-1060
BIT0	= 000001	#61-432
BIT00	= 000001	#61-432 61-432
BIT01	= 000002	#61-432 61-432
BIT02	= 000004	#61-432 61-432
BIT03	= 000010	#61-432 61-432
BIT04	= 000020	#61-432 61-432
BIT05	= 000040	#61-432 61-432
BIT06	= 000100	#61-432 61-432
BIT07	= 000200	#61-432 61-432
BIT08	= 000400	#61-432 61-432
BIT09	= 001000	#61-432 61-432
BIT1	= 000002	#61-432
BIT10	= 002000	#61-432 61-881
BIT11	= 004000	#61-432
BIT12	= 010000	#61-432
BIT13	= 020000	#61-432 61-885
BIT14	= 040000	#61-432
BIT15	= 100000	#61-432 61-951
BIT2	= 000004	#61-432
BIT3	= 000010	#61-432
BIT4	= 000020	#61-432
BIT5	= 000040	#61-432
BIT6	= 000100	#61-432
BIT7	= 000200	#61-432
BIT8	= 000400	#61-432
BIT9	= 001000	#61-432
BPTVEC	= 000014	#61-432
BRHEAD	007021	61-816 #62-1066
BUF1	007722	61-485 61-658 61-672 61-726 61-806 #64-1088
BUF2	010002	61-686 61-692 61-782 61-783 61-789 61-790 61-846 61-850 #64-1091
BUILD	012322	*65-1329 65-1336 *65-1342 #65-1367
CALSUM	002604	61-571 61-584 #61-607
CHECKS	002366	61-525 #61-565
CKSWR	= 104406	#61-1043
CLEAR	011116	61-491 #65-1116
CONER1	012302	*65-1124 65-1193 65-1195 #65-1359
CONER2	012304	*65-1133 65-1204 *65-1208 65-1209 #65-1360
CONF IN	012312	*61-512 65-1121 65-1131 65-1235 #65-1363

SYMBOL CROSS REFERENCE

SYMBOL	VALUE	REFERENCES
CONMES	012350	65-1160 65-1342 #65-1379
CONONE	= 000400	#61-444 65-1197
CONTWO	= 001000	#61-445 65-1206
CON1	011134	61-738 #65-1121
CON2	011162	61-758 #65-1128
CR	= 000015	#61-432 61-811 61-818 61-823 61-849 61-857 61-898 61-955 61-981
		61-1036 65-1176 65-1318 65-1324 65-1335
CRERR	= 000020	#61-440 61-575 61-588
CRCLP	002622	#61-612 61-621
CRMSG	007447	61-963 #63-1076
CRLF	= 000200	#61-432 61-473 61-473 61-1036 61-1036
DAFLAG	003376	61-733 61-742 61-760 #61-766
DDISP	= 177570	#61-432 61-461 61-472
DEVCOD	003164	61-645 61-657 #61-726
DEVFIN	012314	*61-516 61-736 #65-1364
DISPLA	001106	#61-461 *61-472 *61-472
DISPRE	000174	#61-449 61-472
DRHEAD	006754	61-809 #62-1065
DSWR	= 177570	#61-432 61-460 61-472
DUPERR	= 002000	#61-446 65-1270
EHEADT	004436	61-890 #61-959
EMTVEC	= 000030	#61-432
END	011270	65-1142 65-1148 #65-1150
ENDSEQ	012276	65-1256 65-1267 65-1288 #65-1357
ERMES1	012376	61-967 #65-1380
ERMES2	012455	61-968 #65-1381
ERMES3	012535	61-969 #65-1382
ERMES4	012611	65-1322 #65-1383
ERRCNT	001120	#61-466 61-880
ERRHAN	004042	61-547 61-576 61-589 61-651 61-667 61-679 61-690 61-696 #61-878
		65-1213 65-1275 65-1347
ERRMSG	010516	61-879 61-946 61-950 #64-1096
ERROR	= 104000	#61-432
ERRVEC	= 000004	#61-432 61-472 61-472 61-472 61-492 61-493 61-505
ER1MSG	007257	61-959 #63-1071
ER2MSG	007223	61-960 #63-1070
ER3MSG	007315	61-961 #63-1072
ER4MSG	007373	61-962 #63-1074
EXCADD	002676	61-569 61-578 61-591 61-622 #61-631
FILBUF	004464	61-810 61-817 61-828 61-835 61-848 61-853 61-897 61-905 61-927
		61-931 #61-977 65-1161 65-1175 65-1323 65-1334 65-1337
FILTAB	011544	65-1205 #65-1228
FINISH	012324	*61-822 65-1118 65-1154 #65-1368
FIRSTA	002674	61-570 61-577 61-590 61-594 61-608 #61-630
FIRSTB	001114	#61-464 61-507 61-734
FLAG	012310	*65-1149 65-1301 #65-1362
GNS	*****	61-449 61-449 61-473 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 61-1043 61-1043 61-1043
GTSWR	= 104405	61-473 #61-1043
HOLCK1	011226	61-781 #65-1141
HOLCK2	011240	61-788 #65-1144

SYMBOL CROSS REFERENCE		REFERENCES									
SYMBOL	VALUE										
HT	= 000011	#61-432	61-829	61-836	61-840	61-854	61-928	61-932	61-977	61-979	
		61-1036	61-1036	65-1162	65-1178	65-1192	65-1338				
IOTVEC	= 000020	#61-432									
LASTAD	002700	61-568	61-579	61-592	61-625	#61-632					
LF	= 000012	#61-432	61-824	61-858	61-934	61-982	61-1036	61-1036			
LOOP	002614	#61-610	61-626								
MESSAG	001112	#61-463	61-655								
MESSPT	012326	61-479	61-820	65-1196	65-1320	#65-1370					
MESS44	012330	61-479	#65-1371								
MESTAB	012340	65-1370	#65-1375								
MES1	010016	61-647	#64-1094	65-1207	*65-1209	*65-1210	65-1271	*65-1273	*65-1274	65-1317	
		65-1321									
MES2	010416	61-654	#64-1095	65-1329	*65-1331	*65-1332					
N PT	= 000007	#61-470	61-476								
MINORM	006700	61-540	#61-1061								
NODATA	002364	61-542	#61-557								
NOROME	= 000100	#61-442	61-546								
NOROMM	007551	61-965	#64-1079								
NOROMS	002300	61-523	#61-540								
OCADD	004632	61-827	61-834	61-852	#61-1026						
OCASC	004526	61-926	61-930	#61-996	61-1028						
OCTBUF	010006	61-487	61-996	61-1001	61-1008	61-1010	#64-1093				
OUTTAB	012110	65-1311	#65-1317								
OVER1	004104	61-886	#61-888								
OVER10	004414	61-887	#61-951								
OVER11	004406	61-938	61-944	#61-949							
OVER2	004352	61-937	#61-939								
OVER9	004402	*61-889	#61-947								
PFERR	= 000040	#61-441	61-649	61-792	61-899	61-941					
PFHEAD	007156	61-847	#63-1069								
PFMSG	007473	61-964	#63-1077								
PIRQ	= 177772	#61-432									
PIRQVE	000240	#61-432									
PPFVAR	003400	61-648	61-684	#61-778							
PROMP	002702	61-528	#61-643								
PRO	= 000000	#61-432									
PR1	= 000040	#61-432									
PR2	= 000100	#61-432									
PR3	= 000140	#61-432									
PR4	= 000200	#61-432									
PR5	= 000240	#61-432									
PR6	= 000300	#61-432									
PR7	= 000340	#61-432									
PS	= 177776	#61-432	61-432								
PSW	= 177776	#61-432									
PUTMES	003510	61-646	61-653	#61-801							
PWRVEC	= 000024	#61-432									
RDCHR	= 104407	61-1038	#61-1043								
RDLIN	= 104410	#61-1043									
RESREG	= 104412	61-955	#61-1043								
RESVEC	000010	#61-432									
RETURN	012306	*61-780	*61-787	*61-821	65-1150	65-1164	#65-1361				

SYMBOL	CROSS REFERENCE	VALUE	REFERENCES
ROMCNT		002602	61-565 61-566 61-581 51-582 #61-598 61-912
ROMERR		001110	#61-462 61-546 61-575 61-588 61-649 61-666 61-678 61-689 61-695
			61-792 61-888 61-889 61-899 61-901 61-908 61-910 61-941 61-954
			*65-1197 *65-1206 *65-1270 *65-1285 65-1310
ROMFIN		001116	#61-465 61-489 61-501 *61-513 61-515 61-521 61-566 61-582 61-728
			61-939 65-1141 65-1144 65-1170 65-1233 65-1293
ROMNUM		011350	65-1158 65-1159 #65-1166
ROMNUM		006662	61-1049 #61-1055
ROMPTR		006646	61-480 61-913 #61-1049
ROMTYP		011276	61-825 #65-1152
ROM1		012716	65-1375 #65-1388
ROM2		012732	65-1376 #65-1389
ROM3		012746	65-1377 #65-1390
ROM4		012762	65-1378 #65-1391
RSTART		002140	61-452 #61-521 61-530
R6	- %000006		#61-432 *61-492 *61-504 *61-505 61-801 61-860 61-863 61-925 61-929
			61-977 61-986 *61-1026 *61-1029 65-1150 65-1154 65-1164
R7	%000007		#61-432
SAVREG	= 104411		61-878 #61-1043
SCOPE	= 000004		#61-432
SEQBUF	012262		65-1116 65-1228 65-1253 65-1303 65-1305 65-1307 65-1308 65-1319 #65-1351
SEQERR	- 000200		#61-443 65-1285 65-1310
SEQMSG	007627		61-966 #64-1081
SEQTST	011416		61-529 #65-1192
STACK	- 001100		#61-432 61-472
START	001400		61-449 00400 #61-432 61-432
SW09	- 001000		#61-432 61-432
SW1	- 000002		#61-432
SW10	= 002000		#61-432
SW11	- 004000		#61-432
SW12	010000		#61-432
SW13	= 020000		#61-432
SW14	- 040000		#61-432
SW15	= 100000		#61-432
SW2	= 000004		#61-432
SW3	- 000010		#61-432
SW4	000020		#61-432
SW5	000040		#61-432

SYMBOL	VALUE	REFERENCES
SW6	= 000100	#61-432
SW7	= 000200	#61-432
SW8	= 000400	#61-432
SW9	= 001000	#61-432
TBITVE	= 000014	#61-432
TEMP	004630	61-1002 61-1004 61-1012 61-1014 61-1016 #61-1019
TESTAD	003374	61-507 61-508 61-510 61-517 61-519 61-730 61-731 61-732 61-734
		61-739 61-744 61-745 61-746 61-748 61-749 61-750 61-761
		#61-765
TIMES	004040	61-490 61-802 61-805 #61-865
TKVEC	= 000060	#61-432
TPVEC	= 000064	#61-432
TRAPVE	= 000034	#61-432 61-472 61-472
TRTVEC	= 000014	#61-432
TYPE	- 104401	61-473 61-530 61-530 61-540 61-861 61-883 61-1036 61-1038 61-1038
		61-1038 61-1038 61-1038 61-1038 61-1038 61-1039 #61-1043
TYPOC	= 104402	61-1038 #61-1043
TYPON	= 104404	#61-1043
TYPOS	= 104403	#61-1043
\$APTHD	001122	61-468 #61-468
\$ASTAT	= *****	61-1037 61-1037
\$ATYC	005240	61-1037 #61-1037
\$ATY1	005214	61-945 #61-1037
\$ATY3	005222	61-949 61-1036 #61-1037
\$ATY4	005232	#61-1037
\$AUTOB	001100	#61-457 *61-473 61-1038 61-1038 61-1038
\$BASE	001212	#61-469 61-685
\$CDW1	001216	#61-469 61-691
\$CDW2	001220	#61-469
\$CHARC	005174	*61-1036 *61-1036 61-1036 *61-1036 #61-1036
\$CKSWR	005466	#61-1038 61-1043 61-1043
\$CMTAG	- *****	61-472 61-472
\$CNTLG	006213	61-1038 #61-1038
\$CNTLU	006206	61-1038 #61-1038
\$CPUOP	001164	#61-469
\$CRIF	005211	61-1036 61-1036 61-1036 #61-1036 61-1038 61-1038 61-1038
\$CJWO	001222	#61-469 61-659 61-671
\$DDW1	001224	#61-469
\$DDW10	001246	#61-469
\$DDW11	001250	#61-469
\$DDW12	001252	#61-469
\$DDW13	001254	#61-469
\$DDW14	001256	#61-469
\$DDW15	001260	#61-469
\$DDW2	001226	#61-469
\$DDW3	001230	#61-469
\$DDW4	001232	#61-469
\$DDW5	001234	#61-469
\$DDW6	001236	#61-469
\$DDW7	001240	#61-469
\$DDW8	001242	#61-469
\$DDW9	001244	#61-469

SYMBOL	CROSS REFERENCE	VALUE	REFERENCES
\$DEVCT	001146	#61-469	
\$DEVN	001214	#61-469	
\$DOAGN	002256	61-530	61-530 #61-530
\$ENDAD	002246	61-454	61-473 #61-530
\$ENDCT	002222	61-472	#61-530
\$ENDMG	002265	61-530	#61-530
\$ENULL	002262	61-530	#61-530
\$ENV	001156	#61-469	61-473 61-936 61-1036 61-1037 61-1037
\$ENVN	001157	#61-469	61-472 61-643 61-1036 61-1036 61-1037
\$EOP	002176	61-524	61-527 #61-530
\$EOPCT	002214	*61-472	#61-530 61-530
\$ETABL	001156	#61-469	
\$ETEND	001262	61-468	#61-469
\$FATAL	001140	#61-469	*61-1037
\$FFLG	005460	*61-1037	*61-1037 61-1037 *61-1037 #61-1037
\$FILLC	005206	61-1036	61-1036 61-1036 #61-1036
\$FILLS	005205	61-1036	61-1036 #61-1036
\$GET42	002236	#61-530	
\$GTSWR	005536	#61-1038	61-1043 61-1043
\$HD	= 000003	61-430	61-430
\$HIBTS	001122	#61-468	
\$INTAG	001101	#61-458	61-1038 61-1038 61-1038
\$LF	005212	61-1036	61-1036 #61-1036 61-1038 61-1038 61-1038
\$LFLG	005457	*61-1037	#61-1037
\$MADR1	001170	#61-469	
\$MADR2	001174	#61-469	
\$MADR3	001200	#61-469	
\$MADR4	001204	#61-469	
\$MAIL	001136	61-468	61-468 #61-469 61-472 61-473 61-1036
\$MAMS1	001166	#61-469	
\$MAMS2	001172	#61-469	
\$MAMS3	001176	#61-469	
\$MAMS4	001202	#61-469	
\$MBADR	001124	#61-468	
\$MFLG	005456	*61-1037	61-1037 *61-1037 #61-1037
\$MNEW	006231	61-1038	#61-1038
\$MSGAD	001152	#61-469	*61-1037 61-1037
\$MSGLG	001154	#61-469	*61-1037
\$MSGTY	001136	#61-469	61-1037 *61-1037 61-1037 *61-1037
\$MSWR	006220	61-1038	#61-1038
\$MTYP1	001167	#61-469	
\$MTYP2	001173	#61-469	
\$MTYP3	001177	#61-469	
\$MTYP4	001203	#61-469	
\$NULL	005204	61-1036	61-1036 61-1036 #61-1036
\$OCNT	006464	*61-1039	*61-1039 #61-1039
\$OMODE	006466	*61-1039	*61-1039 61-1039 *61-1039 *61-1039 #61-1039
\$PASS	001144	#61-469	*61-472 *61-472 61-526 *61-530 *61-530 61-530 61-530
\$PASTM	001130	#61-468	
\$QUES	005210	61-1036	61-1036 #61-1036 61-1038 61-1038 61-1038 61-1038
\$RDCHR	005750	#61-1038	61-1043 61-1043
\$RDDEC	*****	61-1043	

SYMBOL CROSS REFERENCE

REF

SYMBOL	VALUE	REFERENCES
\$RDLIN	006070	#61-1038 61-1043 61-1043
\$RDOCT	= *****	61-1043
\$RDSZ	= 000010	#61-1038 61-1038
\$RESRE	006526	#61-1040 61-1043
\$RTNAD	002260	#61-530
\$R2A	= *****	61-1043
\$SAVRE	006470	#61-1040 61-1043 61-1043
\$SETUP	= 000124	#61-450 61-450 #61-450 61-450 #61-450 61-450 #61-450 61-450 #61-450 61-472 61-472
		61-472 61-472 61-472 61-472 61-472 61-472 61-472 61-472 61-472 61-472 61-472
		61-472 61-473 61-473 61-473 61-473 61-530 61-530 61-1038 61-1038 61-1038
\$STUP	= 177777	#61-450 #61-450 61-450 #61-450 #61-450 61-450 #61-450 #61-450 61-450
\$SVPC	= 000210	#61-454 61-454
\$SWR	= 160000	61-430 #61-430 61-431 61-431 61-431 61-431 61-431 61-431 61-431 61-431
		61-431 61-472 61-530 61-530 61-530 61-530 61-530 61-530 61-530
\$SWREG	001160	#61-469 61-472
\$TESTN	001142	#61-469
\$TKB	005464	61-1036 61-1036 61-1038 61-1038 #61-1038 61-1038 61-1038 61-1038 61-1038
\$TKS	005462	61-1036 61-1036 61-1038 61-1038 #61-1038 61-1038 61-1038 61-1038 61-1038
		61-1038
\$TN	= 000001	61-430 #61-430
\$TPB	005202	61-1036 61-1036 61-1036 #61-1036
\$TPFLG	005207	61-1036 61-1036 61-1036 #61-1036
\$TPS	005200	61-1036 61-1036 61-1036 #61-1036
\$TRAP	006564	61-472 #61-1043
\$TRAP2	006606	#61-1043 61-1043
\$TRP	= 000013	#61-1043 61-1043 61-1043 61-1043 61-1043 #61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 #61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 #61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 61-1043 #61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 61-1043 61-1043 #61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 61-1043 61-1043 61-1043 #61-1043 61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 #61-1043 61-1043 61-1043 61-1043
		61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 #61-1043 61-1043 61-1043
\$TRPAD	006620	61-1043 #61-1043
\$STM	001126	#61-468
\$TTYIN	006176	61-1038 61-1038 61-1038 #61-1038
\$TYPBN	= *****	61-1043
\$TYPDS	= *****	61-1043
\$TYPE	004646	#61-1036 61-1037 61-1043 61-1043
\$TYPEC	005060	61-1036 61-1036 61-1036 #61-1036 61-1036 61-1038
\$TYPEX	005176	61-1036 61-1036 #61-1036
\$TYPOC	006266	#61-1039 61-1043 61-1043
\$TYPON	006302	61-1039 #61-1039 61-1043
\$TYPOS	006242	#61-1039 61-1043
\$UNIT	001150	#61-469
\$UNITM	001132	#61-468
\$USWR	001162	#61-469
\$VECT1	001206	#61-469
\$VECT2	001210	#61-469
\$GET4	= 000000	#61-530 61-530
\$OFILL	006465	*61-1039 *61-1039 61-1039 #61-1039
.\$ASTA	*****	61-1037 61-1037
.\$X	001122	#61-468 61-468

MACRO CROSS REFERENCE

MACRO NAME	REFERENCES
COMMEN	#18-1530 #61-432
ENDCOM	#18-1542 #61-432
ESCAPE	#20-1658 #61-432
GETPRI	#13-1282 #61-432
GETSWR	#22-1729 #61-432 #61-473 #61-473
MULT	#43-4409 #61-432
NEWTSI	#19-1589 #61-432
POP	#26-2107 #61-427 #61-432 61-1037 61-1037 61-1040 61-1041
PUSH	#26-2099 #61-427 #61-432 61-1037 61-1037 61-1037 61-1040 61-1042
REPORT	#56-5368 #61-427 #61-432
SETPRI	#12-1250 #61-432
SETTRA	#61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
SETUP	61-1043
SKIP	#14-1306 #61-432 #61-472
SLASH	#21-1692 #61-432
SPACE	#17-1482 #61-432
STARS	#61-420 #61-432
SWRSU	#16-1451 #61-426 #61-432 61-433 61-435 61-454 61-468 61-468 61-468 61-469
TRMTRP	61-530 61-1036 61-1037 61-1038 61-1038 61-1038 61-1039 61-1040 61-1043
TYPBIN	#15-1420 #61-432 #61-472 #61-472
TYPDEC	#61-1043
TYPNAM	#25-2043 #61-432
TYPNUM	#25-2013 #61-432
TYPOCS	#23-1783 #61-427 #61-432 #61-473
TYPOCT	#25-1980 #61-432
TYPTXT	#25-1933 #61-432
\$\$ESCA	#25-1896 #61-432 #61-1038
\$\$NEWI	#24-1850 #61-432
\$\$SET	#20-1671 #61-432
\$\$SETM	#19-1625 #61-432
\$\$SKIP	#61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043 61-1043
.EQUAT	61-1043
.EQUIV	#61-472 61-472
.HEADE	#21-1705 #61-432
.KT11	#4-180 #61-426 61-432
.SETUP	#61-416 #61-429 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432
.SWRHI	#61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432
.SWRLO	#61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432 #61-432
.SACT1	#2-54 #61-427 61-430
.SAPT8	#5-323
.SAPTH	#10-1184 #61-425 #61-450
.SAPTY	#3-96 #61-427 61-431
.SASTA	#61-431
.SCATC	#52-4977 #61-427 #61-454
.SCMTA	#53-5021 #61-426 61-469
.SDB2D	#54-5277 #61-426 61-468
.SDB2O	#57-5452 #61-426 #61-1037
	#55-5323 #61-425
	#7-909 #61-425 61-449
	#9-1020 #61-425
	#46-4607
	#48-4730

MACRO CROSS REFERENCE

MACRO NAME	REFERENCES		
.SDIV	#45-4510		
.SEOP	#27-2166	#61-425	#61-530
.SERRO	#29-2647		
.SERRT	#30-2842		
.SMULT	#44-4447		
.SPOWE	#40-4159		
.SRAND	#41-4234		
.SRDDE	#37-3830		
.SRDOC	#36-3739		
.SREAD	#35-3344	#61-428	61-1038
.SR2AZ	#51-4874		
.SSAVE	#38-3905	#61-425	61-1040
.SSB2D	#47-4691		
.SSB2O	#49-4792		
.SSCOP	#28-2401		
.SSIZE	#42-4287		
.SSUPR	#50-4830		
.STRAP	#39-4007	#61-427	#61-1043
.STYPB	#34-3237		
.STYPD	#33-3160		
.STYPE	#31-2929	#61-425	61-1036
.STYPO	#32-3064	#61-428	#61-1039
.S4OCA	#8-948		
.1170	#6-502		