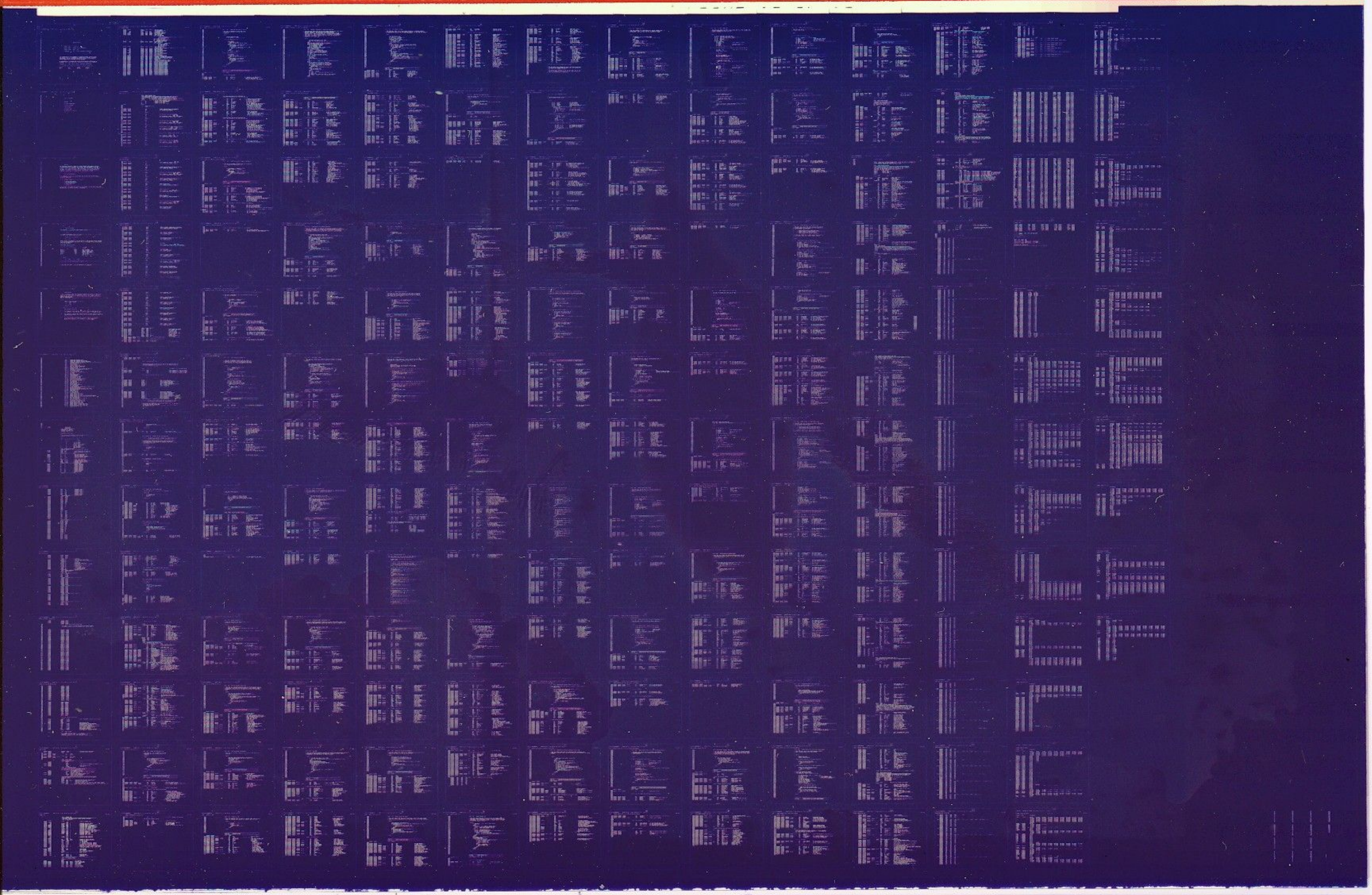
KTJ11-B

KTJ11-B DIAGNOSTIC
COKTAC0

AH-T876C-MC
1 OF 1 JUL 1985

digital
MADE IN USA



```
        .REM    &











                                IDENTIFICATION
                                --------------

                PRODUCT CODE:   AC-T875C-MC

                PRODUCT NAME:   COKTACO KTJ11-B DIAGNOSTIC

                PRODUCT DATE:   MARCH, 1985

                MAINTAINER:     SMALL SYSTEMS DIAGNOSTIC ENGINEERING





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1. ABSTRACT

The following diagnostic tests the Unibus Adapter (UBA) module, KTJ11-B. The functionality of the module is: Unibus - PMI bus adapter (where PMI is a faster version of a Q22-bus), M9312 compatible boot facility, and the Unibus Map logic. The module also has a DMA cache store, utilised for doing DMA transfers from memory to Unibus devices. The UBA can be programmed to do diagnostic cycles to verify some of the functionality without requiring any of the periphirals to be actually connected to the Unibus.

2. RUN-TIME REQUIREMENTS

This diagnostic is the only one written specifically for the UBA module. Therefore, depending on the environment in which the program is run, different devices can be used.

Minimum hardware needed to run the diagnostic:

1) KDJ11-B CPU module
2) at least 28K of memory
3) KTJ11-B UBA module
4) console terminal
5) load media

To do further functional verification of the module 2 Unibus Exercisers (UBE) are required. This should be done in manufacturing or any other environment that needs verification of ALL functions of the UBA.

```
100
101                     3.      STARTING PROCEDURE
102
103                     The diagnostic is a standart XXDP program with APT interface. Therefore,in
104                     stanalone mode, after booting the system, typing in:
105
106                             R OKTAB?
107
108                     will start the program, which will then promt the operator for the software
109                     register switch setting desribed below.
110
111                             COKTABO KTJ11-B DIAGNOSTIC
112
113                             SWR = XXXXXX    NEW =
114
115                     Where "XXXXXX" correspond to the old setting of the software switch register.
116                     At this point an operator can either type in a carriage return, which would
117                     leave the software switch register as it was, or change it, according to the
118                     following parameters.
119
120                     OPERATIONAL SWITCH SETTINGS
121                     ---------------------------
122                     THE SWITCH SETTINGS ARE:
123                                             OCTAL           MEANING
124                                             -----           -------
125                     SW<15>=1...             100000          HALT ON ERROR
126                     SW<14>=1...              40000          LOOP ON CURRENT TEST
127                     SW<13>=1...              20000          INHIBIT ERROR TYPEOUTS
128                     SW<11>=1...               4000          INHIBIT ITERATIONS
129                     SW<10>=1...               2000          RING TTY BELL ON ERROR
130                     SW<9>=1...                1000          LOOP ON ERROR
131                     SW<8>=1...                 400          LOOP ON TEST SPECIFIED IN SW<5>
132                                                             THRU SW<0>
133
134                     For example:
135
136                             SWR = 000000    NEW = 100000
137
138                     In this case the old software switch register didn't set any flags. The
139                     new setting will make the diagnostic halt on error.
140
141
142                     If ran from a UFD chain file, the diagnostic is fully under control of
143                     the UFD monitor that will report only PASS/FAIL messages.
144
```

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```

4. ERROR REPORTS

If ran in standalone mode, the diagnostic reports all errors to a functional level and then continues. Failing program counter, test number, and error number are printed out for all errors. Where possible expected and received data are also provided.
Refer to OPERATIONAL SWITCH SETTINS if anything different is required.

Example of error printout:

```
ERROR IN THE M9312 BOOT ROM SECTION
 TEST   ERROR   ERROR
   #      PC      #
  33    12650    31
```

5. EXECUTION TIME

The diagnostic runs a full pass in less than a minute.

6. UBA REGISTER DEFINITION

DDR The Diagnostic Data register is a buffer that provides the ability of reading and writing the data to and from memory in diagnostic mode.

DCSR The Diagnostic Control and Status register provides means of going in and out of standalone mode and also of initiating diagnostic DATI from memory cycles.

KMCR The KTJ11-B Memory Configuration register identifies the amount of Unibus memory persent in the system. It is also responsible for controllling and describing the status of the DMA cache.

```
179                         7.      TESTS LIST
180
181                                 TEST 1  - UNIBUS MAP REGISTER TESTS
182                                 TEST 2  - UNIBUS MAP REGISTER BIT PATTERN
183                                 TEST 3  - UNIBUS MAP REGISTER ADDRESS UNIQUENESS
184                                 TEST 4  - UNIQENESS BETWEEN LOW MAP REGISTERS AND HIGH MAP REGISTERS
185                                 TEST 5  - DCSR REGISTER RESPONSE TEST
186                                 TEST 6  - KMCR BITS TEST
187                                 TEST 7  - UNIBUS TIMEOUT TEST
188                                 TEST 8  - DATA OUT WITHOUT RELOCATION
189                                 TEST 9  - DATA IN WITHOUT RELOCATION
190                                 TEST 10 - CONTENT OF DDR
191                                 TEST 11 - INDIRECT ACCESSING OF UNIBUS MAP REGISTERS
192                                 TEST 12 - DISABLING OF THE MAPPING REGISTERS
193                                 TEST 13 - NXM MEMORY TIMEOUT
194                                 TEST 14 - CARRY PROPOGATION TEST
195                                 TEST 15 - EXTENSIVE CARRY PROPOGATION TEST
196                                 TEST 16 - ALU TEST
197                                 TEST 17 - MAIN MEMORY DISABLE
198                                 TEST 18 - CACHE PRESENCE
199                                 TEST 19 - CACHE DISABLED AND KMCR
200                                 TEST 20 - AVAILABILITY OF SETS
201                                 TEST 21 - DEALLOCATION OF SETS
202                                 TEST 22 - CACHE WITH RELOCATION DISABLED
203                                 TEST 23 - WRITE CYCLES AND CACHE
204                                 TEST 24 - DMA READ WITH INDEX NOT ZERO
205                                 TEST 25 - TAG REGISTERS
206                                 TEST 26 - CACHE RAM BIT PATTERN TEST
207                                 TEST 27 - BOOT ROMS TEST
208                                 TEST 28 - UNIBUS MEMORY TEST
209                                 TEST 29 - UBE AUTOSIZING ROUTINE
210                                 TEST 30 - NPG ARBITRATION
211                                 TEST 31 - NO BUS GRANTS WITH PROCESSOR AT HIGHER PRIORITY
212                                 TEST 32 - BR7-BR4 ARBITRATION
213                                 TEST 33 - ARBITRATION BETWEEN INTERRUPTS AND PIRQ'S
214                                 TEST 34 - ARBITRATION BETWEEN INTERRUPTS FROM 2 UBE
215                                 TEST 35 - POWER DOWN TEST
216                                 TEST 36 - WRONG PARITY TEST
217                                 TEST 37 - NO SACK TIMEOUT
218                                 TEST 38 - NO INTERRUPT TEST
219                                 TEST 39 - UNIBUS DEVICE DATO CYCLE
220                                 TEST 40 - UNIBUS DEVICE DATI CYCLE
221                                 TEST 41 - UNIBUS DEVICE DATO CYCLE WITH RELOCATION ENABLED
222                                 TEST 42 - UNIBUS DEVICE DATI CYCLE WITH RELOCATION ENABLED
223                                 TEST 43 - ALU TEST USING UBE
224                                 TEST 44 - CARRY PROPOGATION TEST USING UBE
225                                 TEST 45 - NXM TEST USING UBE
226                                 TEST 46 - RELOCATION WITH UNIBUS MEMORY
227                                 TEST 47 - MAIN MEMORY DISABLE THRU UBE
228                                 TEST 48 - UNIBUS DEVICE DATOB CYCLE
229                                 TEST 49 - UNIBUS DEVICE DATIP CYCLE
230                                 TEST 50 - UNIBUS DEVICE I/O PAGE READ CYCLE
231                                 TEST 51 - UNIBUS DEVICE I/O PAGE WRITE CYCLE
232                                 TEST 52 - MAPPING REGISTERS TEST USING UBE
233                                 TEST 53 - UNIBUS DEVICE DATI CYCLE WITH CACHE ENABLED
234                                 TEST 54 - WRONG PARITY AND CACHE
235                         &
```

```
 237
 238
 260
 271
 272     167400                          $SWR=167400
 273     000300                          $SWRMK=300
 274                             .TITLE  KTJ11-B DIAGNOSTIC
                                 ;*COPYRIGHT (C) MAY 83
                                 ;*DIGITAL EQUIPMENT CORP.
                                 ;*MAYNARD, MASS. 01754
                                 ;*
                                 ;*PROGRAM BY DIAG. ENG.
                                 ;*
                                 ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                                 ;*PACKAGE (MAINDEC-11-DZQAC-C8), OCT, 1982.
                                 ;*
         000001                  $TN=1
 275                             .SBTTL  OPERATIONAL SWITCH SETTINGS
                                 ;*
                                 ;*      SWITCH                  USE
                                 ;*      ------          --------------------
                                 ;*        15            HALT ON ERROR
                                 ;*        14            LOOP ON TEST
                                 ;*        13            INHIBIT ERROR TYPEOUTS
                                 ;*        11            INHIBIT ITERATIONS
                                 ;*        10            BELL ON ERROR
                                 ;*         9            LOOP ON ERROR
                                 ;*         8            LOOP ON TEST IN SWR<5:0>
 277                             .SBTTL  BASIC DEFINITIONS
                                 ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
         001100                  STACK=  1100
         104000                  ERROR=  EMT             ;;BASIC DEFINITION OF ERROR CALL
         000004                  SCOPE=  IOT             ;;BASIC DEFINITION OF SCOPE CALL
                                 ;*MISCELLANEOUS DEFINITIONS
         000011                  HT=     11              ;;CODE FOR HORIZONTAL TAB
         000012                  LF=     12              ;;CODE FOR LINE FEED
         000015                  CR=     15              ;;CODE FOR CARRIAGE RETURN
         000200                  CRLF=   200             ;;CODE FOR CARRIAGE RETURN-LINE FEED
         177776                  PS=     177776          ;;PROCESSOR STATUS WORD
         177776                  PSW=    PS
         177774                  STKLMT= 177774          ;;STACK LIMIT REGISTER
         177772                  PIRQ=   177772          ;;PROGRAM INTERRUPT REQUEST REGISTER
         177570                  DSWR=   177570          ;;HARDWARE SWITCH REGISTER
         177570                  DDISP=  177570          ;;HARDWARE DISPLAY REGISTER
                                 ;*GENERAL PURPOSE REGISTER DEFINITIONS
         000000                  R0=     %0              ;;GENERAL REGISTER
         000001                  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
```

BASIC DEFINITIONS

```
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
```

BASIC DEFINITIONS

```
000010                  BIT3=   BIT03
000004                  BIT2=   BIT02
000002                  BIT1=   BIT01
000001                  BIT0=   BIT00
                        ;*BASIC "CPU" TRAP VECTOR ADDRESSES
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                  PIRQVEC=240             ;;PROGRAM INTERRUPT REQUEST VECTOR
  278                   .SBTTL  MEMORY MANAGEMENT DEFINITIONS
                        ;*KT11 VECTOR ADDRESS
000250                  MMVEC=  250
                        ;*KT11 STATUS REGISTER ADDRESSES
177572                  SR0=    177572
177574                  SR1=    177574
177576                  SR2=    177576
172516                  SR3=    172516
                        ;*KERNEL "I" PAGE DESCRIPTOR REGISTERS
172300                  KIPDR0= 172300
172302                  KIPDR1= 172302
172304                  KIPDR2= 172304
172306                  KIPDR3= 172306
172310                  KIPDR4= 172310
172312                  KIPDR5= 172312
172314                  KIPDR6= 172314
172316                  KIPDR7= 172316
                        ;*KERNEL "D" PAGE DESCRIPTOR REGISTERS
172320                  KDPDR0= 172320
172322                  KDPDR1= 172322
172324                  KDPDR2= 172324
172326                  KDPDR3= 172326
172330                  KDPDR4= 172330
172332                  KDPDR5= 172332
172334                  KDPDR6= 172334
172336                  KDPDR7= 172336
                        ;*KERNEL "I" PAGE ADDRESS REGISTERS
172340                  KIPAR0= 172340
172342                  KIPAR1= 172342
172344                  KIPAR2= 172344
172346                  KIPAR3= 172346
172350                  KIPAR4= 172350
172352                  KIPAR5= 172352
172354                  KIPAR6= 172354
172356                  KIPAR7= 172356
                        ;*KERNEL "D" PAGE ADDRESS REGISTERS
172360                  KDPAR0= 172360
172362                  KDPAR1= 172362
172364                  KDPAR2= 172364
172366                  KDPAR3= 172366
```

MEMORY MANAGEMENT DEFINITIONS

```
            172370                  KDPAR4= 172370
            172372                  KDPAR5= 172372
            172374                  KDPAR6= 172374
            172376                  KDPAR7= 172376
    279                             .SBTTL  UNIBUS MAP REGISTER DEFINITIONS
    280
    281                             ;*THE LOWER 16 BITS OF THE MAP REGISTERS ARE LABELED 'MAPLXX'
    282                             ;*THE UPPER 6 BITS OF THE MAP REGISTERS ARE LABELED 'MAPHXX'
    283
    284
    285         170200              MAPL00 = 170200
    286         170202              MAPH00 = 170202
    287         170204              MAPL01 = 170204
    288         170206              MAPH01 = 170206
    289         170210              MAPL02 = 170210
    290         170212              MAPH02 = 170212
    291         170214              MAPL03 = 170214
    292         170216              MAPH03 = 170216
    293         170220              MAPL04 = 170220
    294         170222              MAPH04 = 170222
    295         170224              MAPL05 = 170224
    296         170226              MAPH05 = 170226
    297         170230              MAPL06 = 170230
    298         170232              MAPH06 = 170232
    299         170234              MAPL07 = 170234
    300         170236              MAPH07 = 170236
    301         170240              MAPL10 = 170240
    302         170242              MAPH10 = 170242
    303         170244              MAPL11 = 170244
    304         170246              MAPH11 = 170246
    305         170250              MAPL12 = 170250
    306         170252              MAPH12 = 170252
    307         170254              MAPL13 = 170254
    308         170256              MAPH13 = 170256
    309         170260              MAPL14 = 170260
    310         170262              MAPH14 = 170262
    311         170264              MAPL15 = 170264
    312         170266              MAPH15 = 170266
    313         170270              MAPL16 = 170270
    314         170272              MAPH16 = 170272
    315         170274              MAPL17 = 170274
    316         170276              MAPH17 = 170276
    317         170300              MAPL20 = 170300
    318         170302              MAPH20 = 170302
    319         170304              MAPL21 = 170304
    320         170306              MAPH21 = 170306
    321         170310              MAPL22 = 170310
    322         170312              MAPH22 = 170312
    323         170314              MAPL23 = 170314
    324         170316              MAPH23 = 170316
    325         170320              MAPL24 = 170320
    326         170322              MAPH24 = 170322
    327         170324              MAPL25 = 170324
    328         170326              MAPH25 = 170326
    329         170330              MAPL26 = 170330
    330         170332              MAPH26 = 170332
    331         170334              MAPL27 = 170334
```

UNIBUS MAP REGISTER DEFINITIONS

```
 332          170336                  MAPH27 = 170336
 333          170340                  MAPL30 = 170340
 334          170342                  MAPH30 = 170342
 335          170344                  MAPL31 = 170344
 336          170346                  MAPH31 = 170346
 337          170350                  MAPL32 = 170350
 338          170352                  MAPH32 = 170352
 339          170354                  MAPL33 = 170354
 340          170356                  MAPH33 = 170356
 341          170360                  MAPL34 = 170360
 342          170362                  MAPH34 = 170362
 343          170364                  MAPL35 = 170364
 344          170366                  MAPH35 = 170366
 345          170370                  MAPL36 = 170370
 346          170372                  MAPH36 = 170372
 347          170374                  MAPL37 = 170374
 348          170376                  MAPH37 = 170376
 349
 350          170200                  MAPL0 = MAPL00
 351          170202                  MAPH0 = MAPH00
 352          170204                  MAPL1 = MAPL01
 353          170206                  MAPH1 = MAPH01
 354          170210                  MAPL2 = MAPL02
 355          170212                  MAPH2 = MAPH02
 356          170214                  MAPL3 = MAPL03
 357          170216                  MAPH3 = MAPH03
 358          170220                  MAPL4 = MAPL04
 359          170222                  MAPH4 = MAPH04
 360          170224                  MAPL5 = MAPL05
 361          170226                  MAPH5 = MAPH05
 362          170230                  MAPL6 = MAPL06
 363          170232                  MAPH6 = MAPH06
 364          170234                  MAPL7 = MAPL07
 365          170236                  MAPH7 = MAPH07
 366
 367                                  .SBTTL UBA SPECIFIC REGISTERS
 368
 369          177572                  MMR0    = 177572                ; MEMORY MANAGEMENT REGISTER DEFINITIONS
 370          177574                  MMR1    = 177574                ;
 371          177576                  MMR2    = 177576                ;
 372          172516                  MMR3    = 172516                ;
 373          000001                  UFDSET  = 1                     ; FLAG FOR UFD MODE
 374          177520                  BCSR    = 177520                ; BOOT/DIAGNOSTIC STATUS REGISTER
 375          177730                  DCSR    = 177730                ; DIAGNOSTIC CONTROLLER STATUS REGISTER
 376          177732                  DDR     = 177732                ; DIAGNOSTIC DATA REISTER
 377          177734                  KMCR    = 177734                ; KTJ11-B MEMORY CONFIGURATION REGISTER
 378          177746                  CCR     = 177746                ; CACHE CONTOL REGISTER FOR CPU
 379          177522                  PCR     = 177522                ; PAGE CONTROL REGISTER
 380          120001                  POLY    = 120001                ; POLYNOMIAL USED FOR CRC ROUTINES
 381          170014                  SIMLGO  = 170014                ; SIMULTANEOUS GO ADDRESS FOR MULTIPLE UBE'S
 382
 383                                  .SBTTL  TRAP CATCHER
              000000                          .=0
                                      ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ".+2,HALT"
                                      ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
                                      ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
              000174                          .=174
```

```
                000174  000000                  DISPREG: .WORD  0               ;;SOFTWARE DISPLAY REGISTER
                000176  000000                  SWREG:   .WORD  0               ;;SOFTWARE SWITCH REGISTER
    384                 000200                  .=200
    385 000200  005037  001160                          CLR     $TMP0
    386 000204  000137  002530                          JMP     @#START
    387                 000220                  .=220
    388 000220  012737  000777  001160               MOV     #777,$TMP0
    389 000226  000137  002530                          JMP     @#START
    390
    391                                         .SBTTL  ACT11 HOOKS
                                                ;;******************************************************************
                                                ;HOOKS REQUIRED BY ACT11
                        000232                          $SVPC=.                 ;SAVE PC
                        000046                          .=46
                000046  023340                          $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .$EOP
                        000052                          .=52
                000052  000000                          .WORD   0               ;;2)SET LOC.52 TO ZERO
                        000232                          .=$SVPC                 ;; RESTORE PC
    392                                         .SBTTL  APT PARAMETER BLOCK
                                                ;;******************************************************************
                                                ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
                                                ;;******************************************************************
                        000232                          .$X=.   ;;SAVE CURRENT LOCATION
                        000024                          .=24    ;;SET POWER FAIL TO POINT TO START OF PROGRAM
                000024  000200                          200     ;;FOR APT START UP
                        000044                          .=44    ;;POINT TO APT INDIRECT ADDRESS PNTR.
                000044  000232                          $APTHDR ;;POINT TO APT HEADER BLOCK
                        000232                          .=.$X   ;;RESET LOCATION COUNTER
                                                ;;******************************************************************
                                                ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
                                                ;INTERFACE SPEC.
                000232                          $APTHD:
                000232  000000                  $HIBTS: .WORD   0       ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
                000234  001200                  $MBADR: .WORD   $MAIL   ;;ADDRESS OF APT MAILBOX (BITS 0-15)
                000236  000000                  $TSTM:  .WORD           ;;RUN TIM OF LONGEST TEST
                000240  000000                  $PASTM: .WORD           ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
                000242  000000                  $UNITM: .WORD           ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
                000244  000052                          .WORD   $ETEND-$MAIL/2 ;;LENGTH MAILBOX-ETABLE(WORDS)
```

```
    393                                 .SBTTL  COMMON TAGS
                                        ;;*****************************************************************
                                        ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
                                        ;*USED IN THE PROGRAM.
            001100                              .=1100
    001100                              $CMTAG:                         ;;START OF COMMON TAGS
    001100  000000                              .WORD   0
    001102     000                      $TSTNM: .BYTE   0               ;;CONTAINS THE TEST NUMBER
    001103     000                      $ERFLG: .BYTE   0               ;;CONTAINS ERROR FLAG
    001104  000000                      $ICNT:  .WORD   0               ;;CONTAINS SUBTEST ITERATION COUNT
    001106  000000                      $LPADR: .WORD   0               ;;CONTAINS SCOPE LOOP ADDRESS
    001110  000000                      $LPERR: .WORD   0               ;;CONTAINS SCOPE RETURN FOR ERRORS
    001112  000000                      $ERTTL: .WORD   0               ;;CONTAINS TOTAL ERRORS DETECTED
    001114     000                      $ITEMB: .BYTE   0               ;;CONTAINS ITEM CONTROL BYTE
    001115     001                      $ERMAX: .BYTE   1               ;;CONTAINS MAX. ERRORS PER TEST
    001116  000000                      $ERRPC: .WORD   0               ;;CONTAINS PC OF LAST ERROR INSTRUCTION
    001120  000000                      $GDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'GOOD' DATA
    001122  000000                      $BDADR: .WORD   0               ;;CONTAINS ADDRESS OF 'BAD' DATA
    001124  000000                      $GDDAT: .WORD   0               ;;CONTAINS 'GOOD' DATA
    001126  000000                      $BDDAT: .WORD   0               ;;CONTAINS 'BAD' DATA
    001130  000000                              .WORD   0               ;;RESERVED--NOT TO BE USED
    001132  000000                              .WORD   0
    001134     000                      $AUTOB: .BYTE   0               ;;AUTOMATIC MODE INDICATOR
    001135     000                      $INTAG: .BYTE   0               ;;INTERRUPT MODE INDICATOR
    001136  000000                              .WORD   0
    001140  177570                      SWR:    .WORD   DSWR            ;;ADDRESS OF SWITCH REGISTER
    001142  177570                      DISPLAY: .WORD  DDISP           ;;ADDRESS OF DISPLAY REGISTER
    001144  177560                      $TKS:   177560                  ;;TTY KBD STATUS
    001146  177562                      $TKB:   177562                  ;;TTY KBD BUFFER
    001150  177564                      $TPS:   177564                  ;;TTY PRINTER STATUS REG. ADDRESS
    001152  177566                      $TPB:   177566                  ;;TTY PRINTER BUFFER REG. ADDRESS
    001154     000                      $NULL:  .BYTE   0               ;;CONTAINS NULL CHARACTER FOR FILLS
    001155     002                      $FILLS: .BYTE   2               ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
    001156     012                      $FILLC: .BYTE   12              ;;INSERT FILL CHARS. AFTER A "LINE FEED"
    001157     000                      $TPFLG: .BYTE   0               ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
            000002                              .REPT   2
    001160  000000                      $TMPO:  .WORD   0               ;;USER DEFINED
    001162  000000                      $TMP1:  .WORD   0               ;;USER DEFINED
    001164  000000                      $TIMES: 0                       ;;MAX. NUMBER OF ITERATIONS
    001166  000000                      $ESCAPE:0                       ;;ESCAPE ON ERROR ADDRESS
    001170     207      377     377     $BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
    001173     000
    001174     077                      $QUES:  .ASCII  /?/             ;;QUESTION MARK
    001175     015                      $CRLF:  .ASCII  <15>            ;;CARRIAGE RETURN
    001176     012      000             $LF:    .ASCIZ  <12>            ;;LINE FEED
                                        ;;*****************************************************************
                                        .SBTTL  APT MAILBOX-ETABLE
                                        ;;*****************************************************************
                                        .EVEN
    001200                              $MAIL:                          ;;APT MAILBOX
    001200  000000                      $MSGTY: .WORD   AMSGTY           ;;MESSAGE TYPE CODE
    001202  000000                      $FATAL: .WORD   AFATAL           ;;FATAL ERROR NUMBER
    001204  000000                      $TESTN: .WORD   ATESTN           ;;TEST NUMBER
    001206  000000                      $PASS:  .WORD   APASS            ;;PASS COUNT
    001210  000000                      $DEVCT: .WORD   ADEVCT           ;;DEVICE COUNT
    001212  000000                      $UNIT:  .WORD   AUNIT            ;;I/O UNIT NUMBER
    001214  000000                      $MSGAD: .WORD   AMSGAD           ;;MESSAGE ADDRESS
```

APT MAILBOX-ETABLE

```
001216  000000                  $MSGLG: .WORD   AMSGLG  ;;MESSAGE LENGTH
001220                          $ETABLE:                ;;APT ENVIRONMENT TABLE
001220     000                  $ENV:   .BYTE   AENV    ;;ENVIRONMENT BYTE
001221     000                  $ENVM:  .BYTE   AENVM   ;;ENVIRONMENT MODE BITS
001222  000000                  $SWREG: .WORD   ASWREG  ;;APT SWITCH REGISTER
001224  000000                  $USWR:  .WORD   AUSWR   ;;USER SWITCHES
001226  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
001230     000                  $MAMS1: .BYTE   AMAMS1  ;;HIGH ADDRESS,M.S. BYTE
001231     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
001232  000000                  $MADR1: .WORD   AMADR1  ;;HIGH ADDRESS,BLK#1
                                ;*                        MEM.LAST ADDR.=3 BYTES,THIS WORD AND LOW OF "TYPE" ABOVE
001234     000                  $MAMS2: .BYTE   AMAMS2  ;;HIGH ADDRESS,M.S. BYTE
001235     000                  $MTYP2: .BYTE   AMTYP2  ;;MEM.TYPE,BLK#2
001236  000000                  $MADR2: .WORD   AMADR2  ;;MEM.LAST ADDRESS,BLK#2
001240     000                  $MAMS3: .BYTE   AMAMS3  ;;HIGH ADDRESS,M.S.BYTE
001241     000                  $MTYP3: .BYTE   AMTYP3  ;;MEM.TYPE,BLK#3
001242  000000                  $MADR3: .WORD   AMADR3  ;;MEM.LAST ADDRESS,BLK#3
001244     000                  $MAMS4: .BYTE   AMAMS4  ;;HIGH ADDRESS,M.S.BYTE
001245     000                  $MTYP4: .BYTE   AMTYP4  ;;MEM.TYPE,BLK#4
001246  000000                  $MADR4: .WORD   AMADR4  ;;MEM.LAST ADDRESS,BLK#4
001250  000000                  $VECT1: .WORD   AVECT1  ;;INTERRUPT VECTOR#1,BUS PRIORITY#1
001252  000000                  $VECT2: .WORD   AVECT2  ;;INTERRUPT VECTOR#2BUS PRIORITY#2
001254  000000                  $BASE:  .WORD   ABASE   ;;BASE ADDRESS OF EQUIPMENT UNDER TEST
001256  000000                  $DEVM:  .WORD   ADEVM   ;;DEVICE MAP
001260  000000                  $CDW1:  .WORD   ACDW1   ;;CONTROLLER DESCRIPTION WORD#1
001262  000000                  $CDW2:  .WORD   ACDW2   ;;CONTROLLER DESCRIPTION WORD#2
001264  000000                  $DDW0:  .WORD   ADDW0   ;;DEVICE DESCRIPTOR WORD#0
001266  000000                  $DDW1:  .WORD   ADDW1   ;;DEVICE DESCRIPTOR WORD#1
001270  000000                  $DDW2:  .WORD   ADDW2   ;;DEVICE DESCRIPTOR WORD#2
001272  000000                  $DDW3:  .WORD   ADDW3   ;;DEVICE DESCRIPTOR WORD#3
001274  000000                  $DDW4:  .WORD   ADDW4   ;;DEVICE DESCRIPTOR WORD#4
001276  000000                  $DDW5:  .WORD   ADDW5   ;;DEVICE DESCRIPTOR WORD#5
001300  000000                  $DDW6:  .WORD   ADDW6   ;;DEVICE DESCRIPTOR WORD#6
001302  000000                  $DDW7:  .WORD   ADDW7   ;;DEVICE DESCRIPTOR WORD#7
001304  000000                  $DDW8:  .WORD   ADDW8   ;;DEVICE DESCRIPTOR WORD#8
001306  000000                  $DDW9:  .WORD   ADDW9   ;;DEVICE DESCRIPTOR WORD#9
001310  000000                  $DDW10: .WORD   ADDW10  ;;DEVICE DESCRIPTOR WORD#10
001312  000000                  $DDW11: .WORD   ADDW11  ;;DEVICE DESCRIPTOR WORD#11
001314  000000                  $DDW12: .WORD   ADDW12  ;;DEVICE DESCRIPTOR WORD#12
001316  000000                  $DDW13: .WORD   ADDW13  ;;DEVICE DESCRIPTOR WORD#13
001320  000000                  $DDW14: .WORD   ADDW14  ;;DEVICE DESCRIPTOR WORD#14
001322  000000                  $DDW15: .WORD   ADDW15  ;;DEVICE DESCRIPTOR WORD#15
001324                          $ETEND:
```

ERROR POINTER TABLE

```
                                .SBTTL  ERROR POINTER TABLE
                                ;*THIS TABLE CONTAINS THE INFORMATION FOR EACH ERROR THAT CAN OCCUR.
                                ;*THE INFORMATION IS OBTAINED BY USING THE INDEX NUMBER FOUND IN
                                ;*LOCATION $ITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
                                ;*NOTE1:        IF $ITEMB IS 0 THE ONLY PERTINENT DATA IS ($ERRPC).
                                ;*NOTE2:        EACH ITEM IN THE TABLE CONTAINS 4 POINTERS EXPLAINED AS FOLLOWS:
                                ;*      EM              ;;POINTS TO THE ERROR MESSAGE
                                ;*      DH              ;;POINTS TO THE DATA HEADER
                                 *      DT              ;;POINTS TO THE DATA
                                ;*      DF              ;;POINTS TO THE DATA FORMAT
    001324                      $ERRTB:
394
395                             .SBTTL  ERROR DEFINITIONS
396                             ;       ERROR 1
397
398 001324  027234                      EM1                     ; TIMEOUT ON ACCESSING A MAP REGISTER
399 001326  031422                      DH1                     ; TEST # ERROR PC  ERROR #  ADDRESS
400 001330  032414                      DT1                     ; TEST,$ERRPC,ERRNUM,$BDADR
401 001332  000000                      0
402                             ;       ERROR 2
403
404 001334  027300                      EM2                     ; MAP REGISTER COULD NOT BE CLEARED
405 001336  031471                      DH2                     ;                          GOOD  BAD
406                                                             ; TEST # ERROR PC  ERROR # DATA  DATA ADDRESS
407 001340  032426                      DT2                     ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,$BDADR
408 001342  000000                      0
409                             ;       ERROR 3
410
411 001344  027342                      EM3                     ; MAP REGISTER COULD NOT HOLD PATTERN
412 001346  031471                      DH2                     ;                            GOOD  BAD
413                                                             ; TEST # ERROR PC  ERROR # DATA  DATA ADDRESS
414 001350  032426                      DT2                     ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,$BDADR
415 001352  000000                      0
416                             ;       ERROR 4
417
418 001354  027406                      EM4                     ; MAP REGISTER HAS NOT BEEN ADDRESSED CORRECTLY
419 001356  031563                      DH3                     ;                          GOOD      BAD
420                                                             ; TEST # ERROR PC  ERROR #  ADDRESS  ADDRESS
421 001360  032444                      DT3                     ; TEST,$ERRPC,ERRNUM,$GDADR,$BDADR
422 001362  000000                      0
423                             ;       ERROR 5
424
425 001364  027464                      EM5                     ; THERE WAS NO DIFFERENCE FOUND BETWEEN HI AND LO MAP REGIST
ERS
426 001366  031653                      DH4                     ;                          HI    LOW
427                                                             ; TEST # ERROR PC  ERROR #  MAP   MAP
428 001370  032460                      DT4                     ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
429 001372  000000                      0
430                             ;       ERROR 6
431
432 001374  027562                      EM6                     ; ERROR IN BITS 3-6,9-14 IN THE DCSR
433 001376  031731                      DH5                     ;                          GOOD  BAD
434                                                             ; TEST # ERROR PC  ERROR #  DATA  DATA
435 001400  032460                      DT4                     ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
436 001402  000000                      0
437                             ;       ERROR 7
438
439 001404  027625                      EM7                     ; DCSR DID RESPOND PROPERLY ON RESET
```

ERROR DEFINITIONS

```
001406  031731                  DH5                 ;                                   GOOD  BAD
                                                    ; TEST # ERROR PC  ERROR #  DATA  DATA
001410  032460                  DT4                 ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
001412  000000                  0
                        ;       ERROR 10

001414  027674                  EM10                ; TIMEOUT HAS OCCURED ON ACCESS TO THE DCSR
001416  031422                  DH1                 ; TEST # ERROR PC  ERROR #  ADDRESS
001420  032414                  DT1                 ; TEST,$ERRPC,ERRNUM,$BDADR
001422  000000                  0
                        ;       ERROR 11

001424  027746                  EM11                ; KMCR BITS 0-5,8 DID NOT GET SET CORRECTLY
001426  031471                  DH2                 ;                                GOOD  BAD
                                                    ; TEST # ERROR PC  ERROR # DATA  DATA ADDRESS
001430  032426                  DT2                 ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,$BDADR
001432  000000                  0
                        ;       ERROR 12

001434  030020                  EM12                ; TIMEOUT HAS OCCURED ON ACCESS TO THE KMCR
001436  031422                  DH1                 ; TEST # ERROR PC  ERROR #  ADDRESS
001440  032414                  DT1                 ; TEST,$ERRPC,ERRNUM,$BDADR
001442  000000                  0
                        ;       ERROR 13

001444  030072                  EM13                ; ERROR IN DATA PATH
001446  032013                  DH13                ; TEST # ERROR PC ERROR # PATTERN DDR
001450  032460                  DT4                 ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
001452  000000                  0
                        ;       ERROR 14

001454  030141                  EM14                ; ERROR IN DATA OUT
001456  031731                  DH5                 ;                                GOOD  BAD
                                                    ; TEST # ERROR PC  ERROR #  DATA  DATA
001460  032460                  DT4                 ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
001462  000000                  0
                        ;       ERROR 15

001464  030171                  EM15                ; ERROR IN DATA IN
001466  032013                  DH13                ; TEST # ERROR PC  ERROR # PATTERN DDR
001470  032460                  DT4                 ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
001472  000000                  0
                        ;       ERROR 16

001474  030220                  EM16                ; DDR NOT ZERO WHEN DCSR SELECTS UNIBUS LINES
001476  031731                  DH5                 ;                                   GOOD  BAD
                                                    ; TEST # ERROR PC  ERROR #  DATA  DATA
001500  032460                  DT4                 ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
001502  000000                  0
                        ;       ERROR 17

001504  030302                  EM17                ; ERROR IN SETTING DCSR<7>
001506  032066                  DH16                ; TEST # ERROR PC ERROR #
001510  032474                  DT16                ; TEST,$ERRPC,ERRNUM
001512  000000                  0
                        ;       ERROR 20
```

ERROR DEFINITIONS

```
    497 001514  030335                          EM20                    ; ERROR IN UNIQUE ADDRESSING OF REGISTERS
    498 001516  032125                          DH20                    ; TEST # ERROR PC ERROR # KMCR PAIR FAILED
    499 001520  032504                          DT20                    ; TEST,$ERRPC,ERRNUM,KMCR, $BDADR
    500 001522  000000                          0
    501                                 ;       ERROR 21
    502
    503 001524  030413                          EM21                    ; REG. PAIR 31. PERFORMS RELOCATION
    504 001526  032066                          DH16                    ; TEST # ERROR PC ERROR #
    505 001530  032474                          DT16                    ; TEST,$ERRPC,ERRNUM
    506 001532  000000                          0
    507                                 ;       ERROR 22
    508
    509 001534  030460                          EM22                    ; NXM CONDITION COULDN'T BE CREATED THRU ALU
    510 001536  032066                          DH16                    ; TEST # ERROR PC ERROR #
    511 001540  032474                          DT16                    ; TEST,$ERRPC,ERRNUM
    512 001542  000000                          0
    513                                 ;       ERROR 23
    514
    515 001544  030534                          EM23                    ; ALU ERROR
    516 001546  032205                          DH23                    ;                                   GOOD  BAD
    517                                                                 ; TEST # ERROR PC  ERROR # DATA  DATA ADDRESS
    518 001550  032530                          DT23                    ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,KIPAR6,$BDADR
    519 001552  000000                          0
    520                                 ;       ERROR 24
    521
    522 001554  030546                          EM24                    ; CPU CACHE ERROR
    523 001556  032066                          DH16                    ; TEST # ERROR PC ERROR #
    524 001560  032474                          DT16                    ; TEST,$ERRPC,ERRNUM
    525 001562  000000                          0
    526                                 ;       ERROR 25
    527
    528 001564  030566                          EM25                    ; KMCR<4-0> DOESN'T DISABLE MAIN MEMORY
    529 001566  032066                          DH16                    ; TEST # ERROR PC ERROR #
    530 001570  032474                          DT16                    ; TEST,$ERRPC,ERRNUM
    531 001572  000000                          0
    532                                 ;       ERROR 26
    533
    534 001574  030636                          EM26                    ; KMCR DOES NOT REFLECT EXPECTED STATUS OF THE CACHE/
    535 001576  031731                          DH5                     ;                                     GOOD  BAD
    536                                                                 ; TEST # ERROR PC  ERROR #  DATA  DATA
    537 001600  032460                          DT4                     ; TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT
    538 001602  000000                          0
    539                                 ;       ERROR 27
    540
    541 001604  030721                          EM27                    ; ERROR IN CACHE TAG REGISTERS
    542 001606  032316                          DH27                    ; TEST # ERROR PC  ERROR # ADDRESS
    543 001610  032550                          DT27                    ; TEST,$ERRPC,ERRNUM,MAPH01,MAPL01
    544 001612  000000                          0
    545                                 ;       ERROR 30
    546
    547 001614  030756                          EM30                    ; ERROR IN THE DMA CACHE DATA RAMS
    548 001616  031422                          DH1                     ; TEST # ERROR PC  ERROR # ADDRESS
    549 001620  032564                          DT30                    ; TEST,$ERRPC,ERRNUM,MAPL00
    550 001622  000000                          0
    551                                 ;       ERROR 31
    552
    553 001624  031017                          EM31                    ; ERROR IN THE M9312 BOOT ROM SECTION
```

ERROR DEFINITIONS

```
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT16                    ; TEST,$ERRPC,ERRNUM
                                        0
                                ;       ERROR 32

                                        EM32                    ; ERROR IN ARBITRATION LOGIC THRU UBE
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT16                    ; TEST,$ERRPC,ERRNUM
                                        0
                                ;       ERROR 33

                                        EM33                    ; ERROR TRYING TO DO DMA CYCLES THRU UBE
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT16                    ; TEST,$ERRPC,ERRNUM
                                        0
                                ;       ERROR 34

                                        EM34                    ; ERROR IN THE UNIBUS MEMORY TEST
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT16                    ; TEST,$ERRPC,ERRNUM
                                        0
                                ;       ERROR 35

                                        EM35                    ; UNEXPECTED TIMEOUT HAS OCCURED
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT21                    ; TEST,$BDADR,ERRNUM
                                        0
                                ;       ERROR 36

                                        EM36                    ; UNIBUS TIMEOUT DID NOT OCCUR
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT16                    ; TEST,$ERRPC,ERRNUM
                                        0
                                ;       ERROR 37

                                        EM37                    ; DCSR<3> DIDN'T DISABLE UBA ROM'S
                                        DH16                    ; TEST # ERROR PC  ERROR #
                                        DT16                    ; TEST,$ERRPC,ERRNUM
                                        0

                                .SBTTL  GLOBAL VARIABLES
                                ERRNUM: .WORD   0                       ; ERROR NUMBER FOR REPORT
                                TEST:   .WORD   0                       ; TEST NUMBER FOR REPORT
                                PMIS:   .WORD   0                       ; PMI MEMORY SIZE
                                UBECT:  .WORD   0                       ; NUMBER OF UBE'S
                                BE1INT: .WORD   0                       ; UBE #1 INTERRUPT FLAG
                                BE2INT: .WORD   0                       ; UBE #2 INTERRUPT FLAG
                                TOUT:   .WORD   0                       ; TIMEOUT FLAG
                                MCSR:   .WORD   172100                  ; POINTER TO MEMORY CSR
                                WRTBUF: .BLKW   20                      ; WRITE BUFFER
000377  007417  031463  PTRN16: .WORD   377,7417,31463,52525,125252      ; 16-BIT BINARY DIVIDE
052525  125252
145454  104210  155555          .WORD   145454,104210,155555,021042
021042
053346  146314  000000          .WORD   053346,146314,0
000017  000014  000025  PTRN6:  .WORD   17,14,25,52                      ; 6-BIT BINARY DIVIDE
000052
```

GLOBAL VARIABLES

```
    608 002034  000026  000042  000010          .WORD   26,42,10,55,77,70,7,0
        002042  000055  000077  000070
        002050  000007  000000
    609
    610                                 .SBTTL  CACHE RAM IMAGE TABLE
    611
    612                                 ;
    613                                 ; THE FOLLOWING BLOCK OF DATA WILL BE USED IN THE CACHE RAM BIT TEST
    614                                 ; THE EXACT ADDRESSES WILL BE FIGURED OUT BY THE PROGRAM DEPENDING
    615                                 ; ON THE LOCATION OF THIS TABLE.
    616                                 ;
    617
    618 002054                          CTBLE:  .BLKW   47                              ; THE LARGEST # OF LOCATIONS NEEDED
    619
    620 002172  000000                  OBADR:  .WORD   0                               ; FIRST ADDRESS OF A FIELD IN TABLE
    621 002174  000000                          .WORD   0                               ; FIRST ADDRESS OF B FIELD IN TABLE
    622 002176  000000                          .WORD   0                               ; FIRST ADDRESS OF C FIELD IN TABLE
    623 002200  000000                          .WORD   0                               ; FIRST ADDRESS OF D FIELD IN TABLE
    624
    625                                 .SBTTL  UNIBUS EXERCISER REGISTER TABLES
    626
    627                                 ;
    628                                 ;       UBE #1
    629                                 ;
    630
    631 002202  000000                  BE1DB:  0                       ; UBE #1 DATA REGISTER
    632 002204  000000                  BE1CC:  0                       ; UBE #1 CYCLE COUNT REGISTER
    633 002206  000000                  BE1BA:  0                       ; UBE #1 ADDRESS REGISTER
    634 002210  000000                  BE1CR1: 0                       ; UBE #1 CONTROL REGISTER 1
    635 002212  000000                  BE1CLR: 0                       ; UBE #1 CLEAR ERROR REGISTER ADDRESS
    636 002214  000000                  BE1CR2: 0                       ; UBE #1 CONTROL REGISTER 2
    637 002216  000000                  BE1VEC: 0                       ; UBE #1 VECTOR PC
    638 002220  000000                  BE1PSW: 0                       ; UBE #1 VECTOR PSW
    639
    640                                 ;
    641                                 ;       UBE #2
    642                                 ;
    643
    644 002222  000000                  BE2DB:  0                       ; UBE #2 DATA REGISTER
    645 002224  000000                  BE2CC:  0                       ; UBE #2 CYCLE COUNT REGISTER
    646 002226  000000                  BE2BA:  0                       ; UBE #2 ADDRESS REGISTER
    647 002230  000000                  BE2CR1: 0                       ; UBE #2 CONTROL REGISTER 1
    648 002232  000000                  BE2CLR: 0                       ; UBE #2 CLEAR ERROR REGISTER ADDRESS
    649 002234  000000                  BE2CR2: 0                       ; UBE #2 CONTROL REGISTER 2
    650 002236  000000                  BE2VEC: 0                       ; UBE #2 VECTOR PC
    651 002240  000000                  BE2PSW: 0                       ; UBE #2 VECTOR PSW
    652                                 .SBTTL SUBROUTINE - DIAGNOSTIC_DATA_OUT SUBROUTINE
    653
    654                                 ;* INPUTS: PATTERN TO BE STORED IN DDR AND THEN WRITTEN TO MEMORY $GDDAT
    655                                 ;*         TEST_LOCATION TO BE WRITTEN TO (16 OR 22 BITS) (R1)
    656                                 ;
    657                                 ;* ON RETURN FROM SUBROUTINE TEST_LOCATION SHOULD HAVE THE SAME DATA
    658                                 ;* AS DDR AND THE SAME AS PATTERN
    659                                 ;* THE PROGRAM HAS TO BE RUNNING IN DIAGNOSTIC MODE WITH DIAGNOSTIC
    660                                 ;* NPR REGISTER SELECTED
    661                                 ;
    662                                 ;  BGNROUTINE
```

```
                                        ;
                                        ;       MOVE PATTERN TO DDR
                                        ;       DO EXTERNAL WRITE FROM TEST_LOCATION
                                        ;       RETURN
                                        ;
                                        ;  ENDROUTINE
                                        ;
                                        ;-------------------------------------------------------------------------

002242  013737  001124  177732  DDOUT:  MOV     $GDDAT,DDR              ; STORE PATTERN IN DDR
002250  011111                  1$:     MOV     (R1),(R1)               ; EXTENAL READ TO PROVIDE ADDRESS
002252  000207                          RTS     PC

                                        .SBTTL SUBROUTINE - DIAGNOSTIC_DATA_IN SUBROUITNE

                                        ;* INPUTS: PATTERN TO BE WRITTEN TO MEMORY AND THEN TO DDR $GDDAT
                                        ;*         TEST_LOCATION TO READ FROM (16 OR 22 BITS) (R1)
                                        ;
                                        ;* ON RETURN FROM SUBROUTINE DDR SHOULD HAVE THE SAME DATA AS
                                        ;* SPECIFIED MEMORY LOCATION AND THE SAME AS THE PATTERN
                                        ;* THE PROGRAM HAS TO BE RUNNING IN DIAGNOSTIC MODE WITH DIAGNOSTIC
                                        ;* NPR REGISTER SELECTED.
                                        ;
                                        ;  BGNROUTINE
                                        ;
                                        ;       LET DCSR<0> = #1
                                        ;       DO EXTERNAL WRITE FROM TEST_LOCATION
                                        ;       RETURN
                                        ;
                                        ;  ENDROUTINE
                                        ;
                                        ;-------------------------------------------------------------------------

002254  052737  000001  177730  DDIN:   BIS     #BIT00,DCSR             ; SET GO BIT
002262  011111                  2$:     MOV     (R1),(R1)               ; PROVIDE ADDRESS FOR DMA
002264  000207                  3$:     RTS     PC

                                        .SBTTL SUBROUTINE - TIMEOUT_ROUTINE
                                        ;* THIS ROUTINE IS USED TO FLAG AN UNEXPECTED TIMEOUT.
                                        ;
                                        ;  BGNROUTINE
                                        ;
                                        ;       STORE ADDRESS THAT CAUSED TIMEOUT
                                        ;       ERROR
                                        ;       RETURN
                                        ;
                                        ;  ENDROUTINE
                                        ;
                                        ;-------------------------------------------------------------------------

002266  011637  001122          TIMOUT: MOV     (SP),$BDADR             ; STORE ADDRESS THAT TIMED OUT
002272  104035                          ERROR   +35                     ; UNEXPECTED TIMEOUT
002274  000002                          RTI
```

```
                                .SBTTL SUBROUTINE - MAP_PROGRAM_AREA

                                ;* THIS ROUTINE MAPS THE PROGRAM AREA TO THE FIRST 32K
                                ;
                                ;  BGNROUTINE
                                ;
                                ;       MAP PROGRAM AREA THRU KIPAR'S TO FIRST 32 K
                                ;       NO CACHE BYPASS
                                ;       RETURN
                                ;
                                ;  ENDROUTINE
                                ;
                                ;---------------------------------------------------------------

002276                          MAPPR:
002276  010046                         MOV     R0,-(SP)        ;;PUSH R0 ON STACK
002300  010146                         MOV     R1,-(SP)        ;;PUSH R1 ON STACK
002302  010246                         MOV     R2,-(SP)        ;;PUSH R2 ON STACK
002304  012700  172300                 MOV     #172300,R0              ; R0 POINTS TO FIRST KIPDR
002310  012701  000010                 MOV     #8.,R1                  ; DO FOR ALL 8 REGISTERS
002314  012720  077406         1$:     MOV     #77406,(R0)+            ; . 4K PAGE, CACHE ON, READ/WRITE
002320  077103                         SOB     R1,1$                   ; . CONTINUE TILL DONE
002322  012700  172340                 MOV     #172340,R0              ; R0 POINTS TO FIRST KIPAR
002326  012701  000006                 MOV     #6.,R1                  ; DO FOR ALL 8 REGISTERS
002332  012702  000000                 MOV     #0,R2                   ; START WITH ADDRESS 0
002336  010220         2$:     MOV     R2,(R0)+                ; . LOAD WITH ADDRESS
002340  062702  000200                 ADD     #200,R2                 ; . NEXT 4K
002344  077104                         SOB     R1,2$                   ; . CONTINUE TILL DONE
002346  005020                         CLR     (R0)+                   ; CLEAR KIPAR6
002350  012710  177600                 MOV     #177600,(R0)            ; I/O PAGE TO KIPAR7
002354  012602                         MOV     (SP)+,R2        ;;POP STACK INTO R2
002356  012601                         MOV     (SP)+,R1        ;;POP STACK INTO R1
002360  012600                         MOV     (SP)+,R0        ;;POP STACK INTO R0
002362  000207                         RTS     PC

                                .SBTTL SUBROUTINE - MEMORY SIZE

                                ;* THIS ROUTINE SIZES MAIN (PMI) MEMORY IN 4K WORDS.
                                ;
                                ;  BGNROUTINE
                                ;
                                ;       REMAP TIMEOUT VECTOR AND PROGRAM AREA
                                ;       ENABLE MEMORY MANAGEMENT UNIT
                                ;       DO UNTIL TIMEOUT OR ALL 2M CHECKED
                                ;       .  CHECK LOCATION 0 IN EACH 4K PAGE THRU KIPAR6
                                ;       ENDDO
                                ;
                                ;  ENDROUTINE
                                ;
                                ;---------------------------------------------------

002364  013702  000004         MEMSIZ: MOV     ERRVEC,R2                       ; SAVE TIME OUT VECTOR
002370  012737  002444  000004         MOV     #3$,ERRVEC                      ; POINT NEW TO PROGRAM
002376  012737  000340  000006         MOV     #340,ERRVEC+2                   ; AT PRIORITY 7
                                ;
                                ; SIZE MEMORY IN 4K WORDS
```

J2

SUBROUTINE - MEMORY SIZE

```
                                        ;
002404  012737  000200  172354          MOV     #200,KIPAR6                     ; FIRST 4K
002412  000403                          BR      2$                              ; GO TRY TO ACCESS
002414  062737  000200  172354  1$:     ADD     #200,KIPAR6                     ; . NEXT 4K
002422  005737  140000          2$:     TST     @#140000                        ; . ACCESS THRU KIPAR6
002426  022737  170000  172354          CMP     #170000,KIPAR6                  ; . LAST PAGE?
002434  001367                          BNE     1$                              ; . IF NOT, BRANCH
002436  012701  000040                  MOV     #40,R1                          ; IF 2M PRESENT, ONLY 21ST MASKED
002442  000402                          BR      4$                              ; BRANCH
002444  005726                  3$:     TST     (SP)+                           ; RESTORE STACK
002446  005726                          TST     (SP)+                           ;
002450  010237  000004          4$:     MOV     R2,ERRVEC                       ; RESTORE TIMEOUT VECTOR
002454  000207                          RTS     PC                              ; RETURN

                        .SBTTL SUBROUTINE - SIZE UNIBUS MEMORY FROM KMCR

                        ;* ON RETURN FROM THIS SUBROUTINE R2 WOULD HAVE PAR VALUE
                        ;* OF UNIBUS MEMORY
                        ;
002456  013701  177734  UMSIZ:  MOV     KMCR,R1                 ; SAVE KMCR
002462  042701  000040  1$:     BIC     #BIT05,R1               ; LEAVE ONLY # OF PAGES
002466  012702  007600          MOV     #7600,R2                ; START W/O UNIBUS MEMORY
002472  162702  000200  100$:   SUB     #200,R2                 ; . SUBTRACT 4K
002476  077103                  SOB     R1,100$                 ; . FOR ALL PAGES PRESENT
002500  000207                  RTS     PC

                        .SBTTL SUBROUTINE - INITIALIZE THE UBE'S

                        ;* THIS ROUTINE IS USED TO INITIALIZE THE UBE'S
                        ;
                        ;  BGNROUTINE
                        ;
                        ;       SAVE R0,R1
                        ;       LET R0 := FIRST UBE ADDRESS
                        ;       DO FOR (R0) := BE1DB TO BE1CR1
                        ;       .  LET (R0) := 0
                        ;       ENDDO
                        ;       RESTORE R1,R0
                        ;       RETURN
                        ;
                        ;  ENDROUTINE
                        ;
                        ;-----------------------------------------------------------------

002502                  IUBE:
002502  010046                  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
002504  010146                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
002506  013700  002202          MOV     BE1DB,R0        ; POINT R0 TO UBE REGISTERS
002512  012701  000010          MOV     #10,R1          ; SET UP A LOOP COUNTER
002516  005020          5$:     CLR     (R0)+           ; CLEAR OUT A REGISTER
002520  077102                  SOB     R1,5$           ; HAVE WE INITIALIZED THE UBE ?
002522  012601                  MOV     (SP)+,R1        ;;POP STACK INTO R1
002524  012600                  MOV     (SP)+,R0        ;;POP STACK INTO R0
002526  000207                  RTS     PC
```

SUBROUTINE - INITIALIZE THE UBE'S

```
                                        ;
                                        ; STARTING POINT OF PROGRAM
                                        ;

002530                                  START:
                                        ;; LCP/ORION ROUTINE TO SAVE EMTULATOR AND PRIORITY
002530  005737  002616                  EMTSAV: TST     SAV30                   ;; FIRST TIME THROUGH ?
002534  001034                                  BNE     VMKOR                   ;; BRANCH IF BEEN HERE ALREADY
002536  032737  000040  000052                  BIT     #BIT5,@#52              ;; ARE WE IN UFD MODE ?
002544  001430                                  BEQ     VMKOR                   ;; LEAVE IF NOT
002546  012737  177777  002622                  MOV     #-1,UFDFLG              ;; SET UFD FLAG
002554  032737  000100  000052                  BIT     #BIT6,@#52              ;; ARE WE IN QUIET MODE ?
002562  001403                                  BEQ     1$                      ;; BR IF NOT
002564  012737  177777  002624                  MOV     #-1,UQUIET              ;; SET QUIET MODE
002572  104042                          1$:     EMT     42                      ;; GET ADDRESS OF XXDP DCA TABLE
002574  005060  000042                          CLR     42(R0)                  ;; CLR XXDP+ "DRSERR"
002600  013737  000030  002616                  MOV     30,SAV30                ;; SAVE EMULATOR ADDRESS
002606  013737  000032  002620                  MOV     32,SAV32                ;; SAVE EMULATOR PRIORITY LEVEL
002614  000404                                  BR      VMKOR                   ;; GET AROUND TAG AREA
002616  000000                          SAV30:  .WORD   0                       ;; PUT EMULATOR INFO HERE
002620  000000                          SAV32:  .WORD   0                       ;; PUT PRIORITY LOCATION        HERE
002622  000000                          UFDFLG: .WORD   0                       ;; USER FRIENDLY MODE FLAG
002624  000000                          UQUIET: .WORD   0                       ;; UFD QUIET MODE FLAG
002626                                  VMKOR:
                                        ;******************************************************************************
                                        .SBTTL  INITIALIZE THE COMMON TAGS
                                        ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
002626  012706  001100                          MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
002632  005026                                  CLR     (R6)+           ;;CLEAR MEMORY LOCATION
002634  022706  001140                          CMP     #SWR,R6 ;;DONE?
002640  001374                                  BNE     .-6             ;;LOOP BACK IF NO
002642  012706  001100                          MOV     #STACK,SP       ;;SETUP THE STACK POINTER
                                        ;;INITIALIZE A FEW VECTORS
002646  012737  023360  000020                  MOV     #$SCOPE,@#IOTVEC ;;IOT VECTOR FOR SCOPE ROUTINE
002654  012737  000340  000022                  MOV     #340,@#IOTVEC+2 ;;LEVEL 7
002662  012737  025764  000030                  MOV     #$ERROR,@#EMTVEC ;;EMT VECTOR FOR ERROR ROUTINE
002670  012737  000340  000032                  MOV     #340,@#EMTVEC+2 ;;LEVEL 7
002676  012737  026772  000034                  MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
002704  012737  000340  000036                  MOV     #340,@#TRAPVEC+2;LEVEL 7
002712  012737  027056  000024                  MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
002720  012737  000340  000026                  MOV     #340,@#PWRVEC+2 ;;LEVEL 7
002726  013737  023220  023212                  MOV     $ENDCT,$EOPCT   ;;SETUP END-OF-PROGRAM COUNTER
002734  005037  001164                          CLR     $TIMES          ;;INITIALIZE NUMBER OF ITERATIONS
002740  005037  001166                          CLR     $ESCAPE         ;;CLEAR THE ESCAPE ON ERROR ADDRESS
002744  112737  000001  001115                  MOVB    #1,$ERMAX       ;;ALLOW ONE ERROR PER TEST
002752  012737  002752  001106                  MOV     #.,$LPADR       ;;INITIALIZE THE LOOP ADDRESS FOR SCOPE
002760  012737  002760  001110                  MOV     #.,$LPERR       ;;SETUP THE ERROR LOOP ADDRESS
                                        ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
                                        ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
002766  013746  000004                          MOV     @#ERRVEC,-(SP)  ;;SAVE ERROR VECTOR
002772  012737  003026  000004                  MOV     #30000$,@#ERRVEC        ;;SET UP ERROR VECTOR
003000  012737  177570  001140                  MOV     #DSWR,SWR       ;;SETUP FOR A HARDWARE SWICH REGISTER
003006  012737  177570  001142                  MOV     #DDISP,DISPLAY  ;;AND A HARDWARE DISPLAY REGISTER
003014  022777  177777  176116                  CMP     #-1,@SWR        ;;TRY TO REFERENCE HARDWARE SWR
003022  001012                                  BNE     30002$          ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
                                                                        ;;AND  THE HARDWARE SWR IS NOT = -1
003024  000403                                  BR      30001$          ;;BRANCH IF NO TIMEOUT
```

INITIALIZE THE COMMON TAGS

```
        003026  012716  003034          30000$: MOV     #30001$,(SP)    ;;SET UP FOR TRAP RETURN
        003032  000002                          RTI
        003034  012737  000176  001140  30001$: MOV     #SWREG,SWR      ;;POINT TO SOFTWARE SWR
        003042  012737  000174  001142          MOV     #DISPREG,DISPLAY
        003050  012637  000004          30002$: MOV     (SP)+,@#ERRVEC  ;;RESTORE ERROR VECTOR
        003054  005037  001206                  CLR     $PASS           ;;CLEAR PASS COUNT
        003060  132737  000200  001221          BITB    #APTSIZE,$ENVM  ;;TEST USER SIZE UNDER APT
        003066  001403                          BEQ     30003$          ;;YES,USE NON-APT SWITCH
        003070  012737  001222  001140          MOV     #$SWREG,SWR     ;;NO,USE APT SWITCH REGISTER
        003076                          30003$:
    832 003076  005737  002624                  TST     UQUIET          ; ARE WE UNDER UFD QUIET MODE ?
    833 003102  001056                          BNE     1$              ; YES,THEN SKIP THE DIAGNOSTIC TITLE PRINTOUT
    834 003104  122737  000001  001220          CMPB    #APTENV,$ENV    ; APT?
    835 003112  001452                          BEQ     1$              ; IF YES, SKIP PRINTOUT
    836                                 .SBTTL  TYPE PROGRAM NAME
                                        ;;TYPE THE NAME OF THE PROGRAM IF FIRST PASS
        003114  005227  177777                  INC     #-1             ;;FIRST TIME?
        003120  001047                          BNE     30004$          ;;BRANCH IF NO
        003122  022737  023340  000042          CMP     #$ENDAD,@#42    ;;ACT-11?
        003130  001443                          BEQ     30004$          ;;BRANCH IF YES
        003132  104401  003200                  TYPE    ,30005$         ;;TYPE ASCIZ STRING
                                        .SBTTL  GET VALUE FOR SOFTWARE SWITCH REGISTER
        003136  005737  000042                  TST     @#42            ;;ARE WE RUNNING UNDER XXDP/ACT?
        003142  001012                          BNE     30006$          ;;BRANCH IF YES
        003144  123727  001220  000001          CMPB    $ENV,#1         ;;ARE WE RUNNING UNDER APT?
        003152  001406                          BEQ     30006$          ;;BRANCH IF YES
        003154  023727  001140  000176          CMP     SWR,#SWREG      ;;SOFTWARE SWITCH REG SELECTED?
        003162  001005                          BNE     30007$          ;;BRANCH IF NO
        003164  104406                          GTSWR                   ;;GET SOFT-SWR SETTINGS
        003166  000403                          BR      30007$
        003170  112737  000001  001134  30006$: MOVB    #1,$AUTOB       ;;SET AUTO-MODE INDICATOR
        003176                          30007$:
        003176  000420                          BR      30004$          ;;GET OVER THE ASCIZ
                                        ;;30005$:       .ASCIZ  <CRLF>* COKTACO KTJ11-B DIAGNOSTIC *<CRLF>
        003240                          30004$:
    837 003240  012737  002266  000004  1$:     MOV     #TIMOUT,@#4     ; SETUP TIMEOUT VECTOR FOR UNEXPECTED TIMEOUT
    838 003246  012737  000340  000006          MOV     #340,@#6        ;
    839 003254  005037  001716                  CLR     TEST            ; TEST # FOR ERROR REPORTING
    840                                 ; SIZE MEMORY IN 4K PAGES
    841 003260  004737  002276                  JSR     PC,MAPPR        ; REMAP PROGRAM AREA
    842 003264  052737  000060  172516          BIS     #BIT05!BIT04,MMR3       ; ENABLE RELOCATION AND 22BITS
    843 003272  005237  177572                  INC     MMR0            ; ENABLE MMU
    844 003276  004737  002364                  JSR     PC,MEMSIZ       ; GET HIGHEST 128K OF MEMORY
    845 003302  005037  177572                  CLR     MMR0            ; DISABLE MMU
    846 003306  005037  172516                  CLR     MMR3            ;
    847 003312  013737  172354  001720          MOV     KIPAR6,PMIS     ; STORE HIGHEST PAGE
    848 003320                          RESTART:
    849 003320  012706  001100                  MOV     #1100,SP        ; SET UP THE STACK POINTER
    850
    851
    852
```

```
                        .SBTTL TEST - UNIBUS MAP REGISTER TESTS

                        ;* THIS TEST WILL TRY TO ACCESS ALL THE MAP
                        ;* REGISTERS WITH BOTH MAPPING ENABLED AND
                        ;* DISABLED
                        ;
                        ;  BGNTST
                        ;
                        ;       LET 4:= ADDRESS OF ERROR ROUTINE
                        ;       LET 6:= PRIORITY OF 7
                        ;       DO FOR BOTH UNIBUS MAP ENABLED AND DISABLED
                        ;       .  DO FOR ADDRESS := 170200 TO 170376
                        ;       .  .  READ ADDRESS
                        ;       .  .  IF ADDRESS CAN'T BE READ THEN
                        ;       .  .  .  TRAP THRU VECTOR 4
                        ;       .  .  ENDIF
                        ;       .  ENDDO
                        ;       ENDDO
                        ;       EXIT TEST
                        ;
                        ;  ERROR:
                        ;       REPORT WHICH MAP REGISTER TIMED OUT
                        ;
                        ;  ENDTST
                        ;
                        ;----------------------------------------

                        ;;*****************************************************************
                        ;*TEST 1        UNIBUS MAP REGISTER RESPONSE TEST
                        ;;*****************************************************************
003324  000004          TST1:   SCOPE

                        ;
                        ; SET UP MEMORY TIMEOUT VECTOR TO ERROR ROUTINE
                        ;
003326  013705  000004          MOV     @#4,R5                  ; SAVE THE TIMEOUT VECTOR
003332  012737  003424  000004  MOV     #20$,@#4                ; SET UP TIMEOUT VECTOR TO ERROR ROUTINE
003340  012737  000340  000006  MOV     #340,@#6                ; SET UP TIMEOUT PRIORITY
                        ;
                        ; DISABLE UNIBUS MAPPING
                        ;
003346  042737  000040  172516  BIC     #BIT5,@#SR3             ; DISABLE UNIBUS MAPPING
                        ;
                        ; TRY TO ACCESS ALL THE UNIBUS MAP REGISTERS
                        ;
003354  005001          CLR     R1                      ; INITIALIZE LOOP COUNT
003356  012700  170200  5$:     MOV     #MAPLOO,R0      ; . R0 POINTS TO MAP REGISTER #0
003362  005720          10$:    TST     (R0)+           ; . . TRY TO READ MAP REGISTER
003364  020027  170400  12$:    CMP     R0,#170400      ; . . HAVE WE READ ALL THE MAP REGISTERS
003370  001374          BNE     10$                     ; . . NO THEN GO READ THE NEXT ONE
003372  005701          TST     R1                      ; . HAVE WE DONE THIS TWICE ?
003374  001406          BEQ     15$                     ; . GO TURN ON UNIBUS MAP AND TRY AGAIN
003376  042737  000040  172516  BIC     #BIT5,SR3       ; . TURN OFF UNIBUS MAPPING
003404  010537  000004          MOV     R5,@#4          ; RESTORE THE TIMEOUT VECTOR
003410  000417          BR      TST2            ;; . GO TO NEXT TEST
003412  005201          15$:    INC     R1              ; . INCREMENT LOOP COUNT
003414  052737  000040  172516  BIS     #BIT5,SR3       ; . TURN ON UNIBUS MAP
```

```
    908 003422  000755                          BR      5$                      ; . GO TRY TO ACCESS THE REGISTERS
    909                                 ;
    910                                 ; MAP REGISTER TIMEOUT ROUTINE
    911                                 ;
    912 003424  005726                  20$:    TST     (SP)+                   ; CLEAN UP THE STACK
    913 003426  005726                          TST     (SP)+                   ;
    914 003430  162700  000002                  SUB     #2,R0                   ; GET ADDRESS THAT TIMED OUT
    915 003434  010037  001122                  MOV     R0,$BDADR               ; PUT IT IN $BDADR
    916 003440  062700  000002                  ADD     #2,R0                   ; GET NEXT ADDRESS
    917 003444  104001                          ERROR   +1                      ; REPORT THAT ACCESS HAS TIMED OUT
    918 003446  000746                          BR      12$                     ;
    919
```

```
                                .SBTTL  TEST - UNIBUS MAP REGISTER BIT PATTERN

                                ;* THIS TEST IS DESIGNED TO DETECT ANY STUCK
                                ;* AT BITS OR SHORTED BITS IN THE UNIBUS MAP
                                ;* REGISTERS
                                ;
                                ;  BGNTST
                                ;
                                ;       CLEAR ALL MAP REGISTERS
                                ;       DO FOR ADDRESS := 170200 TO 170376
                                ;*
                                ;*  CHECK LOW MAPPING REGISTERS
                                ;*
                                ;         .  READ ADDRESS
                                ;         .  IF ADDRESS NE 0 THEN
                                ;         .  .  ERROR MAP REGISTER DID NOT CLEAR
                                ;         .  ENDIF
                                ;         .  DO FOR PATTERNS := 377,7417,1463,52525,125252
                                ;         .  .  WRITE PATTERN INTO ADDRESS
                                ;         .  .  READ PATTERN
                                ;         .  .  IF CONTENTS OF ADDRESS NE PATTERN THEN
                                ;         .  .  .  ERROR IN BITS OF ADDRESS
                                ;         .  .  ENDIF
                                ;         .  ENDDO
                                ;         .  LET ADDRESS := ADDRESS * 2
                                ;*
                                ;* CHECK HIGH MAPPING REGISTERS
                                ;*
                                ;         .  READ ADDRESS
                                ;         .  IF ADDRESS NE 0 THEN
                                ;         .  .  ERROR MAP REGISTER DID NOT CLEAR
                                ;         .  ENDIF
                                ;         .  DO FOR PATTERNS := 17,14,25,52
                                ;         .  .  WRITE PATTERN INTO ADDRESS
                                ;         .  .  READ PATTERN
                                ;         .  .  IF CONTENTS OF ADDRESS NE PATTERN THEN
                                ;         .  .  .  ERROR IN BITS OF ADDRESS
                                ;         .  .  ENDIF
                                ;         .  ENDDO
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-----------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 2        UNIBUS MAP REGISTER BIT PATTERN TEST
                                ;;*****************************************************************
003450  000004                  TST2:   SCOPE

                                ;
                                ; CLEAR ALL MAP REGISTERS
                                ;
003452  012700  170200                  MOV     #MAPL00,R0              ; GET ADDRESS TO 1ST MAP REGISTER
003456  005020                  5$:     CLR     (R0)+                   ; . CLEAR THE MAP REGISTER
003460  020027  170400                  CMP     R0,#170400              ; . HAVE WE CLEARED ALL THE MAP REGISTERS ?
003464  001374                          BNE     5$                      ; . NO THEN GO CLEAR THE NEXT ONE
```

T2 UNIBUS MAP REGISTER BIT PATTERN TEST

```
                                        ;
                                        ; DO A READ,WRITE,READ ON THE REGISTERS TO
                                        ; VERIFY ALL THE BITS OF THE  LOW MAP REGISTERS
                                        ;
003466  012700  170200          MOV     #MAPL00,R0              ; GET ADDRESS TO 1ST MAP REGISTER
003472  005710          10$:    TST     (R0)                    ; . IS THE MAP REGISTER CLEAR ?
003474  001410                  BEQ     15$                     ; . YES,THEN GO CHECK THE BITS
003476  011037  001126          MOV     (R0),$BDDAT             ; . NO,THEN GET THE BAD DATA
003502  012737  000000  001124  MOV     #0,$GDDAT               ; .  GET THE GOOD DATA
003510  010037  001122          MOV     R0,$BDADR               ; .  GET THE ADDRESS THAT DID NOT CLEAR
003514  104002                  ERROR   +2                      ; .  ERROR - REGISTER DID NOT CLEAR
003516  012701  001774  15$:    MOV     #PTRN16,R1              ; . GET POINTER TO PATTERN TABLE
003522  011110  20$:    MOV     (R1),(R0)               ; . . MOVE PATTERN TO MAP REGISTER
003524  011102          MOV     (R1),R2                 ; . . MOVE COPY OF PATTERN TO R2
003526  042702  000001  BIC     #BIT0,R2                ; . . CLEAR BIT0 OF THE PATTERN
003532  020210          CMP     R2,(R0)                 ; . . DID PATTERN GET WRITTEN CORRECTLY ?
003534  001407          BEQ     25$                     ; . . YES,THEN GO SEE IF ALL PATTERNS HAVE BEEN WRIT
TEN
003536  011037  001126          MOV     (R0),$BDDAT             ; . . NO,GET THE BAD DATA
003542  010237  001124          MOV     R2,$GDDAT               ; . .  GET THE GOOD DATA
003546  010037  001122          MOV     R0,$BDADR               ; . .  GET THE ADDRESS OF DATA FAULT
003552  104003                  ERROR   +3                      ; . .  ERROR - REGISTER COULD NOT HOLD PATTERN
003554  005721  25$:    TST     (R1)+                   ; . . ARE WE THROUGH THE TABLE ?
003556  001361          BNE     20$                     ; . . NO THEN GO WRITE NEXT PATTERN
                                        ;
                                        ; DO A READ,WRITE,READ ON THE REGISTERS TO
                                        ; VERIFY ALL THE BITS OF THE HIGH MAP REGISTERS
                                        ;
003560  062700  000002          ADD     #2,R0                   ; . POINT TO THE HIGH MAPPING REGISTER
003564  005710  30$:    TST     (R0)                    ; . IS THE MAP REGISTER CLEAR ?
003566  001410          BEQ     35$                     ; . YES,THEN GO CHECK THE BITS
003570  011037  001126          MOV     (R0),$BDDAT             ; . NO,THEN GET THE BAD DATA
003574  012737  000000  001124  MOV     #0,$GDDAT               ; .  GET THE GOOD DATA
003602  010037  001122          MOV     R0,$BDADR               ; .  GET THE ADDRESS THAT DID NOT CLEAR
003606  104002                  ERROR   +2                      ; .  ERROR - REGISTER DID NOT CLEAR
003610  012701  002024  35$:    MOV     #PTRN6,R1               ; . GET POINTER TO PATTERN TABLE
003614  011110  40$:    MOV     (R1),(R0)               ; . . MOVE PATTERN TO MAP REGISTER
003616  011102          MOV     (R1),R2                 ; . . MOVE COPY OF THE PATTERN TO R2
003620  042702  177700  BIC     #177700,R2              ; . . MASK OUT THE UPPER 10 BITS
003624  020210          CMP     R2,(R0)                 ; . . DID PATTERN GET WRITTEN CORRECTLY ?
003626  001407          BEQ     45$                     ; . . YES,THEN GO SEE IF ALL PATTERNS HAVE BEEN WRIT
TEN
003630  011037  001126          MOV     (R0),$BDDAT             ; . . NO,GET THE BAD DATA
003634  010237  001124          MOV     R2,$GDDAT               ; . .  GET THE GOOD DATA
003640  010037  001122          MOV     R0,$BDADR               ; . .  GET THE ADDRESS OF DATA FAULT
003644  104003                  ERROR   +3                      ; . .  ERROR - REGISTER COULD NOT HOLD PATTERN
003646  005721  45$:    TST     (R1)+                   ; . . ARE WE THROUGH THE TABLE ?
003650  001361          BNE     40$                     ; . . NO THEN GO WRITE NEXT PATTERN
                                        ;
                                        ; SEE IF WE HAVE CHECKED ALL THE MAP REGISTERS
                                        ;
003652  062700  000002          ADD     #2,R0                   ; . POINT TO NEXT REGISTER
003656  020027  170400          CMP     R0,#170400              ; . ARE WE THROUGH ALL THE MAP REGISTERS ?
003662  001303          BNE     10$                     ; . GO CHECK THE NEXT REGISTER
```

```
                                .SBTTL  TEST - UNIBUS MAP REGISTER ADDRESS UNIQUENESS
                                ;
                                ;* THIS TEST IS DESIGNED TO DETECT ANY DUAL ADDRESSING
                                ;* IN THE UNIBUS MAP ADDRESSING LOGIC
                                ;
                                ;  BGNTST
                                ;
                                ;       DO FOR ADDRESS := 170200 TO 170376
                                ;       .  WRITE #ADDRESS TO ADDRESS
                                ;       ENDDO
                                ;       DO FOR ADDRESS := 170200 TO 170376
                                ;       .  READ ADDRESS
                                ;       .  IF CONTENTS OF ADDRESS NE ADDRESS THEN
                                ;       .  .  REPORT ERROR IN ADDRESSING
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 3        UNIBUS MAP REGISTER UNIQUENESS TEST
                                ;;*****************************************************************
003664  000004                  TST3:   SCOPE

                                ;
                                ; WRITE ADDRESS INTO ALL MAP REGISTERS
                                ;
003666  012700  170200                  MOV     #MAPLOO,R0              ; GET ADDRESS OF 1ST MAP REGISTER
003672  012701  170200                  MOV     #MAPLOO,R1              ; GET ADDRESS OF 1ST MAP REGISTER
003676  010021                  5$:     MOV     R0,(R1)+                ; . WRITE ADDRESS TO ITSELF
003700  062700  000002                  ADD     #2,R0                   ; . GET THE NEXT ADDRESS
003704  022700  170400                  CMP     #170400,R0              ; . HAVE WE WRITTEN TO ALL MAP REGISTERS ?
003710  001372                          BNE     5$                      ; . NO,THEN GO WRITE TO NEXT ADDRESS
                                ;
                                ; MAKE SURE EACH LOW MAP REGISTER CONTAINS ITS ADDRESS
                                ;
003712  012700  170200                  MOV     #MAPLOO,R0              ; GET ADDRESS TO 1ST MAP REGISTER
003716  012701  170200                  MOV     #MAPLOO,R1              ; GET ADDRESS TO 1ST MAP REGISTER
003722  020021                  10$:    CMP     R0,(R1)+                ; . WAS THE ADDRESS WRITTEN TO THE MAP REGISTER ?
003724  001406                          BEQ     15$                     ; . YES,THEN GO CHECK THE HIGH MAP REGISTER
003726  010037  001120                  MOV     R0,$GDADR               ; .  GET THE GOOD ADDRESS
003732  016137  177776  001122          MOV     -2(R1),$BDADR           ; .  GET THE BAD ADDRESS
003740  104004                          ERROR   +4                      ; .  ERROR IN ADDRESSING OF MAP REGISTERS
                                ;
                                ; MAKE SURE EACH HIGH MAP REGISTER CONTAINS ITS ADDRESS
                                ;
003742  062700  000002          15$:    ADD     #2,R0                   ; . POINT R0 TO HIGH MAP REGISTER
003746  010002                          MOV     R0,R2                   ; . PUT A COPY OF IT INTO R2
003750  042702  177700                  BIC     #177700,R2              ; . MASK OUT THE UPPER 10 BITS
003754  020221                          CMP     R2,(R1)+                ; . WAS THE ADDRESS WRITTEN TO THE HIGH MAP REGISTER
?
003756  001406                          BEQ     20$                     ; . YES,THEN GO CHECK IF WE ARE THROUGH ALL THE MAP
REGISTERS
003760  010237  001120                  MOV     R2,$GDADR               ; .  GET THE GOOD ADDRESS
003764  016137  177776  001122          MOV     -2(R1),$BDADR           ; .  GET THE BAD ADDRESS
003772  104004                          ERROR   +4                      ; .  ERROR IN ADDRESSING OF MAP REGISTERS
```

```
                                        ;
                                        ; CHECK TO SEE IF WE HAVE CHECKED ALL MAP REGISTERS
                                        ;
003774  062700  000002          20$:    ADD     #2,R0                   ; . GET THE NEXT REGISTER
004000  020027  170400                  CMP     R0,#170400              ; . HAVE WE CHECKED ALL THE MAPPING REGISTERS
004004  001346                          BNE     10$                     ; . NO,THEN GO CHECK THE NEXT REGISTER
```

```
                                .SBTTL  TEST - UNIQENESS BETWEEN LOW MAP REGISTERS AND HIGH MAP REGISTERS

                                ;
                                ;* THIS TEST IS DESIGNED TO TEST THE UNIQUENESS BETWWEN THE LOW
                                ;* AND HIGH MAP REGISTERS
                                ;
                                ;  BGNTST
                                ;
                                ;       DO FOR ADDRESS := 170200 TO 170374
                                ;       .  WRITE #77777 TO ADDRESS
                                ;       ENDDO
                                ;       DO FOR ADDRESS := 170200 TO 170374 BY 4
                                ;       .  LET R2 := CONTENTS OF ADDRESS
                                ;       .  LET R3 := CONTENTS OF ADDRESS * 2
                                ;       .  LET R3 := R3 - R2
                                ;       .  IF R3 EQ 0 THEN
                                ;       .  . ERROR IN DIFFERENTIATING BETWEEN HI AND LO REGISTERS
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 4         HIGH AND LOW MAP REGISTER UNIQUENESS TEST
                                ;;*****************************************************************
    004006  000004              TST4:   SCOPE

                                ;
                                ; WRITE #77777 TO ALL ADDRESSES
                                ;
    004010  012700  170200              MOV     #MAPL00,R0              ; GET ADDRESS OF FIRST MAP REGISTER
    004014  012720  077777      5$:     MOV     #77777,(R0)+            ; . WRITE 77777 TO MAP REGISTER
    004020  020027  170400              CMP     R0,#170400              ; . HAVE WE WRITTEN TO ALL REGISTERS ?
    004024  001373                      BNE     5$                      ; . NO,THEN GO WRITE TO THE NEXT REGISTER ?
                                ;
                                ; MAKE SURE THAT HIGH MAP REGISTER BITS 6-15 ARE CLEARED
                                ;
    004026  012700  170200              MOV     #MAPL00,R0              ; GET ADDRESS OF FIRST MAP REGISTER
    004032  012002              10$:    MOV     (R0)+,R2                ; . GET CONTENTS OF LOW MAP REGISTER
    004034  012003                      MOV     (R0)+,R3                ; . GET CONTENTS OF HIGH MAP REGISTER
    004036  160302                      SUB     R3,R2                   ; . DID THE REGISTERS GET ADDRESSED CORRECTLY ?
    004040  003006                      BGT     15$                     ; . YES,THEN GO SEE IF WE HAVE CHECKED ALL THE MAP R
EGISTERS
    004042  024040                      CMP     -(R0),-(R0)             ; .  NO, POINT TO THE LOW MAP REGISTER
    004044  012037  001124              MOV     (R0)+,$GDDAT            ; .  GET CONTENTS OF LOW MAP REGISTER
    004050  012037  001126              MOV     (R0)+,$BDDAT            ; .  GET CONTENTS OF HIGH MAP REGISTER
    004054  104005                      ERROR   +5                      ; .  ERROR - MAP REGISTERS WERE NOT ADDRESSED CORREC
TLY
                                ;
                                ; SEE IF WE HAVE CHECKED ALL THE MAP REGISTER PAIRS
                                ;
    004056  020027  170400      15$:    CMP     R0,#170400              ; . HAVE WE CHECKED ALL THE REGISTERS ?
    004062  001363                      BNE     10$                     ; . NO,THEN GO CHECK THE NEXT PAIR !!!

```

```
                                .SBTTL  TEST - DCSR REGISTER RESPONSE TEST
                                ;
                                ;* THIS TEST IS DESIGNED TO SEE IF WE CAN ACCESS THE
                                ;* DIAGNOSTIC CONTROLLER STATUS REGISTER.IF WE CAN IT
                                ;* TESTS OUT BITS 3-6,9-14 OF THE DCSR AND MAKES SURE
                                ;* THAT A BUS INIT HAS A PROPER RESPONSE IN THE DCSR.
                                ;
                                ;
                                ;  BGNTST
                                ;
                                ;       LET 4 := ADDRESS OF ERROR ROUTINE
                                ;       LET 6 := PRIORITY OF 7
                                ;       LET ADDRESS := 177730
                                ;       READ ADDRESS
                                ;
                                ; CHECK BITS 3-6,9 14 OF THE DCSR REGISTER
                                ;
                                ;       LET DCSR := DCSR .OR. #77170
                                ;       READ DCSR
                                ;       IF DCSR .AND. #77160 NE 0 THEN
                                ;       .  REPORT ERROR IN BITS 3-6,9-14 OF THE DCSR REGISTER
                                ;       ENDIF
                                ;
                                ; CHECK OUT THE DCSR RESPONSE TO A RESET
                                ;
                                ;       CACHE THE RESET INSRUCTION
                                ;       LET DCSR := DCSR .OR. #206
                                ;       DO A RESET TO INITIALIZE THE BUS
                                ;       IF LOWER BYTE OF DCSR GE 0 THEN
                                ;       .  REPORT ERROR (BIT 7 DID NOT GET SET BY BUS INIT)
                                ;       ELSE
                                ;       .  LET DCSR := DCSR .AND. #6
                                ;       .  IF DCSR NE 0 THEN
                                ;       .  .  REPORT ERROR (BITS 1,2 DIDN'T CLEAR ON BUS INIT)
                                ;       .  ENDIF
                                ;       ENDIF
                                ;       EXIT TEST
                                ;  ERROR:
                                ;       REPORT THAT ACCESS TO DCSR HAS TIMED OUT
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 5        DCSR REGISTER TEST
                                ;;*****************************************************************
004064  000004                  TST5:   SCOPE
                                ;
                                ; SET UP MEMORY TIMEOUT VECTOR
                                ;
004066  012737  004240  000004          MOV     #20$,@#4                ; SET UP VECTOR PC TO ERROR ROUTINE
004074  012737  000340  000006          MOV     #340,@#6                ; SET UP VECTOR PSW TO PRIORITY 7
                                ;
                                ; READ ADDRESS OF DCSR TO SEE IF IT TIMES OUT
```

T5 DCSR REGISTER TEST

```
                                        ;
004102  005737  177730                  TST     @#DCSR                  ; WILL THE DCSR TIMEOUT ?
004106  012737  002266  000004          MOV     #TIMOUT,@#4             ; RESTORE TIMEOUT VECTOR
                                        ;
                                        ; TRY TO WRITE ONES TO BITS 3-6 AND 9-14 ( BIT 03 SHOULD STAY WRITTEN)
                                        ;
004114  052737  077170  177730          BIS     #77170,@#DCSR           ; TRY TO WRITE TO READ ONLY BITS
004122  032737  077160  177730          BIT     #77160,@#DCSR           ; DID THEY GET WRITTEN TO ?
004130  001412                          BEQ     5$                      ; NO,THEN GO CHECK THE EFFECT OF A RESET ON THE DCSR
004132  013701  177730                  MOV     @#DCSR,R1               ; GET COPY OF DCSR INTO R1
004136  042701  100607                  BIC     #100607,R1              ; MASK OUT UNTESTED BITS
004142  010137  001126                  MOV     R1,$BDDAT               ; PUT THEM INTO BAD DATA
004146  012737  000010  001124          MOV     #10,$GDDAT              ; GOOD DATA
004154  104006                          ERROR   +6                      ; ERROR - IN BITS 3-6,9-14 OF DCSR
                                        ;
                                        ; CACHE THE RESET INSTRUCTION
                                        ;
004156  012737  000200  001124  5$:     MOV     #BIT7,$GDDAT            ; ONLY 7 SHOULD BE SET AFTER RESET
004164  053737  177730  001124          BIS     DCSR,$GDDAT             ; SET BOOT BITS
004172  005737  004204                  TST     10$                     ; CACHE THE RESET
                                        ;
                                        ; SET UP DCSR,DO A RESET,MAKE SURE PROPER RESPONSE OCCURS
                                        ;
004176  052737  000006  177730          BIS     #6,@#DCSR               ; SET BIT 7 AND CLEAR BIT 1,2
004204  000005                  10$:    RESET                           ; DO A BUS INIT
004206  032737  000200  177730          BIT     #BIT7,@#DCSR            ; DID BIT 7 GET SET ?
004214  001001                          BNE     15$                     ; YES,THEN GO CHECK IF BITS 1,2 GOT CLEAR
004216  104007                          ERROR   +7                      ; NO,THEN ERROR - BIT 7 DIDN'T GET SET
004220  032737  000006  177730  15$:    BIT     #6,@#DCSR               ; DID BIT 1,2 GET CLEARED ?
004226  001410                          BEQ     TST6            ;; YES,THEN GO TO NEXT TEST
004230  013737  177730  001126          MOV     @#DCSR,$BDDAT           ; NO,THEN GET CONTENTS OF THE DCSR
004236  104007                          ERROR   +7                      ;  ERROR - BIT 1,2 DID NOT GET CLEAR
                                        ;
                                        ; ERROR ROUTINE
                                        ;
004240  012737  177730  001122  20$:    MOV     #DCSR,$BDADR            ; GET ADDRESS OF THE DCSR
004246  104010                          ERROR   +10                     ; ERROR - DCSR REGISTER ACCESS HAS TIMED OUT
```

TEST - KMCR BITS TEST

```
                        .SBTTL TEST - KMCR BITS TEST
                        ;
                        ;* THIS TEST CHECKS THAT OUT OF DIAGNOSTIC MODE (DCSR<8>=0), WRITE ACCESS
                        ;* TO KMCR<5-0> IS DISABLED.
                        ;
                        ;  BGNTST
                        ;
                        ;       LET 4 := ADDRESS OF TIMEOUT ROUTINE
                        ;       LET 6 := PRIORITY OF TIMEOUT ROUTINE
                        ;       READ THE MEMORY CONFIGURATION FROM THE EAROM
                        ;       CHECK THAT IF DCSR<8>=0 WRITE ACCESS TO KMCR<5-0> DISABELD
                        ;       IF NOT THEN
                        ;       .  ERROR
                        ;       ENDIF
                        ;
                        ;  ENDTST
                        ;
                        ;-------------------------------------------------------------
                        ;;*************************************************************
                        ;*TEST 6        KMCR MEMORY CONFIGURATION BITS TEST
                        ;;*************************************************************
004250  000004          TST6:   SCOPE
                        ;
                        ; SETUP TIMEOUT VECTOR,TO ERROR ROUTINE
                        ; VERIFY THAT AT LEAST SOME PMI MEMORY PRESENT
                        ;
004252  012737  004416  000004          MOV     #10$,@#4                ; SET VECTOR PC TO ERROR ROUTINE
004260  012737  000340  000006          MOV     #340,@#6                ; SET VECTOR PSW TO ERROR ROUTINE
004266  013737  177734  001160          MOV     KMCR,$TMP0              ; STORE KMCR
004274  012737  002266  000004          MOV     #TIMOUT,@#4             ; RESTORE TIMEOUT VECTOR
004302  042737  177700  001160          BIC     #177700,$TMP0           ; CLEAR ALL BUT U.MEMORY
004310  022737  000077  001160          CMP     #77,$TMP0               ; NO PMI MEMORY?
004316  001003                          BNE     2$                      ; IF SOME, GO TO THE NEXT TEST
004320  005037  001720                  CLR     PMIS                    ; OTHERWISE FLAG NO PMI MEMORY
004324  000440                          BR      TST7            ;; AND EXIT TEST
                        ;
                        ; CHECK THAT NOT IN DIAGNOSTIC MODE WRITE ACCESS TO KMCR<5-0> IS DISABLED
                        ;
004326  013701  177734  2$:     MOV     KMCR,R1                 ; STORE PATTERN FROM KMCR TO R1
004332  005101                  COM     R1                      ; COMPLEMENT THE PATTERN
004334  042701  177700          BIC     #177700,R1              ; CLEAR BITS <15-6>
004340  042737  000400  177730  BIC     #BIT08,DCSR             ; MAKE SURE THAT NOT IN DIAGN. MODE
004346  042701  000010          BIC     #BIT03,R1               ; ENABLE 32K, IN CASE OF ERROR
004352  050137  177734          BIS     R1,KMCR                 ; TRY TO WRITE TO KMCR<5-0>
004356  020137  177734          CMP     R1,KMCR                 ; WRITTEN OK?
004362  001014                  BNE     1$                      ; IF DIDN'T WRITE, BRANCH
004364  013737  177734  001124  MOV     KMCR,$GDDAT             ; NO,THEN GET THE GOOD DATA
004372  010137  001126          MOV     R1,$BDDAT               ;  GET THE BAD DATA
004376  012737  177734  001122  MOV     #KMCR,$BDADR            ;  GET THE ADDRESS OF THE KMCR
004404  013737  001160  177734  MOV     $TMP0,KMCR              ; RESTORE KMCR
004412  104011                  ERROR   +11                     ; NO,THEN ERROR - BITS DID NOT GET SET CORRECTLY IN
THE KMCR
004414                  1$:
004414  000404                  BR      TST7            ;;  GO TO THE NEXT TEST
                        ;
```

```
                                        ; TIMEOUT ROUTINE
                                        ;
004416  012737  177734  001122  10$:    MOV     #KMCR,$BDADR        ; GET THE ADDRESS OF THE KMCR
004424  104012                          ERROR   +12                 ; ERROR - MEMORY TIMEOUT HAS OCCURED
```

TEST - UNIBUS TIMEOUT TEST

```
                                .SBTTL TEST - UNIBUS TIMEOUT TEST

                                ;* THIS TEST CHECKS OUT THE UNIBUS TIMEOUT LOGIC
                                ;* BEFORE IT IS USED IN ANY TESTS
                                ;
                                ;  BGNTST
                                ;
                                ;       LET 4 := THE ADDRESS 10$
                                ;       LET 6 := #340
                                ;       MAKE SURE THAT UBA IS IN DIAGNOSTIC MODE,DCSR<8> IS SET
                                ;       READ UNIBUS LOCATION
                                ;       IF NO TIMEOUT THEN
                                ;          ERROR - UBA DIDN'T TIMEOUT ON UNIBUS ACCESS IN DIAGNOSTIC MODE
                                ;       ENDIF
                                ;  10$: CLEAN UP THE STACK
                                ;
                                ;  ENDTST
                                ;
                                ;-----------------------------------------

                                ;;*****************************************************************
                                ;*TEST 7          UNIBUS TIMEOUT TEST
                                ;;*****************************************************************
004426  000004                  TST7:   SCOPE

                                ;
                                ; SET UP MEMORY TIMEOUT VECTOR AND PUT UBA INTO DIAGNOSTIC MODE
                                ;
004430  005737  001720                  TST     PMIS                    ; ANY PMI MEMORY?
004434  001425                          BEQ     TST10           ;; IF NONE, EXIT TEST
004436  012737  004470  000004          MOV     #10$,@#4                ; SET UP TIMEOUT VECTOR TO END OF TEST
004444  012737  000340  000006          MOV     #340,@#6                ;
004452  052737  000400  177730          BIS     #BIT8,DCSR              ; PUT UBA INTO DIAGNOSTIC MODE

                                ;
                                ; READ A UNIBUS LOCATION
                                ;

004460  005737  170002                  TST     @#170002                ; TRY TO READ UBE REGISTER ?
004464  104036                          ERROR   +36                     ; ERROR - SHOULD TIMEOUT HERE
004466  000402                          BR      11$                     ; GO TO THE NEXT TEST

                                ;
                                ; TIMEOUT ROUTINE
                                ;

004470  005726                  10$:    TST     (SP)+                   ; CLEAN UP THE STACK
004472  005726                          TST     (SP)+                   ;
004474  012737  002266  000004  11$:    MOV     #TIMOUT,@#4             ; RESTORE TIMEOUT VECTOR
004502  042737  000400  177730          BIC     #BIT8,DCSR              ;
```

TEST - DATA OUT WITHOUT RELOCATION

```
                                .SBTTL TEST - DATA OUT WITHOUT RELOCATION

                                ;* THIS TEST WILL PERFORM DIAGNOSTIC DATA OUT CYCLES WITHOUT ENABLING
                                ;* RELOCATION.  THE CYCLES WILL BE VERIFIED TO WORK CORRECTLY AND
                                ;* DIAGNOSTIC NPR REGISTER WILL BE CHECKED TO BE ABLE TO STORE PROPER
                                ;* DATA.
                                ;
                                ;  BGNTST
                                ;
                                ;       MAKE SURE THAT DIGNOSTIC MODE IS ON DCSR<8>=1
                                ;       SELECT DIAGNOSTIC NPR THRU DDR BY DCSR<2-1>=<0,0>
                                ;       LET TEST_LOCATION = 0
                                ;       DO FOR PATTERN = 377,7417,31463,52525,125152 (BINARY DIVIDE)
                                ;       .  CALL DIAGNOSTIC_DATA_OUT <TEST_LOCATION,PATTERN>
                                ;       .  IF DDR NE PATTERN THEN
                                ;       .  .  ERROR IN PATH
                                ;       .  ENDIF
                                ;       .  IF TEST_LOCATION NE PATTERN THEN
                                ;       .  .  ERROR PERFORMINDG DATA OUT
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 10       DATA OUT WITHOUT RELOCATION
                                ;;*****************************************************************
     004510  000004             TST10:  SCOPE
1375
1376 004512  005737  001720             TST     PMIS                    ; ANY PMI MEMORY?
1377 004516  001451             BEQ     TST11           ;; IF NONE, EXIT TEST
1378 004520  052737  000400  177730     BIS     #BIT08,DCSR             ; MAKE SURE DIAGNOSTIC MODE IS ON
1379 004526  042737  000006  177730     BIC     #BIT02!BIT01,DCSR       ; MAKE SURE NPR REGISTER IS SELECTED
1380 004534  012702  001774             MOV     #PTRN16,R2              ; POINT TO BINARY DIVIDE PATTERN
1381 004540  012701  001160             MOV     #$TMP0,R1               ; STORE TEST LOCATION
1382 004544  005011             CLR     (R1)                    ; CLEAR TEST LOCATION
1383 004546  032737  000200  177730     BIT     #BIT07,DCSR             ; READY BIT SET?
1384 004554  001001             BNE     1$                      ; IF SO, BRANCH
1385 004556  104017             ERROR   +17                     ; DCSR<7> NOT SET
1386 004560  011237  001124     1$:     MOV     (R2),$GDDAT             ; . STORE PATTERN
1387 004564  004737  002242             JSR     PC,DDOUT                ; . PERFORM DIAGNOSTIC DATA OUT
1388 004570  023737  177732  001124     CMP     DDR,$GDDAT              ; . DDR HAS PROPER PATTERN
1389 004576  001404             BEQ     2$                      ; . IF YES, BRANCH
1390 004600  013737  177732  001126     MOV     DDR,$BDDAT              ; . STORE DDR FOR ERROR REPORTS
1391 004606  104013             ERROR   +13                     ; . ERROR IN DATA PATH
1392 004610  023737  001160  001124     2$:     CMP     $TMP0,$GDDAT            ; . DATA OUT OK?
1393 004616  001404             BEQ     3$                      ; . BRANCH, IF YES
1394 004620  013737  001160  001126     MOV     $TMP0,$BDDAT            ; . STORE MEMORY FOR ERROR REPORTS
1395 004626  104014             ERROR   +14                     ; . ERROR IN DATA OUT
1396 004630  005722             3$:     TST     (R2)+                   ; . LAST PATTERN?
1397 004632  001352             BNE     1$                      ; . IF NOT, BRANCH
1398 004634  042737  000400  177730     BIC     #BIT8,DCSR              ;
```

TEST - DATA IN WITHOUT RELOCATION

```
                                .SBTTL TEST - DATA IN WITHOUT RELOCATION

                                ;* THIS TEST WILL PERFORM DIAGNOSTIC DATA IN CYCLE AND VERIFY ITS
                                ;* OPERATION
                                ;
                                ;  BGNTST
                                ;
                                ;       MAKE SURE THAT DIGNOSTIC MODE IS ON DCSR<8>=1
                                ;       SELECT DIAGNOSTIC NPR THRU DDR BY DCSR<2-1>=<0,0>
                                ;       LET PATTERN = 52525
                                ;       LET DCSR<0> = #1
                                ;       WRITE PATTERN TO TEST_LOCATION
                                ;       IF DDR NE PATTERN THEN
                                ;       .  ERROR PERFORMING DATA IN
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------

                                ;;*********************************************************************
                                ;*TEST 11       DATA IN WITHOUT RELOCATION
                                ;;*********************************************************************
     004642  000004             TST11:  SCOPE

                                        TST     PMIS                    ; ANY PMI MEMORY?
 004644  005737  001720                 BEQ     TST12           ;; IF NONE, EXIT TEST
 004650  001435                         BIS     #BIT08,DCSR             ; MAKE SURE DIAGNOSTIC MODE IS ON
 004652  052737  000400  177730         BIC     #BIT02!BIT01,DCSR       ; MAKE SURE NPR REGISTER IS SELECTED
 004660  042737  000006  177730         MOV     #PTRN16,R2              ; GET TEST PATTERN TABLE
 004666  012702  001774                 MOV     (R2),$GDDAT     5$:     ; USE TEST PATTERN
 004672  011237  001124                 BIS     #BIT00,DCSR             ; SET GO BIT
 004676  052737  000001  177730         MOV     $GDDAT,$TMP0            ; STORE PATTERN IN TEST LOCATON
 004704  013737  001124  001160         ;
                                ; NOW COMPARE THE RESULTS
                                ;
                                        CMP     DDR,$GDDAT              ; DDR GOT DATA OK?
 004712  023737  177732  001124         BEQ     10$                     ; IF NO, ERROR
 004720  001404                         MOV     DDR,$BDDAT              ; STORE DDR FOR ERROR REPORTS
 004722  013737  177732  001126         ERROR   +15                     ; ERROR IN DATA IN
 004730  104015                 10$:    TST     (R2)+                   ; ARE WE DONE?
 004732  005722                         BNE     5$                      ; NO
 004734  001356                         BIC     #BIT08,DCSR
 004736  042737  000400  177730
```

```
                                .SBTTL TEST - CONTENT OF DDR

                                ;* THIS TEST VERIFIES THAT IF DCSR<2-1> ARE NOT ZERO, DDR IS ALWAYS
                                ;* READ AS 0, MEANING THAT NONE OF THE UNIBUS LINES ARE STUCK.
                                ;
                                ;  BGNTST
                                ;
                                ;       DO FOR DCSR<2-1> FROM <0,1> TO <1,1>
                                ;       .  DO DATI
                                ;       .  IF DDR NE 0 THEN
                                ;       .  .  ERROR IN UNIBUS LINES
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;---------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 12       CONTENT OF DDR
                                ;;*****************************************************************
004744  000004                  TST12:  SCOPE
1460 004746  005737  001720             TST     PMIS                            ; ANY PMI MEMORY?
1461 004752  001445             BEQ     TST13           ;; IF NONE, EXIT TEST
1462 004754  052737  000400  177730    BIS     #BIT08,DCSR                     ; MAKE SURE IN DIAG. MODE
1463 004762  052737  000002  177730    BIS     #BIT01,DCSR                     ; START WITH 1 IN DCSR
1464 004770  012703  000003             MOV     #3,R3                           ; DO 3 TIMES
1465 004774  005037  001124             CLR     $GDDAT                          ; RECIEVED DATA 0
1466 005000  005001             1$:     CLR     R1                              ; . ADDRESS 0
1467 005002  004737  002254             JSR     PC,DDIN                         ; . DO DIAGNOSTIC DATI
1468 005006  022703  000001             CMP     #1,R3                           ; . CONTROL LINES SELECTED?
1469 005012  001403             BEQ     2$                              ; . IF YES, CHECK IT
1470 005014  005737  177732             TST     DDR                             ; . ALL ZEROES?
1471 005020  001413             BEQ     3$                              ; . IF YES, BRANCH
1472 005022  012737  177400  001124  2$:     MOV     #177400,$GDDAT                  ; . EXPECTED PATTERN
1473 005030  032737  000373  177732         BIT     #373,DDR                        ; . SELECT ONLY USED
1474 005036  001404             BEQ     3$                              ; . IF ALL ZEROES, BRANCH
1475 005040  013737  177732  001126         MOV     DDR,$BDDAT                      ; . STORE RECIEVED DATA
1476 005046  104016             ERROR   +16                             ; . ERROR IN UNIBUS LINES
1477 005050  062737  000002  177730  3$:     ADD     #BIT01,DCSR                     ; . GET NEXT SET OF UNIBUS LINES
1478 005056  077330             SOB     R3,1$                           ; . DO FOR ALL COMBINATIONS
1479 005060  042737  000400  177730         BIC     #BIT8,DCSR                      ; .
1480
```

```
1482                                .SBTTL TEST - INDIRECT ACCESSING OF UNIBUS MAP REGISTERS
1483
1484                                ;* THIS TEST WILL CHECK THAT EACH OF THE UNIBUS MAP REGISTER PAIRS CAN BE
1485                                ;* ACCESSED INDIRECTLY AND THAT RELOCATION WORKS PROPERLY
1486                                ;* DATA OUT CYCLES WILL BE PERFORMED. EACH REGISTER EXCEPT THE ONE
1487                                ;* UNDER TEST WILL POINT TO NXM 17760000.  THE REGISTER PAIR UNDER TEST
1488                                ;* WILL POINT TO 0, AND DIAGNOSTIC DATA OUT CYCLES WILL BE PERFORMED
1489                                ;* TO PHYSICAL LOCATION 0.  IN UFD MODE THIS TEST WILL RUN ONLY IF
1490                                ;* KMCR<5>=0, I.E. 22 BIT MODE.
1491                                ;
1492                                ;  BGNTST
1493                                ;
1494                                ;       IF UFD MODE AND KMCR<5> EQ #1 THEN
1495                                ;       .  EXIT TEST (RELOCATION DOES NOT HAVE TO BE PERFORMED IN 18 BIT)
1496                                ;       ENDIF
1497                                ;       MAKE SURE THAT DIGNOSTIC MODE IS ON DCSR<8>=1
1498                                ;       SELECT DIAGNOSTIC NPR THRU DDR BY DCSR<2-1>=<0,0>
1499                                ;       DO FOR 32. MAPPING REGISTERS
1500                                ;       .  LET LO REGISTER = #160000
1501                                ;       .  LET HI REGISTER = #77
1502                                ;       ENDDO (ALL REGISTERS POINT TO NXM 17760000)
1503                                ;       POINT TIMEOUT_ROUTINE TO VECTOR 4
1504                                ;       CALL MAP_PROGRAM_AREA
1505                                ;       LET MMR0<0> = 1 TO ENABLE MMU
1506                                ;       LET MMR3<5> = 1 TO ENABLE RELOCATION
1507                                ;       POINT R0 TO ADDRESS OF MAP REGISTER 0
1508                                ;       LET KIPAR6 = #0 TO ACCESS REGISTER 0
1509                                ;       LET (R0) = #0
1510                                ;       LET (R0)+2 = #0 TO USE ONLY 16 BITS
1511                                ;       LET R1 = #140000 TO ACCESS THRU KIPAR6
1512                                ;       IF NOT UFD THEN
1513                                ;       .  SAVE KMCR
1514                                ;       .  CLEAR KMCR<4-0>
1515                                ;       .  LET R4 = #31. (DO FOR ALL REGISTERS)
1516                                ;       ELSE
1517                                ;       .  LET R4 = 31. - (KMCR<4-1>) ONLY NOT DISABLED REGISTERS
1518                                ;       ENDIF
1519                                ;       DO FOR R3 FROM #0 TO R4 FOR ALL REGISTERS
1520                                ;       .  CLEAR @#0 (THIS LOCATION IS ACTUALLY USED)
1521                                ;       .  LET PATTERN = R0 (ADDRESS OF LOW REGISTER)
1522                                ;       .  CALL DIAGNOSTIC_DATA_OUT <(R1),PATTERN>
1523                                ;       .  IF TIMEOUT THEN
1524                                ;       .  .  ERROR IN UNIQUE ADDRESSING OF REGISTERS
1525                                ;       .  ENDIF
1526                                ;       .  IF @#0 NE PATTERN THEN
1527                                ;       .  .  ERROR PERFORMING DATA OUT
1528                                ;       .  ENDIF
1529                                ;       .  LET (R0)+ = #160000
1530                                ;       .  LET (R0)+ = #77 TO MAP JUST USED PAIR TO NXM
1531                                ;       .  LET (R0) = #0
1532                                ;       .  LET (R0)+2 = #0 TO MAP NEXT PAIR TO TEST_LOCATION
1533                                ;       .  LET KIPAR6 = KIPAR6 + #200 TO ACCESS NEXT PAIR
1534                                ;       ENDDO
1535                                ;       DISABLE MMU
1536                                ;
1537                                ;  ENDTST
1538                                ;
```

```
                                        ;------------------------------------------------------------------
                                        ;;******************************************************************
                                        ;*TEST 13       INDIRECT ACCESSING OF UNIBUS MAP REGISTERS
                                        ;;******************************************************************
     005066  000004                     TST13:  SCOPE
                                        
005070  005737  001720                          TST     PMIS                    ; ANY PMI MEMORY?
005074  001576                          BEQ     TST14           ;; IF NONE, EXIT TEST
005076  032737  000040  000052          BIT     #BIT05,@#52             ; UFD MODE ?
005104  001406                          BEQ     1$                      ; BRANCH, IF NOT
005106  032737  000040  177734          BIT     #BIT05,KMCR             ; 18 BIT MODE ?
005114  001402                          BEQ     1$                      ; BRANCH, IF NOT
005116  000137  005452                  JMP     10$                     ; EXIT TEST
005122  052737  000400  177730  1$:     BIS     #BIT08,DCSR             ; SET DIAGNOSTIC MODE
005130  042737  000006  177730          BIC     #BIT02!BIT01,DCSR       ; SELECT NPR THRU DDR
                                        ;
                                        ; POINT EACH OF MAPPING REGISTER PAIRS TO 17760000
                                        ;
005136  012701  000040                  MOV     #32.,R1                 ; DO FOR 32. REGISTER PAIRS
005142  012702  170200                  MOV     #MAPL00,R2              ; POINT TO ADDRESS OF THE FIRST REGISTER
005146  012722  160000          2$:     MOV     #160000,(R2)+           ; . 160000 -> LO REGISTER
005152  012722  000077                  MOV     #77,(R2)+               ; . 77 -> HI REGISTER
005156  077105                          SOB     R1,2$                   ; . CONTINUE UNTILL ALL DONE
                                        ;
                                        ; INITIALISE TO DO RELOCATION IN 22 BIT MODE
                                        ;
005160  012737  002266  000004          MOV     #TIMOUT,@#4             ; POINT TIMEOUT ROUTINE
005166  004737  002276                  JSR     PC,MAPPR                ; REMAP PROGRAM AREA
005172  005237  177572                  INC     MMR0                    ; TURN ON MMU
005176  052737  000040  172516          BIS     #BIT05,MMR3             ; ENABLE RELOCATION
005204  012700  170200                  MOV     #MAPL00,R0              ; POINT R0 TO FIRST REGISTER
005210  012737  000000  172354          MOV     #0, KIPAR6              ; LET KIPAR6 SELECT MAP PAIR 0
005216  012710  000000                  MOV     #0,(R0)                 ; MOVE 0 TO LOW ADDRESS
005222  012760  000000  000002          MOV     #0,2(R0)                ; MOVE 0 TO HI ADDRESS
005230  012701  140000                  MOV     #140000,R1              ; TO ACCESS THRU KIPAR6
                                        ;
                                        ; STORE # OF REGISTERS TO TEST IN R4
                                        ;
005234  032737  000040  000052          BIT     #BIT05,@#52             ; UFD MODE ?
005242  001010                          BNE     3$                      ; IF YES, BRANCH
005244  013737  177734  001162          MOV     KMCR,$TMP1              ; SAVE KMCR
005252  005037  177734                  CLR     KMCR                    ; DO NOT DISABLE ANY REGISTERS
005256  012704  000036                  MOV     #30.,R4                 ; DO FOR ALL REGISTERS
005262  000407                          BR      4$                      ; BRANCH AROUND
005264  113703  177734          3$:     MOVB    KMCR,R3                 ; STORE # OF DISABLED REGISTERS
005270  042703  177740                  BIC     #177740,R3              ; LEAVE JUST BITS <4-0>
005274  012704  000036                  MOV     #30.,R4                 ; STORE MAX. # OF REGISTERS
005300  160304                          SUB     R3,R4                   ; GET # OF ACCESSABLE REGISTERS
                                        ;
                                        ; DO DATA OUT FOR EACH REGISTER PAIR UNDER TEST
                                        ;
005302  005003                  4$:     CLR     R3                      ; START WITH REGISTER PAIR 0
005304  005037  000000          5$:     CLR     @#0                     ; . CLEAR LOCATION UNDER TEST
005310  005037  001730                  CLR     TOUT                    ; . CLEAR TIMEOUT FLAG
005314  010037  001124                  MOV     R0,$GDDAT               ; . PATTERN IS ADDRESS OF LO REGISTER
005320  004737  002242                  JSR     PC,DDOUT                ; . DO DIAGN. DATA OUT
```

T13 INDIRECT ACCESSING OF UNIBUS MAP REGISTERS

```
1593 005324  005737  001730                    TST     TOUT            ; . TIMEOUT FLAG SET?
1594 005330  001411                            BEQ     6$              ; . IF NOT BRANCH
1595 005332  013737  172354  001122            MOV     KIPAR6,$BDADR   ; . STORE # OF PAIR FOR ERRORS
1596 005340  012705  000007                    MOV     #7,R5           ; . PREPARE TO SHIFT TO GET TO LOWER BITS
1597 005344  006237  001122          11$:      ASR     $BDADR          ; . . SHIFT ONCE
1598 005350  077503                            SOB     R5,11$          ; . . SHIFT 7 TIMES
1599 005352  104020                            ERROR   +20             ; . IN UNIQUE ADDRESSING OF REGISTERS
1600 005354  023737  000000  001124  6$:       CMP     @#0,$GDDAT      ; . DATA OUT OK?
1601 005362  001404                            BEQ     7$              ; . IF YES, BRANCH
1602 005364  013737  000000  001126            MOV     @#0,$BDDAT      ; . STORE FOR ERROR REPORTS
1603 005372  104013                            ERROR   +13             ; . PERFORMING DATA OUT
1604 005374  012720  160000          7$:       MOV     #160000,(R0)+   ; . POINT JUST USED REGISTER
1605 005400  012720  000077                    MOV     #77,(R0)+       ; . TO NXM
1606 005404  012710  000000                    MOV     #0,(R0)         ; . POINT NEXT REGISTER PAIR
1607 005410  012760  000000  000002            MOV     #0,2(R0)        ; . TO LOCATION 0
1608 005416  062737  000200  172354            ADD     #200,KIPAR6     ; . ACCESS NEXT REGISTER PAIR
1609 005424  062703  000001                    ADD     #1,R3           ; . INCREMENT COUNT
1610 005430  020304                            CMP     R3,R4           ; . ALL AVAILABLE PAIRS DONE?
1611 005432  003724                            BLE     5$              ; . BRANCH IF NOT
1612 005434  032737  000040  000052            BIT     #BIT05,@#52     ; CHECK TO SEE IF KMCR WAS SAVED
1613 005442  001003                            BNE     10$             ; NO, DON'T RESTORE KMCR
1614 005444  013737  001162  177734            MOV     $TMP1,KMCR      ; RESTORE KMCR
1615 005452  005037  177572          10$:      CLR     MMR0            ; DISABLE MMU
1616 005456  042737  000040  172516            BIC     #BIT05,MMR3     ; DISABLE MAPPING
1617 005464  042737  000400  177730            BIC     #BIT8,DCSR      ; EXIT DIAGNOSTIC MODE
```

```
                                .SBTTL TEST - DISABLING OF THE MAPPING REGISTERS

                                ;* THIS TEST WILL CHECK THAT NONE OF THE REGISTERS DISABLED BY KMCR<4-0>
                                ;* PERFORM RELOCATION.  IN UFD MODE ONLY THE BITS ACTUALLY SET IN THE KMCR WILL
                                ;* BE CHECKED, OTHREWISE ALL OF THEM EXCEPT THE FIRST 4 ARE CHECKED.
                                ;* IN UFD MODE THIS TEST WILL RUN ONLY IF KMCR<5>=0. (IN 22 BIT MODE)
                                ;
                                ;  BGNTST
                                ;
                                ;       IF UFD MODE AND KMCR<5> EQ #1 THEN
                                ;       .  EXIT TEST (RELOCATION DOES NOT HAVE TO BE PERFORMED IN 18 BIT)
                                ;       ENDIF
                                ;       MAKE SURE THAT DIGNOSTIC MODE IS ON DCSR<8>=1
                                ;       SELECT DIAGNOSTIC NPR THRU DDR BY DCSR<2-1>=<0,0>
                                ;       CALL MAP_PROGRAM_AREA
                                ;       LET MMR3<5> = #1 TO ENABLE RELOCATION
                                ;       LET MMR0<0> = #1 TO ENABLE MMU
                                ;       LET R1 = #140000 TO ACCESS THRU KIPAR6
                                ;       LET KIPAR6 = #7600 TO ACCESS MAP REG. 32.
                                ;       SET 4 TO IGNORE TIMEOUT
                                ;       LET PATTERN = #125252
                                ;       LET @#0 = #0
                                ;       LET MAPL37 = #0
                                ;       LET MAPH37 = #0
                                ;       CALL DIAGNOSTIC_DATA_OUT<(R0),PATTERN>
                                ;       IF @#0 EQ PATTERN THEN
                                ;       .  ERROR REG. PAIR 37 PERFORMS RELOCATION
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 14       DISABLING REGISTERS
                                ;;*****************************************************************
    005472  000004              TST14:  SCOPE
                                ;
                                ; INITIALISE MMU AND DIAGNOSTIC REGISTERS
                                ;
                                1$:     BIS     #BIT08,DCSR             ; SET DIAGNOSTIC MODE
                                        BIC     #BIT02!BIT01,DCSR       ; SELECT NPR THRU DDR
                                        JSR     PC,MAPPR                ; REMAP PROGRAM AREA
                                        INC     MMR0                    ; TURN ON MMU
                                        BIS     #BIT05,MMR3             ; ENABLE RELOCATION
                                ;
                                ; TRY TO DO RELOCATION THRU REGISTER PAIR 31.
                                ;
                                        MOV     #2$,@#4                 ; INITIALISE TIMEOUT ROUTINE
                                        MOV     #140000,R1              ; ACCESS THRU KIPAR6
```

1653
1654 005474 005737 001720 TST PMIS ; ANY PMI MEMORY?
1655 005500 001473 BEQ TST15 ;; IF NONE, EXIT TEST
1656 005502 032737 000040 000052 BIT #BIT05,@#52 ; UFD MODE ?
1657 005510 001404 BEQ 1$; BRANCH, IF NOT
1658 005512 032737 000040 177734 BIT #BIT05,KMCR ; 18 BIT MODE ?
1659 005520 001063 BNE TST15 ;;EXIT TEST IF 18 BIT MODE
1660
1661
1662
1663 005522 052737 000400 177730
1664 005530 042737 000006 177730
1665 005536 004737 002276
1666 005542 005237 177572
1667 005546 052737 000040 172516
1668
1669
1670
1671 005554 012737 005636 000004
1672 005562 012701 140000

T14 DISABLING REGISTERS

```
1673 005566  012737  007600  172354          MOV     #7600,KIPAR6            ; ACCESS REG. PAIR 31.
1674 005574  012737  125252  001124          MOV     #125252,$GDDAT          ; STORE PATTERN
1675 005602  005037  000000                  CLR     @#0                     ; CLEAR LOCATION UNDER TEST
1676 005606  012737  000000  170374          MOV     #0,MAPL37               ; LET MAP PAIR 31.
1677 005614  012737  000000  170376          MOV     #0,MAPH37               ; POINT TO 0
1678 005622  013737  001124  177732          MOV     $GDDAT,DDR              ; STORE PATTERN IN DDR
1679 005630  005011                          CLR     (R1)                    ; EXTENAL READ TO PROVIDE ADDRESS
1680 005632  104021                          ERROR   +21                     ; RELOCATION PERFORMED THRU REG. 31.
1681 005634  000402                          BR      3$                      ; EXIT TEST
1682 005636  005726                  2$:     TST     (SP)+                   ; RESTORE STACK
1683 005640  005726                          TST     (SP)+
1684 005642  005037  177572          3$:     CLR     MMR0                    ; DISABLE MMU
1685 005646  042737  000040  172516          BIC     #BIT05,MMR3             ; DISABLE MAPPING
1686 005654  012737  002266  000004          MOV     #TIMOUT,@#4             ; RESTORE TIMEOUT
1687 005662  042737  000400  177730          BIC     #BIT8,DCSR              ; EXIT DIAGNOSTIC MODE
```

```
                                .SBTTL TEST - NXM MEMORY TIMEOUT

                                ;* THIS TEST WILL VERIFY THAT WHENEVER LOCATION 17760000 IS ACCESSED
                                ;* DIAGNOSTIC NPR CYCLES RESULT IN A TIMEOUT SETTING BIT <15> IN DCSR.
                                ;
                                ;  BGNTST
                                ;
                                ;       MAKE SURE THAT DIGNOSTIC MODE IS ON DCSR<8>=1
                                ;       SELECT DIAGNOSTIC NPR THRU DDR BY DCSR<2-1>=<0,0>
                                ;       CALL MAP_PROGRAM_AREA
                                ;       LET MMR0<0> = 1 TO ENABLE MMU
                                ;       IF NOT UFD MODE OR KMCR<5> EQ #0
                                ;       .  LET TEST_LOCATION = #140000 TO ACCESS THRU KIPAR6
                                ;       .  LET KIPAR6 = #0 TO ACCESS REGISTER PAIR 0
                                ;       .  LET LO REGISTER = #160000 TO SET REG. 0 TO NXM
                                ;       .  LET HI REGISTER = ##77
                                ;       .  LET MMR3<5> = 1 TO ENABLE RELOCATION
                                ;       ELSE
                                ;       .  IF KMCR<5> EQ #1 THEN(18 BIT MODE)
                                ;       .  .  LET TEST_LOCATION = #140000 TO ACCESS THRU KIPAR6
                                ;       .  .  LET KIPAR6 = #177600 TO ACCESS NXM
                                ;       .  ENDIF
                                ;       ENDIF
                                ;       START DIAGNOSTIC_DATA_OUT TO @#0
                                ;       IF DCSR<15> NE 0 THEN
                                ;       .  ERROR NXM BIT SET
                                ;       ENDIF
                                ;       PUT ACTUAL EXTERNAL ADDRESS ON THE BUS
                                ;       IF DCSR<15> NE 1 THEN
                                ;       .  ERROR NXM MEMORY DOES NOT SET DCSR<15>
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 15       NXM MEMORY TIMEOUT
                                ;;*****************************************************************
    005670  000004              TST15:  SCOPE

005672  005737  001720                  TST     PMIS                    ; ANY PMI MEMORY?
005676  001476                          BEQ     TST16           ;; IF NONE, EXIT TEST
005700  052737  000400  177730          BIS     #BIT8,DCSR              ; SELECT DIAGNOSTIC MODE
005706  004737  002276                  JSR     PC,MAPPR                ; REMAP PROGRAM AREA
005712  005237  177572                  INC     MMR0                    ; ENABLE MMU
                                ;
                                ; DECIDE WHETHER TO  ACCESS WITH RELOCATION OR NOT
                                ;
005716  012701  140000                  MOV     #140000,R1              ; ACCESS THRU KIPAR6
005722  032737  000040  000052          BIT     #BIT05,@#52             ; UFD MODE?
005730  001410                          BEQ     1$                      ; IF NOT, BRANCH
005732  032737  000040  177734          BIT     #BIT05,KMCR             ; 18 BIT MODE?
005740  001412                          BEQ     2$                      ; IF NOT BRANCH
005742  012737  177600  172354          MOV     #177600,KIPAR6          ; KIPAR6 HAS NXM
005750  000422                          BR      3$                      ; GO DO IT
005752  013737  177734  001162  1$:     MOV     KMCR,$TMP1              ; SAVE KMCR
```

T15 NXM MEMORY TIMEOUT

```
 1743 005760  042737  000040  177734          BIC     #BIT05,KMCR                     ; IN NOT UFD, DO IN 22 BITS
 1744 005766  012737  000000  172354  2$:     MOV     #0,KIPAR6                       ; KIPAR6 ACCESS MAP REG. 0
 1745 005774  012737  160000  170200          MOV     #160000,MAPL00                  ; MAP PAIR HAS NXM
 1746 006002  012737  000077  170202          MOV     #77,MAPH00
 1747 006010  052737  000040  172516          BIS     #BIT05,MMR3                     ; ENABLE RELOCATION
 1748                                  ;
 1749                                  ; DO ACTUAL DATA OUT CYCLE
 1750                                  ;
 1751 006016  005037  177732          3$:     CLR     DDR                             ; PROMT DIAG. DATO
 1752 006022  005011                          CLR     (R1)                            ; WRITE TO NXM
 1753 006024  032737  100000  177730          BIT     #BIT15,DCSR                     ; NXM SET?
 1754 006032  001001                          BNE     5$                              ; IF YES, BRANCH
 1755 006034  104022                          ERROR   +22                             ; NXM ACCESS DOES NOT SET DCSR<15>
 1756 006036  005037  177572          5$:     CLR     MMR0                            ; DISABLE MMU
 1757 006042  042737  000040  172516          BIC     #BIT05,MMR3                     ; AND MAPPING TOO
 1758 006050  032737  000040  000052          BIT     #BIT05,@#52                     ; UFD MODE
 1759 006056  001006                          BNE     TST16           ;;IF NOT UFD, GO TO NEXT TEST
 1760 006060  013737  001162  177734          MOV     $TMP1,KMCR                      ; OTHERWISE, RESTORE KMCR
 1761 006066  042737  000400  177730          BIC     #BIT8,DCSR                      ; EXIT DIAGNOSTIC MODE
 1762
```

```
                                .SBTTL TEST - CARRY PROPOGATION TEST

                                ;* THIS TEST CHECKS THE CARRY PROPOGATION THRU THE ALU. MAPPING REGISTER PAIR 0
                                ;* IS LOADED WITH ALL 1'S.  LOCATION 1 IS ACCESSED. THE RESULT OF THE DATO
                                ;* CYCLE IS SUPPOSED TO BE LOADED IN LOCATION 0.
                                ;
                                ;  BGNTST
                                ;
                                ;       IF UFD MODE AND KMCR<5> EQ #1 THEN
                                ;       .  EXIT TEST (RELOCATION DOES NOT HAVE TO BE PERFORMED IN 18 BIT)
                                ;       ENDIF
                                ;       MAKE SURE THAT DIGNOSTIC MODE IS ON DCSR<8>=1
                                ;       SELECT DIAGNOSTIC NPR THRU DDR BY DCSR<2-1>=<0,0>
                                ;       POINT TIMEOUT_ROUTINE TO VECTOR 4
                                ;       CALL MAP_PROGRAM_AREA
                                ;       LET MMR0<0> = 1 TO ENABLE MMU
                                ;       LET MMR3<5> = 1 TO ENABLE RELOCATION
                                ;       LET KIPAR6 = #0 TO ACCESS THRU MAP REG.0
                                ;       LET R1 = #140001 TO ACCESS THRU KIPA6
                                ;       LET LO MAP REG. = #177777
                                ;       LET HI MAP REG. = #77
                                ;       LET PATTERN = #125252
                                ;       CALL DIAGNOSTIC_DATA_OUT<(R1),PATTERN>
                                ;       LET MMR0<0> = #0 TO DISABLE MMU
                                ;       IF @0 NE #125252 THEN
                                ;       .  ERROR IN CARRY PROPOGATION
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------

                                ;;*********************************************************************
                                ;*TEST 16       CARRY PROPOGATION TEST
                                ;;*********************************************************************
    006074  000004              TST16:  SCOPE

                                        TST     PMIS                    ; ANY PMI MEMORY?
    006076  005737  001720              BEQ     TST17           ;; IF NONE, EXIT TEST
    006102  001470              BIT     #BIT05,@#52                     ; UFD MODE ?
    006104  032737  000040  000052      BEQ     1$                      ; BRANCH, IF NOT
    006112  001404              BIT     #BIT05,KMCR                     ; 18 BIT MODE ?
    006114  032737  000040  177734      BNE     TST17           ;; GO TO NEXT TEST, IF YES
    006122  001060              ;
                                ; INITIALISE MMU AND DIAGNOSTIC REGISTERS
                                ;
    006124  052737  000400  177730  1$:     BIS     #BIT08,DCSR             ; SET DIAGNOSTIC MODE
    006132  042737  000006  177730      BIC     #BIT02!BIT01,DCSR       ; SELECT NPR THRU DDR
    006140  004737  002276              JSR     PC,MAPPR                ; REMAP PROGRAM AREA
    006144  005237  177572              INC     MMR0                    ; TURN ON MMU
    006150  052737  000040  172516      BIS     #BIT05,MMR3             ; ENABLE RELOCATION
                                ;
                                ; ACCESS LOCATION 0 THRU RELOCATION REGISTERS
                                ;
    006156  005037  172354              CLR     KIPAR6                  ; CLEAR KIPAR6
    006162  012701  140002              MOV     #140002,R1              ; ACCESS THRU KIPAR6
    006166  012737  177777  170200      MOV     #177777,MAPLO0          ; ALL ONE'S TO LO REG
```

T16 CARRY PROPOGATION TEST

```
 1818 006174  012737  000077  170202          MOV     #77,MAPH00              ; ALL ONE'S TO HI REG
 1819 006202  012737  125252  001124          MOV     #125252,$GDDAT          ; THE PATTERN TO BE STORED
 1820 006210  005037  000000                  CLR     @#0                     ; CLEAR TEST LOCATION
 1821 006214  004737  002242                  JSR     PC,DDOUT                ; DO DATA OUT
 1822 006220  005037  177572                  CLR     MMR0                    ; DISABLE MMU
 1823 006224  042737  000040  172516          BIC     #BIT05,MMR3             ; AND MAPPING
 1824 006232  042737  000400  177730          BIC     #BIT8,DCSR              ; EXIT DIAGNOSTIC MODE
 1825 006240  022737  125252  000000          CMP     #125252,@#0             ; DATA OUT OK?
 1826 006246  001406                          BEQ     TST17           ;; IF YES, GO TO NEXT TEST
 1827 006250  013737  000000  001126          MOV     @#0,$BDDAT              ; STORE FOR ERROR REPORTS
 1828 006256  005037  001122                  CLR     $BDADR                  ; ADDRESS 0
 1829 006262  104023                          ERROR   +23                     ; IN CARRY PROPOGATION
 1830
```

```
                                .SBTTL TEST - EXTENSIVE CARRY PROPOGATION TEST
                                ;
                                ;* THIS TEST PERFORMS EXTENSIVE CHECKING OF CARRY PROPOGATION. FIRST 1K IS
                                ;* CHECKED IN WORD INCREMENTS, AFTER THAT EACH 1K UP TO 4K. DIAGNOSTIC DATI
                                ;* CYCLES ARE PERFORMED AND A MAPPING REGISTER PAIR USED IS ALWAYS AT ALL 1'S.
                                ;
                                ;  BGNTST
                                ;
                                ;       IF UFD MODE AND KMCR<5> EQ #1 THEN
                                ;       .  EXIT TEST (RELOCATION DOES NOT HAVE TO BE PERFORMED IN 18 BIT)
                                ;       ENDIF
                                ;       CALL MAP_PROGRAM_AREA
                                ;       ENABLE MAPPING
                                ;       INITIALISE ALL MAPPING REGISTERS TO POINT TO ALL 1'S
                                ;       DO FOR 4K OF MEMORY
                                ;       .  IF MEMORY ACCESSED LESS THEN 1K
                                ;       .  .  DO WORD INCREMENTS
                                ;       .  ELSE
                                ;       .  .  DO 1K INCREMENTS
                                ;       .  ENDIF
                                ;       .  DO DATI INCREMENTS
                                ;       .  IF DDR NE TO LOCATION IN MEMORY THEN
                                ;       .  .  ALU ERROR
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;       ENDTST
                                ;
                                ;-------------------------------------------------------------------
                                ;;*****************************************************************
                                ;*TEST 17       EXTENSIVE CARRY PROPOGATION TEST
                                ;;*****************************************************************
    006264  000004              TST17:  SCOPE
                                ;
                                ; INITIALISE MMU AND RELOCATION
                                ;
1873 006314  052737  000400  177730  1$:     BIS     #BIT08,DCSR                     ; SET DIAGNOSTIC MODE
1874 006322  042737  000006  177730          BIC     #BIT02!BIT01,DCSR               ; SELECT NPR THRU DDR
1875 006330  004737  002276                  JSR     PC,MAPPR                        ; REMAP PROGRAM AREA
1876 006334  052737  000060  172516          BIS     #BIT05!BIT04,MMR3               ; ENABLE RELOCATION AND 22BITS
1877 006342  005237  177572                  INC     MMR0                            ; ENABLE MMU
                                ;
                                ; POINT ALL MAPPING REGISTERS TO ALL 1'S
                                ;
1881 006346  012701  170200                  MOV     #MAPL00,R1                      ; START WITH 0
1882 006352  012703  000036                  MOV     #36,R3                          ; DO FOR ALL REGISTERS
1883 006356  012721  177776          2$:     MOV     #177776,(R1)+                   ; LOW MAP REGISTER
1884 006362  012721  000077                  MOV     #77,(R1)+                       ; HIGH MAP REGISTER
1885 006366  077305                          SOB     R3,2$                           ; DO FOR ALL
```

```
                                        ;
                                        ; START WITH DATI ON A WORD BOUNDARY
                                        ;
006370  005037  172354                CLR     KIPAR6                          ; ACCESS REGISTER PAIR 0
006374  012701  140002                MOV     #140002,R1                      ; START WITH 0 THRU KIPAR6
006400  000401                        BR      4$                              ;
006402  005721                3$:     TST     (R1)+                           ; . DO IN WORD INCREMENTS
006404  004737  002254        4$:     JSR     PC,DDIN                         ; . DO DATI
006410  010137  001122                MOV     R1,$BDADR                       ; . STORE JUST ACCESSED ADDRESS
006414  162737  000002  001122        SUB     #2,$BDADR                       ; . GET RID OF OVERFLOW
006422  027737  172474  177732        CMP     @$BDADR,DDR                     ; . PROPER DATA?
006430  001412                        BEQ     7$                              ; . IF EQUAL, BRANCH
006432  017737  172464  001124        MOV     @$BDADR,$GDDAT                  ; . STORE RECEIVED DATA
006440  013737  177732  001126        MOV     DDR,$BDDAT                      ; . STORE EXPECTED DATA
006446  042737  160000  001122        BIC     #BIT15!BIT14!BIT13,$BDADR       ; . STRIP OF PAR BITS
006454  104023                        ERROR   +23                             ; . ERROR IN RELOCATION
                                        ;
                                        ; DECIDE WHICH CYCLE SHOULD OCCUR NEXT
                                        ;
006456  005737  172354        7$:     TST     KIPAR6                          ; . FIRST TIME 1K BOUNDARY?
006462  001011                        BNE     10$                             ; . IF NOT, BRANCH
006464  022701  144000                CMP     #144000,R1                      ; . LESS THAN 1K DONE?
006470  103744                        BLO     3$                              ; . DO IN WORD INCREMENTS
006472  012701  140002                MOV     #140002,R1                      ; . NOW DO INCREMENTING THRU PAR
006476  012737  000040  172354        MOV     #40,KIPAR6                      ; . FIRST 1K
006504  000737                        BR      4$                              ; . GO DO COMPARE
006506  062737  000040  172354 10$:   ADD     #40,KIPAR6                      ; . ACCESS NEXT 1K
006514  022737  000200  172354        CMP     #200,KIPAR6                     ; . OVER 4K BOUNDARY?
006522  003330                        BGT     4$                              ; . IF NOT, GO DO DATI
006524  005037  177572                CLR     MMR0                            ; DISABLE MMU
006530  042737  000400  177730        BIC     #BIT8,DCSR                      ; EXIT DIAGNOSTIC MODE
```

```
                                .SBTTL TEST - ALU TEST
                                ;
                                ;* THIS TEST PERFORMS EXTENSIVE CHECKING OF ALU BY USING BINARY COUNT PATTERN
                                ;* FOR EACH OF THE 5 ADDERS AT THE SAME TIME. HIGHEST LOCATIONS CHECKED
                                ;* CORRESPOND TO MAXIMUM AMOUNT OF MEMORY AVAILABLE.
                                ;
                                ;  BGNTST
                                ;
                                ;       IF UFD MODE AND KMCR<5> EQ #1 THEN
                                ;       .  EXIT TEST (RELOCATION DOES NOT HAVE TO BE PERFORMED IN 18 BIT)
                                ;       ENDIF
                                ;       CALL MAP_PROGRAM_AREA
                                ;       ENABLE MAPPING AND RELOCATION
                                ;       SIZE MEMORY AND MAKE UP MASK FOR NXM
                                ;       DO FOR BINARY COUNT PATTERNS THRU ALL FOR ADDERS
                                ;       .  MASK OUT NXM
                                ;       .  IF LESS THAN 32K THEN
                                ;       .  .  DO DATI
                                ;       .  ELSE
                                ;       .  .  DO DATO
                                ;       .  ENDIF
                                ;       .  IF RESULT OF THE CYCLE IS NOT PROPER THEN
                                ;       .  .  ERROR IN ALU
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 20        ALU TEST
                                ;;*****************************************************************
    006536  000004              TST20:  SCOPE

006540  005737  001720                  TST     PMIS                            ; ANY 22-BIT PMI MEMORY?
006544  001574                  BEQ     TST21           ;; IF NONE, EXIT TEST
006546  032737  000040  177734  BIT     #BIT05,KMCR                             ; 18 BIT MODE
006554  001170                  BNE     TST21           ;; IF 18 BIT MODE, DON'T DO THIS TEST
                                ;
                                ; INITIALISE MMU AND RELOCATION
                                ;
006556  052737  000400  177730  1$:     BIS     #BIT08,DCSR                     ; SET DIAGNOSTIC MODE
006564  042737  000006  177730          BIC     #BIT02!BIT01,DCSR               ; SELECT NPR THRU DDR
006572  004737  002276                  JSR     PC,MAPPR                        ; REMAP PROGRAM AREA
006576  052737  000060  172516          BIS     #BIT05!BIT04,MMR3               ; ENABLE RELOCATION AND 22BITS
006604  005237  177572                  INC     MMR0                            ; ENABLE MMU
006610  013702  001720                  MOV     PMIS,R2                         ; STORE SIZE OF PMI MEMORY
006614  010237  001160                  MOV     R2,$TMP0                        ; CREATE A PATTERN
006620  012703  004200                  MOV     #4200,R3                        ; CONSTANT FOR PAR
006624  040203                          BIC     R2,R3                           ; MASK OUT NXM
006626  072227  177766                  ASH     #-10.,R2                        ; FOR MAPH00
                                ;
                                ; DO FOR ALL COMBINATIONS POSSIBLE, 4 BITS AT A TIME
                                ;
006632  012701  140000                  MOV     #140000,R1                      ; ACCESS THRU KIPAR6
006636  005037  172354                  CLR     KIPAR6                          ; ACCESS REGISTER PAIR 0
```

```
 1973 006642  005037  170200              CLR     MAPL00                          ; CLEAR MAP REGISTERS
 1974 006646  005037  170202              CLR     MAPH00                          ;
 1975 006652  005037  001162              CLR     $TMP1                           ; CLEAR STORAGE FOR PAR
 1976 006656  005037  001122              CLR     $BDADR                          ; FIRST ADDRESS USED
 1977 006662  005037  001124              CLR     $GDDAT                          ; CLEAR PATTERN
 1978 006666  004737  002254      2$:     JSR     PC,DDIN                         ; . DO DATI
 1979 006672  013737  001162  172354      MOV     $TMP1,KIPAR6                    ; . GET ADDED PAR
 1980 006700  023777  177732  172214      CMP     DDR,@$BDADR                     ; . DATI OK?
 1981 006706  001435                      BEQ     10$                             ; . IF SO, BRANCH
 1982 006710  013737  177732  001126      MOV     DDR,$BDDAT                      ; . STORE RECIEVED DATA
 1983 006716  017737  172200  001124      MOV     @$BDADR,$GDDAT                  ; . STORE EXPECTED DATA
 1984 006724  042737  160000  001122      BIC     #BIT15!BIT14!BIT13,$BDADR       ; . STRIP OF PAR BITS
 1985 006732  104023                      ERROR   +23                             ;
 1986 006734  005037  001124              CLR     $GDDAT                          ;
 1987 006740  000420                      BR      10$                             ;
 1988 006742  004737  002242      5$:     JSR     PC,DDOUT                        ; . DO DATO
 1989 006746  013737  001162  172354      MOV     $TMP1,KIPAR6                    ; . GET ADDED PAR
 1990 006754  023777  001124  172140      CMP     $GDDAT,@$BDADR                  ; . DATI OK?
 1991 006762  001407                      BEQ     10$                             ; . IF SO, BRANCH
 1992 006764  017737  172132  001126      MOV     @$BDADR,$BDDAT                  ; . STORE EXPECTED DATA
 1993 006772  042737  160000  001122      BIC     #BIT15!BIT14!BIT13,$BDADR       ; . STRIP OF PAR BITS
 1994 007000  104023                      ERROR   +23                             ;
 1995                             ;
 1996                             ; DECIDE WHAT ACCESS NEXT
 1997                             ;
 1998 007002  005037  172354      10$:    CLR     KIPAR6                          ; . CLEAR PAR
 1999 007006  062701  001042              ADD     #1042,R1                        ; . START INCREMENTING
 2000 007012  062737  021042  170200      ADD     #21042,MAPL00                   ; . EVERY 4TH BIT
 2001 007020  005537  170202              ADC     MAPH00                          ; . DON'T FORGET CARRY
 2002 007024  062737  000002  170202      ADD     #2,MAPH00                       ; . FOR ALL REGISTERS
 2003 007032  010137  001122              MOV     R1,$BDADR                       ; . SAVE ADDRESS USED
 2004 007036  063737  170200  001122      ADD     MAPL00,$BDADR                   ; . ADD UNIBUS MAP REG.
 2005 007044  052737  140000  001122      BIS     #140000,$BDADR                  ; . MAKE SURE KIPAR6 SELECTED
 2006 007052  042737  020000  001122      BIC     #20000,$BDADR                   ;
 2007 007060  022701  150420              CMP     #150420,R1                      ; . OVERFLOW FROM ADDITION?
 2008 007064  001003                      BNE     15$                             ; . IF NO, BRANCH
 2009 007066  062737  000200  001162      ADD     #200,$TMP1                      ; . ADD OVERFLOW FOR PAR
 2010 007074  060337  001162      15$:    ADD     R3,$TMP1                        ; . ADD INCR. TO PAR
 2011 007100  022737  002000  001162      CMP     #2000,$TMP1                     ; . LESS THAN 32K?
 2012 007106  003267                      BGT     2$                              ; . IF YES, DO DATI
 2013 007110  005237  001124              INC     $GDDAT                          ; . INCREMENT PATTERN
 2014 007114  023737  001160  001162      CMP     $TMP0,$TMP1                     ; . OVER AVAILABLE MEMORY?
 2015 007122  003307                      BGT     5$                              ; . IF NOT, DO ANOTHER DATO
 2016 007124  005037  177572      25$:    CLR     MMR0                            ; DISABLE MMU
 2017 007130  042737  000400  177730      BIC     #BIT8,DCSR                  ; EXIT DIAGNOSTIC MODE
```

TEST - MAIN MEMORY DISABLE

```
                                .SBTTL TEST - MAIN MEMORY DISABLE
                                ;
                                ;* THIS TEST WILL CHECK THAT A MAIN MEMORY RESPONSE IS DISABLED WHENEVER
                                ;* THE APPROPRIATE BITS IN THE KMCR REGISTER ARE SET. IN UFD MODE ONLY BITS SET
                                ;* IN KMCR WILL BE TESTED. IN ALL OTHER ENVIRONMENTS ALL BITS WILL BE TESTED.
                                ;
                                ;  BGNTST
                                ;
                                ;       CALL MAP_PROGRAM_AREA
                                ;       LET MMR0<0> = 1 TO ENABLE MMU
                                ;       LET R1 = KMCR_LOW_BYTE
                                ;       CLEAR BITS <5,6,7> IN R1
                                ;       IF KMCR<5> EQ #1 THEN (18 BIT MODE)
                                ;       .  LET KIPAR6 = #7400
                                ;       ELSE (22 BIT MODE)
                                ;       .  LET KIPAR6 = #177400
                                ;       ENDIF
                                ;       LET TEST_LOCATION = #140000 TO ACCESS THRU KIPAR6
                                ;       DO FOR R0 FROM #1 TO R1 ALL PAGES SPECIFIED IN KMCR
                                ;       .  LET R2 = @TEST_LOCATION
                                ;       .  IF NO TIMEOUT THEN
                                ;       .  .  ERROR KMCR<4-5> DOESNOT DISABLE MAIN MEMORY
                                ;       .  ENDIF
                                ;       .  LET KIPAR6 = KIPAR6 - #200
                                ;       ENDDO
                                ;       IF NOT UFD MODE THEN
                                ;       .  SAVE KMCR
                                ;       .  CHECK KMCR<5-0> TO BE READ-WRITE
                                ;       .  LET KMCR<5-0> = #0 (ALL NON-UNIBUS MEMORY)
                                ;       .  LET KIPAR6 = #171600
                                ;       .  IF @#140000 DOES NOT TIMEOUT THEN
                                ;       .  .  LET KMCR<4-0> = <1000> TO DISABLE HIGHER THAN 28K
                                ;       .  .  IF @#140000 DOESNOT TIMEOUT THEN
                                ;       .  .  .  ERROR SETTING KMCR<5-0> DOESNOT DISABLE MEMORY
                                ;       .  .  ENDIF
                                ;       .  ENDIF
                                ;       .  RESTORE KMCR
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------
                                ;;*********************************************************************
                                ;*TEST 21       MAIN MEMORY DISABLE
                                ;;*********************************************************************
    007136  000004              TST21:  SCOPE
2063 007140  005737  001720             TST     PMIS                    ; ANY PMI MEMORY?
2064 007144  001002             BNE     20$                             ; IF YES, DO THE TEST
2065 007146  000137  007616             JMP     100$                    ; OTHERWISE EXIT TEST
2066 007152  052737  000400  177730 20$:    BIS     #BIT08,DCSR         ; STANDALONE MODE
2067 007160  004737  002276             JSR     PC,MAPPR                ; REMAP PROGRAM AREA
2068 007164  005237  177572             INC     MMR0                    ; ENABLE MMU
2069 007170  113701  177734             MOVB    KMCR,R1                 ; SAVE KMCR
2070 007174  042701  177740             BIC     #177740,R1              ; R1 HAS # OF PAGES DISABLED
2071                            ;
2072                            ; GET THE HIGHEST NXM LOCATION
```

```
                                        ;
007200  032737  000040  177734           BIT     #BIT05,KMCR             ; 18 BIT MODE?
007206  001404                           BEQ     1$                      ; IF NOT, BRANCH
007210  012737  007400  172354           MOV     #7400,KIPAR6            ; NXM FOR 18 BITS
007216  000403                           BR      2$                      ; GO DO IT
007220  012737  177400  172354  1$:      MOV     #177400,KIPAR6          ; NXM FOR 22 BITS
                                        ;
                                        ; GO THRU ALL PAGES OF MEMORY DISABLED
                                        ;
007226  105701                  2$:      TSTB    R1                      ; ANY UNIBUS MEMORY?
007230  001420                           BEQ     6$                      ; IF NO, BRANCH
007232  012737  007250  000004           MOV     #4$,@#4                 ; POINT TIMEOUT VECTOR TO PROGRAM
007240  005737  140000          3$:      TST     @#140000                ; . ACCESS THRU KIPAR6
007244  104025                           ERROR   +25                     ; . KMCR<4-0> DOES NOT DISABLE MAIN MEMORY
007246  000402                           BR      5$                      ; .
007250  005726                  4$:      TST     (SP)+                   ; . ADJUST STACK
007252  005726                           TST     (SP)+                   ; .
007254  162737  000200  172354  5$:      SUB     #200,KIPAR6             ; . ACCESS NEXT LOWER PAGE
007262  077112                           SOB     R1,3$                   ; . DO FOR ALL PAGES IN KMCR
007264  012737  002266  000004           MOV     #TIMOUT,@#4             ; RESTORE TIMEOUT VECTOR
                                        ;
                                        ; IN NON-UFD MODE, CHECK KMCR<5-0>
                                        ;
007272  032737  000040  000052  6$:      BIT     #BIT05,@#52             ; UFD MODE?
007300  001146                           BNE     TST22           ;; IF YES, GO TO NEXT TEST
007302  013737  177734  001162           MOV     KMCR,$TMP1              ; SAVE KMCR
007310  012701  000067                   MOV     #67,R1                  ; HIGHEST VALUE (32K OF MEMORY)
007314  110137  177734          7$:      MOVB    R1,KMCR                 ; . WRITE TO KMCR
007320  120137  177734                   CMPB    R1,KMCR                 ; . WRITTEN OK?
007324  001426                           BEQ     8$                      ; . IF SO, BRANCH
007326  010137  001124                   MOV     R1,$GDDAT               ; . NO,THEN GET THE GOOD DATA
007332  052737  000200  001124           BIS     #BIT07,$GDDAT           ; . IN CASE REBOOT BIT SET
007340  123737  001124  177734           CMPB    $GDDAT,KMCR             ; . WAS THAT THE ONLY WRONG?
007346  001415                           BEQ     8$                      ; . IF YES, BRANCH
007350  010137  001124                   MOV     R1,$GDDAT               ; . IF NOT, RESTORE PATTERN WRITTEN
007354  013737  177734  001126           MOV     KMCR,$BDDAT             ; . GET THE BAD DATA
007362  012737  177734  001122           MOV     #KMCR,$BDADR            ; . GET THE ADDRESS OF THE KMCR
007370  013737  001160  177734           MOV     $TMP0,KMCR              ; . RESTORE RREGISTER
007376  104011                           ERROR   +11                     ; . ERROR IN KMCR<5-0>
007400  000446                           BR      12$                     ; . EXIT TEST ON ERROR
007402  005301                  8$:      DEC     R1                      ; . LAST LOCATION (0)?
007404  002343                           BGE     7$                      ; . IF NOT, BRANCH
                                        ;
                                        ; IN NON-UFD MODE, GO THRU THE PAGE JUST ABOVE 32K
                                        ;

007406  052737  000020  172516           BIS     #BIT04,MMR3             ; ENABLE 22-BIT
007414  013702  001720                   MOV     PMIS,R2                 ; STORE HIGHEST PAGE
007420  005037  170200                   CLR     MAPL00                  ; CLEAR MAP REG. 0
007424  012737  000001  170202           MOV     #1,MAPH00               ; POINTS TO 32K
007432  052737  000040  172516           BIS     #BIT05,MMR3             ; ENABLE MAPPING
007440  005001                           CLR     R1                      ; ADDRESS FOR DMA CYCLES
007442  012737  007474  000004           MOV     #10$,@#4                ; TIMEOUT TO PROGRAM
007450  012737  002000  172354           MOV     #2000,KIPAR6            ; PAGE JUST ABOVE 32K
007456  012737  000067  177734           MOV     #67,KMCR                ; DISABLE HIGHER THEN 32K
                                        ;
                                        ; DO A CPU CYCLE TO DISABLED MEMORY
```

T21 MAIN MEMORY DISABLE

```
                                        ;
007464  005737  140000          9$:   TST     @#140000                ; . ACCESS DISABLED MEMORY
007470  104025                        ERROR   +25                     ; . IN DISABLING MEMORY THRU KMCR<4-0>
007472  000411                        BR      12$                     ;
007474  005726                  10$:  TST     (SP)+                   ; . RESTORE STACK
007476  005726                        TST     (SP)+
                                        ;
                                        ; DO A DMA DATI CYCLE TO DISABLED MEMORY
                                        ;
007500  004737  002254          11$:  JSR     PC,DDIN                 ; . DIAGNOSTIC DATI
007504  032737  100000  177730        BIT     #BIT15,DCSR             ; . NXM SET?
007512  001001                        BNE     12$                     ; . IF SET, BRANCH
007514  104025                        ERROR   +25                     ; . IN DMA MEMORY NOT DISABLED
                                        ;
                                        ; CHECK WHETHER ALL PAGES IN MEMORY VERIFIED
                                        ;
007516  023702  172354          12$:  CMP     KIPAR6,R2               ; . IS IT IN MEMORY?
007522  103020                        BHIS    14$                     ; . IF NOT, BRANCH
007524  062737  020000  170200        ADD     #20000,MAPL00           ; . ACCESS NEXT 4K
007532  103002                        BCC     13$                     ; . IF DIDN'T EXCEED 32K, BRANCH
007534  005237  170202                INC     MAPH00                  ; . OTHERWISE, INCREMENT MAP REGISTER
007540  005337  177734          13$:  DEC     KMCR                    ; . ENABLE NEXT 4K OF MEMORY
007544  032737  000040  177734        BIT     #BIT05,KMCR             ; . ALL 128K DONE?
007552  001404                        BEQ     14$                     ; . IF SO, BRANCH
007554  062737  000200  172354        ADD     #200,KIPAR6             ; . ACCESS NEXT 4K
007562  000740                        BR      9$                      ; . TRY TO DO IT
007564  012737  002266  000004  14$:  MOV     #TIMOUT,@#4             ; RESTORE TIMEOUT VECTOR
007572  013737  001162  177734        MOV     $TMP1,KMCR              ; RESTORE KMCR
007600  005037  172516                CLR     MMR3                    ; DISABLE 22-BIT MODE
007604  005037  177572                CLR     MMR0                    ; DISABLE MMU
007610  042737  000400  177730        BIC     #BIT8,DCSR              ; EXIT DIAGNOSTIC MODE
007616                          100$:
```

TEST - CACHE PRESENCE

```
                                .SBTTL  TEST  - CACHE PRESENCE

                                ;* THIS TEST WILL FIND OUT WHETHER THE CACHE IS PRESENT
                                ;
                                ;  BGNTST
                                ;
                                ;       LET KMCR<6>=#1
                                ;       IF KMCR<6> NE #1 THEN
                                ;       .  CACHE NOT PRESENT OR NOT SEEN
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-----------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 22        CACHE PRESENCE
                                ;;*****************************************************************
 007616  000004                 TST22:  SCOPE

 007620  005737  001720                 TST     PMIS                            ; ANY PMI MEMORY?
 007624  001440                 BEQ     TST23           ;; IF NONE, EXIT TEST
 007626  052737  000100  177734 BIS     #BIT06,KMCR                             ; SET CACHE ENABLE BIT
 007634  032737  000100  177734 BIT     #BIT06,KMCR                             ; DID IT GET SET?
 007642  001031                 BNE     TST23           ;;      IF CACHE PRESENT, EXIT TEST
 007644  005737  001206                 TST     $PASS                           ; FIRST PASS?
 007650  001014                 BNE     1$                                      ; IF YES, SKIP PRINTOUT
 007652  122737  000001  001220 CMPB    #APTENV,$ENV                            ; IN APT MODE?
 007660  001410                 BEQ     1$                                      ; IF SO, SKIP PRINTOUT
 007662  032737  000040  000052 BIT     #BIT05,@#52                             ; UFD MODE ?
 007670  001004                 BNE     1$                                      ; IF YES, BRANCH
 007672  104401  007706         TYPE    ,NOCAH                                  ; TYPE NO CACHE MESSAGE
 007676  104401  001175         TYPE    ,$CRLF                                  ;
 007702  000137  013224         1$:     JMP     UBETST                          ; IF NO CACHE, SKIP ALL CACHE TSTS

 007706      040     116     117 NOCAH:  .ASCIZ  / NO CACHE SEEN/
 007711      040     103     101
 007714      103     110     105
 007717      040     123     105
 007722      105     116     000
                                .EVEN
```

```
                                .SBTTL  TEST  - CACHE DISABLED AND KMCR

                                ;* THIS TEST WILL CHECK THAT WHENEVER THE DMA CACHE IS DISABLED
                                ;* THE STATUS BITS IN KMCR REGISTER ARE INITIALISED TO POWER UP
                                ;* CONDITIONS: THE VALID BITS ARE CLEARED, A IS THE NEXT AVAILABLE
                                ;* SET, FOLLOWED BY B, C, AND D.
                                ;
                                ;  BGNTST
                                ;
                                ;       DO FOR MMR3<5>=0,1 WITH RELOCATION ENABLED AND DISABLED
                                ;       .  LET KMCR<6> = #0 TO DISABLE CACHE
                                ;       .  LET KMCR<8>=0
                                ;       .  IF KMCR<12!11!10!9> NE #0 THEN
                                ;       .  .  ERROR IN VALID BITS WITH CACHE DISABLED
                                ;       .  ENDIF
                                ;       .  LET KMCR<8>=1
                                ;       .  IF KMCR<14!13!12!11!10!9!> NE #1 THEN
                                ;       .  .  ERROR IN LRU BITS SELECTION
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;---------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 23       CACHE DISABLED AND KMCR
                                ;;*****************************************************************
    007726  000004              TST23:  SCOPE

                                        TST     PMIS                            ; ANY PMI MEMORY?
007730  005737  001720                  BEQ     TST24           ;; IF NONE, EXIT TEST
007734  001471                          BIS     #BIT8,DCSR                      ; SELECT DIAGNOSTIC MODE
007736  052737  000400  177730          BIC     #BIT05,MMR3                     ; FIRST DO WITH RELOCATION DISABLED
007744  042737  000040  172516          BR      2$                              ; GO DO IT
007752  000403                  1$:     BIS     #BIT05,MMR3                     ; NOW DO WITH RELOCATION ENABLED
007754  052737  000040  172516  2$:     BIC     #BIT06,KMCR                     ; MAKE SURE THAT CACHE IS DISABLED
007762  042737  000100  177734          BIC     #BIT08,KMCR                     ; READ VALID BITS FIRST
007770  042737  000400  177734          BIT     #BIT12!BIT11!BIT10!BIT9,KMCR    ; ALL VALID BITS CLEAR?
007776  032737  017000  177734          BEQ     3$                              ; IF YES, BRANCH
010004  001412                          MOV     KMCR,$BDDAT                     ; STORE KMCR
010006  013737  177734  001126          MOV     KMCR,$GDDAT                     ; STORE TO PRESERVE LOW BYTE
010014  013737  177734  001124          BIC     #BIT12!BIT11!BIT10!BIT9,$GDDAT  ; HIGH BYTE CLEAR
010022  042737  017000  001124          ERROR   +26                             ; VALID BITS NOT CLEAR WITH KMCR<6>=0
010030  104026                  3$:     BIS     #BIT08,KMCR                     ; NOW READ AVAILABILITY BITS
010032  052737  000400  177734          MOV     KMCR,$TMP0                      ; STORE KMCR
010040  013737  177734  001160          CMPB    #177,$TMP0+1                    ; ALL SET?
010046  122737  000177  001161          BEQ     4$                              ; IF YES, BRANCH
010054  001412                          MOV     KMCR,$BDDAT                     ; STORE KMCR
010056  013737  177734  001126          MOV     KMCR,$GDDAT                     ; STORE TO PRESERVE LOW BYTE
010064  013737  177734  001124          BISB    #177,$GDDAT                     ; HIGH BYTE SET
010072  152737  000177  001124          ERROR   +26                             ; AVAIL. BITS NOT SET WITH KMCR<6>=0
010100  104026                  4$:     BIT     #BIT05,MMR3                     ; DONE WITH RELOCATION ENABLED?
010102  032737  000040  172516          BEQ     1$                              ; IF NOT, BRANCH
010110  001721                          BIC     #BIT8,DCSR                      ; EXIT DIAGNOSTIC MODE
010112  042737  000400  177730
```

```
                        .SBTTL  TEST - AVAILABILITY OF SETS

                        ;* THIS TEST WILL CHECK KMCR<15-8>. FIRST, EACH SET IN THE CACHE IS ALLOCATED,
                        ;* THEN EACH SET IS MADE MOST RECENTLY USED (MRU), AND THEN EACH SET IS
                        ;* INVALIDATED BY READING THE 8TH REGISTER OF THE SET.
                        ;
                        ;  BGNTST
                        ;
                        ;       ENABLE CACHE
                        ;       POINT R2 TO VALTBL FOR VALID BITS (KMCR<8>=0)
                        ;       POINT R3 TO TOPTBL FOR AVAILABILITY (KMCR<8>=1)
                        ;       ENABLE RELOCATION
                        ;*
                        ;* ALLOCATE SETS IN CACHE MAKING EACH OF THEM VALID AND GETTING MISSES
                        ;*
                        ;       DO FOR ALL 4 SETS ALLOCATING THEM IN CACHE
                        ;       .  LET KMCR<8>=0
                        ;       .  DO DMA READ ON OCTAL BOUNDARY USING DIAGNOSTIC_DATA_IN
                        ;       .  IFB (R2)+ NE IN KMCR+1 THEN
                        ;       .  .  ERROR IN READING VALID BITS ON MISS
                        ;       .  ENDIF
                        ;       .  LET KMCR<8>=1
                        ;       .  IFB KMCR+1 NE (R3)+ THEN
                        ;       .  .  ERROR READING AVAILABILITY BITS ON MISS
                        ;       .  ENDIF
                        ;       ENDDO
                        ;*
                        ;* READ A REGISTER FROM A VALID SET MAKING EACH OF THE SETS MOST RECENTLY USED
                        ;*
                        ;       DO FOR ALL 4 SETS MAKING THEM MRU AND THEN MOST AVAILABLE
                        ;       .  LET KMCR<8>=0
                        ;       .  DO DMA READ FROM 3RD LOCATION USING DIAGNOSTIC_DATA_IN
                        ;       .  IFB KMCR+1 NE (R2)+ THEN
                        ;       .  .  ERROR IN READING VALID BITS ON HIT
                        ;       .  ENDIF
                        ;       .  LET KMCR<8>=1
                        ;       .  IFB KMCR+1 NE (R3)+ THEN
                        ;       .  .  ERROR READING AVAILABILITY BITS ON HIT
                        ;       .  ENDIF
                        ;*
                        ;* READ THE LAST REGISTER FROM A SET MAKING EACH SET INVALID AND MOST AVAILABLE
                        ;*
                        ;       .  LET KMCR<8>=0
                        ;       .  DO DMA READ FROM 8TH LOCATION USING DIAGNOSTIC_DATA_IN
                        ;       .  IFB KMCR+1 NE (R2)+ THEN
                        ;       .  .  ERROR IN READING VALID BITS INVALIDATING A SET
                        ;       .  ENDIF
                        ;       .  LET KMCR<8>=1
                        ;       .  IFB KMCR+1 NE (R3)+ THEN
                        ;       .  .  ERROR READING AVAILABILITY BITS INVALIDATING A SET
                        ;       .  ENDIF
                        ;       ENDDO
                        ;
                        ;  ENDTST
                        ;
                        ;-------------------------------------------------------------------
```

```
                                ;;*****************************************************************
                                ;*TEST 24       AVAILABILITY OF SETS
                                ;;*****************************************************************
    010120  000004              TST24:  SCOPE
                                
    010122  005737  001720              TST     PMIS                    ; ANY PMI MEMORY?
    010126  001002              BNE     20$                             ; IF SOME, DO THE TEST
    010130  000137  010546      JMP     100$                            ; OTHERWISE EXIT
    010134  052737  000400  177730  20$:  BIS     #BIT8,DCSR              ; SELECT DIAGNOSTIC MODE
    010142  052737  000100  177734      BIS     #BIT06,KMCR             ; ENABLE CACHE
    010150  012702  010550              MOV     #VALTBL,R2              ; POINT TO VALID BITS
    010154  012703  010564              MOV     #TOPTBL,R3              ; POINT TO AVAILABILITY BITS
    010160  052737  000040  172516      BIS     #BIT05,MMR3             ; ENABLE RELOCATION
    010166  012737  000200  170200      MOV     #200,MAPL00             ; POINT MAP00 TO FIRST 8KB
    010174  012737  000000  170202      MOV     #0,MAPH00               ; IN HIGH AND LOW MAP REGISTERS
    010202  013737  177734  001124      MOV     KMCR,$GDDAT             ; PRESERVE LOW BYTE
    010210  105037  001125              CLRB    $GDDAT+1                ; CLEAR TO REPORT ERRORS, IF ANY
                                ;
                                ; ALLOCATE 4 SETS BY READING THEM THRU DIAGNOSTIC_DATA_IN
                                ;
    010214  012701  000000              MOV     #0,R1                   ; START READING MEMORY FROM 0
    010220  004737  002254      1$:     JSR     PC,DDIN                 ; . ALLOCATE IN CACHE NEXT 8 WORDS
    010224  042737  000400  177734      BIC     #BIT08,KMCR             ; . READ VALID BITS
    010232  013737  177734  001126      MOV     KMCR,$BDDAT             ; . STORE KMCR
    010240  122237  001127              CMPB    (R2)+,$BDDAT+1          ; . VALID BITS OK?
    010244  001404                      BEQ     2$                      ; . IF YES, BRANCH
    010246  105742                      TSTB    -(R2)                   ; . GET THE PATTERN JUST WRITTEN
    010250  112237  001125              MOVB    (R2)+,$GDDAT+1          ; . STORE HIGH BYTE
    010254  104026                      ERROR   +26                     ; . ERROR IN VALID BITS
    010256  052737  000400  177734  2$:  BIS     #BIT08,KMCR             ; . READ AVAILABILITY BIT
    010264  013737  177734  001126      MOV     KMCR,$BDDAT             ; . STORE KMCR
    010272  122337  001127              CMPB    (R3)+,$BDDAT+1          ; . AVAILABILITY BITS OK?
    010276  001404                      BEQ     3$                      ; . IF YES, BRANCH
    010300  105743                      TSTB    -(R3)                   ; . GET THE PATTERN JUST WRITTEN
    010302  112337  001125              MOVB    (R3)+,$GDDAT+1          ; . STORE HIGH BYTE
    010306  104026                      ERROR   +26                     ; . ERROR IN AVAILABILITY BITS
    010310  062701  000020      3$:     ADD     #20,R1                  ; . DO FOR NEXT OCTAL BOUNDARY
    010314  022701  000100              CMP     #100,R1                 ; . ALL 4 DONE?
    010320  003337                      BGT     1$                      ; . IF NOT, BRANCH
                                ;
                                ; NOW READ 3RD AND THEN 8TH LOCATION FROM CACHE
                                ;
    010322  012701  000004              MOV     #4,R1                   ; START WITH 3RD LOCATION A SET
    010326  042737  000400  177734  4$:  BIC     #BIT08,KMCR             ; . READ VALID BITS
    010334  004737  002254              JSR     PC,DDIN                 ; . READ FROM CACHE
    010340  013737  177734  001126      MOV     KMCR,$BDDAT             ; . STORE KMCR
    010346  122237  001127              CMPB    (R2)+,$BDDAT+1          ; . VALID BITS OK?
    010352  001404                      BEQ     5$                      ; . IF YES, BRANCH
    010354  105742                      TSTB    -(R2)                   ; . GET THE PATTERN JUST WRITTEN
    010356  112237  001125              MOVB    (R2)+,$GDDAT+1          ; . STORE HIGH BYTE
    010362  104026                      ERROR   +26                     ; . ERROR IN VALID BITS
    010364  052737  000400  177734  5$:  BIS     #BIT08,KMCR             ; . READ AVAILABILITY BIT
    010372  013737  177734  001126      MOV     KMCR,$BDDAT             ; . STORE KMCR
    010400  122337  001127              CMPB    (R3)+,$BDDAT+1          ; . AVAILABILITY BITS OK?
    010404  001404                      BEQ     6$                      ; . IF YES, BRANCH
    010406  105743                      TSTB    -(R3)                   ; . GET THE PATTERN JUST WRITTEN
    010410  112337  001125              MOVB    (R3)+,$GDDAT+1          ; . STORE HIGH BYTE
```

```
                                        ERROR   +26                     ; . ERROR IN AVAILABILITY BITS
                                6$:     ADD     #12,R1                  ; . READ THE 8TH WORD
                                        BIS     #BIT08,KMCR             ; . READ AVAILABILITY BIT
                                        JSR     PC,DDIN                 ; . READ FROM CACHE
                                        MOV     KMCR,$BDDAT             ; . STORE KMCR
                                        CMPB    (R3)+,$BDDAT+1          ; . AVAILABILITY BITS OK?
                                        BEQ     7$                      ; . IF YES, BRANCH
                                        TSTB    -(R3)                   ; . GET THE PATTERN JUST WRITTEN
                                        MOVB    (R3)+,$GDDAT+1          ; . STORE HIGH BYTE
                                        ERROR   +26                     ; . ERROR IN AVAILABILITY BITS
                                7$:     BIC     #BIT08,KMCR             ; . READ VALID BITS
                                        MOV     KMCR,$BDDAT             ; . STORE KMCR
                                        CMPB    (R2)+,$BDDAT+1          ; . VALID BITS OK?
                                        BEQ     8$                      ; . IF YES, BRANCH
                                        TSTB    -(R2)                   ; . GET THE PATTERN JUST WRITTEN
                                        MOVB    (R2)+,$GDDAT+1          ; . STORE HIGH BYTE
                                        ERROR   +26                     ; . ERROR IN VALID BITS
                                8$:     ADD     #6,R1                   ; . DO FOR NEXT OCTAL BOUNDARY
                                        CMP     #100,R1                 ; . ALL 4 DONE?
                                        BGT     4$                      ; . IF NOT, BRANCH
                                        BIC     #BIT05,MMR3             ; DISABLE RELOCATION
                                        BIC     #BIT06,KMCR             ; DISABLE CACHE
                                        BIC     #BIT8,DCSR              ; EXIT DIAGNOSTIC MODE
                                100$:
010546  000414                          BR      TST25           ;; EXIT TEST

                        ;* THIS TABLE HAS BITS KMCR<15-8> WHEN KMCR<8>=0
                        ;* KMCR<15>=0 FLAGGING CACHE MISS

010550  020     030     034     VALTBL: .BYTE   20,30,34,36              ; ORDER FOR VALID: A, AB, ABC, ABCD
010553  036
                                                                        ; NOW ALL VALID, HITS-MISS(WRITE TO I/O)
010554  236     016             .BYTE   236,16                          ; HIT-MISS, A: VALID - NOT VALID
010556  216     006             .BYTE   216,6                           ; HIT-MISS, B: VALID - NOT VALID
010560  206     002             .BYTE   206,2                           ; HIT-MISS, C: VALID - NOT VALID
010562  202     000             .BYTE   202,0                           ; HIT-MISS, D: VALID - NOT VALID

                        ;* THIS TABLE HAS BITS KMCR<15-8> WHEN KMCR<8>=1
                        ;* AT FIRST NO HITS ARE RECORDED, THE COMMENT FIELD SHOWS SETS
                        ;* STARTING WITH LEAST AVAILABLE

010564  017            TOPTBL: .BYTE   17                               ; ADCB - 000111
010565  103                    .BYTE   103                              ; BADC - 100001
010566  151                    .BYTE   151                              ; CBAD - 110100
010567  177                    .BYTE   177                              ; DCBA - 111111
                                                                        ; NOW MISS-HITS
010570  017    377             .BYTE   17,377                          ; ->ADCB->DCBA - 000111,111111
010572  163    277             .BYTE   163,277                         ; ->BDCA->DCAB - 111001,011111
010574  075    227             .BYTE   75,227                          ; ->CDAB->DABC - 011110,001011
010576  027    201             .BYTE   27,201                          ; ->DABC->ABCD - 001011,000000

                       .EVEN
```

```
                        .SBTTL TEST - DEALLOCATION OF SETS

                        ;* THIS TEST CHECKS THAT EACH SET CAN BE MADE MOST AVAILABLE AND
                        ;* DEALLOCATED ON THE NEXT READ ON THE OCTAL BOUNDARY.
                        ;
                        ;       DISABLE CACHE TO MAKE A MOST AVAILABLE
                        ;       ENABLE CACHE
                        ;*
                        ;* ALLOCATE SETS IN CACHE MAKING EACH OF THEM VALID AND GETTING MISSES
                        ;*
                        ;       DO FOR ALL 4 SETS ALLOCATING THEM IN CACHE
                        ;       .  DO DMA READ ON OCTAL BOUNDARY USING DIAGNOSTIC_DATA_IN
                        ;       ENDDO - THIS LEAVES A AS THE MOST AVAILABLE SET
                        ;*
                        ;* TRY TO BRING A NEW LOCATIONS TO SET A
                        ;*
                        ;       DO DMA READ ON OCTAL BOUNDARY FROM A FIFTH LOCATION TO SET A AGAIN
                        ;       LET KMCR<8> = #0
                        ;       IF KMCR<15!12!11!10!9!> NE <0,1,1,1,1> THEN
                        ;       .  ERROR DEALLOCATIONG LRU SET (A)
                        ;       ENDIF
                        ;       LET KMCR<8> = #1
                        ;       IF KMCR<15-9> NE <0,0,0,0,1,1,1> THEN
                        ;       .  ERROR DEALLOCATING LRU SET (A)
                        ;       ENDIF
                        ;*
                        ;* TRY TO BRING A NEW LOCATIONS TO SET B
                        ;*
                        ;       DO DMA READ ON OCTAL BOUNDARY FROM 1ST LOCATION TO SET B
                        ;       LET KMCR<8> = #0
                        ;       IF KMCR<15!12!11!10!9!> NE <0,1,1,1,1> THEN
                        ;       .  ERROR DEALLOCATIONG LRU SET (B)
                        ;       ENDIF
                        ;       LET KMCR<8> = #1
                        ;       IF KMCR<15-9> NE <0,1,0,0,0,0,1> THEN
                        ;       .  ERROR DEALLOCATING LRU SET (B)
                        ;       ENDIF
                        ;*
                        ;* TRY TO BRING A NEW LOCATIONS TO SET C
                        ;*
                        ;       DO DMA READ ON OCTAL BOUNDARY FROM 1ST LOCATION TO SET C
                        ;       LET KMCR<8> = #0
                        ;       IF KMCR<15!12!11!10!9!> NE <0,1,1,1,1> THEN
                        ;       .  ERROR DEALLOCATIONG LRU SET (C)
                        ;       ENDIF
                        ;       LET KMCR<8> = #1
                        ;       IF KMCR<15-9> NE <0,1,1,0,1,0,0> THEN
                        ;       .  ERROR DEALLOCATING LRU SET (C)
                        ;       ENDIF
                        ;*
                        ;* TRY TO BRING A NEW LOCATIONS TO SET D
                        ;*
                        ;       DO DMA READ ON OCTAL BOUNDARY FROM 1ST LOCATION TO SET D
                        ;       LET KMCR<8> = #0
                        ;       IF KMCR<15!12!11!10!9!> NE <0,1,1,1,1> THEN
                        ;       .  ERROR DEALLOCATIONG LRU SET (D)
                        ;       ENDIF
```

```
                                ;       LET KMCR<8> = #1
                                ;       IF KMCR<15-9> NE <0,1,1,1,1,1,1> THEN
                                ;       .  ERROR DEALLOCATING LRU SET (D)
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 25       DEALLOCATION OF SETS
                                ;;*****************************************************************
    010600  000004              TST25:  SCOPE

                                        TST     PMIS                    ; ANY PMI MEMORY?
                                        BNE     20$                     ; IF SOME, DO THE TEST
                                        JMP     100$                    ; OTHERWISE, EXIT
                            20$:        BIS     #BIT8,DCSR              ; SELECT DIAGNOSTIC MODE
                                        BIS     #BIT05,MMR3             ; ENABLE RELOCATION
                                        BIS     #BIT06,KMCR             ; ENABLE CACHE
                                        MOV     #200,MAPL00             ; POINT MAP00 TO FIRST 8KB
                                        MOV     #0,MAPH00               ; IN HIGH AND LOW MAP REGISTERS
                                        MOV     KMCR,$GDDAT             ; STORE LOW BYTE OF KMCR
                                ;
                                ; ALLOCATE ALL SETS MAKING A MOST AVAILABLE
                                ;
                                        MOV     #0,R1                   ; START WITH 0 IN SET A
                            1$:         JSR     PC,DDIN                 ; . ALLOCATE A SET
                                        ADD     #20,R1                  ; . GET READY FOR NEXT SET
                                        CMP     #100,R1                 ; . ALL 4 DONE?
                                        BGT     1$                      ; . IF NOT, BRANCH
                                ;
                                ; TRY TO BRING A NEW SET TO A
                                ;
                                        MOV     #100,R1                 ; TRY TO DO DATI
                                        BIC     #BIT08,KMCR             ; READ VALID BITS
                                        JSR     PC,DDIN                 ; ALLOCATE IN CACHE
                                        MOV     KMCR,$BDDAT             ; STORE KMCR
                                        CMPB    #36,$BDDAT+1            ; ALL SETS VALID?
                                        BEQ     2$                      ; IF OK, BRANCH
                                        MOVB    #36,$GDDAT+1            ; STORE EXPECTED PATTERN
                                        ERROR   +26                     ; DEALLOCATING A
                            2$:         BIS     #BIT08,KMCR             ; READ AVAILABILITY BITS
                                        MOV     KMCR,$BDDAT             ; STORE KMCR
                                        CMPB    #17,$BDDAT+1            ; MRU:A,D,C,B
                                        BEQ     3$                      ; IF OK, BRANCH
                                        MOVB    #17,$GDDAT+1            ; STORE EXPECTED PATTERN
                                        ERROR   +26                     ; DEALLOCATING A
                                ;
                                ; TRY TO BRING A NEW SET TO B
                                ;
                            3$:         MOV     #120,R1                 ; PREPARE FOR NEXT READ
                                        BIC     #BIT08,KMCR             ; READ VALID BITS
                                        JSR     PC,DDIN                 ; READ INTO CACHE
                                        MOV     KMCR,$BDDAT             ; STORE KMCR
                                        CMPB    #36,$BDDAT+1            ; ALL VALID?
                                        BEQ     4$                      ; IF YES, BRANCH
```

T25 DEALLOCATION OF SETS

```
2526 011036  112737  000036  001125          MOVB    #36,$GDDAT+1            ; STORE EXPECTED PATTERN
2527 011044  104026                          ERROR   +26                     ; DEALLOCATING B
2528 011046  052737  000400  177734  4$:     BIS     #BIT08,KMCR             ; READ AVAILABILITY BITS
2529 011054  013737  177734  001126          MOV     KMCR,$BDDAT             ; STORE KMCR
2530 011062  122737  000103  001127          CMPB    #103,$BDDAT+1           ; MRU:B,A,D,C
2531 011070  001404                          BEQ     5$                      ; IF OK, BRANCH
2532 011072  112737  000103  001125          MOVB    #103,$GDDAT+1           ; STORE EXPECTED PATTERN
2533 011100  104026                          ERROR   +26                     ; DEALLOCATING B
2534                                 ;
2535                                 ; TRY TO BRING A NEW SET TO C
2536                                 ;
2537 011102  012701  000140          5$:     MOV     #140,R1                 ; PREPARE FOR NEXT READ
2538 011106  042737  000400  177734          BIC     #BIT08,KMCR             ; READ VALID BITS
2539 011114  004737  002254                  JSR     PC,DDIN                 ; READ INTO CACHE
2540 011120  013737  177734  001126          MOV     KMCR,$BDDAT             ; STORE KMCR
2541 011126  122737  000036  001127          CMPB    #36,$BDDAT+1            ; ALL VALID?
2542 011134  001404                          BEQ     6$                      ; IF YES, BRANCH
2543 011136  112737  000036  001125          MOVB    #36,$GDDAT+1            ; STORE EXPECTED PATTERN
2544 011144  104026                          ERROR   +26                     ; DEALLOCATING C
2545 011146  052737  000400  177734  6$:     BIS     #BIT08,KMCR             ; READ AVAILABILITY BITS
2546 011154  013737  177734  001126          MOV     KMCR,$BDDAT             ; STORE KMCR
2547 011162  122737  000151  001127          CMPB    #151,$BDDAT+1           ; MRU:C,B,A,D
2548 011170  001404                          BEQ     7$                      ; IF OK, BRANCH
2549 011172  112737  000151  001125          MOVB    #151,$GDDAT+1           ; STORE EXPECTED PATTERN
2550 011200  104026                          ERROR   +26                     ; DEALLOCATING C
2551                                 ;
2552                                 ; TRY TO BRING A NEW SET TO D
2553                                 ;
2554 011202  012701  000160          7$:     MOV     #160,R1                 ; PREPARE FOR NEXT READ
2555 011206  042737  000400  177734          BIC     #BIT08,KMCR             ; READ VALID BITS
2556 011214  004737  002254                  JSR     PC,DDIN                 ; READ INTO CACHE
2557 011220  013737  177734  001126          MOV     KMCR,$BDDAT             ; STORE KMCR
2558 011226  122737  000036  001127          CMPB    #36,$BDDAT+1            ; ALL VALID?
2559 011234  001404                          BEQ     8$                      ; IF YES, BRANCH
2560 011236  112737  000036  001125          MOVB    #36,$GDDAT+1            ; STORE EXPECTED PATTERN
2561 011244  104026                          ERROR   +26                     ; DEALLOCATING D
2562 011246  052737  000400  177734  8$:     BIS     #BIT08,KMCR             ; READ AVAILABILITY BITS
2563 011254  013737  177734  001126          MOV     KMCR,$BDDAT             ; STORE KMCR
2564 011262  042737  000400  177730          BIC     #BIT08,DCSR             ; EXIT DIAGNOSTIC MODE
2565 011270  122737  000177  001127          CMPB    #177,$BDDAT+1           ; MRU:D,C,B,A
2566 011276  001404                          BEQ     TST26           ;;      IF OK, EXIT TEST
2567 011300  112737  000177  001125          MOVB    #177,$GDDAT+1           ; STORE EXPECTED PATTERN
2568 011306  104026                          ERROR   +26                     ; DEALLOCATING D
2569 011310                          100$:
2570
```

```
                                .SBTTL  TEST - CACHE WITH RELOCATION DISABLED

                                ;* THIS TEST CHECKS THAT CACHE IS NOT OPERATIONAL WHEN RELOCATION IS
                                ;* DISABLED AND KMCR<15-9> ARE NOT INITIALIZED.
                                ;
                                ;  BGNTST
                                ;
                                ;       SAVE KMCR<15-9> FOR KMCR<8>=0,1
                                ;       LET MMR3<5>=#0 TO DISABLE RELOCATION
                                ;       DO DMA READ USING DIAGNOSTIC_DATA_IN
                                ;       LET KMCR<8>=0
                                ;       IFB KMCR+1 NE SAVED THEN
                                ;       .  ERROR RELOCATION DISABLED STILL AFFECTS THE CACHE
                                ;       ENDIF
                                ;       LET KMCR<8>=1
                                ;       IFB KMCR+1 NE SAVED THEN
                                ;       .  ERROR RELOCATION DISABLED STILL AFFECTS THE CACHE
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 26       CACHE WITH RELOCATION DISABLED
                                ;;*****************************************************************
    011310  000004              TST26:  SCOPE

                                        TST     PMIS                            ; ANY PMI MEMORY?
    011312  005737  001720      BEQ     TST27           ;; IF NONE, EXIT TEST
    011316  001455              BIS     #BIT06,KMCR                             ; MAKE SURE THAT CACHE IS ENABLED
    011320  052737  000100  177734  BIS     #BIT08,DCSR                             ; SELECT DIAGNOSTIC MODE
    011326  052737  000400  177730  BIC     #BIT05,MMR3                             ; DISABLE RELOCATION
    011334  042737  000040  172516  BIC     #BIT08,KMCR                             ; READ VALID BITS FIRST
    011342  042737  000400  177734  MOV     KMCR,$GDDAT                             ; STORE LOW BYTE
    011350  013737  177734  001124  CLRB    $GDDAT+1                                ; CLEAR HIGH BYTE
    011356  105037  001125      BIT     #BIT12!BIT11!BIT10!BIT9,KMCR    ; ALL VALID BITS CLEAR?
    011362  032737  017000  177734  BEQ     3$                                      ; IF YES, BRANCH
    011370  001404              MOV     KMCR,$BDDAT                             ; STORE KMCR
    011372  013737  177734  001126  ERROR   +26                                    ; VALID BITS NOT CLEAR WITH KMCR<6>=0
    011400  104026              BIS     #BIT08,KMCR                             ; NOW READ AVAILABILITY BITS
    011402  052737  000400  177734  3$:     MOV     KMCR,$BDDAT                             ; STORE KMCR
    011410  013737  177734  001126  CMPB    #177,$BDDAT+1                           ; ALL SET?
    011416  122737  000177  001127  BEQ     4$                                      ; IF YES, EXIT TEST
    011424  001404              MOVB    #177,$GDDAT+1                           ; EXPECTED PATTERN
    011426  112737  000177  001125  ERROR   +26                                    ; AVAIL. BITS NOT SET WITH KMCR<6>=0
    011434  104026              BIC     #BIT06,KMCR                             ; DISABLE CACHE
    011436  042737  000100  177734  4$:     BIC     #BIT08,DCSR                             ; EXIT DIAGNOSTIC MODE
    011444  042737  000400  177730
```

```
                                .SBTTL  TEST - WRITE CYCLES AND CACHE

                                ;* THIS TEST CHECKS THAT DMA WRITE CYCLES DON'T AFFECT THE CACHE, EXCEPT
                                ;* WRITE HITS WHICH INVALIDATE THE SET AND MAKE THIS SET THE MOST AVAILABLE.
                                ;
                                ;  BGNTST
                                ;
                                ;       SAVE KMCR<15-9> FOR KMCR<8>=0,1
                                ;       DO DIAGNOSTIC_DATA_OUT WITH TAGS NOT CORRESPONDING TO ANY SETS
                                ;       DO FOR KMCR<8>=0,1
                                ;       .  IF KMCR<15-9> NE SAVED VALUES THEN
                                ;       .  .  ERROR WRITE CYCLES AFFECT THE CACHE
                                ;       .  ENDIF
                                ;       ENDDO
                                ;       DO DIAGNOSTIC_DATA_OUT THAT CAUSES A HIT
                                ;       IF NOT A HIT THEN
                                ;       .  ERROR RECORDING HITS
                                ;       IF THE SET IS VALID OR NOT MOST AVAILABLE THEN
                                ;       .  ERROR IN LEAST RECENTLY USED LOGIC
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 27       WRITE CYCLES AND CACHE
                                ;;*****************************************************************
    011452  000004              TST27:  SCOPE
2645
2646 011454  005737  001720            TST     PMIS                    ; ANY PMI MEMORY?
2647 011460  001002            BNE     20$                             ; IF SOME, DO THE TEST
2648 011462  000137  012134            JMP     100$                    ; OTHERWISE EXIT
2649 011466  052737  000400  177730  20$:     BIS     #BIT08,DCSR     ; SELECT DIAGNOSTIC MODE
2650 011474  052737  000100  177734            BIS     #BIT06,KMCR     ; CACHE STILL ENABLED
2651 011502  052737  000040  172516            BIS     #BIT05,MMR3     ; ENABLE RELOCATION
2652 011510  012737  000200  170200            MOV     #200,MAPL00     ; POINT MAP00 TO FIRST 8KB
2653 011516  012737  000000  170202            MOV     #0,MAPH00       ; IN HIGH AND LOW MAP REGISTERS
2654 011524  042737  000400  177734            BIC     #BIT08,KMCR     ; SELECT VALID BITS
2655 011532  013702  177734            MOV     KMCR,R2                 ; SAVE VALID BITS OF KMCR
2656 011536  052737  000400  177734            BIS     #BIT08,KMCR     ; SELECT AVAILABILITY BITS
2657 011544  013703  177734            MOV     KMCR,R3                 ; SAVE AVAILABILITY BITS
2658                            ;
2659                            ; ACCESS LOCATION NOT IN CACHE
2660                            ;
2661 011550  012701  000200            MOV     #200,R1                 ; ACCESS ADDRESS
2662 011554  013737  000400  001124    MOV     @#400,$GDDAT            ; THE PATTERN TO BE WRITTEN
2663 011562  004737  002242            JSR     PC,DDOUT                ; DO DIAGNOSTIC DATA OUT
2664 011566  042737  000400  177734    BIC     #BIT08,KMCR             ; SELECT VALID BITS
2665 011574  020237  177734            CMP     R2,KMCR                 ; KMCR CHANGED?
2666 011600  001406            BEQ     1$                              ; IF NOT, BRANCH
2667 011602  010237  001124            MOV     R2,$GDDAT               ; EXPECTED PATTERN
2668 011606  013737  177734  001126    MOV     KMCR,$BDDAT             ; RECIEVED PATTERN
2669 011614  104026            ERROR   +26                             ; WRITE MISSES AFFETS CACHE
2670 011616  052737  000400  177734  1$:     BIS     #BIT08,KMCR     ; SELECT AVAILABILITY BITS
2671 011624  020337  177734            CMP     R3,KMCR                 ; KMCR CHANGED?
2672 011630  001406            BEQ     2$                              ; IF OK, BRANCH
```

```
 2673 011632  010337  001124                    MOV     R3,$GDDAT                       ; EXPECTED PATTERN
 2674 011636  013737  177734  001126            MOV     KMCR,$BDDAT                     ; RECIEVED PATTERN
 2675 011644  104026                            ERROR   ;26                             ; WRITE MISSES AFFETS CACHE
 2676                                ;
 2677                                ; CHECK THAT WRITE HIT INVALIDATES CACHE
 2678                                ;
 2679 011646  042737  000100  177734  2$:       BIC     #BIT06,KMCR                     ; DISABLE CACHE TO GET TO KNOW STATE
 2680 011654  052737  000100  177734            BIS     #BIT06,KMCR                     ; ENABLE CACHE
 2681 011662  012701  000000                    MOV     #0,R1                           ; ADDRESS 0
 2682 011666  004737  002254                    JSR     PC,DDIN                         ; ALLOCATE CACHE SET A
 2683 011672  012701  000020                    MOV     #20,R1                          ; ADDRESS 20
 2684 011676  004737  002254                    JSR     PC,DDIN                         ; AND ALLOCATE SET B
 2685 011702  005001                            CLR     R1                              ; ACCESS SET A
 2686 011704  013737  000200  001124            MOV     @#200,$GDDAT                    ; THE PATTERN TO BE WRITTEN
 2687 011712  004737  002242                    JSR     PC,DDOUT                        ; INVALIDATE CACHE
 2688 011716  032737  100000  177734            BIT     #BIT15,KMCR                     ; HIT?
 2689 011724  001012                            BNE     3$                              ; IF YES, BRANCH
 2690 011726  013737  177734  001124            MOV     KMCR,$GDDAT                     ; PRESERVE LOW BYTE IF ERROR
 2691 011734  112737  000363  001124            MOVB    #363,$GDDAT                     ; HIT, B LEAST AVAILABLE
 2692 011742  013737  177734  001126            MOV     KMCR,$BDDAT                     ; RECIEVED PATTERN
 2693 011750  104026                            ERROR   ;26                             ; WRITE HIT WAS NOT RECORDED
 2694 011752  042737  000400  177734  3$:       BIC     #BIT08,KMCR                     ; READ VALID BITS
 2695 011760  032737  010000  177734            BIT     #BIT12,KMCR                     ; A VALID?
 2696 011766  001412                            BEQ     4$                              ; IF INVALIDATED, BRANCH
 2697 011770  013737  177734  001124            MOV     KMCR,$GDDAT                     ; PRESERVE LOW BYTE IF ERROR
 2698 011776  112737  000010  001125            MOVB    #BIT03,$GDDAT+1                 ; MISS, B VALID
 2699 012004  013737  177734  001126            MOV     KMCR,$BDDAT                     ; RECIEVED PATTERN
 2700 012012  104026                            ERROR   ;26                             ; WRITE HIT DOES NOT INVALIDATE
 2701 012014  013737  177734  001124  4$:       MOV     KMCR,$GDDAT                     ; PRESERVE LOW BYTE IF ERROR
 2702 012022  112737  000200  001125            MOVB    #200,$GDDAT+1                   ; HIT RECIEVED
 2703 012030  013737  000220  000220            MOV     @#220,@#220                     ; CPU WRITE TO SET B
 2704 012036  032737  100000  177734            BIT     #BIT15,KMCR                     ; HIT?
 2705 012044  001004                            BNE     5$                              ; IF YES, BRANCH
 2706 012046  013737  177734  001126            MOV     KMCR,$BDDAT                     ; STORE KMCR
 2707 012054  104026                            ERROR   ;26                             ; HIT NOT RECORDED
 2708 012056  032737  004000  177734  5$:       BIT     #BIT11,KMCR                     ; B STILL VALID?
 2709 012064  001412                            BEQ     6$                              ; IF NOT, EXIT TEST
 2710 012066  013737  177734  001124            MOV     KMCR,$GDDAT                     ; IN CASE HIT WENT AWAY
 2711 012074  142737  000030  001125            BICB    #BIT04!BIT03,$GDDAT+1           ; CLEAR ALL EXTRA
 2712 012102  013737  177734  001126            MOV     KMCR,$BDDAT                     ; RECIEVED PATTERN
 2713 012110  104026                            ERROR   ;26                             ; CPU WRITE DOES NOT INVALIDATE
 2714 012112  042737  000100  177734  6$:       BIC     #BIT06,KMCR                     ; DISABLE CACHE
 2715 012120  042737  000040  172516            BIC     #BIT05,MMR3                     ; AND MAPPING
 2716 012126  042737  000400  177730            BIC     #BIT08,DCSR                     ; EXIT DIAGNOSTIC MODE
 2717 012134                                100$:
```

TEST - DMA READ WITH INDEX NOT ZERO

```
                                .SBTTL TEST - DMA READ WITH INDEX NOT ZERO
                                
                                ;* THIS TEST CHECKS THAT A DMA READ MISS DOES NOT AFFECT THE CACHE IF THE INDEX
                                ;* FIELD IS NOT ZERO.
                                ;
                                ;  BGNTST
                                ;
                                ;       SAVE KMCR<15-9> FOR KMCR<8>=0,1
                                ;       DO DIAGNOSTIC_DATA_IN FOR A LOCATION WITH NON-ZERO INDEX
                                ;       DO FOR KMCR<8>=0,1
                                ;       .  IF KMCR<15-9> NE SAVED THEN
                                ;       .  .  ERROR IN COMPARING INDEXES
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------
                                
                                ;;*********************************************************************
                                ;*TEST 30       DMA READ WITH INDEX NOT ZERO
                                ;;*********************************************************************
012134  000004                  TST30:  SCOPE
                                
012136  005737  001720                  TST     PMIS                            ; ANY PMI MEMORY?
012142  001502                          BEQ     TST31           ;; IF NONE, EXIT TEST
                                
                                ;
                                ; ENABLE CACHE AND ALLOCATE SET A
                                ;
012144  052737  000400  177730          BIS     #BIT08,DCSR                     ; SELECT DIAGNOSTIC MODE
012152  052737  000040  172516          BIS     #BIT05,MMR3                     ; ENABLE RELOCATION
012160  052737  000100  177734          BIS     #BIT06,KMCR                     ; ENABLE CACHE
012166  012737  000200  170200          MOV     #200,MAPL00                     ; POINT MAP00 TO FIRST 8KB
012174  012737  000000  170202          MOV     #0,MAPH00                       ; IN HIGH AND LOW MAP REGISTERS
012202  012701  000000                  MOV     #0,R1                           ; ALLOCATE 200-216
012206  004737  002254                  JSR     PC,DDIN                         ; IN CACHE
                                ;
                                ; TRY TO CHECK WHETHER NON-ZERO INDEX EFFECT CACHE
                                ;
012212  042737  000400  177734          BIC     #BIT08,KMCR                     ; SELECT VALID BITS
012220  013737  177734  001124          MOV     KMCR,$GDDAT                     ; SAVE VALID BITS OF KMCR
012226  052737  000400  177734          BIS     #BIT08,KMCR                     ; SELECT AVAILABILITY BITS
012234  013703  177734                  MOV     KMCR,R3                         ; SAVE AVAILABILITY BITS
012240  012701  000102                  MOV     #102,R1                         ; TRY CACHING 102
012244  004737  002254                  JSR     PC,DDIN                         ; DO DIAGNOSTIC DATA IN
012250  042737  000400  177734          BIC     #BIT08,KMCR                     ; SELECT VALID BITS
012256  023737  001124  177734          CMP     $GDDAT,KMCR                     ; KMCR CHANGED?
012264  001404                          BEQ     1$                              ; IF NOT, BRANCH
012266  013737  177734  001126          MOV     KMCR,$BDDAT                     ; RECIEVED PATTERN
012274  104026                          ERROR   +26                             ; NON-ZERO INDEX AFFECTS CACHE
012276  052737  000400  177734  1$:     BIS     #BIT08,KMCR                     ; SELECT AVAILABILITY BITS
012304  020337  177734                  CMP     R3,KMCR                         ; KMCR CHANGED?
012310  001406                          BEQ     2$                              ; IF NOT, EXIT TEST
012312  010337  001124                  MOV     R3,$GDDAT                       ; EXPECTED DATA
012316  013737  177734  001126          MOV     KMCR,$BDDAT                     ; RECIEVEED DATE
012324  104026                          ERROR   +26                             ; NON-ZERO INDEX AFFECTS CACHE
```

T30 DMA READ WITH INDEX NOT ZERO

```
2773 012326  042737  000100  177734  2$:     BIC     #BIT06,KMCR                     ; DISABLE CACH
2774 012334  042737  000040  172516          BIC     #BIT05,MMR3                     ; AND MAPPING
2775 012342  042737  000400  177730          BIC     #BIT08,DCSR                     ; EXIT DIAGNOSTIC MODE
2776
```

```
                                .SBTTL TEST - TAG REGISTERS
                                ;
                                ;* THIS TEST WILL AUTOSIZE MEMORY IN 128K WORDS. THEN DEPENDING
                                ;* ON THE AMOUNT OF MEMORY AVAILABLE, A PATTERN OF ALTERNATING 0'S
                                ;* AND 1'S WILL BE CONSTRUCTED TO VERIFY THE TAG REGISTERS.
                                ;
                                ;  BGNTST
                                ;
                                ;       SAVE TIMEOUT VECTOR
                                ;       ENABLE MMU
                                ;       LET R1 = KIPAR6
                                ;       REPEAT TO CONSTRUCT A MASK FOR NXM FOR MAPHO1
                                ;       .  LET R1 = R1 SHIFT.LEFT BY #1
                                ;       .  LET R1 = R1 + KIPAR6
                                ;       UNTIL CARRY SET
                                ;       SWAP R1
                                ;       LET R1 = R1 SHIFT.RIGHT BY #3 TO GET BITS<21-16> FROM <21-13>
                                ;       LET KMCR<6> = #1 TO ENABLE CACHE
                                ;       LET R2 = #TBLML FOR PATTERNS FOR LOW REGISTER
                                ;       LET R3 = #TBLMH FOR PATTERNS FOR HIGH REGISTER
                                ;       DO FOR ALL 16 PATTERNS
                                ;       .  DO FOR 4 PATTERNS
                                ;       .  .  LET MAPLO1 = (R2)+
                                ;       .  .  LET MAPHO1 = (R3)+
                                ;       .  .  LET MAPHO1 = MAPHO1 CLEAR.BY R1 NOT TO GET NXM
                                ;       .  .  DO DIAGNOSTIC_DATA_IN TO ALLOCATE TAG PATTERN
                                ;       .  ENDDO
                                ;       .  MOVE POINTERS THRU PATTERN TABLE TO PREVIOUS 4 WORDS
                                ;       .  ENABLE 22-BIT MMU
                                ;       .  DO FOR 4 PATTERNS
                                ;       .  .  LET MAPLO1 = (R2)+
                                ;       .  .  LET MAPHO1 = (R3)+
                                ;       .  .  LET MAPHO1 = MAPHO1 CLEAR.BY R1 NOT TO GET NXM
                                ;       .  .  DO DIAGNOTIC_DATA_IN FROM IN CACHE
                                ;       .  .  IF NOT A HIT THEN
                                ;       .  .  .  ERROR IN TAG REGISTERS
                                ;       .  ENDDO
                                ;       .  DISABLE 22-BIT MMU
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------

                                ;;*********************************************************************
                                ;*TEST 31       TAG REGISTERS
                                ;;*********************************************************************
    012350  000004              TST31:  SCOPE

012352  005737  001720                  TST     PMIS                            ; ANY PMI MEMORY?
012356  001002                          BNE     1$                              ; YES
012360  000137  012670                  JMP     100$                            ; IF NONE, EXIT TEST
012364  032737  000040  177734  1$:     BIT     #BIT05,KMCR                     ; 18-BIT MODE?
012372  001177                          BNE     TST32           ;; IF YES, EXIT TEST
012374  052737  000400  177730          BIS     #BIT08,DCSR                     ; SELECT DIAGNOSTIC MODE
012402  004737  002276                  JSR     PC,MAPPR                        ; REMAP PROGRAM AREA
012406  005237  177572                  INC     MMR0                            ; ENABLE MMU
```

```
2832 012412  052737  000020  172516          BIS     #BIT04,MMR3                     ; ENABLE 22-BIT
2833 012420  022737  000040  001720          CMP     #40,PMIS                        ; IF 2M PRESENT, ONLY 21ST MASKED
2834 012426  001412                          BEQ     5$                              ; DON'T CONSTRUCT MASK
2835                                 ;
2836                                 ; IF LESS THEN 2M OF MEMORY, MAKE UP A MASK FOR MAP HIGH REGISTERS
2837                                 ;
2838 012430  000241                          CLC                                     ; CLEAR CARRY
2839 012432  013701  001720                  MOV     PMIS,R1                         ; SAVE KIPAR6
2840 012436  006101                  4$:     ROL     R1                              ; . ROTATE LEFT R1
2841 012440  053701  001720                  BIS     PMIS,R1                         ; . AND ADD BIT AT FIRST POSITION
2842 012444  103374                          BHIS    4$                              ; . IF CARRY NOT SET, BRANCH
2843 012446  000301                          SWAB    R1                              ; <15-8><---><7-0>
2844 012450  006001                          ROR     R1                              ; NOW GET ADDRESS BITS <21-16>
2845 012452  006001                          ROR     R1                              ; FROM <21-14>
2846                                 ;
2847                                 ; ALLOCATE DIFFERENT PATTERNS IN TAG REGISTERS
2848                                 ;
2849 012454  042737  000100  177734  5$:     BIC     #BIT06,KMCR                     ; DISABLE CACHE
2850 012462  052737  000100  177734          BIS     #BIT06,KMCR                     ; ENABLE CACHE
2851 012470  042737  000400  177734          BIC     #BIT08,KMCR                     ; MAKE SURE THAT VALID READ
2852 012476  052737  000040  172516          BIS     #BIT05,MMR3                     ; ENABLE MAPPING
2853 012504  012702  012672                  MOV     #TBLML,R2                       ; POINTER FOR LOW MAP PATTERNS
2854 012510  012703  012732                  MOV     #TBLMH,R3                       ; POINTER FOR HIGH MAP PATTERNS
2855 012514  010137  001160                  MOV     R1,$TMP0                        ; SAVE THE MASK
2856 012520  012704  000004                  MOV     #4,R4                           ; COUNTER FOR 16 PATTERNS
2857 012524  012701  020000          6$:     MOV     #20000,R1                       ; . TO ACCESS THRU MAP REG. 1
2858 012530  012705  000004                  MOV     #4,R5                           ; . DO EACH FOR AT A TIME
2859 012534  012237  170204          7$:     MOV     (R2)+,MAPL01                    ; . . LOAD LOW MAP
2860 012540  012337  170206                  MOV     (R3)+,MAPH01                    ; . . LOAD HIGH MAP
2861 012544  043737  001160  170206          BIC     $TMP0,MAPH01                    ; . . MASK OUT NXM
2862 012552  004737  002254                  JSR     PC,DDIN                         ; . . DO DIAGNOSTIC DATI
2863 012556  077512                          SOB     R5,7$                           ; . . DO FOR ALL 4 PATTERNS
2864 012560  013701  177734                  MOV     KMCR,R1                         ; . STORE SETS VALID?
2865 012564  005101                          COM     R1                              ; . COMPLEMENT VALID BITS
2866 012566  032701  017000                  BIT     #17000,R1                       ; . THAT'S ALL VALID BITS
2867 012572  001401                          BEQ     8$                              ; . IF ALL SET BEFORE COM, BRANCH
2868 012574  104027                          ERROR   +27                             ; . NOT ALL VALID BITS SET
2869                                 ;
2870                                 ; NOW INVALIDATE BY WRITING TO THE SAME LOCATIONS
2871                                 ;
2872 012576  162702  000010          8$:     SUB     #10,R2                          ; . MOVE POINTER TO -4
2873 012602  162703  000010                  SUB     #10,R3                          ; . MOVE HIGH MAP POINTER TOO
2874 012606  012705  000004                  MOV     #4,R5                           ; . VALIDATE ALLOCATED PATTERNS
2875 012612  012701  020000                  MOV     #20000,R1                       ; . POINTER TO MAP 1
2876 012616  012237  170204          9$:     MOV     (R2)+,MAPL01                    ; . . LOAD LOW MAP
2877 012622  012337  170206                  MOV     (R3)+,MAPH01                    ; . . LOAD HIGH MAP
2878 012626  043737  001160  170206          BIC     $TMP0,MAPH01                    ; . . MASK OUT NXM
2879 012634  004737  002254                  JSR     PC,DDIN                         ; . . DO DAIGN. DATA IN
2880 012640  032737  100000  177734          BIT     #BIT15,KMCR                     ; . . HIT?
2881 012646  001001                          BNE     10$                             ; . . IF HIT, BRANCH
2882 012650  104027                          ERROR   +27                             ; . . IN TAG REGISTERS
2883 012652  077517                  10$:    SOB     R5,9$                           ; . . DO FOR ALL 4 PATTERNS
2884 012654  077455                          SOB     R4,6$                           ; . REPEAT FOR ALL 16 PATTERNS
2885 012656  005037  177572                  CLR     MMR0                            ; DISABLE MMU
2886 012662  042737  000400  177730          BIC     #BIT08,DCSR                     ; EXIT DIAGNOSTIC MODE
2887 012670                          100$:
     012670  000440                          BR      TST32           ;;      EXIT TEST
```

```
                                        ;
                                        ; PATTERNS FOR LOW MAP REGISTER
                                        ;
012672  125240  052520  000000  TBLML:  .WORD   125240,52520,0,177760          ; FIRST PATTERN THRU 4 TAGS
012700  177760
012702  052520  000000  177760          .WORD   52520,0,177760,125240          ; SECOND PATTERN
012710  125240
012712  000000  177760  125240          .WORD   0,177760,125240,52520          ; THIRD
012720  052520
012722  177760  125240  052520          .WORD   177760,125240,52520,0          ; FOURTH
012730  000000
                                        ;
                                        ; PATTERNS FOR HIGH MAP REGISTER
                                        ;
012732  000052  000025  000000  TBLMH:  .WORD   52,25,0,77                      ; FIRST FOR HIGH MAP REGISTER
012740  000077
012742  000025  000000  000077          .WORD   25,0,77,52                     ; SECOND
012750  000052
012752  000000  000077  000052          .WORD   0,77,52,25                     ; THIRD
012760  000025
012762  000077  000052  000025          .WORD   77,52,25,0                     ; FOURTH
012770  000000
```

```
2904                            .SBTTL  TEST - CACHE RAM BIT PATTERN TEST
2905
2906                            ;* THIS TEST IS DONE TO CHECK THE OPERATION OF
2907                            ;* THE CACHE RAM . BIT PATTERNS 0,177777,52525
2908                            ;* AND 125252 ARE WRITTEN TO ALL OF THE MEMORY
2909                            ;* USED AND THEN VERIFIED
2910                            ;
2911                            ;  BGNTST
2912                            ;
2913                            ;*
2914                            ;* GO SET UP THE CACHE IMAGE TABLE
2915                            ;*
2916                            ;       LET R0 := #CTBLE
2917                            ;       REPEAT
2918                            ;       .  IF R0 POINTS TO OCTAL BOUNDARY ADDRESS THEN
2919                            ;       .  .  WE HAVE FOUND THE BEGINNING OF THE TABLE
2920                            ;       .  ELSE
2921                            ;       .  .  POINT R0 TO THE NEXT ADDRESS
2922                            ;       .  ENDIF
2923                            ;       UNTIL WE HAVE FOUND BEGINNING OF THE TABLE
2924                            ;*
2925                            ;* SET UP BOARD FOR THE TRANSFERS
2926                            ;*
2927                            ;       ENABLE UNIBUS MAPPING
2928                            ;       ENABLE DIAGNOSTIC MODE
2929                            ;       ENABLE CACHE
2930                            ;       DO FOR PATTERN := 0,177777,52525,125252
2931                            ;*
2932                            ;* INITIALIZE THE CACHE TABLE
2933                            ;*
2934                            ;       .  DO FOR ALL OF THE CACHE TABLE
2935                            ;       .  .  WRITE PATTERN TO TABLE
2936                            ;       .  ENDDO
2937                            ;*
2938                            ;* ALLOCATE ALL THE CACHE
2939                            ;*
2940                            ;       .  DO UNTIL ALL CACHE ALLOCATED
2941                            ;       .  .  DO A DIAGNOSTIC DATI NPR CYCLE (ON OCTAL BOUNDARY)
2942                            ;       .  ENDDO
2943                            ;*
2944                            ;* CHECK THAT THE DATA GOT CACHED CORRECTLY
2945                            ;*
2946                            ;       .  DO FOR ALL OF THE CACHE TABLE
2947                            ;       .  .  DO A DIAGNOSTIC DATI NPR CYCLE
2948                            ;       .  .  IF DDR NEQ PATTERN THEN
2949                            ;       .  .  .  ERROR IN CACHE RAM
2950                            ;       .  .  ENDIF
2951                            ;       .  ENDDO
2952                            ;      ENDDO
2953                            ;
2954                            ;  ENDTST
2955                            ;
2956                            ;---------------------------------------------------------------
2957
2958                            ;;*****************************************************************
                                ;*TEST 32       CACHE RAM BIT TEST
                                ;;*****************************************************************
```

```
T32     CACHE RAM BIT TEST

        012772  000004                  TST32:  SCOPE
   2959 012774  005737  001720                  TST     PMIS            ; ANY PMI MEMORY?
   2960 013000  001511                          BEQ     TST33           ;; IF NONE, EXIT TEST
   2961                                 ;
   2962                                 ; FIND THE FIRST OCTAL BOUNDARY ADDRESS IN THE TABLE
   2963                                 ;
   2964 013002  052737  000400  177730          BIS     #BIT08,DCSR     ; SELECT DIAGNOSTIC MODE
   2965 013010  012700  002054                  MOV     #CTBLE,R0       ; GET POINTER TO THE START OF THE SPACE ALLOCATED FOR THE CA
CHE TABLE
   2966 013014  010001                  5$:     MOV     R0,R1           ; SAVE IT IN R1 FOR WORKING
   2967 013016  042701  177760                  BIC     #177760,R1      ; MASK IN THE LEAST SIGNIFICANT DIGIT
   2968 013022  005701                          TST     R1              ; IS THE ADDRESS ON AN OCTAL BOUNDARY ?
   2969 013024  001402                          BEQ     10$             ; YES,THEN GO SET UP THE TABLE ADDRESSES
   2970 013026  005720                          TST     (R0)+           ; NO,THEN GET THE NEXT ADDRESS
   2971 013030  000771                          BR      5$              ; . GO CHECK IF IT FALLS ON AN OCTAL BOUNDARY
   2972 013032  012702  002172          10$:    MOV     #OBADR,R2       ; GET POINTER TO THE OCTAL BOUNDARY TABLE
   2973 013036  012703  000004                  MOV     #4,R3           ; SET UP THE LOOP COUNTER
   2974 013042  010022                  12$:    MOV     R0,(R2)+        ; . GO PUT ADDRESS INTO THE TABLE
   2975 013044  062700  000020                  ADD     #20,R0          ; . GET NEXT OCTAL BOUNDARY
   2976 013050  077304                          SOB     R3,12$          ; . FILL UP THE TABLE ?
   2977                                 ;
   2978                                 ; INITIALIZE THE BOARD FOR THE TRANSFERS
   2979                                 ;
   2980 013052  052737  000040  172516          BIS     #BIT5,@#MMR3    ; ENABLE UNIBUS MAPPING
   2981 013060  005037  170202                  CLR     MAPH00          ; CLEAR HIGH MAP REGISTER
   2982 013064  052737  000400  177730          BIS     #BIT8,DCSR      ; ENABLE DIAGNOSTIC MODE
   2983 013072  052737  000100  177734          BIS     #BIT6,KMCR      ; ENABLE THE CACHE
   2984 013100  012700  001774                  MOV     #PTRN16,R0      ; GET POINTER TO THE CACHE PATTERN TABLE
   2985 013104  013701  002172          15$:    MOV     OBADR,R1        ; GET POINTER TO THE CACHE IMAGE TABLE
   2986                                 ;
   2987                                 ; INITIALIZE THE CACHE IMAGE TABLE TO CURRENT PATTERN
   2988                                 ;
   2989 013110  012702  000040                  MOV     #40,R2          ; . SET UP LOOP COUNTER
   2990 013114  011021                  20$:    MOV     (R0),(R1)+      ; . . MOVE PATTERN TO TABLE
   2991 013116  077202                          SOB     R2,20$          ; . . HAVE WE DONE IT 40 TIMES ?
   2992                                 ;
   2993                                 ; ALLOCATE ALL THE CACHE MEMORY AVAILABLE
   2994                                 ;
   2995 013120  012702  002172                  MOV     #OBADR,R2       ; . GET ADDRESS OF OCTAL BOUNDARIRES WITHIN THE TAB;E
   2996 013124  012703  000004                  MOV     #4,R3           ; . SET UP LOOP COUNTER
   2997 013130  005001                          CLR     R1              ; . NON-MAPPED ADDRRESS=0
   2998 013132  012237  170200          25$:    MOV     (R2)+,MAPL00    ; . . SET UP MAP FOR DIAG NPR DATI CALL
   2999 013136  004737  002254                  JSR     PC,DDIN         ; . . GO DO A DIAGNOSTIC DATA IN CYCLE
   3000 013142  077305                          SOB     R3,25$          ; . . HAVE WE DONE IT 4 TIMES ?
   3001                                 ;
   3002                                 ; CHECK THE CACHE RAM IMAGE PATTERN
   3003                                 ;
   3004 013144  012703  000040                  MOV     #40,R3          ; . SET UP LOOP COUNTER
   3005 013150  013702  002172                  MOV     OBADR,R2        ; . GET ADDRESS OF CACHE IMAGE TABLE
   3006                                                                 ;   (THIS WHOLE TABLE SHOULD BE CACHED)
   3007 013154  005001                          CLR     R1              ; . USE ADDRESS 0
   3008 013156  010237  170200          30$:    MOV     R2,MAPL00       ; . . GET ADDRESS FPR DIAG. DATA IN CYCLE
   3009 013162  004737  002254                  JSR     PC,DDIN         ; . . GO DO A DIAGNOSTIC DATA IN
   3010 013166  032737  100000  177734          BIT     #BIT15,KMCR     ; . . HIT?
   3011 013174  001001                          BNE     35$             ; . . IF YES, BRANCH
   3012 013176  104030                          ERROR   +30             ; . . OTHERWISE, ERROR
   3013 013200  023722  177732          35$:    CMP     DDR,(R2)+       ; . . DID IT GET STORED CORRECTLY ?
   3014 013204  001401                          BEQ     40$             ; . . YES,THEN GO CHECK THE NEXT LOCATION
```

J6

SEQ 0074

T32 CACHE RAM BIT TEST

```
3015 013206  104030                    ERROR   +30             ; . . NO,THEN ERROR IN CACHE RAM
3016 013210  077316              40$:   SOB     R3,30$          ; . . HAVE WE CHECKED ALL THE RAM ?
3017 013212  005720                     TST     (R0)+           ; . ALL PATTERNS DONE?
3018 013214  001333                     BNE     15$             ; . IF NOT HAVE DONE, BRANCH
3019 013216  042737  000400  177730     BIC     #BIT08,DCSR     ; EXIT DIAGNOSTIC MODE
3020
```

```
                                .SBTTL TEST - BOOT ROMS TEST

                                ;* THIS TEST CHECKS FOR THE PRESENCE OF BOOT ROMS.  IF THEY ARE FOUND,
                                ;* A CRC TEST IS PERFORMED FOR ALL THE ROM'S.
                                ;
                                ;  BGNTST
                                ;
                                ;       LET BCSR = BCSR SET.BY #BIT05 TO ENABLE ACCESSING OF ROM'S
                                ;       LET PCR = #0 TO ACCESS FIRST PAGE
                                ;       LET R4 = #173000 FOR STARTING ADDRESS
                                ;       LET $TMPO = #0 TO CLEAR COUNT FOR EMPTY ROM'S
                                ;       DO FOR ALL 4 POSSIBLE ROMS
                                ;       .  IF (R4) EQ #161777 (EMPTY SOCKET) THEN
                                ;       .  .  INCREMENT $TMPO TO COUNT EMPTY ROM'S
                                ;       .  .  IDENTIFY POSITION OF EMPTY SOCKET
                                ;       .  ELSE
                                ;       .  .  LET R1 = #0 TO COUNT BYTES IN ROMS
                                ;       .  .  DO FOR EACH LOCATION IN A ROM UNTILL R1=128
                                ;       .  .  .  IF LOCATION 24 ACCESSED THEN
                                ;       .  .  .  .  IF (R4) NE #173000 THEN
                                ;       .  .  .  .  .  ERROR IN LOCATION 24
                                ;       .  .  .  .  ENDIF
                                ;       .  .  .  .  INCREMENT R1 NOT TO DO BYTE 25
                                ;       .  .  .  ELSE
                                ;       .  .  .  .  CALCULATE CRC FOR THE BYTE
                                ;       .  .  .  ENDIF
                                ;       .  .  .  INCREMENT R1 FOR THE NEXT BYTE
                                ;       .  .  ENDDO
                                ;       ENDDO
                                ;       IF $TMPO NE #4 NOT ALL EMPTY
                                ;       .  TRY TO WRITE TO @#173000 IN DIAGNOSTIC MODE AND OUT
                                ;       .  IF NO TIMEOUT THEN
                                ;       .  .  ERROR WRITE ACCESS TO ROMS DOES NOT TIMEOUT
                                ;       .  ENDIF
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------

013224                          UBETST:
                                ;;*************************************************************
                                ;*TEST 33       BOOT ROMS TEST
                                ;;*************************************************************
013224  000004                  TST33:  SCOPE
                                ;
                                ; PREPARE TO DO CRC
                                ;
013226  042737  000410  177730          BIC     #BIT08!BIT03,DCSR       ; LEAVE STANDALONE MODE AND ENABLE ROMS
013234  052737  000200  177520          BIS     #BIT07,BCSR             ; TO ENABLE BOOT ROMS
013242  005037  177522                  CLR     PCR                     ; TO READ PAGE 0
013246  012704  173000                  MOV     #173000,R4              ; R4 POINTS TO FIRST ADDRESS
013252  005037  001160                  CLR     $TMPO                   ; CLEAR EMPTY SOCKET COUNT
                                ;
                                ; DO FOR EACH POSSIBLE ROM
                                ;
```

```
3075 013256  022704  173776          1$:     CMP     #173776,R4              ; . ALL ROM'S DONE?
3076 013262  103475                          BLO     11$                     ; . IF SO, EXIT
3077 013264  005001                          CLR     R1                      ; . CLEAR COUNTER THRU A ROM
3078 013266  005005                          CLR     R5                      ; . INITIALIZE PARTIAL CRC
3079                                 ;
3080                                 ; CHECK FOR EMPTY SOCKETS AND EXIT IF SO
3081                                 ;
3082 013270  022714  161777                  CMP     #161777,(R4)            ; . EMPTY SOCKET?
3083 013274  001027                          BNE     3$                      ; . IF NOT, BRANCH TO DO CRC
3084 013276  005737  001206                  TST     $PASS                   ; . FIRST PASS?
3085 013302  001017                          BNE     2$                      ; . IF NOT, BRANCH
3086 013304  122737  000001  001220          CMPB    #APTENV,$ENV            ; IN APT MODE?
3087 013312  001413                          BEQ     2$                      ; IF SO, SKIP PRINTOUT
3088 013314  032737  000040  000052          BIT     #BIT05,@#52             ; . IN UFD MODE?
3089 013322  001007                          BNE     2$                      ; . IF IN UFD, BRANCH
3090 013324  010446                          MOV     R4,-(SP)                ; . PUT NUMBER TO TYPE OUT
3091 013326  104401  013612                  TYPE    ,NROM                   ; . TYPE ASCII MESSAGE
3092 013332  104403                          TYPOS                           ; . CALL TYPE OUT ROUTINE
3093 013334     006                          .BYTE   6                       ; . TYPE 6 DIGITS
3094 013335     000                          .BYTE   0                       ; . SUPRESS LEADING 0'S
3095 013336  104401  001175                  TYPE    ,$CRLF                  ; . CARRIAGE RETURN
3096 013342  005237  001160          2$:     INC     $TMP0                   ; . INCREMENT EMPTY SOCKET COUNT
3097 013346  062704  000200                  ADD     #200,R4                 ; . PREPARE TO DO NEXT ROM
3098 013352  000741                          BR      1$                      ; . BRANCH TO DO NEXT ROM
3099                                 ;
3100                                 ; IN EACH ROM CHECK LOCATION 24 AND DON'T DO CRC ON IT
3101                                 ;
3102 013354  022701  000024          3$:     CMP     #24,R1                  ; . LOCATION 24 ACCESSED?
3103 013360  001007                          BNE     5$                      ; . IF NO, GO DO CRC
3104 013362  022724  173000                  CMP     #173000,(R4)+           ; . PROPER DATA AT 24?
3105 013366  001401                          BEQ     4$                      ; . IF YES, BRANCH
3106 013370  104031                          ERROR   +31                     ; . WRONG DATA AT 24
3107 013372  005201                  4$:     INC     R1                      ; . INCREMENT FOR AN EXTRA BYTE
3108 013374  000137  013434                  JMP     8$                      ; . DO NOT DO CRC FOR 24
3109                                 ;
3110                                 ; DO CRC FOR EACH BYTE
3111                                 ;
3112 013400  112403                  5$:     MOVB    (R4)+,R3                ; . STORE CORRECT DATA IN R3
3113 013402  012702  000010                  MOV     #8.,R2                  ; . NUMBER OF BITS PER BYTE
3114 013406  000241                  6$:     CLC                             ; . . CLEAR CARRY
3115 013410  006005                          ROR     R5                      ; . . LOW BIT PARTIAL TO CARRY
3116 013412  006003                          ROR     R3                      ; . . CARRY TO BYTE AND BYTE TO CARRY
3117 013414  102006                          BVC     7$                      ; . . XOR OF PARIAL AND BYTE LOW BITS
3118 013416  012746  120001                  MOV     #POLY,-(SP)             ; . . XOR POLY TO PARTIAL (4 INSTRUCTIONS)
3119 013422  040516                          BIC     R5,(SP)                 ; . . NOT PARTIAL AND POLY
3120 013424  042705  120001                  BIC     #POLY,R5                ; . . NOT POLY AND PARTIAL
3121 013430  052605                          BIS     (SP)+,R5                ; . . POLY XOR PARTIAL
3122 013432  077213                  7$:     SOB     R2,6$                   ; . . DECREMENT BIT COUNT AND CONTINUE
3123 013434  005201                  8$:     INC     R1                      ; . COUNT BYTES
3124                                 ;
3125                                 ; IF A ROM DONE, CHECK FOR 0 IN R5
3126                                 ;
3127 013436  022701  000200                  CMP     #128.,R1                ; . ALL 64 WORDS DONE?
3128 013442  003344                          BGT     3$                      ; . IF NOT, BRANCH
3129 013444  005705                          TST     R5                      ; . IF YES, CRC 0?
3130 013446  001401                          BEQ     10$                     ; . IF CRC = 0, BRANCH
3131 013450  104031                          ERROR   +31                     ; . CRC FOR A ROM NOT EQUAL TO 0
```

```
3132 013452  000137  013256          10$:   JMP     1$                      ; . DO FOR NEXT ROM
3133                                ;
3134                                ; TRY TO WRITE TO GET A TIMEOUT
3135                                ;
3136 013456  013737  000004  001160 11$:   MOV     ERRVEC,$TMP0            ; SAVE TIMEOUT VECTOR
3137 013464  012737  013502  000004        MOV     #15$,ERRVEC             ; POINT NEW TO PROGRAM
3138 013472  005037  173000          14$:   CLR     @#173000                ; TRY TO WRITE TO 1ST PAGE OF ROM
3139 013476  104031                        ERROR   +31                     ; WRITE ACCESS TO ROM'S DIDN'T TIMEOUT
3140 013500  000402                        BR      16$                     ;
3141 013502  005726          15$:   TST     (SP)+                   ; RESTORE STACK
3142 013504  005726                 TST     (SP)+                   ;
3143 013506  032737  000400  177730 16$:   BIT     #BIT08,DCSR             ; OUT OF STANDALONE MODE?
3144 013514  001013                        BNE     20$                     ; IF NOT, EXIT TEST
3145 013516  013702  177734                MOV     KMCR,R2                 ; MAKE SURE THAT
3146 013522  042702  177700                BIC     #177700,R2              ; AT LEAST SOME OF
3147 013526  022702  000077                CMP     #77,R2                  ; MEMORY PMI
3148 013532  001404                        BEQ     20$                     ; IF NOT, BRANCH
3149 013534  052737  000400  177730        BIS     #BIT08,DCSR             ; DO 1 MORE TIME IN STANDALONE MODE
3150 013542  000753                        BR      14$                     ;
3151 013544  052737  000010  177730 20$:   BIS     #BIT03,DCSR             ; DISABLE UBA ROM RESPONSE
3152 013552  012737  013570  000004        MOV     #25$,ERRVEC             ; POINT NEW TIMEOUT VECTOR
3153 013560  005737  173000                TST     @#173000                ; READ BOOT ROM
3154 013564  104037                        ERROR   +37                     ; DSCR<3> DIDN'T DISABLE UBA ROM
3155 013566  000402                        BR      26$                     ;
3156 013570  005726          25$:   TST     (SP)+                   ; RESTORE STACK
3157 013572  005726                 TST     (SP)+
3158 013574  042737  000410  177730 26$:   BIC     #BIT08!BIT03,DCSR       ; LEAVE STANDALONE MODE
3159 013602  013737  001160  000004        MOV     $TMP0,ERRVEC            ; RESTORE STACK
3160 013610  000417                        BR      TST34           ;; EXIT TEST
3161
3162 013612     101     104     104 NROM:  .ASCIZ  /ADDRESS OF EMPTY UBA SOCKET /
     013615     122     105     123
     013620     123     040     117
     013623     106     040     105
     013626     115     120     124
     013631     131     040     125
     013634     102     101     040
     013637     123     117     103
     013642     113     105     124
     013645     040     000
3163                                .EVEN
```

```
                                .SBTTL TEST - UNIBUS MEMORY TEST

                                ;* THIS TEST READS KMCR<5-0> TO FIND OUT HOW MUCH UNIBUS MEMORY IS
                                ;* AVAILABLE. THEN ALTERNATING 0'S AND 1'S WILL BE WRITTEN AND READ
                                ;* FROM MEMORY. IF THE SYSTEM CONTAINS ALL UNIBUS MEMORY, THE FIRST
                                ;* 32K ARE NOT GOING TO TESTED.
                                ;
                                ;  BGNTST
                                ;       IF KMCR<5-0> = <0-0> THEN NO UNIBUS MEMORY
                                ;       .  EXIT TEST
                                ;       ENDIF
                                ;       IF KMCR<5-0> = <1-1> THEN ALL UNIBUS MEMORY
                                ;       .  LET R1 = #1600 LOWER BOUNDARY FOR PAR
                                ;       .  LET R2 = #7600 HIGH BOUNDARY FOR PAR
                                ;       ELSE
                                ;       .  LET R1 = COMPLEMENT(KMCR<4-0>)
                                ;       .  LET R1 = R1 SHIFT.LEFT BY #7 TO GET LOWER BOUNDARY PAR
                                ;       .  LET R2 = #7600 HIGH BOUNDARY
                                ;       .  IF KMCR<5> = #0 THEN 22 BIT MODE
                                ;       .  .  LET R1 = R1 SET.BY #BIT15!BIT14!BIT13!BIT12 FOR 22 BITS
                                ;       .  .  LET R2 = R2 SET.BY #BIT15!BIT14!BIT13!BIT12
                                ;       .  ENDIF
                                ;       ENDIF
                                ;       LET MMR0<0> = #1 TO ENABLE MMU
                                ;       REMAP PROGRAM AREA
                                ;       DO FOR KIPAR6 FROM R1 TO R2
                                ;       .  DO FOR R4 FROM #140000 TO #157776 BY #2 FOR 4K THRU KIPAR6
                                ;       .  .  LET (R4) = #125252 TO WRITE A PATTERN
                                ;       .  .  IF (R4) NE #125252 THEN
                                ;       .  .  .  ERROR IN UNIBUS MEMORY
                                ;       .  .  ENDIF
                                ;       .  .  LET (R4) = COMPLEMENT <(R4)>
                                ;       .  .  IF (R4) NE #52525 THEN
                                ;       .  .  .  ERROR IN UNIBUS MEMORY
                                ;       .  .  ENDIF
                                ;       .  ENDDO
                                ;       ENDDO
                                ;       DISABLE MMU
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------

                                ;;*********************************************************************
                                ;*TEST 34       UNIBUS MEMORY TEST
                                ;;*********************************************************************
013650  000004                  TST34:  SCOPE
                                ;
                                ; CHECK IF ALL NON-UNIBUS MEMORY
                                ;
013652  032737  000037  177734          BIT     #37,KMCR                ; BITS <5-0> CLEAR?
013660  001473                        BEQ     TST35           ;;      IF YES, SKIP TEST
                                ;
                                ; CHECK IF ALL UNIBUS MEMORY
                                ;
013662  013701  177734                  MOV     KMCR,R1                 ; SAVE KMCR
```

```
 3219 013666  042701  177700                BIC     #177700,R1              ; LEAVE ONLY <5-0>
 3220 013672  022701  000077                CMP     #77,R1                  ; BITS <5-0> ALL SET?
 3221 013676  001005                        BNE     1$                      ; IF NOT, BRANCH
 3222 013700  012701  001600                MOV     #1600,R1                ; DON'T TEST FIRST 32K
 3223 013704  012702  007600                MOV     #7600,R2                ; 248KB MAXIMUM CONFIGURATION
 3224 013710  000420                        BR      2$                      ; GO DO TEST
 3225 013712  004737  002456          1$:   JSR     PC,UMSIZ                ; SIZE UNIBUS MEMORY
 3226                                       ;
 3227                                       ; ON RETURN R2 HAS PAR VALUE FOR UNIBUS MEMORY
 3228                                       ;
 3229 013716  010201                        MOV     R2,R1                   ; STORE LOWER BOUNDARY
 3230 013720  012702  007600                MOV     #7600,R2                ; HIGHER BOUNDARY
 3231 013724  032737  000040  177734        BIT     #BIT05,KMCR             ; 18 BIT MODE?
 3232 013732  001007                        BNE     2$                      ; IF YES, GO DO TEST
 3233 013734  052701  170000                BIS     #170000,R1              ; EXTEND TO 22 BITS
 3234 013740  052702  170000                BIS     #170000,R2              ; FOR HIGHER BOUNDARY TOO
 3235 013744  052737  000020  172516        BIS     #BIT04,MMR3             ; ENABLE 22 BIT MAPPING
 3236                                       ;
 3237                                       ; NOW WRITE MEMORY WITH 01 PATTERN, VERIFY IT AND DO THE SAME FOR 10 PATTERN
 3238                                       ;
 3239 013752  004737  002276          2$:   JSR     PC,MAPPR                ; REMAP PROGRAM TO FIRST 32K
 3240 013756  005237  177572                INC     MMR0                    ; ENABLE MMU
 3241 013762  010137  172354                MOV     R1,KIPAR6               ; START AT LOWER BOUNDARY
 3242 013766  012704  140000          3$:   MOV     #140000,R4              ; . START 4K PAGE
 3243 013772  012714  125252          4$:   MOV     #125252,(R4)            ; . . WRITE FIRST PATTERN
 3244 013776  022714  125252                CMP     #125252,(R4)            ; . . WRITEN OK?
 3245 014002  001401                        BEQ     5$                      ; . . IF OK, BRANCH
 3246 014004  104034                        ERROR   +34                     ; . . IN UNIBUS MEMORY
 3247 014006  005114          5$:   COM     (R4)                    ; . . COMPLEMENT INITIAL PATTERN
 3248 014010  022714  052525                CMP     #52525,(R4)             ; . . NEW PATTERN OK?
 3249 014014  001401                        BEQ     6$                      ; . . IF OK, BRANCH
 3250 014016  104034                        ERROR   +34                     ; . . IN UNIBUS MEMORY
 3251 014020  005724          6$:   TST     (R4)+                   ; . . GET NEXT MEMORY LOCATION
 3252 014022  022704  160000                CMP     #160000,R4              ; . . LAST ONE IN 4K PAGE?
 3253 014026  101361                        BHI     4$                      ; . . IF NOT, BRANCH
 3254 014030  062737  000200  172354        ADD     #200,KIPAR6             ; . GET NEXT PAGE
 3255 014036  020237  172354                CMP     R2,KIPAR6               ; . LAST PAGE DONE?
 3256 014042  101351                        BHI     3$                      ; . IF NOT, BRANCH
 3257 014044  005037  177572                CLR     MMR0                    ; DISABLE MMU
 3258
 3259                                   .SBTTL UBE TESTS FOR THE UNIBUS ADAPTER BOARD
 3260
 3261                                   ;*
 3262                                   ;* THE FOLLOWING TESTS REQUIRE THE USE OF THE UNIBUS EXERCISER
 3263                                   ;* TO TEST OUT THE UNIBUS ADAPTER BOARD.SOME TESTS REQUIRE ONE
 3264                                   ;* UBE OTHER TESTS REQUIRE TWO UBE'S.
 3265                                   ;*
 3266                                   ;* THE PROGRAM WILL AUTOSIZE TO SEE HOW MANY UBE'S ARE IN THE
 3267                                   ;* SYSTEM. DEPENDING ON THE RESULTS OF THE AUTOSIZING CERTAIN
 3268                                   ;* TESTS WILL BE SELECTED OR DESELECTED.
 3269                                   ;*
 3270                                   ;-------------------------------------------------------------
 3271
```

```
                        .SBTTL TEST - UBE AUTOSIZING ROUTINE

                        ;*
                        ;* THE FOLLOWING ROUTINE IS USED TO AUTOSIZE THE NUMBER OF
                        ;* UBE'S PRESENT IN THE SYSTEM.
                        ;*
                        ;
                        ;  BGNTST
                        ;
                        ;       LET R0 := #170000               ;1ST UBE ADDRESS
                        ;       LET R2 := #510                  ;1ST UBE VECTOR
                        ;       LET R1 := #BE1DB                ;TABLE FOR 1ST UBE
                        ;       LET R3 := #BE1VEC               ;LOCATION FOR FIRST UBE VECTOR
                        ;       LET 4  := #TOUT                 ;SETUP TIMEOUT VECTOR
                        ;       DO FOR R0 := #170000 TO 170160 BY 20
                        ;       .  TEST FOR (R0)                ;WILL TIMEOUT IF NOT THERE
                        ;       .  IF TIMEOUT OCCURS THEN
                        ;       .  .  LET R0 := R0 + 20         ;GET NEXT UBE ADDRESS
                        ;       .  .  LET R2 := R2 + 4          ;GET NEXT UBE VECTOR LOCATION
                        ;       .  .  LET (SP) := #CHECK
                        ;       .  ELSE
                        ;*
                        ;*  ASSIGN THE UBE ADDRESSES TO THE CURRENT UBE TABLE
                        ;*
                        ;       .  .  DO FOR R4 := 1 TO 5 BY 1
                        ;       .  .  .  LET (R1)+ := R0
                        ;       .  .  .  LET R0 := R0+2
                        ;       .  .  ENDDO
                        ;       .  .  LET R0 := R0 + 4          ;POINT TO LAST DEVICE ADDRESS
                        ;       .  .  LET (R1)+ := R0
                        ;       .  .  LET R0 := R0 + 2          ;POINT R0 TO NEXT UBE ADDRESSES
                        ;*
                        ;*  ASSIGN UBE VECTORS TO CURRENT UBE TABLE
                        ;*
                        ;       .  .  LET (R3)+ := R2           ;GET POINTER TO VECTOR ADDRESS
                        ;       .  .  LET R2 := R2 + 2          ;GET VECTOR PSW LOCATION
                        ;       .  .  LET (R3)+ := R2           ;GET POINTER TO VECTOR PSW
                        ;       .  .  LET R2 := R2 + 2          ;GET NEXT VECTOR ADDRESS
                        ;       .  .  IF WE HAVE FOUND TWO UBE'S THEN
                        ;       .  .  .  EXIT TEST
                        ;       .  .  ENDIF
                        ;       .  ENDIF
                        ;       ENDDO
                        ;  ENDTST
                        ;
                        ;-------------------------------------------------------------------------


                        ;;*********************************************************************
                        ;*TEST 35       UNIBUS EXERCISER AUTOSIZING ROUTINE
                        ;;*********************************************************************
    014050  000004      TST35:  SCOPE

3323 014052  042737  000400  177730        BIC     #BIT08,DCSR     ; MAKE SURE THAT OUT OF DIAGN. MODE
3324 014060  042737  000040  172516        BIC     #BIT05,MMR3     ; MAPPING DISABLED
3325 014066  005737  001206              TST     @#$PASS         ; IS THIS THE FIRST PASS ?
3326 014072  001051                      BNE     10$             ; NO,THEN NO NEED TO SIZE AGAIN
```

```
                                ;
                                ; INITIALIZE POINTERS FOR AUTO-SIZING
                                ;
014074  012700  170000          MOV     #170000,R0      ; GET ADDRESS OF FIRST POSSIBLE UBE
014100  012702  000510          MOV     #510,R2         ; GET VECTOR OF FIRST POSSIBLE UBE
014104  012701  002202          MOV     #BE1DB,R1       ; TABLE HEADER FOR 1ST UBE
014110  012737  014122  000004  MOV     #1$,@#4         ; SET UP TIMEOUT VECTOR
014116  005710          100$:   TST     (R0)            ; . IS THERE A UBE HERE ?
014120  000412                  BR      2$              ; . . YES,THEN BRANCH AROUND TOMEOUT ROUTINE
                                ;
                                ; TIMEOUT ROUTINE
                                ;
014122  062706  000004  1$:     ADD     #4,SP           ; . . READJUST THE STACK
014126  020027  170160          CMP     R0,#170160      ; . . HAVE WE CHECKED ALL THE ADDRESSES
014132  001431                  BEQ     10$             ; . . YES THEN GO SEE IF WE FOUND ANY UBE'S
014134  062700  000020          ADD     #20,R0          ; . . NO,THEN GET THE NEXT UBE ADDRESS
014140  062702  000004          ADD     #4,R2           ; . . GET THE NEXT UBE VECTOR
014144  000764                  BR      100$            ; . . GO SEE IF THE NEXT UBE IS THERE
                                ;
                                ; ASSIGN UBE ADDRESSES TO THE CURRENT UBE TABLE
                                ;
014146  012704  000005  2$:     MOV     #5,R4           ; . SET UP LOOP COUNTER
014152  010021          3$:     MOV     R0,(R1)+        ; . . ASSIGN AN ADDRESS TO THE POINTER
014154  005720                  TST     (R0)+           ; . . GET THE NEXT ADDRESS
014156  077403                  SOB     R4,3$           ; . . ARE WE DONE ? NO THEN GO GET NEXT ADDRESS
014160  062700  000004          ADD     #4,R0           ; . POINT R0 TO LAST UBE ADDRESS
014164  010021                  MOV     R0,(R1)+        ; . PUT THE ADDRESS INTO THE POINTER TABLE
014166  005720                  TST     (R0)+           ; . POINT R0 TO NEXT UBE ADDRESS
                                ;
                                ; ASSIGN UBE VECTORS TO CURRENT UBE TABLE
                                ;
014170  010221                  MOV     R2,(R1)+        ; . GET POINTER TO VECTOR ADDRESS
014172  005722                  TST     (R2)+           ; . GET THE VECTOR PSW LOCATION
014174  010221                  MOV     R2,(R1)+        ; . GET POINTER TO VECTOR PSW
014176  005722                  TST     (R2)+           ; . GET THE NEXT UBE'S VECTOR ADDRESS
014200  005237  001722          INC     UBECT           ; . FLAG WE HAVE FOUND ANOTHER UBE
                                ;
                                ; SEE IF WE HAVE FOUND TWO UBE'S
                                ;
014204  022737  000002  001722  CMP     #2,UBECT        ; . HAVE WE FOUND TWO UBE'S
014212  001401                  BEQ     10$             ; . GO DO THE UBE TESTS
014214  000740                  BR      100$
                                ;
                                ;  PROGRAM WILL CHECK IF ANY UBE'S WERE FOUND
                                ;
014216  012737  002266  000004  10$:    MOV     #TIMOUT,@#4     ; RESTORE TIMEOUT VECTOR
014224  005737  001722          TST     UBECT           ; HAVE ANY UBE'S BEEN FOUND ?
014230  001002                  BNE     TST36           ;; GO DO THE SELECTED TESTS FOR 1 UBE
014232  000137  023122          JMP     UBEM            ; SKIP ALL THE UBE TESTS
```

```
                                .SBTTL TEST - NPG ARBITRATION
                                ;
                                ;* THIS TEST CHECKS THAT A NPG CAN BE GRANTED AT ANY PRIORITY OF THE CPU.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       DO FOR PSW FROM #340 DOWNTO #0 BY #40
                                ;       .  LET @BE1CC = -1 TO DO 1 CYCLE
                                ;       .  LET @BE1BA = #$TMP0 FOR THE ADDRESS
                                ;       .  LET @BE1CR1 = #2041 TO DO 1 DATI
                                ;       .  WAIT FOR @BE1CR1<7>=1 READY
                                ;       .  IF @BE1CC EQ -1 THEN
                                ;       .  .  ERROR NPG DIDN'T HAPPEN
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*************************************************************
                                ;*TEST 36       NPG ARBITRATION
                                ;;*************************************************************
014236  000004                  TST36:  SCOPE

014240  004737  002502                  JSR     PC,IUBE                         ; INITIALIZE THE UBE
014244  012737  000340  177776          MOV     #340,PSW                        ; STORE PRIORITY 7
014252  012777  177777  165724  1$:     MOV     #-1,@BE1CC                      ; . DO FOR 1 CYCLE
014260  012777  001160  165720          MOV     #$TMP0,@BE1BA                   ; . STORE ADDRESS FOR DATI
014266  012777  002041  165714          MOV     #2041,@BE1CR1                   ; . DO 1 DATI AT NPG
014274  105777  165710          2$:     TSTB    @BE1CR1                         ; . . READY ON?
014300  100375                          BPL     2$                              ; . . WAIT FOR READY
014302  022777  177777  165674          CMP     #-1,@BE1CC                      ; . CYCLE COUNT INCREMENTED?
014310  001001                          BNE     3$                              ; . IF YES, BRANCH
014312  104032                          ERROR   +32                             ; . IF NO, ERROR IN NPG
014314  162737  000040  177776  3$:     SUB     #40,PSW                         ; . DECREMENT PRIORITY
014322  022737  000000  177776          CMP     #0,PSW                          ; . LAST ONE?
014330  003750                          BLE     1$                              ; . IF NOT, BRANCH
014332  012737  000340  177776          MOV     #340,PSW                        ; RESTORE PRIORITY
```

TEST - NO BUS GRANTS WITH PROCESSOR AT HIGHER PRIORITY

```
3424                            .SBTTL TEST - NO BUS GRANTS WITH PROCESSOR AT HIGHER PRIORITY
3425                            ;
3426                            ;* THIS TEST CHECKS THAT NO BUS REQUESTS ARE GOING TO BE HONORED
3427                            ;* WHEN THE PROCESSOR HAS HIGHER PRIORITY THAN THE REQUESTING DEVICE.
3428                            ;*
3429                            ;
3430                            ;  BGNTST
3431                            ;
3432                            ;       SET UP @BE1VEC TO POINT TO ERROR_CHECK_ROUTINE
3433                            ;       SET UP @BE1PSW TO #340
3434                            ;*
3435                            ;* TRY TO DO BR7 WITH CPU PRIORITY AT 7
3436                            ;*
3437                            ;       LET @BE1CR1 = #21 TO DO 1 DATI
3438                            ;       LET PSW = #340 TO SET PRIORITY AT 7
3439                            ;       DO "NOP"
3440                            ;       IF INTERUPT THEN
3441                            ;       .  ERROR BG7 GRANTED WITH PROCESSOR AT HIGHER PRIORITY
3442                            ;       ENDIF
3443                            ;
3444                            ;*
3445                            ;* TRY TO DO BR6 WITH CPU PRIORITY AT 7 - 6
3446                            ;*
3447                            ;       DO FOR R3 FROM #340 DOWNTO #300 BY #40
3448                            ;       .  LET @BE1CR1 = #11 TO DO 1 DATI
3449                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3450                            ;       .  DO "NOP"
3451                            ;       .  IF INTERRUPT  THEN
3452                            ;       .  .  ERROR BG6 GRANTED WITH PROCESSOR AT HIGHER PRIORITY
3453                            ;       .  ENDIF
3454                            ;       ENDDO
3455                            ;       LET PSW = #340 FOR THE NEXT PART
3456                            ;*
3457                            ;* TRY TO DO BR5 WITH CPU PRIORITY AT 7 - 5
3458                            ;*
3459                            ;       DO FOR R3 FROM #340 DOWNTO #240 BY #40
3460                            ;       .  LET @BE1CR1 = #5 TO DO 1 DATI
3461                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3462                            ;       .  DO "NOP"
3463                            ;       .  IF INTERRUPT THEN
3464                            ;       .  .  ERROR BG5 GRANTED WITH PROCESSOR AT HIGHER PRIORITY
3465                            ;       .  ENDIF
3466                            ;       ENDDO
3467                            ;       LET PSW = #340
3468                            ;*
3469                            ;* TRY TO DO BR4 WITH CPU PRIORITY AT 7 - 4
3470                            ;*
3471                            ;       DO FOR R3 FROM #340 DOWNTO #200 BY #40
3472                            ;       .  LET @BE1CR1 = #2003 TO DO 1 DATI
3473                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3474                            ;       .  DO "NOP"
3475                            ;       .  IF INTERRUPT THEN
3476                            ;       .  .  ERROR BR4 GRANTED WITH PROCESSOR AT HIGHER PRIORITY
3477                            ;       .  ENDIF
3478                            ;       ENDDO
3479                            ;
3480                            ;  ENDTST
```

TEST - NO BUS GRANTS WITH PROCESSOR AT HIGHER PRIORITY

```
                                        ;
                                        ;-------------------------------------------------------------
                                        ;;*************************************************************
                                        ;*TEST 37       NO BUS GRANTS WITH PROCESSOR AT HIGHER PRIORITY
                                        ;;*************************************************************
    014340  000004                      TST37:  SCOPE
                                        
014342  004737  002502                          JSR     PC,IUBE                 ; INITIALIZE THE UBE
014346  012737  000340  177776            MOV     #340,PSW                ; SET CPU PRIORITY AT 7
014354  012777  000340  165636            MOV     #340,@BE1PSW            ; AT PRIORITY 7
                                        ;
                                        ; TRY TO DO BR7 WITH CPU PRIORITY AT 7
                                        ;
014362  012777  014402  165626            MOV     #1$,@BE1VEC             ; POINT UBE VECTOR TO PROGRAM
014370  012777  000021  165612            MOV     #21,@BE1CR1             ; BR7 WITH FUNO
014376  000240                           NOP                             ; JUST IN CASE
014400  000405                           BR      2$                      ; BRANCH AROUND IF NO INTERRUPT
014402  005077  165602            1$:     CLR     @BE1CR1                 ; CLEAR ANY OTHER REQUESTS
014406  062706  000004                     ADD     #4,SP                   ; ADJUST STACK POINTER
014412  104032                           ERROR   +32                     ; BG7 GRANTED WITH CPU AT 7
                                        ;
                                        ; TRY TO DO BR6 WITH CPU PRIORITY AT 7-6
                                        ;
014414  012777  014444  165574    2$:     MOV     #4$,@BE1VEC             ; POINT UBE VECTOR TO PROGRAM
014422  012703  000340                   MOV     #340,R3                 ; START WITH PRIORITY AT 7
014426  012777  000011  165554    3$:     MOV     #11,@BE1CR1             ; . BR6 WITH FUNO
014434  010337  177776                   MOV     R3,PSW                  ; . CHANGE PRIORITY
014440  000240                           NOP                             ; . JUST IN CASE OF INTERRUPS
014442  000405                           BR      5$                      ; . IF NO INTERRUPS, BRANCH
014444  005077  165540            4$:     CLR     @BE1CR1                 ; . CLEAR ANY OTHER REQUESTS
014450  062706  000004                     ADD     #4,SP                   ; . ADJUST STACK POINTER
014454  104032                           ERROR   +32                     ; . BG6 GRANTED WITH CPU AT 6-7
014456  162703  000040            5$:     SUB     #40,R3                  ; . LOWER PRIORITY
014462  020327  000300                   CMP     R3,#300                 ; . LAST ONE TO CHECK?
014466  002357                           BGE     3$                      ; . IF NOT, BRANCH
                                        ;
                                        ; TRY TO DO BR5 WITH CPU PRIORITY AT 7-5
                                        ;
014470  012777  014520  165520            MOV     #7$,@BE1VEC             ; POINT UBE VECTOR TO PROGRAM
014476  012703  000340                   MOV     #340,R3                 ; START WITH PRIORITY AT 7
014502  012777  000005  165500    6$:     MOV     #5,@BE1CR1              ; . BR5 WITH FUNO
014510  010337  177776                   MOV     R3,PSW                  ; . CHANGE PRIORITY
014514  000240                           NOP                             ; . JUST IN CASE OF INTERRUPS
014516  000405                           BR      8$                      ; . IF NO INTERRUPS, BRANCH
014520  005077  165464            7$:     CLR     @BE1CR1                 ; . CLEAR ANY OTHER REQUESTS
014524  062706  000004                     ADD     #4,SP                   ; . ADJUST STACK POINTER
014530  104032                           ERROR   +32                     ; . BG5 GRANTED WITH CPU AT 5-7
014532  162703  000040            8$:     SUB     #40,R3                  ; . LOWER PRIORITY
014536  020327  000240                   CMP     R3,#240                 ; . LAST ONE TO CHECK?
014542  002357                           BGE     6$                      ; . IF NOT, BRANCH
                                        ;
                                        ; TRY TO DO BR4 WITH CPU PRIORITY AT 7-4
                                        ;
014544  012777  014574  165444            MOV     #10$,@BE1VEC            ; POINT UBE VECTOR TO PROGRAM
014552  012703  000340                   MOV     #340,R3                 ; START WITH PRIORITY AT 7
014556  012777  000003  165424    9$:     MOV     #3,@BE1CR1              ; . BR6 WITH FUNO
```

T37 NO BUS GRANTS WITH PROCESSOR AT HIGHER PRIORITY

```
 3535 014564  010337  177776              MOV     R3,PSW          ; . CHANGE PRIORITY
 3536 014570  000240                      NOP                     ; . JUST IN CASE OF INTERRUPS
 3537 014572  000405                      BR      11$             ; . IF NO INTERRUPS, BRANCH
 3538 014574  005077  165410      10$:    CLR     @BE1CR1         ; . CLEAR ANY OTHER REQUESTS
 3539 014600  062706  000004              ADD     #4,SP           ; . ADJUST STACK POINTER
 3540 014604  104032                      ERROR   +32             ; . BG4 GRANTED WITH CPU AT 4-7
 3541 014606  162703  000040      11$:    SUB     #40,R3          ; . LOWER PRIORITY
 3542 014612  020327  000200              CMP     R3,#200         ; . LAST ONE TO CHECK?
 3543 014616  002357                      BGE     9$              ; . IF NOT, BRANCH
 3544
 3545
```

```
3547                            .SBTTL TEST - BR7-BR4 ARBITRATION
3548
3549                            ;* THIS TEST CHECKS THAT BR7-BR4 INTERRUPTS CAN OCCUR WITH A PROCESSOR
3550                            ;* PRIORITY AT A LOWER LEVEL
3551                            ;*
3552                            ;
3553                            ;  BGNTST
3554                            ;
3555                            ;       SET UP @BE1PSW TO #340
3556                            ;*
3557                            ;* TRY TO DO BR7 WITH CPU PRIORITY AT 6 - 0
3558                            ;*
3559                            ;       DO FOR R3 FROM #300 DOWNTO #0 BY #40
3560                            ;       .  LET PSW = #340
3561                            ;       .  LET @BE1CR1 = #21 TO DO 1 DATI
3562                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3563                            ;       .  DO "NOP"
3564                            ;       .  IF NO INTERRUPT THEN
3565                            ;       .  .  ERROR BG7 DOESN'T  OCCUR
3566                            ;       .  ENDIF
3567                            ;       ENDDO
3568                            ;*
3569                            ;* TRY TO DO BR6 WITH CPU PRIORITY AT 5 - 0
3570                            ;*
3571                            ;       DO FOR R3 FROM #240 DOWNTO #0 BY #40
3572                            ;       .  LET PSW = #340
3573                            ;       .  LET @BE1CR1 = #11 TO DO 1 DATI
3574                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3575                            ;       .  DO "NOP"
3576                            ;       .  IF NO INTERUPT THEN
3577                            ;       .  .  ERROR BG6 DOESN'T  OCCUR
3578                            ;       .  ENDIF
3579                            ;       ENDDO
3580                            ;*
3581                            ;* TRY TO DO BR5 WITH CPU PRIORITY AT 4 - 0
3582                            ;*
3583                            ;       DO FOR R3 FROM #200 DOWNTO #0 BY #40
3584                            ;       .  LET PSW = #340
3585                            ;       .  LET @BE1CR1 = #5 TO DO 1 DATI
3586                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3587                            ;       .  DO "NOP"
3588                            ;       .  IF NO INTERRUPT THEN
3589                            ;       .  .  ERROR BG5 DOESN'T  OCCUR
3590                            ;       .  ENDIF
3591                            ;       ENDDO
3592                            ;*
3593                            ;* TRY TO DO BR4 WITH CPU PRIORITY AT 3 - 0
3594                            ;*
3595                            ;       DO FOR R3 FROM #140 DOWNTO #0 BY #40
3596                            ;       .  LET PSW = #340
3597                            ;       .  LET @BE1CR1 = #3 TO DO 1 DATI
3598                            ;       .  LET PSW = R3 TO CHANGE PRIORITY
3599                            ;       .  DO "NOP"
3600                            ;       .  IF NO INTERRUPT THEN
3601                            ;       .  .  ERROR BG4 DOESN'T  OCCUR
3602                            ;       .  ENDIF
3603                            ;       ENDDO
```

```
3604                                    ;
3605                                    ;  ENDTST
3606                                    ;
3607                                    ;-------------------------------------------------------------
3608
3609                                    ;;*************************************************************
                                        ;*TEST 40       BR7-BR4 ARBITRATION
                                        ;;*************************************************************
    014620  000004                      TST40:  SCOPE
3610
3611 014622  004737  002502                    JSR     PC,IUBE                 ; INITIALIZE THE UBE
3612 014626  012777  000340  165364            MOV     #340,@BE1PSW            ; AT PRIORITY 7
3613                                    ;
3614                                    ; TRY TO DO BR7 WITH CPU PRIORITY AT 6-0
3615                                    ;
3616 014634  012777  014700  165354            MOV     #2$,@BE1VEC             ; POINT UBE VECTOR TO PROGRAM
3617 014642  012703  000300                    MOV     #300,R3                 ; START WITH PRIORITY AT 6
3618 014646  012737  000340  177776  1$:       MOV     #340,PSW                ; . RAISE PRIORITY TO 7
3619 014654  012777  000021  165326            MOV     #21,@BE1CR1             ; . BR7 WITH FUNO
3620 014662  010337  177776                    MOV     R3,PSW                  ; . LOWER PRIORITY
3621 014666  000240                            NOP                             ; . JUST IN CASE OF INTERRUPS
3622 014670  005077  165314                    CLR     @BE1CR1                 ; . CLEAR ANY OTHER REQUESTS
3623 014674  104032                            ERROR   +32                     ; . BR7 NOT GRANTED WITH CPU AT 6-0
3624 014676  000402                            BR      3$                      ; . DON'T ADJUST STACK IF NO INTERRUPT
3625 014700  062706  000004          2$:       ADD     #4,SP                   ; . ADJUST STACK POINTER
3626 014704  162703  000040          3$:       SUB     #40,R3                  ; . LOWER PRIORITY
3627 014710  022703  000000                    CMP     #0,R3                   ; . LAST ONE TO CHECK?
3628 014714  002354                            BGE     1$                      ; . IF NOT, BRANCH
3629                                    ;
3630                                    ; TRY TO DO BR6 WITH CPU PRIORITY AT 5-0
3631                                    ;
3632 014716  004737  002502                    JSR     PC,IUBE                 ; INITIALIZE THE UBE
3633 014722  012777  014766  165266            MOV     #5$,@BE1VEC             ; POINT UBE VECTOR TO PROGRAM
3634 014730  012703  000240                    MOV     #240,R3                 ; START WITH PRIORITY AT 5
3635 014734  012737  000340  177776  4$:       MOV     #340,PSW                ; . RAISE PRIORITY TO 7
3636 014742  012777  000011  165240            MOV     #11,@BE1CR1             ; . BR6 WITH FUNO
3637 014750  010337  177776                    MOV     R3,PSW                  ; . LOWER PRIORITY
3638 014754  000240                            NOP                             ; . JUST IN CASE OF INTERRUPS
3639 014756  005077  165226                    CLR     @BE1CR1                 ; . CLEAR ANY OTHER REQUESTS
3640 014762  104032                            ERROR   +32                     ; . BR6 NOT GRANTED WITH CPU AT 5-0
3641 014764  000402                            BR      6$                      ; . DON'T ADJUST STACK
3642 014766  062706  000004          5$:       ADD     #4,SP                   ; . ADJUST STACK POINTER
3643 014772  162703  000040          6$:       SUB     #40,R3                  ; . LOWER PRIORITY
3644 014776  022703  000000                    CMP     #0,R3                   ; . LAST ONE TO CHECK?
3645 015002  002354                            BGE     4$                      ; . IF NOT, BRANCH
3646                                    ;
3647                                    ; TRY TO DO BR5 WITH CPU PRIORITY AT 4-0
3648                                    ;
3649 015004  004737  002502                    JSR     PC,IUBE                 ; INITIALIZE THE UBE
3650 015010  012777  015054  165200            MOV     #8$,@BE1VEC             ; POINT UBE VECTOR TO PROGRAM
3651 015016  012703  000200                    MOV     #200,R3                 ; START WITH PRIORITY AT 4
3652 015022  012737  000340  177776  7$:       MOV     #340,PSW                ; . RAISE PRIORITY TO 7
3653 015030  012777  000005  165152            MOV     #5,@BE1CR1              ; . BR5 WITH FUNO
3654 015036  010337  177776                    MOV     R3,PSW                  ; . LOWER PRIORITY
3655 015042  000240                            NOP                             ; . JUST IN CASE OF INTERRUPS
3656 015044  005077  165140                    CLR     @BE1CR1                 ; . CLEAR ANY OTHER REQUESTS
3657 015050  104032                            ERROR   +32                     ; . BR5 NOT GRANTED WITH CPU AT 4-0
```

T40 BR7-BR4 ARBITRATION

```
3658 015052  000402                        BR      9$                      ; . DON'T TOUCH STACK
3659 015054  062706  000004          8$:   ADD     #4,SP                   ; . ADJUST STACK POINTER
3660 015060  162703  000040          9$:   SUB     #40,R3                  ; . LOWER PRIORITY
3661 015064  022703  000000                CMP     #0,R3                   ; . LAST ONE TO CHECK?
3662 015070  002354                        BGE     7$                      ; . IF NOT, BRANCH
3663                                 ;
3664                                 ; TRY TO DO BR4 WITH CPU PRIORITY AT 3-0
3665                                 ;
3666 015072  004737  002502                JSR     PC,IUBE                 ; INITIALIZE THE UBE
3667 015076  012777  015142  165112        MOV     #11$,@BE1VEC            ; POINT UBE VECTOR TO PROGRAM
3668 015104  012703  000140                MOV     #140,R3                 ; START WITH PRIORITY AT 3
3669 015110  012737  000340  177776  10$:   MOV     #340,PSW                ; . RAISE PRIORITY TO 7
3670 015116  012777  000003  165064        MOV     #3,@BE1CR1              ; . BR4 WITH FUNO
3671 015124  010337  177776                MOV     R3,PSW                  ; . LOWER PRIORITY
3672 015130  000240                        NOP                             ; . JUST IN CASE OF INTERRUPS
3673 015132  005077  165052                CLR     @BE1CR1                 ; . CLEAR ANY OTHER REQUESTS
3674 015136  104032                        ERROR   +32                     ; . BR4 NOT GRANTED WITH CPU AT 3-0
3675 015140  000402                        BR      12$                     ; . DON'T ADJUST STACK
3676 015142  062706  000004          11$:  ADD     #4,SP                   ; . ADJUST STACK POINTER
3677 015146  162703  000040          12$:  SUB     #40,R3                  ; . LOWER PRIORITY
3678 015152  022703  000000                CMP     #0,R3                   ; . LAST ONE TO CHECK?
3679 015156  002354                        BGE     10$                     ; . IF NOT, BRANCH
3680
3681
```

```
                                .SBTTL TEST - ARBITRATION BETWEEN INTERRUPTS AND PIRQ'S

                                ;* THIS TEST CHECKS THAT PIRQ REQUESTS OVERRIDE INTERRUPT REQUESTS
                                ;* OF THE SAME LEVEL.
                                ;*
                                ;       SET UP @BE1VEC AND PIRQVEC AND PRIORITY FOR BOTH
                                ;       LET R1 = #20 FOR BG7 FROM UBE
                                ;       LET R2 = #100000 FOR PIRQ7
                                ;       DO FOR R3 FROM #300 DOWNTO #140 BY #40
                                ;       .  LET PSW = #340
                                ;       .  LET @BE1CR1 = R1 FOR INTERRUPT LEVEL
                                ;       .  LET @BE1CR1 = @BE1CR1 SET.BY #1 TO DO 1 DATI
                                ;       .  LET PIRQ = PIRQ SET.BY R2 FOR PIRQ LEVEL
                                ;       .  LET PSW = R3 TO CHANGE PRIORITY
                                ;       .  WAIT FOR INTERRUPT
                                ;       .  IF PIRQ INTERRUPT DIDN'T HAPPEN OR @BE1CC NE -1 THEN
                                ;       .  .  ERROR IN ARBITRATION BETWEEN PIRQ'S AND INTERRUPTS
                                ;       .  ENDIF
                                ;       .  LET R1 = R1 SHIFT RIGHT 1
                                ;       .  LET R2 = R2 SHIFT RIGHT 1
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 41       ARBITRATION BETWEEN INTERRUPTS AND PIRQ'S
                                ;;*****************************************************************
                                TST41:  SCOPE
     015160  000004
3710 015162  004737  002502            JSR     PC,IUBE                 ; INITIALIZE THE UBE
3711 015166  012777  015256  165014    MOV     #2$,@BE1CR1             ; POINT UBE VECTOR TO PROGRAM
3712 015174  012777  000340  165016    MOV     #340,@BE1PSW            ; AT PRIORITY 7
3713 015202  012737  015266  000240    MOV     #3$,PIRQVEC             ; POINT PIRQ VECTOR TO PROGRAM
3714 015210  012737  000340  000242    MOV     #340,@#242              ; AT PRIORITY 7
3715 015216  012701  000020            MOV     #20,R1                  ; STORE FOR BR7
3716 015222  012702  100000            MOV     #100000,R2              ; STORE FOR PIRQ 7
3717 015226  012703  000300            MOV     #300,R3                 ; START WITH PRIORITY 6
3718                                   ;
3719                                   ; DO ARBITRATION FOR LEVEL 7-4
3720                                   ;
3721 015232  012737  000340  177776  1$:     MOV     #340,PSW          ; . START WITH PRIORITY 7
3722 015240  010177  164744            MOV     R1,@BE1CR1              ; . CHANGE UBE PRIORITY
3723 015244  010237  177772            MOV     R2,PIRQ                 ; . CHANGE PIRQ PRIORITY
3724 015250  010337  177776            MOV     R3,PSW                  ; . LOWER CPU PRIORITY
3725 015254  000001                    WAIT                            ; . WAIT FOR INTERRUPT
3726 015256  062706  000004            2$:     ADD     #4,SP           ; . CLEAN UP STACK
3727 015262  104032                    ERROR   +32                     ; . PIRQ'S DON'T TAKE PRIORITY
3728 015264  000402                    BR      4$                      ; . DON'T CLEAN UP STACK TWICE
3729 015266  062706  000004            3$:     ADD     #4,SP           ; . CLEAN UP STACK
3730 015272  006001                    4$:     ROR     R1              ; . ADJUST BR FOR UBE
3731 015274  006002                    ROR     R2                      ; . ADJUST PIRQ'S
3732 015276  162703  000040            SUB     #40,R3                  ; . LOWER FOR CPU PRIORITY
3733 015302  022703  000140            CMP     #140,R3                 ; . PRIORITY 3?
3734 015306  001351                    BNE     1$                      ; . BRANCH IF NOT YET
3735 015310  005037  177772            CLR     PIRQ                    ; CLEAR ANY REQUESTS
```

```
                                .SBTTL TEST - ARBITRATION BETWEEN INTERRUPTS FROM 2 UBE

                                ;* THIS TEST CHECKS THAT WHEN TWO INTERRUPTS FROM DIFFERENT UBE'S
                                ;* COME IN AT THE SAME TIME, THE BUS IS GRANTED TO THE REQUEST WITH HIGHER
                                ;* PRIORITY.
                                ;*
                                ;
                                ;   BGNTST
                                ;
                                ;       IF UBECT NE #2 THEN THERE'S NO 2ND UBE
                                ;       .  EXIT TEST
                                ;       ENDIF
                                ;       SET UP VECTORS AND PSW FOR BOTH UBE'S
                                ;       LET R1 = #20 FOR BR7
                                ;       DO 3 TIMES FOR BG7-BG6, BG6-BG5,BG5-BG4
                                ;       .  LET PSW = #340 FOR PRIORITY 7
                                ;       .  LET @BE1CR1 = R1
                                ;       .  LET R1 = R1 SHIFT RIGHT 1
                                ;       .  LET @BE2CR1 = R1 TO SET PRIORITY OF 2ND UBE
                                ;       .  LET @SIMLGO = #1 TO DO SIMULTANEOUS "GO"
                                ;       .  LET PSW = #140 TO LOWER PRIORITY FOR INTERRUPTS
                                ;       .  WAIT FOR INTERRUPTS
                                ;       .  IF INTERRUPTS FROM 1ST HAPPENED AFTER 2ND THEN
                                ;       .  .  ERROR IN BR ARBITRATION
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;   ENDTST
                                ;
                                ;-------------------------------------------------------------


                                ;;*****************************************************************
                                ;*TEST 42       ARBITRATION BETWEEN INTERRUPTS FROM 2 UBE
                                ;;*****************************************************************
    015314  000004              TST42:  SCOPE

    015316  022737  000002  001722      CMP     #2,UBECT                ; 2 UBE'S?
    015324  001112                      BNE     TST43           ;;      EXIT, IF NO
    015326  004737  002502              JSR     PC,IUBE                 ; INITIALIZE THE UBE
                                ;
                                ; INITIAL SETUP
                                ;
    015332  012703  000240              MOV     #240,R3                 ; START AT PRIORITY 6
    015336  012701  000020              MOV     #20,R1                  ; UBE AT LEVEL 7
    015342  012777  015512  164646      MOV     #BE1SV,@BE1VEC          ; POINT UBE1 VECTOR TO PROGRAM
    015350  012777  000340  164642      MOV     #340,@BE1PSW            ; AT PRIORITY 7
    015356  012777  015532  164652      MOV     #BE2SV,@BE2VEC          ; POINT UBE2 VECTOR TO PROGRAM
    015364  012777  000340  164646      MOV     #340,@BE2PSW            ; AT PRIORITY 7
                                ;
                                ; ARBITRATE BETWEEN 2 INTERRUPTS OF DIFFERENT LEVEL
                                ;
    015372  012737  000340  177776  1$: MOV     #340,PSW                ; . RAISE PRIORITY TO 7
    015400  010177  164604              MOV     R1,@BE1CR1              ; . HIGHER PRIORITY TO UBE1
    015404  006001                      ROR     R1                      ; . GET LOWER PRIORITY
    015406  010177  164616              MOV     R1,@BE2CR1              ; . LOWER PRIORITY TO UBE2
    015412  052777  000001  164570      BIS     #BIT00,@BE1CR1          ; . SET GO BIT OF UBE #1
```

T42 ARBITRATION BETWEEN INTERRUPTS FROM 2 UBE

```
3791 015420  052777  000001  164602          BIS     #BIT00,@BE2CR1          ; . SET GO BIT OF UBE #2
3792 015426  010337  177776                  MOV     R3,PSW                  ; . LOWER CPU PRIORITY
3793 015432  000240                          NOP                             ; . GIVE UBE TIME TO INTERRUPT
3794 015434  000240                          NOP                             ;
3795 015436  000240                          NOP                             ;
3796 015440  005737  001724                  TST     BE1INT                  ; . DID UBE1 INTERRUPT
3797 015444  001002                          BNE     5$                      ; . YES,THEN GO MAKE SURE UBE2 DIDN'T
3798 015446  104032                          ERROR   +32                     ; . LOWER ORDER INTERRUPTS HAPPNE BEFORE
3799 015450  000404                          BR      10$                     ; . GO SEE IF WE ARE DONE
3800 015452  005737  001726          5$:     TST     BE2INT                  ; . DID UBE2 INTERRUPT
3801 015456  001401                          BEQ     10$                     ; . NO,THEN GO SEE IF WE ARE DONE
3802 015460  104032                          ERROR   +32                     ; . YES,THEN ERROR IN ARBITRATION
3803 015462  005037  001724          10$:    CLR     BE1INT                  ; . INITIALIZE INTERRUPT FLAGS
3804 015466  005037  001726                  CLR     BE2INT                  ;
3805 015472  162703  000040                  SUB     #40,R3                  ; . DO THE NEXT LEVEL
3806 015476  022703  000100                  CMP     #100,R3                 ; . CPU AT 2 (LAST ONE)?
3807 015502  001333                          BNE     1$                      ; . BRANCH IF NOT YET
3808 015504  005077  164522                  CLR     @BE2CLR                 ; CLEAR ERRORS ON 2ND UBE
3809 015510  000420                          BR      TST43           ;;      GO TO NEXT TEST
3810
3811 015512  012777  000000  164510  BE1SV:  MOV     #0,@BE2CR1              ; CLEAR PENDING UBE #2 INTERRUPTS
3812 015520  005237  001724                  INC     BE1INT                  ; SET BE1 INTERRUPT FLAG
3813 015524  005037  001726                  CLR     BE2INT                  ; CLEAR BE2 INTERRUPT FLAG
3814 015530  000002                          RTI
3815
3816 015532  012777  000000  164450  BE2SV:  MOV     #0,@BE1CR1              ; CLEAR PENDING UBE #1 INTERRUPTS
3817 015540  005237  001726                  INC     BE2INT                  ; SET BE2 INTERRUPT FLAG
3818 015544  005037  001724                  CLR     BE1INT                  ; CLEAR BE1 INTERRUPT FLAG
3819 015550  000002                          RTI
3820
```

```
                                .SBTTL TEST - POWER DOWN TEST

                                ;* THIS TEST INSURES THAT POWER DOWN CYCLE CAN BE INVOKED FROM THE
                                ;* UNIBUS SIDE OF UBA. IT WILL RUN ONLY IF POWER UP OPTION 11
                                ;* IS SELECTED (TRAP THRU 24/26) IN THE EAROM ON CPU BOARD.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       LET BCSR<6,5>=<0,1> TO ACCESS EAROM
                                ;       IF @#165002<7,6> NE <1,1> FOR POWER UP CODE 00 THEN
                                ;       .  EXIT TEST
                                ;       ENDIF
                                ;       SAVE PWRVEC
                                ;       POINT PWRVEC TO PROGAM AREA
                                ;       LET @BE1CR2<4> = #1
                                ;       IF NO TRAP TO 24 THEN
                                ;       .  ERROR EXECUTING POWER DOWN THRU UNIBUS
                                ;       ENDIF
                                ;       LET @BE1CR2<4> = #0 FOR POWER UP
                                ;       RESTORE PWRVEC
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 43       POWER DOWN TEST
                                ;;*****************************************************************
015552  000004                  TST43:  SCOPE
                                ;
                                ; RESTRICTIONS ON RUNNING THIS TEST
                                ;
015554  005737  001206                  TST     $PASS                   ; FIRST PASS
015560  001076                          BNE     TST44           ;;IF NOT 1ST PASS, DON'T DO IT
015562  032737  000040  000052          BIT     #BIT05,@#52             ; UFD MODE?
015570  001072                          BNE     TST44           ;;EXIT TEST, IF SO
015572  122737  000001  001220          CMPB    #APTENV,$ENV            ; APT?
015600  001466                          BEQ     TST44           ;;EXIT TEST IF APT
015602  032737  000010  177524          BIT     #BIT03,@#177524         ; FORCED CONSOLE MODE?
015610  001062                          BNE     TST44           ;;IF YES, EXIT TEST
015612  042737  000100  177520          BIC     #BIT06,BCSR             ; ENABLE ACCESS THRU 165000
015620  052737  000040  177520          BIS     #BIT05,BCSR             ; READ EAROM
015626  032737  000200  165002          BIT     #BIT07,@#165002         ; POWER UP CODE 00?
015634  001450                          BEQ     TST44           ;;EXIT TEST, IF NOT
015636  032737  000100  165002          BIT     #BIT06,@#165002         ; POWER UP CODE 00?
015644  001444                          BEQ     TST44           ;;EXIT TEST, IF NOT
015646  004737  002502                  JSR     PC,IUBE                 ; INITIALIZE THE UBE
                                ;
                                ; DO POWER DOWN SEQUENCE
                                ;
015652  013737  000024  001160          MOV     PWRVEC,$TMP0            ; STORE POWER DOWN VECTOR
015660  012737  015712  000024          MOV     #1$,PWRVEC              ; POINT NEW ONE TO PROGRAM
015666  013737  000026  000026          MOV     PWRVEC+2,@#26           ; AT PRIORITY 7
015674  052777  000020  164312          BIS     #BIT04,@BE1CR2          ; START POWER DOWN
015702  000240                          NOP
015704  000240                          NOP                             ; WAIT WHAT HAPPENED
```

T43 POWER DOWN TEST

```
 3876 015706  104032                          ERROR   +32                     ; NO POWER DOWN FOR THRU UNIBUS
 3877 015710  000417                          BR      10$                     ;
 3878 015712  042777  000020  164274  1$:     BIC     #BIT04,@BE1CR2          ; CLEAR POWER DOWN BIT
 3879 015720  062706  000004                  ADD     #4,SP                   ; ADJUST STACK POINTER
 3880 015724  012737  015744  000024          MOV     #3$,PWRVEC              ; POINT POWER UP VECTOR
 3881 015732  012701  177777                  MOV     #177777,R1              ; TIMEOUT ROUTINE
 3882 015736  077101                  2$:     SOB     R1,2$                   ; WAIT A WHILE
 3883 015740  104032                          ERROR   +32                     ; NO POWER UP
 3884 015742  000402                          BR      10$                     ;
 3885 015744  012706  001100          3$:     MOV     #1100,SP                ; ADJUST STACK
 3886 015750  013737  001160  000024  10$:    MOV     $TMP0,PWRVEC            ; RESTORE POWER DOWN VECTOR
 3887
```

```
                                .SBTTL TEST - WRONG PARITY TEST

                                ;* THIS TEST CHECKS THAT A WRONG PARITY TRAP CAN BE GENERATED ON
                                ;* DATI CYCLES.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       SAVE 114 WRONG PARITY VECTOR AND POINT IT TO PROGRAM AREA
                                ;       LET @BE1CC = -1 TO DO 1 CYCLE
                                ;       LET @BE1BA = #$TMP0 FOR THE ADDRESS
                                ;       LET @BE1CR2 = @BE1CR2 SET.BY #BIT12 TO ENABLE WRONG PARITY
                                ;       LET @BE1CR1 = #13041 TO DO 1 DATO FROM BE1CC
                                ;       IF NO TRAP TO 114 THEN
                                ;       .  ERROR GENERATING WRONG PARITY TRAP THRU UNIBUS
                                ;       ENDIF
                                ;       LET @BE1CR2 = #0 TO CLEAR WRONG PARITY BIT
                                ;       RESTORE VECTOR 114
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 44        WRONG PARITY TEST
                                ;;*****************************************************************
015756  000004                  TST44:  SCOPE

015760  004737  002502                  JSR     PC,IUBE                 ; INITIALIZE THE UBE
015764  013701  000114                  MOV     @#114,R1                ; SAVE PARITY TRAP
015770  012737  016036  000114          MOV     #1$,@#114               ; POINT TO PROGRAM AREA
015776  012737  000340  000116          MOV     #340,@#116              ; AT PRIORITY 7
016004  012777  177777  164172          MOV     #-1,@BE1CC              ; DO 1 CYCLE
016012  012777  001160  164166          MOV     #$TMP0,@BE1BA           ; SETUP ADDRESS REGISTER
016020  052777  010000  164166          BIS     #BIT12,@BE1CR2          ; SET WRONG PARITY BIT
016026  005777  164156                  TST     @BE1CR1                 ; READ A UBE REGISTER
016032  000240                          NOP                             ; SHOULD CAUSE A PARITY TRAP
016034  104032                          ERROR   +32                     ; NO PARITY TRAP
016036  012777  000000  164150  1$:     MOV     #0,@BE1CR2              ; CLEAR WRONG PARITY BIT
016044  062706  000004                  ADD     #4,SP                   ; ADJUST STACK POINTER
```

```
                                .SBTTL TEST - NO SACK TIMEOUT

                                ;* THIS TEST INSURES THAT THE CPU TIMES OUT AND DROPS A GRANT IF NO
                                ;* SACK SIGNAL IS RECEIVED.  IF THE CPU DOES NOT TIMEOUT, THE UBE
                                ;* WILL TIME OUT AND SEND SACK TO PREVENT THE BUS FROM HANGING AND WILL SET
                                ;* THE ERROR BIT IN CR2.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       LET @BE1CC = -1 TO DO 1 TRANSFER
                                ;       LET @BE1CR2 = @BE1CR2 SET.BY #BIT03 TO INHIBIT SACK
                                ;       LET @BE1CR1 = #6003 TO DO FUN 3
                                ;       WAIT FOR TIMEOUT OR @BE1CC NE -1
                                ;       IF  NO TIMEOUT AND @BE1CR2 SET.BY #BIT07 THEN
                                ;       .  ERROR CPU FAILED TO DO NO SACK TIMEOUT
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 45       NO SACK TIMEOUT
                                ;;*****************************************************************
    016050  000004              TST45:  SCOPE

016052  004737  002502                  JSR     PC,IUBE                 ; INITIALIZE THE UBE
016056  012777  000010  164130          MOV     #BIT03,@BE1CR2          ; INHIBIT SACK BIT
016064  005037  177776                  CLR     PSW                     ; LOWER PRIORITY
016070  012777  006003  164112          MOV     #6003,@BE1CR1           ; GIVE UP BUS AFTER BECOMING MASTER
016076  012701  007777                  MOV     #7777,R1                ; DELAY CONSTANT
016102  077101                  1$:     SOB     R1,1$                   ; WAIT IN A LOOP
016104  105777  164104                  TSTB    @BE1CR2                 ; NO NO SACK TIMEOUT?
016110  100001                          BPL     2$                      ; IF NO, BRANCH
016112  104032                          ERROR   +32                     ; NO NO SACK TIMEOUT
016114  012777  000000  164072  2$:     MOV     #0,@BE1CR2              ; CLEAR INHIBIT SACK BIT
016122  012737  000340  177776          MOV     #340,PSW                ; RESTORE PRIORITY
```

```
                                .SBTTL TEST - NO INTERRUPT TEST

                                ;* THIS TEST CHECKS THAT NO INTERRUPT CONDITION DOES NOT HANG THE BUS.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       PROGRAM UBE TO DO DMA ON BR7
                                ;       IF CYCLE NOT DONE OR INTERRUPT THEN
                                ;       .  ERROR IN NO INTERRUPT LOGIC
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;---------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 46       PASSIVE RELEASE
                                ;;*****************************************************************
016130  000004                  TST46:  SCOPE

016132  004737  002502                  JSR     PC,IUBE                 ; INITIALISE UBE
016136  012777  177777  164040          MOV     #-1,@BE1CC              ; DO 1 CYCLE
016144  012777  001160  164034          MOV     #$TMP0,@BE1BA           ; AT ADDRESS $TMP0
016152  012777  016224  164036          MOV     #10$,@BE1VEC            ; POINT VECTOR
016160  012737  000003  177776          MOV     #3,PSW                  ; LOWER PRIORITY TO 3
016166  012777  002021  164014          MOV     #2021,@BE1CR1           ; BR7, DATI
016174  105777  164010          1$:     TSTB    @BE1CR1                 ; DONE?
016200  100375                          BPL     1$                      ; IF NOT, WAIT
016202  012737  000340  177776          MOV     #340,PSW                ; RESTORE PRIORITY
016210  023777  001160  163764          CMP     $TMP0,@BE1DB            ; DATA OK?
016216  001404                          BEQ     TST47           ;; IF OK, EXIT TEST
016220  104032                          ERROR   +32                     ; DATI ON BR7 IS WRONG
016222  000402                          BR      TST47           ;; GO TO NEXT TEST

016224  104032                  10$:    ERROR   +32                     ; NO INTERRUPT LOGIC IS WRONG
016226  000002                          RTI
```

```
                                .SBTTL TEST - UNIBUS DEVICE DATO CYCLE

                                ;* THE FOLLOWING TEST WILL SEE IF A UNIBUS DEVICE DATA OUT
                                ;* CAN OCCUR ON THE KTJ11-B MODULE.THE UNIBUS DATA PATH
                                ;* ON THE BOARD IS ALSO TESTED OUT.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       DISABLE UNIBUS MAPPING
                                ;       LET R0 := POINTER TO WRITE BUFFER
                                ;       LET R1 := POINTER TO PATTERN TABLE
                                ;*
                                ;*  GO DO THE TRANSFERS
                                ;*
                                ;       DO FOR PATTERNS 377,7417,31463,52525,125252
                                ;       .  LET BE1DB := (R1)+                   ;DATA IS CURRENT PATTERN
                                ;       .  LET BE1BA := (R0)+                   ;ADDRESS IS CURRENT ADDRESS OF WRITE BUFFER
                                ;       .  LET BE1CC := -1                      ;SET UBE FOR 1 DATA XFER
                                ;       .  SET UBE FOR NPR-DATO-1 XFER
                                ;       .  SET OFF THE TRANSFER
                                ;       ENDDO
                                ;       LET R0 := POINTER TO WRITE BUFFER
                                ;       LET R1 := POINTER TO PATTERN TABLE
                                ;*
                                ;*  CHECK IF THE TRANSFERS WERE CORRECT
                                ;*
                                ;       DO UNTIL TABLE IS COMPLETE
                                ;       .  IF (R0)+ NEQ (R1)+ THEN
                                ;       .  .  ERROR DATO DID NOT OCCUR CORRECTLY
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 47        UNIBUS DEVICE DATO CYCLE TEST
                                ;;*****************************************************************
    016230  000004              TST47:  SCOPE

                                        JSR     PC,IUBE         ; INITIALIZE THE UBE
                                ;
                                ; INITIALIZE POINTERS FOR THE TRANSFERS
                                ;
    016236  042737  000040  172516      BIC     #BIT5,MMR3      ; MAKE SURE UNIBUS MAPPING IS DISABLED
    016244  012700  001734              MOV     #WRTBUF,R0      ; POINTER TO WRITE BUFFER
    016250  012701  001774              MOV     #PTRN16,R1      ; POINTER TO PATTERN TABLE

                                ;
                                ; EXECUTE THE LOOP TO DO THE TRANSFERS
                                ;
    016254  012737  000002  177730      MOV     #BIT01,DCSR     ; SELECT UNIBUS LINES
```

T47 UNIBUS DEVICE DATO CYCLE TEST

```
4054 016262  012704  000005              MOV     #5,R4           ; SET UP LOOP COUNT
4055 016266  012177  163710        1$:   MOV     (R1)+,@BE1DB    ; . GET CURRENT DATA
4056 016272  010077  163710              MOV     R0,@BE1BA       ; . GET ADDRESS IN THE WRITE BUFFER
4057 016276  005077  163712              CLR     @BE1CR2         ; . CLEAR ADDRESS BITS 16,17
4058 016302  012777  177777  163674      MOV     #-1.,@BE1CC     ; . SET UBE FOR 1 DATA TRANSFER
4059 016310  012777  003041  163672      MOV     #3041,@BE1CR1   ; . SET UBE FOR NPR-DATO-1 XFER
4060
4061                                     ;
4062                                     ; WAIT FOR THE TRANSFER TO BE COMPLETE
4063                                     ;
4064
4065 016316  032777  000200  163664  5$: BIT     #BIT7,@BE1CR1   ; . . IS THE TRANSFER COMPLETE ?
4066 016324  001774                      BEQ     5$              ; . . NO,THEN GO WAIT FOR IT
4067 016326  005737  177732              TST     DDR             ; . . UNIBUS LINES 0?
4068 016332  001415                      BEQ     7$              ; . . IF SO, BRANCH
4069 016334  022704  000003              CMP     #3,R4           ; . . SELECTING CONTROL LINES
4070 016340  001004                      BNE     6$              ; . . IF NOT, BRANCH
4071 016342  032737  000373  177732      BIT     #373,DDR        ; . . ONLY USED LINES 0'S?
4072 016350  001406                      BEQ     7$              ; . . IF SO, BRANCH
4073 016352  013737  177732  001126  6$: MOV     DDR,$BDDAT      ; . . RECIEVED DATA
4074 016360  005037  001124              CLR     $GDDAT          ; . . EXPECTED DATA
4075 016364  104016                      ERROR   +16             ; . . ERROR IN UNIBUS LINES
4076 016366  062737  000002  177730  7$: ADD     #BIT01,DCSR     ; . . THRU ALL COMBINATIONS
4077 016374  032737  000006  177730      BIT     #6,DCSR         ; . . ALL DONE?
4078 016402  001003                      BNE     8$              ; . . IF NOT, BRANCH
4079 016404  012737  000002  177730      MOV     #BIT01,DCSR     ; . . OTHERWISE, START OVER
4080 016412  062700  000002        8$:   ADD     #2,R0           ; . . GET THE NEXT ADDRESS TO TRANSFER TO
4081 016416  077455                      SOB     R4,1$           ; . HAVE WE GONE THROUGH THE TABLE ?
4082
4083                                     ;
4084                                     ; CHECK IF THE TRANSFERS WERE COMPLETED CORRECTLY
4085                                     ;
4086
4087 016420  012700  001734              MOV     #WRTBUF,R0      ; POINTER TO WRITE BUFFER
4088 016424  012701  001774              MOV     #PTRN16,R1      ; POINTER TO PATTERN TABLE
4089 016430  012704  000005              MOV     #5,R4           ; SET UP LOOP COUNT
4090 016434  022021                10$:  CMP     (R0)+,(R1)+     ; . WAS THE TRANSFER CORRECT ?
4091 016436  001401                      BEQ     15$             ; . YES,THEN SKIP THE ERROR MESSAGE
4092 016440  104032                      ERROR   +32             ; . NO, THEN ERROR IN THE TRANSFER
4093 016442  077404                15$:  SOB     R4,10$          ; . HAVE WE CHECKED ALL 5 XFERS ?
4094
4095
4096
```

```
                                .SBTTL TEST - UNIBUS DEVICE DATI CYCLE

                                ;* THIS TEST WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE A
                                ;* UNIBUS DEVICE DATI CYCLE.THE UNIBUS ADDRESS PATH ON THE
                                ;* MODULE IS ALSO TESTED OUT.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;*
                                ;*  INITIALIZE THE POINTERS FOR THE TRANSFERS
                                ;*
                                ;       DISABLE UNIBUS MAPPING
                                ;       LET R0 := POINTER TO 16 BIT PATTERNS
                                ;       LET R1 := (R0)                          ;CURRENT PATTERN
                                ;*
                                ;*  GO DO THE TRANSFER THEN CHECK IF IT OCCURED CORRECTLY
                                ;*
                                ;       LET BE1DB := 0                  ;CLEAR DATA BUFFER
                                ;       LET BE1BA := R0                 ;READ FROM DATA PATTERN
                                ;       LET BE1CC := -1                 ;1 DATA XFER
                                ;       SETUP UBE TO DO NPR-DATI-1 DATA XFER
                                ;       SET OFF THE TRANSFER
                                ;       IF BE1DB NEQ #377  THEN
                                ;       .  ERROR DATA READ IN WAS INCORRECT
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 50        UNIBUS DEVICE DATI CYCLE TEST
                                ;;*****************************************************************
    016444  000004              TST50:  SCOPE
                                
016446  004737  002502                  JSR     PC,IUBE                         ; INITIALIZE THE UBE
016452  042737  000040  172516          BIC     #BIT5,MMR3      ; DISABLE UNIBUS MAPPING

                                ;
                                ; INITIALIZE POINTERS FOR THE TRANSFERS
                                ;

016460  012700  001774                  MOV     #PTRN16,R0      ; GET POINTER TO PATTERN TABLE
016464  011001                          MOV     (R0),R1         ; GET CURRENT PATTERN

                                ;
                                ; GO DO THE TRANSFER
                                ;

016466  005077  163510          5$:     CLR     @BE1DB          ; . INITIALIZE THE DATA BUFFER
016472  010077  163510                  MOV     R0,@BE1BA       ; . GET ADDRESS WE WANT TO READ
016476  005077  163512                  CLR     @BE1CR2         ; . CLEAR ADDRESS BITS 16,17
016502  012777  177777  163474          MOV     #-1,@BE1CC      ; . SET UBE FOR 1 TRANSFER
016510  012777  002041  163472          MOV     #2041,@BE1CR1   ; . SET UBE FOR NPR-DATI-1 XFER

                                ;
```

T50 UNIBUS DEVICE DATI CYCLE TEST

```
4152                                    ; WAIT FOR THE TRANSFER TO COMPLETE
4153                                    ;
4154
4155 016516  032777  000200  163464  10$:    BIT     #BIT7,@BE1CR1   ; . . IS THE TRANSFER COMPLETE ?
4156 016524  001774                          BEQ     10$             ; . . WAIT FOR IT TO BE COMPLETE
4157
4158                                    ;
4159                                    ; CHECK THE TRANSFER
4160                                    ;
4161
4162 016526  027710  163450                  CMP     @BE1DB,(R0)     ; . WAS THE TRANSFER CORRECT ?
4163 016532  001401                          BEQ     18$             ; . YES,THEN GO TO THE NEXT TEST
4164 016534  104032                          ERROR   +32             ; . NO,THEN ERROR IN THE TRANSFER
4165 016536  005720                  18$:    TST     (R0)+           ; . DONE WITH PATTERNS?
4166 016540  001352                          BNE     5$              ; . LOOP TILL DONE
4167
4168
4169
```

```
                                .SBTTL TEST - UNIBUS DEVICE DATO CYCLE WITH RELOCATION ENABLED

                                ;* THIS TEST WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE
                                ;* A UNIBUS DEVICE DATO CYCLE THROUGH THE UNIBUS MAP.
                                ;*
                                ;
                                ;  BGNTST
                                ;       IF ALL UNIBUS MEMORY THEN GO TO END OF PASS
                                ;*
                                ;*  SET UP UBE AND UNIBUS MAP REGISTERS FOR TRANSFER
                                ;*
                                ;       LET BE1BA := 0                  ;POINT TO UMR0
                                ;       LET BE1DB := 125252             ;DATA PATTERN IS 125252
                                ;       LET BE1CC := -8.                ;DO 8 XFERS
                                ;       SET UBE TO DO NPR-DATO-2 DATA XFERS
                                ;       LET MAPL00 := ADDRESS OF WRITE BUFFER
                                ;       LET MAPH00 := 0
                                ;*
                                ;*     GO DO THE TRANSFER
                                ;*
                                ;       SET OFF TRANSFER
                                ;       WAIT TILL XFER IS DONE
                                ;*
                                ;*     CHECK IF THE TRANSFER OCCURED CORRECTLY
                                ;*
                                ;       LET R0 := POINTER TO WRITE BUFFER
                                ;       DO FOR R1 := 1 TO 8
                                ;       .  IF (R0)+ NEQ #125252 THEN
                                ;       .  .  ERROR DATO DID NOT EXECUTE CORRECTLY
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 51       UNIBUS DEVICE DATO CYCLE WITH RELOCATION ENABLED
                                ;;*****************************************************************
    016542  000004              TST51:  SCOPE

                                        MOV     KMCR,R1         ; STORE KMCR
                                        BIC     #177700,R1      ; LEAVE ONLY BITS <5-0>
                                        CMP     #77,R1          ; ALL UNIBUS MEMORY?
                                        BNE     1$              ; IF NOT, BRANCH
                                        JMP     UBEM            ; IF ALL UNIBUS, SKIP TILL END OF PASS
                                1$:     JSR     PC,IUBE         ; INITIALIZE THE UBE
                                        MOV     #PTRN16,R2      ; TEST PATTERN ADDRESS

                                ;
                                ; SET UP UBE AND UNIBUS MAP REGISTERS FOR TRANSFER
                                ;

                                2$:     CLR     @BE1BA          ; POINT UBE ADDRESS TO UNIBUS MAP
                                        CLR     @BE1CR2         ; REGISTER #0
                                        MOV     (R2),@BE1DB     ; DATA PATTERN
                                        MOV     #-8.,@BE1CC     ; DO 8. TRANSFERS
```

T51 UNIBUS DEVICE DATO CYCLE WITH RELOCATION ENABLED

```
4225 016620  012737  001734  170200          MOV     #WRTBUF,MAPL00  ; SET UP LOW MAP REGISTER
4226 016626  005037  170202                  CLR     MAPH00          ; SET UP HIGH MAP REGISTER
4227 016632  052737  000040  172516          BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
4228
4229                                ;
4230                                ; GO DO THE TRANSFER
4231                                ;
4232
4233 016640  012777  003041  163342          MOV     #3041,@BE1CR1   ; DO A NPR-DATO-1 XFER
4234 016646  032777  000200  163334  10$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE ?
4235 016654  001774                          BEQ     10$             ; WAIT FOR IT TO COMPLETE
4236
4237                                ;
4238                                ; CHECK IF THE TRANSFER OCCURED CORRECTLY
4239                                ;
4240
4241 016656  042737  000040  172516          BIC     #BIT5,MMR3      ; DISABLE UNIBUS MAPPING
4242 016664  012700  001734                  MOV     #WRTBUF,R0      ; GET POINTER TO WRITE BUFFER
4243 016670  012701  000010                  MOV     #8.,R1          ; SET UP LOOP COUNTER
4244 016674  022012                  15$:    CMP     (R0)+,(R2)      ; . SEE IF TRANSFER OCCURED CORRECTLY ?
4245 016676  001401                          BEQ     20$             ; . YES,THEN SKIP ERROR MESSAGE
4246 016700  104032                          ERROR   +32             ; . NO,THEN ERROR IN TRANSFER
4247 016702  077104                  20$:    SOB     R1,15$          ; . HAVE WE CHECKED ALL THE TRANSFERS
4248 016704  005722                          TST     (R2)+           ; GET NEXT PATTERN
4249 016706  001333                          BNE     2$              ; LOOP TILL DONE
4250
```

```
                                .SBTTL TEST - UNIBUS DEVICE DATI CYCLE WITH RELOCATION ENABLED

                                ;* THIS TEST WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE
                                ;* A UNIBUS DEVICE DATI CYCLE THROUGH THE UNIBUS MAP WITH
                                ;* CACHE DISABLED.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;*
                                ;*  SET UP THE UBE FOR A DATI CYCLE
                                ;*
                                ;       LET BE1BA := 0          ;POINT ADDRESS TO MAPX00
                                ;       LET BE1CR2 := 0         ;
                                ;       LET BE1DB := 0          ;INITIALIZE DATA BUFFER
                                ;       LET BE1CC := -1         ;SET FOR 1 XFER
                                ;       SET UBE FOR A NPR-DATI-1 XFER
                                ;*
                                ;*  SET UP THE MAP REGISTER FOR THE TRANSFER
                                ;*
                                ;       LET MAPL00 := R0                ;POINT UMR #0 TO DATA PATTERN
                                ;       LET MAPH00 := 0
                                ;       ENABLE UNIBUS MAPPING
                                ;*
                                ;*  GO DO THE TRANSFER
                                ;*
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR TRANSFER TO COMPLETE
                                ;       DISABLE UNIBUS MAPPING
                                ;*
                                ;*  CHECK IF THE TRANSFER OCCURED CORRECTLY
                                ;*
                                ;       IF BE1DB NEQ (R0)+ THEN
                                ;       .  ERROR DATI THROUGH UNIBUS MAP DID NOT EXECUTE CORRECTLY
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------


                                ;;*****************************************************************
                                ;*TEST 52       UNIBUS DEVICE DATI CYCLE WITH RELOCATION ENABLED
                                ;;*****************************************************************
    016710  000004              TST52:  SCOPE

                                        JSR     PC,IUBE         ; INITIALIZE THE UBE

                                ;
                                ; SET UP UBE AND UNIBUS MAP REGISTERS FOR A DATI CYCLE
                                ;

    016716  012700  001774              MOV     #PTRN16,R0      ; PATTERN AREA
    016722  005077  163260      1$:     CLR     @BE1BA          ; POINT UBE TO THE FIRST UNIBUS MAP
    016726  005077  163262              CLR     @BE1CR2         ; REGISTER
    016732  005077  163244              CLR     @BE1DB          ; INITIALIZE THE DATA BUFFER
    016736  012777  177777  163240      MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
```

```
T52     UNIBUS DEVICE DATI CYCLE WITH RELOCATION ENABLED

 4306 016744  010037  170200                 MOV     R0,MAPL00       ; POINT MAP REGISTERS TO PATTERN TABLE
 4307 016750  005037  170202                 CLR     MAPH00          ;
 4308 016754  052737  000040  172516         BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
 4309
 4310                                ;
 4311                                ; GO DO THE TRANSFER
 4312                                ;
 4313
 4314 016762  012777  002041  163220         MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
 4315 016770  032777  000200  163212  5$:    BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE
 4316 016776  001774                         BEQ     5$              ; NO,THEN WAIT FOR IT TO BE COMPLETE
 4317 017000  042737  000040  172516         BIC     #BIT5,@#MMR3    ; YES,THEN DISABLE UNIBUS MAPPING
 4318
 4319                                ;
 4320                                ; CHECK THE TRANSFER
 4321                                ;
 4322
 4323 017006  027710  163170                 CMP     @BE1DB,(R0)     ; DID THE TRANSFER HAPPEN CORRECTLY ?
 4324 017012  001401                         BEQ     10$             ; YES
 4325 017014  104032                         ERROR   +32             ; TRANSFER DID NOT OCCUR CORRECTLY
 4326 017016  005720                 10$:    TST     (R0)+           ; ALL DONE?
 4327 017020  001340                         BNE     1$              ; LOOP TILL DONE
 4328
 4329
 4330
```

```
                        .SBTTL TEST - ALU TEST USING UBE

                        ;* THIS TEST WILL CHECK THE FIRST 3 ALU'S EACH ONE AT A TIME. AT FIRST THE
                        ;* PATTERN THAT DOES NOT RESULT IN OVERFLOW WILL BE USED, THE SECOND PATTERN
                        ;* GENERATES OVERFLOW INTO THE NEXT ALU.
                        ;*
                        ;
                        ;  BGNTST
                        ;
                        ;       IN 18-BIT MODE DON'T RUN THIS TEST
                        ;       LET R1 := 1001 (PATTERN WITHOUT OVERFLOW FROM ALU)
                        ;       LET R2 := 0101 (MAP REGISTER PATTERN)
                        ;       LET R3 := @MAPL00
                        ;       LET R4 := 0110 (OVERFLOW)
                        ;       LET R5 := 1011
                        ;       DO FOR 3 PATTERNS
                        ;       .  LET BE1BA := R1              ;POINT ADDRESS TO MAPX00
                        ;       .  LET BE1CR2 := 0              ;
                        ;       .  LET BE1DB := 0               ;INITIALIZE DATA BUFFER
                        ;       .  LET BE1CC := -1              ;SET FOR 1 XFER
                        ;       .  SET UBE FOR A NPR-DATI-1 XFER
                        ;*
                        ;*  SET UP THE MAP REGISTER FOR THE TRANSFER WITHOUT OVERFLOW FROM ALU
                        ;*
                        ;       .  LET (R3) := R2               ;POINT UMR @0 TO DATA PATTERN
                        ;       .  LET 2(R3) := 0
                        ;       .  ENABLE UNIBUS MAPPING
                        ;*
                        ;*  GO DO THE TRANSFER
                        ;*
                        ;       .  SET OFF THE TRANSFER
                        ;       .  WAIT FOR TRANSFER TO COMPLETE
                        ;       .  DISABLE UNIBUS MAPPING
                        ;*
                        ;*  CHECK IF THE TRANSFER OCCURED CORRECTLY
                        ;*
                        ;       .  IF BE1DB NEQ (R1+R2) THEN
                        ;       .  .  ERROR DATI THROUGH UNIBUS MAP DID NOT EXECUTE CORRECTLY
                        ;       .  ENDIF
                        ;*
                        ;* NOW CHECK CARRY OUT FROM ALU
                        ;*
                        ;       .  LET BE1BA := R4              ;POINT ADDRESS TO MAPX00
                        ;       .  LET BE1CR2 := 0              ;
                        ;       .  LET BE1DB := 0               ;INITIALIZE DATA BUFFER
                        ;       .  LET BE1CC := -1              ;SET FOR 1 XFER
                        ;       .  SET UBE FOR A NPR-DATI-1 XFER
                        ;*
                        ;*  SET UP THE MAP REGISTER FOR THE TRANSFER
                        ;*
                        ;       .  LET (R3) := R5               ;POINT UMR @0 TO DATA PATTERN
                        ;       .  LET 2(R3) := 0
                        ;       .  ENABLE UNIBUS MAPPING
                        ;*
                        ;*  GO DO THE TRANSFER
                        ;*
                        ;       .  SET OFF THE TRANSFER
```

```
4389                                    ;       .  WAIT FOR TRANSFER TO COMPLETE
4390                                    ;       .  DISABLE UNIBUS MAPPING
4391                                    ;*
4392                                    ;*  CHECK IF THE TRANSFER OCCURED CORRECTLY
4393                                    ;*
4394                                    ;       .  IF BE1DB NEQ (R4+R5) THEN
4395                                    ;       .  .  ERROR DATI THROUGH UNIBUS MAP DID NOT EXECUTE CORRECTLY
4396                                    ;       .  ENDIF
4397                                    ;*
4398                                    ;* CHANGE THE PATTERN
4399                                    ;*
4400                                    ;       .  SHIFT R1,R2,R4,R5 4 TIMES AND POINT TO MAPL03 AND MAPL06
4401                                    ;       .  POINT R3 TO MAPL03 AND THEN TO MAPL06
4402                                    ;      ENDDO
4403                                    ;
4404                                    ;  ENDTST
4405                                    ;
4406                                    ;-------------------------------------------------------------------
4407
4408
4409                                    ;;*****************************************************************
                                        ;*TEST 53       ALU TEST USING UBE
                                        ;;*****************************************************************
     017022  000004                     TST53:  SCOPE
4410
4411 017024  032737  000040  177734             BIT     #BIT05,KMCR     ; 18 BIT MODE?
4412 017032  001402                             BEQ     10$             ; IF NOT, CONTINUE
4413 017034  000137  017452                     JMP     20$             ; OTHERWISE, EXIT
4414 017040  005037  172354             10$:    CLR     KIPAR6          ; FOR ERROR REPORTING
4415 017044  004737  002502                     JSR     PC,IUBE         ; INITIALIZE THE UBE
4416 017050  012700  000022                     MOV     #22,R0          ; INITIAL PATTERN FOR ADDRESS LINES
4417 017054  012701  000012                     MOV     #12,R1          ; INITIAL PATTERN FOR MAP REGISTER
4418 017060  012703  170200                     MOV     #MAPL00,R3      ; FIRST REGISTER PAIR TO BE USED
4419 017064  012704  000014                     MOV     #14,R4          ; PATTERN FOR THE OVERFLOW FOR A. LINES
4420 017070  012705  000026                     MOV     #26,R5          ; PATTERN FOR MAP PAIR
4421 017074  005037  001162                     CLR     $TMP1           ; LOCATION TO SELECT REGISTER PAIR
4422                                    ;
4423                                    ; SET UP UBE AND UNIBUS MAP REGISTERS FOR A DATI CYCLE
4424                                    ;
4425
4426 017100  010077  163102             1$:     MOV     R0,@BE1BA       ; POINT UBE TO THE PATTERN
4427 017104  005077  163104                     CLR     @BE1CR2         ; REGISTER
4428 017110  005077  163066                     CLR     @BE1DB          ; INITIALIZE THE DATA BUFFER
4429 017114  012777  177777  163062             MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
4430 017122  010113                             MOV     R1,(R3)         ; POINT MAP REGISTERS TO PATTERN
4431 017124  005063  000002                     CLR     2(R3)           ; CLEAR HIGH MAP REGISTER
4432 017130  052737  000040  172516             BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
4433
4434                                    ;
4435                                    ; GO DO THE TRANSFER
4436                                    ;
4437
4438 017136  012777  002041  163044             MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
4439 017144  032777  000200  163036     2$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE
4440 017152  001774                             BEQ     2$              ; NO,THEN WAIT FOR IT TO BE COMPLETE
4441 017154  042737  000040  172516             BIC     #BIT5,@#MMR3    ; YES,THEN DISABLE UNIBUS MAPPING
4442
```

```
                                        ;
                                        ; CHECK THE TRANSFER
                                        ;

017162  010037  001160                  MOV     R0,$TMP0        ; FIND ADDRESS ACCESSED
017166  042737  160000  001160          BIC     #160000,$TMP0   ; MAKE SURE THAT USING ALL 16 BITS FOR ADDRESS
017174  060137  001160                  ADD     R1,$TMP0        ;
017200  027777  162776  161752          CMP     @BE1DB,@$TMP0   ; DID THE TRANSFER HAPPEN CORRECTLY ?
017206  001412                          BEQ     3$              ; IF SO, BRANCH
017210  017737  162766  001126          MOV     @BE1DB,$BDDAT   ; WRONG DATA
017216  017737  161736  001124          MOV     @$TMP0,$GDDAT   ; EXPECTED DATA
017224  013737  001160  001122          MOV     $TMP0,$BDADR    ; ADDRESS USED
017232  104023                          ERROR   +23             ; TRANSFER DID NOT OCCUR CORRECTLY
                                        ;
                                        ; NOW CHECK THE SAME ALU FOR OVERFLOW
                                        ;
017234  010477  162746          3$:     MOV     R4,@BE1BA       ; POINT UBE TO THE PATTERN
017240  005077  162750                  CLR     @BE1CR2         ; REGISTER
017244  005077  162732                  CLR     @BE1DB          ; INITIALIZE THE DATA BUFFER
017250  012777  177777  162726          MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
017256  010513                          MOV     R5,(R3)         ; POINT MAP REGISTERS TO PATTERN
017260  005063  000002                  CLR     2(R3)           ; CLEAR HIGH MAP REGISTER
017264  052737  000040  172516          BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING

                                        ;
                                        ; GO DO THE TRANSFER
                                        ;

017272  012777  002041  162710          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
017300  032777  000200  162702  4$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE
017306  001774                          BEQ     4$              ; NO,THEN WAIT FOR IT TO BE COMPLETE
017310  042737  000040  172516          BIC     #BIT5,@#MMR3    ; YES,THEN DISABLE UNIBUS MAPPING

                                        ;
                                        ; CHECK THE TRANSFER
                                        ;

017316  010437  001160                  MOV     R4,$TMP0        ; FIND ADDRESS ACCESSED
017322  042737  160000  001160          BIC     #160000,$TMP0   ; MAKE SURE THAT USING ALL 16 BITS FOR ADDRESS
017330  060537  001160                  ADD     R5,$TMP0        ;
017334  027777  162642  161616          CMP     @BE1DB,@$TMP0   ; DID THE TRANSFER HAPPEN CORRECTLY ?
017342  001412                          BEQ     5$              ; IF SO, BRANCH
017344  017737  162632  001126          MOV     @BE1DB,$BDDAT   ; WRONG DATA
017352  017737  161602  001124          MOV     @$TMP0,$GDDAT   ; EXPECTED DATA
017360  013737  001160  001122          MOV     $TMP0,$BDADR    ; ADDRESS USED
017366  104023                          ERROR   +23             ; TRANSFER DID NOT OCCUR CORRECTLY
                                        ;
                                        ; CHANGE THE PATTERN
                                        ;
017370  022737  002000  001720  5$:     CMP     #2000,PMIS      ; MORE THAN 32K OF PMI MEMORY?
017376  103025                          BHIS    TST54           ;; IF NOT, EXIT TEST
017400  072027  000004                  ASH     #4,R0           ; TO GET TO NEXT ALU
017404  072127  000004                  ASH     #4,R1           ; BY SHIFYING 4 TIMES
017410  072427  000004                  ASH     #4,R4           ;
017414  072527  000004                  ASH     #4,R5           ;
017420  062703  000014                  ADD     #12.,R3         ; GET NEXT REGISTER PAIR
017424  062737  060000  001162          ADD     #60000,$TMP1    ;
```

T53 ALU TEST USING UBE

```
 4500 017432  053700  001162                BIS     $TMP1,R0        ; SET TO SELECT NEXT REGISTER PAIR
 4501 017436  053704  001162                BIS     $TMP1,R4        ;
 4502 017442  022737  020000  001162        CMP     #20000,$TMP1    ; ALL 3 ALU'S DONE?
 4503 017450  001213                        BNE     1$              ; IF NOT, BRANCH
 4504 017452                          20$:
```

```
                                .SBTTL TEST - CARRY PROPOGATION TEST USING UBE

                                ;* THIS TEST VALIDATES THAT CARRY CAN BE PROPOGATED THRU ALL ALU'S CORRECTLY.
                                ;* THE RESULT IS OBTAINED FROM LOCATION 0.
                                ;
                                ;  BGNTST
                                ;
                                ;*
                                ;*  SET UP THE UBE FOR A DATI CYCLE
                                ;*
                                ;       LET @#0 := #52525
                                ;       LET BE1BA := #2
                                ;       LET BE1CR2 := 0         ;
                                ;       LET BE1DB := 0          ;INITIALIZE DATA BUFFER
                                ;       LET BE1CC := -1         ;SET FOR 1 XFER
                                ;       SET UBE FOR A NPR-DATI-1 XFER
                                ;*
                                ;*  SET UP THE MAP REGISTER FOR THE TRANSFER
                                ;*
                                ;       LET MAPLOO := #177777           ;POINT UMR #0 TO DATA PATTERN
                                ;       LET MAPHOO := #77
                                ;       ENABLE UNIBUS MAPPING
                                ;*
                                ;*  GO DO THE TRANSFER
                                ;*
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR TRANSFER TO COMPLETE
                                ;       DISABLE UNIBUS MAPPING
                                ;*
                                ;*  CHECK IF THE TRANSFER OCCURED CORRECTLY
                                ;*
                                ;       IF BE1DB NEQ @#0 (52525) THEN
                                ;       .  ERROR DATI THROUGH UNIBUS MAP DID NOT EXECUTE CORRECTLY
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------
                                ;;*****************************************************************
                                ;*TEST 54        CARRY PROPOGATION TEST USING UBE
                                ;;*****************************************************************
    017452  000004              TST54:  SCOPE

                                        CLR     KIPAR6          ; CLEAR FOR ERROR REPORTS
    017454  005037  172354              JSR     PC,IUBE         ; INITIALIZE THE UBE
    017460  004737  002502

                                ;
                                ; SET UP UBE AND UNIBUS MAP REGISTERS FOR A DATI CYCLE
                                ;

    017464  012737  052525  000000      MOV     #52525,@#0      ; TEST LOCATION
    017472  012777  000002  162506      MOV     #2,@BE1BA       ; POINT UBE TO THE FIRST UNIBUS MAP
    017500  005077  162510              CLR     @BE1CR2         ; REGISTER
    017504  005077  162472              CLR     @BE1DB          ; INITIALIZE THE DATA BUFFER
    017510  012777  177777  162466      MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
    017516  012737  177777  170200      MOV     #177777,MAPLOO  ; POINT MAP REGISTERS TO OVERFLOW
    017524  012737  000077  170202      MOV     #77,MAPHOO      ;
```

```
 4560 017532  052737  000040  172516 .       BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
 4561
 4562                                ;
 4563                                ; GO DO THE TRANSFER
 4564                                ;
 4565
 4566 017540  012777  002041  162442         MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
 4567 017546  032777  000200  162434 5$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE
 4568 017554  001774                        BEQ     5$              ; NO,THEN WAIT FOR IT TO BE COMPLETE
 4569 017556  042737  000040  172516         BIC     #BIT5,@#MMR3    ; YES,THEN DISABLE UNIBUS MAPPING
 4570
 4571                                ;
 4572                                ; CHECK THE TRANSFER
 4573                                ;
 4574
 4575 017564  027727  162412  052525         CMP     @BE1DB,#52525   ; DID THE TRANSFER HAPPEN CORRECTLY ?
 4576 017572  001411                        BEQ     TST55           ;; GO TO THE NEXT TEST
 4577 017574  017737  162402  001126         MOV     @BE1DB,$BDDAT   ; WRONG DATA
 4578 017602  012737  052525  001124         MOV     #52525,$GDDAT   ; EXPECTED DATA
 4579 017610  005037  001122                CLR     $BDADR          ; ADDRESS USED
 4580 017614  104023                        ERROR   +23             ; TRANSFER DID NOT OCCUR CORRECTLY
 4581
```

```
                                .SBTTL TEST - NXM TEST USING UBE
                                ;* THIS TEST CHECKS THAT ACCESSING NXM MEMORY CAN BE DONE CORRECTLY THRU
                                ;* UBE. TEST LOCATION USED IS 17760000.
                                ;
                                ;  BGNTST
                                ;
                                ;*
                                ;*  SET UP THE UBE FOR A DATI CYCLE
                                ;*
                                ;       LET BE1BA := 0          ;POINT ADDRESS TO MAPX00
                                ;       LET BE1CR2 := 0         ;
                                ;       LET BE1DB := 0          ;INITIALIZE DATA BUFFER
                                ;       LET BE1CC := -1         ;SET FOR 1 XFER
                                ;       SET UBE FOR A NPR-DATI-1 XFER
                                ;*
                                ;*  SET UP THE MAP REGISTER FOR THE TRANSFER
                                ;*
                                ;       LET MAPL00 := #160000           ;POINT UMR #0 TO DATA PATTERN
                                ;       LET MAPH00 := #77
                                ;       ENABLE UNIBUS MAPPING
                                ;*
                                ;*  GO DO THE TRANSFER
                                ;*
                                ;       SET OFF THE TRANSFER
                                ;*
                                ;*  CHECK IF THE TRANSFER OCCURED CORRECTLY
                                ;*
                                ;       IF #BIT08 NOTSET IN @BE1CR2 THEN
                                ;       .  ERROR DATI TO NXM IS WRONG
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 55       NXM TEST USING UBE WITH RELOCATION ENABLED
                                ;;*****************************************************************
    017616  000004              TST55:  SCOPE
4619 017620  004737  002502             JSR     PC,IUBE         ; INITIALIZE THE UBE
4620
4621                            ;
4622                            ; SET UP UBE AND UNIBUS MAP REGISTERS FOR A DATI CYCLE
4623                            ;
4624 017624  012777  017754  162364     MOV     #10$,@BE1VEC    ; POINT INTERUPT VECTOR
4625 017632  012777  000340  162360     MOV     #340,@BE1PSW    ;
4626 017640  005077  162342             CLR     @BE1BA          ; POINT UBE TO THE FIRST UNIBUS MAP
4627 017644  005077  162344             CLR     @BE1CR2         ; REGISTER
4628 017650  005077  162326             CLR     @BE1DB          ; INITIALIZE THE DATA BUFFER
4629 017654  012777  177777  162322     MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
4630 017662  012737  160000  170200     MOV     #160000,MAPL00  ; POINT MAP REGISTERS TO NXM 17760000
4631 017670  012737  000077  170202     MOV     #77,MAPH00      ;
4632 017676  052737  000040  172516     BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
4633                            ;
4634                            ; GO DO THE TRANSFER
4635                            ;
4636 017704  012777  002041  162276     MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
```

T55 NXM TEST USING UBE WITH RELOCATION ENABLED

```
 4637 017712  032777  000200  162270  5$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE
 4638 017720  001774                          BEQ     5$              ; NO,THEN WAIT FOR IT TO BE COMPLETE
 4639 017722  032777  000400  162264          BIT     #BIT08,@BE1CR2  ; NXM ?
 4640 017730  001001                          BNE     6$              ; IF SO, BRANCH
 4641 017732  104022                          ERROR   +22             ; NXM NOT SET
 4642 017734  106427  000140          6$:     MTPS    #140            ; ALLOW INTERRUPTS
 4643 017740  000240                          NOP
 4644 017742  000240                          NOP
 4645 017744  104022                          ERROR   +22             ; NXM WITHOUT INTERRUPT
 4646 017746  000404                          BR      12$             ;
 4647 017750  106427  000340                  MTPS    #340            ; RESTORE PRIORITY
 4648                              ;
 4649                              ; CHECK THE TRANSFER
 4650                              ;
 4651 017754  062706  000004          10$:    ADD     #4,SP           ; ADJUST STACK
 4652 017760  042737  000040  172516  12$:    BIC     #BIT5,@#MMR3    ; YES,THEN DISABLE UNIBUS MAPPING
 4653
```

```
                                .SBTTL TEST - RELOCATION WITH UNIBUS MEMORY

                                ;* THIS TEST WILL CHECK THAT MAPPING REGISTER PAIRS THAT ARE
                                ;* ASSOCIATED WITH UNIBUS MEMORY DO NOT PERFORM RELOCATION.
                                ;* IF ANY UNIBUS MEMORY PRESENT, DATI CYCLES TO THAT MEMORY
                                ;* WILL BE CHECKED.
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;       DO FOR KMCR = 067,27 (18-BIT AND 22-BIT MODES, 32K OF PMI MEMORY)
                                ;       DO WITH MAPPING PAIRS 10 TO 36
                                ;       .  DO DATI TO 0 USING SELCTED MAPPING PAIR
                                ;       .  IF NO TIMEOUT THEN
                                ;       .  .  ERROR DISABLED REGISTER PAIRS DO RELOCATION
                                ;       .  ENDIF
                                ;       ENDDO
                                ;       IF ANY UNIBUS MEMORY PRESENT THEN
                                ;       .  DO DATI WITH RELOCATION ENABLED
                                ;       .  IF RELOCATED THEN
                                ;       .  .  ERROR
                                ;       .  ENDIF
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------

                                ;;*********************************************************************
                                ;*TEST 56       RELOCATION WITH UNIBUS MEMORY
                                ;;*********************************************************************
    017766  000004              TST56:  SCOPE

017770  013737  177734  001162          MOV     KMCR,$TMP1      ; STORE KMCR
017776  013701  177734                  MOV     KMCR,R1         ; STORE KMCR
020002  042701  177740                  BIC     #177740,R1      ; LEAVE ONLY <4-0>
020006  012737  170374  001160          MOV     #MAPL37,$TMP0   ; START WITH HIGHEST ADDRESS
020014  032701  000037                  BIT     #37,R1          ; ANY UNIBUS MEMRORY?
020020  001404                          BEQ     101$            ; IF NOT, BRANCH
020022  162737  000004  001160  100$:   SUB     #4,$TMP0        ; GET LOWER REGISTER PAIR
020030  077104                          SOB     R1,100$         ; LEAVE IN $TMP0 HIGHEST AVAILABLE PAIR
020032  052737  000400  177730  101$:   BIS     #BIT08,DCSR     ; ENABLE DIAGN. MODE
020040  012737  000067  177734          MOV     #67,KMCR        ; 18-BIT, 32K PMI
020046  042737  000400  177730          BIC     #BIT08,DCSR     ; DISABLE DIAGN. MODE
                                ;
                                ; SETUP MAPPING REGISTERS FOR INITIAL CONDITIONS
                                ;
020054  052737  000040  172516          BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
020062  012701  170240          1$:     MOV     #MAPL10,R1      ; . POINT TO MAPL10
020066  005002                          CLR     R2              ; . ADDRESS BITS <15-0> REG. 10
020070  012703  000001                  MOV     #1,R3           ; . ADDRESS FOR CR2<17-16>
020074  004737  002502          2$:     JSR     PC,IUBE         ; . . INITIALIZE THE UBE

                                ;
                                ; SET UP UBE AND UNIBUS MAP REGISTERS FOR A DATI CYCLE
                                ;
```

```
4709 020100  010277  162102                MOV     R2,@BE1BA       ; . . POINT UBE TO FIRST MAP REGISTER
4710 020104  005077  162104                CLR     @BE1CR2         ; . . REGISTER
4711 020110  010377  162100                MOV     R3,@BE1CR2      ; . . LOAD ADDRESS <17-16>
4712 020114  005077  162062                CLR     @BE1DB          ; . . INITIALIZE THE DATA BUFFER
4713 020120  012777  177777  162056        MOV     #-1,@BE1CC      ; . . SET FOR 1 TRANSFER
4714 020126  005021                        CLR     (R1)+           ; . . CLEAR LOW MAP REGISTER
4715 020130  005021                        CLR     (R1)+           ; . . AND HIGH MAP TOO
4716 020132  012777  020220  162056        MOV     #10$,@BE1VEC    ; . . LOAD INTERRUPT VECTOR
4717 020140  012777  000340  162052        MOV     #340,@BE1PSW    ;
4718                                ;
4719                                ; GO DO THE TRANSFER
4720                                ;
4721
4722 020146  012777  002041  162034        MOV     #2041,@BE1CR1   ; . . SET UBE FOR NPR-DATI-1 XFER
4723 020154  032777  000200  162026  5$:   BIT     #BIT7,@BE1CR1   ; . . IS THE TRANSFER COMPLETE
4724 020162  001774                        BEQ     5$              ; . . NO,THEN WAIT FOR IT TO BE COMPLETE
4725 020164  032777  000400  162022        BIT     #BIT08,@BE1CR2  ; . . NXM SET?
4726 020172  001002                        BNE     6$              ; . . IF SO, BRANCH
4727 020174  104022                        ERROR   +22             ; . . NO NXM
4728 020176  000412                        BR      11$             ;
4729 020200  106427  000140          6$:   MTPS    #140            ; . . LOWER PRIORITY
4730 020204  000240                        NOP                     ; . . WAIT FOR INTERRUPT
4731 020206  000240                        NOP                     ;
4732 020210  104022                        ERROR   +22             ; . . NO INTERRUPT ON NXM
4733 020212  106427  000340                MTPS    #340            ; . . RAISE PRIORITY
4734 020216  000402                        BR      11$             ;
4735 020220  062706  000004          10$:  ADD     #4,SP           ; . . ADJUST STACK
4736 020224  062702  020000          11$:  ADD     #20000,R2       ; . . SELECT NEXT MAP PAIR REGISTER
4737 020230  103001                        BCC     12$             ; . . IF NO CARRY, BRANCH
4738 020232  005203                        INC     R3              ; . . OTHERWISE INCREMENT ADDRESS <17-16>
4739 020234  023701  001160          12$:  CMP     $TMP0,R1        ; . . ALL DONE?
4740 020240  101315                        BHI     2$              ; . . IF LESS THAN, BRANCH
4741                                ;
4742                                ; CHECK IF DONE WITH 22-BIT MODE AND 18-BIT
4743                                ;
4744 020242  032737  000040  177734        BIT     #BIT05,KMCR     ; . 22-BIT MODE DONE?
4745 020250  001412                        BEQ     13$             ; . IF YES, BRANCH TO EXIT
4746 020252  052737  000400  177730        BIS     #BIT08,DCSR     ; . ENABLE DIAGN. MODE
4747 020260  012737  000027  177734        MOV     #27,KMCR        ; . 22-BIT, 32K PMI
4748 020266  042737  000400  177730        BIC     #BIT08,DCSR     ; . DISABLE DIAGN. MODE
4749 020274  000672                        BR      1$              ; . DO AGAIN IN 22-BIT MODE
4750                                ;
4751                                ; IF ANY UNIBUS MEMORY PRESENT, DO RELOCATION THRU IT
4752                                ;
4753 020276  022737  170374  001160  13$:   CMP     #MAPL37,$TMP0   ; ANY UNIBUS MEMORY?
4754 020304  001432                        BEQ     200$            ; IF NO, EXIT
4755 020306  012777  140000  161672        MOV     #140000,@BE1BA  ; TRY TO DO DATI THRU
4756 020314  012777  000003  161672        MOV     #3,@BE1CR2      ;  THRU MAP 36 REGISTER
4757 020322  005037  170370                CLR     MAPL36          ; CLEAR MAPPING REGISTER
4758 020326  005037  170372                CLR     MAPH36          ;  PAIR
4759 020332  012737  123456  000000        MOV     #123456,@#0     ; SET UP PATTERN AT 0
4760 020340  005077  161636                CLR     @BE1DB          ; CLEAR DATA REGISTER
4761 020344  012777  002071  161636        MOV     #2071,@BE1CR1   ; START DATI
4762 020352  105777  161632          20$:  TSTB    @BE1CR1         ; WAIT TILL
4763 020356  100375                        BPL     20$             ;  DONE
4764 020360  022777  123456  161614        CMP     #123456,@BE1DB  ; DATA CAME FROM @#0?
4765 020366  001001                        BNE     200$            ; IF NOT, BRANCH
```

L9

T56 RELOCATION WITH UNIBUS MEMORY SEQ 0115

```
 4766 020370  104033                        ERROR   +33             ; RELOCATED UNIBUS MEMORY
 4767 020372  052737  000400  177730  200$: BIS     #BIT08,DCSR     ; ENABLE DIAGN. MODE
 4768 020400  013737  001162  177734        MOV     $TMP1,KMCR      ; RESTORE KMCR
 4769 020406  042737  000400  177730        BIC     #BIT08,DCSR     ; DISABLE DIAGN. MODE
```

```
                                .SBTTL MAIN MEMORY DISABLE THRU UBE

                                ;* THIS TEST CHECKS THAT A MAIN MEMORY RESPONSE IS DISABLED WHENEVER
                                ;* THE APPROPRIATE BITS IN KMCR ARE SET. THE FIRST 32K ARE NOT GOING
                                ;* TO BE CHECKED. THE DMA DATI CYCLES WILL BE DONE THAT SHOULD CAUSE
                                ;* NXM BIT TO BE SET IN THE UBE REGISTER.
                                ;
                                ;  BGNTST
                                ;
                                ;       SIZE THE MEMORY AVAILABLE
                                ;       DO FOR ALL MEMORY PAGES
                                ;       .  LET KMCR DISABLE THAT PAGE IN MEMORY
                                ;       .  DO DATI TO THAT LOCATION
                                ;       .  IF NO TIMEOUT THEN
                                ;       .  . ERROR DISABLED MEMORY DOES NOT TIMEOUT
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 57       MAIN MEMORY DISABLE THRU UBE
                                ;;*****************************************************************
    020414  000004              TST57:  SCOPE

                                        TST     PMIS                    ; ANY PMI MEMORY?
    020416  005737  001720              BEQ     TST60           ;; IF NONE, EXIT TEST
    020422  001561              ;
                                ; ENABLE MMU AND SIZE MEMORY
                                ;
    020424  004737  002276              JSR     PC,MAPPR        ; REMAP PROGRAM AREA
    020430  052737  000001  177572      BIS     #BIT00,MMR0     ; ENABLE MMU
    020436  052737  000020  172516      BIS     #BIT04,MMR3     ; ENABLE 22-BIT MODE
    020444  013702  001720              MOV     PMIS,R2         ; STORE HIGHEST PAGE
    020450  042737  000001  177572      BIC     #BIT00,MMR0     ; DISABLE MMU
                                ;
                                ; SETUP MAPPING REGISTERS AND KMCR
                                ;
    020456  052737  000040  172516      BIS     #BIT5,@#MMR3    ; ENABLE UNIBUS MAPPING
    020464  013737  177734  001160      MOV     KMCR,$TMP0      ; SAVE KMCR
    020472  052737  000400  177730      BIS     #BIT08,DCSR     ; ENABLE DIAGNOSTIC MODE
    020500  012737  000067  177734      MOV     #67,KMCR        ; 18-BIT, >32K DISABLED
    020506  042737  000400  177730      BIC     #BIT08,DCSR     ; DISABLE DIAGNOSTIC MODE
    020514  005037  170200              CLR     MAPL00          ; CLEAR LOW MAP REGISTER
    020520  012737  000001  170202      MOV     #1,MAPH00       ; POINT TO 32K
    020526  012777  020640  161462      MOV     #20$,@BE1VEC    ; . LOAD INTERRUPT VECTOR
    020534  012777  000340  161456      MOV     #340,@BE1PSW    ;
    020542  012737  002000  172354      MOV     #2000,KIPAR6    ; INITIAL POINTER TO ABOVE 32K
                                ;
                                ; DO DATI TO DISABLED MEMORY
                                ;
    020550  004737  002502      10$:    JSR     PC,IUBE         ; INTIALISE UBE
    020554  005077  161426              CLR     @BE1BA          ; . ADDRESS TO ACCESS THRU MAP 0
    020560  012777  177777  161416      MOV     #-1,@BE1CC      ; . ONE CYCLE
    020566  012777  002041  161414      MOV     #2041,@BE1CR1   ; . SET UBE FOR NPR-DATI-1 XFER
```

T57 MAIN MEMORY DISABLE THRU UBE

```
4825 020574  032777  000200  161406  14$:   BIT     #BIT7,@BE1CR1   ; . IS THE TRANSFER COMPLETE
4826 020602  001774                         BEQ     14$             ; . NO,THEN WAIT FOR IT TO BE COMPLETE
4827 020604  032777  000400  161402         BIT     #BIT08,@BE1CR2  ; . NXM SET?
4828 020612  001002                         BNE     15$             ; . IF SO, BRANCH
4829 020614  104022                         ERROR   +22             ; . NO NXM
4830 020616  000412                         BR      25$             ;
4831 020620  106427  000140         15$:    MTPS    #140            ; . LOWER PRIORITY
4832 020624  000240                         NOP                     ; . WAIT FOR INTERRUPT
4833 020626  000240                         NOP                     ;
4834 020630  104022                         ERROR   +22             ; . NO INTERRUPT ON NXM
4835 020632  106427  000340                 MTPS    #340            ; . RAISE PRIORITY
4836 020636  000402                         BR      25$             ; . BRANCH
4837 020640  062706  000004         20$:    ADD     #4,SP           ; . ADJUST STACK
4838                                 ;
4839                                 ; CHANGE PAGE ACCESSED AND CHECK END CONDITIONS
4840                                 ;
4841 020644  023702  172354         25$:    CMP     KIPAR6,R2       ; . ALL PAGES DONE?
4842 020650  103032                         BHIS    30$             ; . IF YES, EXIT
4843 020652  062737  004000  170200         ADD     #4000,MAPL00    ; . INCREMENT IN 1K
4844 020660  103002                         BCC     26$             ; . IF NO CARRY, BRANCH
4845 020662  005237  170202                 INC     MAPH00          ; . OTHERWISE INCR. HIGH MAP
4846 020666  032737  017777  170200  26$:   BIT     #17777,MAPL00   ; . IS IT ON 4K BOUNDARY?
4847 020674  001017                         BNE     27$             ; . IF NOT, BRANCH
4848 020676  062737  000200  17235.         ADD     #200,KIPAR6     ; . INCREMENT COUNTER
4849 020704  052737  000400  177730         BIS     #BIT08,DCSR     ; . ENABLE DIAG. MODE
4850 020712  005337  177734                 DEC     KMCR            ; . ACCESS NEXT HIGHER LOCATION
4851 020716  032737  000040  177734         BIT     #BIT05,KMCR     ; . ALL 128K DONE?
4852 020724  001404                         BEQ     30$             ; . IF SO, BRANCH
4853 020726  042737  000400  177730         BIC     #BIT08,DCSR     ; . DISABLE DIAG. MODE
4854 020734  000705                 27$:    BR      10$             ; . DO FOR THE NEXT PAGE
4855 020736  042737  000040  172516  30$:   BIC     #BIT05,MMR3     ; DISABLE MAPPING
4856 020744  052737  000400  177730         BIS     #BIT08,DCSR     ; ENABLE DIAG. MODE
4857 020752  013737  001160  177734         MOV     $TMP0,KMCR      ; RESTORE KMCR
4858 020760  042737  000400  177730         BIC     #BIT08,DCSR     ; DISABLE DIAG. MODE
4859
```

```
                                .SBTTL TEST - UNIBUS DEVICE DATOB CYCLE
                                ;* THIS TEST WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE
                                ;* A UNIBUS DEVICE DATOB .
                                ;*
                                ;
                                ;  BGNTST
                                ;
                                ;*
                                ;*  SET UP UBE FOR A DATOB CYCLE
                                ;*
                                ;       LET R1 := ADDRESS OF THE WRITE BUFFER
                                ;       LET (R1) := 0                   ;CLEAR OUT THE LOCATION
                                ;       LET BE1DB := 77777              ;DATA PATTERN IS 77777
                                ;       LET BE1CC := -1                 ;SET FOR 1 DATA XFER
                                ;       LET BE1BA := R1                 ;ADDRESS IS FIRST LOCATION IN WRITE BUFFER
                                ;       SET UBE FOR NPR-DATOB-1 XFER
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR THE TRANSFER TO COMPLETE
                                ;*
                                ;*  CHECK IF THE TRANSFER OCCURED CORRECTLY
                                ;*
                                ;       IF (R1) NEQ #377 THEN
                                ;       .  ERROR TRANSFER DID NOT EXECUTE CORRECTLY
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------

                                ;;*********************************************************************
                                ;*TEST 60        UNIBUS DEVICE DATOB CYCLE TEST
                                ;;*********************************************************************
    020766  000004              TST60:  SCOPE

 020770  004737  002502                 JSR     PC,IUBE         ; INITIALIZE THE UBE
 020774  012701  001734                 MOV     #WRTBUF,R1      ; GET POINTER TO WRITE BUFFER
 021000  005011                         CLR     (R1)            ; CLEAR OUT THE LOCATION
 021002  012777  077777  161172         MOV     #77777,@BE1DB   ; SET DATA BUFFER UP
 021010  012777  177777  161166         MOV     #-1,@BE1CC      ; SET FOR 1 DATA TRANSFER
 021016  010177  161164                 MOV     R1,@BE1BA       ; POINT UBE XFER TO WRITE BUFFER
                                ;
                                ; DO THE TRANSFER
                                ;
 021022  012777  003441  161160         MOV     #3441,@BE1CR1   ; SET UP UBE FOR NPR-DATOB-1 XFER
 021030  032777  000200  161152 5$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE ?
 021036  001774                         BEQ     5$              ; NO,THEN WAIT FOR IT TO COMPLETE
                                ;
                                ; CHECK THE TRANSFER
                                ;
 021040  021127  000377                 CMP     (R1),#377       ; WAS THE TRANSFER CORRECT ?
 021044  001401                         BEQ     TST61           ;; YES GO TO THE NEXT TEST
 021046  104033                         ERROR   +33             ; ERROR TRANSFER WAS INCORRECT
```

```
                                .SBTTL TEST - UNIBUS DEVICE DATIP CYCLE
                                ;
                                ;* THIS TEST WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE
                                ;* A UNIBUS DEVICE DATIP CYCLE.
                                ;*
                                ;
                                ;  BGNTST
                                ;*
                                ;*  INITIALIZE WRITE BUFFER FOR DATIP CYCLE
                                ;*
                                ;       LET R1 := POINTER TO WRITE BUFFER
                                ;       DO FOR R2 := 1 TO 8
                                ;       .  LET (R1)+ := #52525
                                ;       ENDDO
                                ;*
                                ;*  SET UP UBE TO DO 8 DATIP'S TO WRITE BUFFER
                                ;*
                                ;       LET BE1BA := ADDRESS OF WRITE BUFFER
                                ;       LET BE1CC := -8.                ;SET FOR 8 TRANSFERS
                                ;       SET UBE FOR NPR-DATIP-1 XFER
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR TRANSFER TO BE COMPLETE
                                ;*
                                ;*  CHECK IF DATIP WAS EXECUTED CORRECTLY
                                ;*
                                ;       LET R1 := ADDRESS OF WRITE BUFFER
                                ;       DO FOR R2 := 1 TO 8
                                ;       .  IF (R1)+ NEQ 125252 THEN
                                ;       .  .  ERROR TRANSFER DID NOT EXECUTE CORRECTLY
                                ;       .  ENDIF
                                ;       ENDDO
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 61        UNIBUS DEVICE DATIP CYCLE TEST
                                ;;*****************************************************************
021050  000004                  TST61:  SCOPE

021052  004737  002502                  JSR     PC,IUBE         ; INITIALIZE THE UBE

                                ;
                                ; INITIALIZE WRITE BUFFER FOR DATIP CYCLE
                                ;

021056  012701  001734                  MOV     #WRTBUF,R1      ; GET POINTER TO WRITE BUFFER
021062  012702  000010                  MOV     #8.,R2          ; SET UP LOOP COUNTER
021066  012721  052525          5$:     MOV     #52525,(R1)+    ; . INITIALIZE WRITE BUFFER LOCATION
021072  077203                          SOB     R2,5$           ; . HAVE WE DONE IT 8 TIMES ?

                                ;
                                ; SET UP UBE TO 8 DATIP'S TO WRITE BUFFER
                                ;

021074  012777  001734  161104          MOV     #WRTBUF,@BE1BA  ; SET UP UBE TO WRITE BUFFER
```

T61 UNIBUS DEVICE DATIP CYCLE TEST

```
 4968 021102  005077  161106                CLR     @BE1CR2          ;
 4969 021106  012777  177770  161070        MOV     #-8.,@BE1CC      ; SET UP FOR 8 TRANSFERS
 4970 021114  012777  002441  161066        MOV     #2441,@BE1CR1    ; SET UP UBE FOR NPR-DATIP-1 XFER
 4971 021122  032777  000200  161060  10$:   BIT     #BIT7,@BE1CR1    ; IS THE TRANSFER COMPLETE ?
 4972 021130  001774                        BEQ     10$              ; NO,THEN WAIT FOR IT TO BE COMPLETE
 4973
 4974                                ;
 4975                                ; CHECK IF DATIP WAS EXECUTED CORRECTLY
 4976                                ;
 4977
 4978 021132  012701  001734                MOV     #WRTBUF,R1       ; GET POINTER TO WRITE BUFFER
 4979 021136  012702  000010                MOV     #8.,R2           ; SET UP LOOP COUNTER
 4980 021142  022127  125252          15$:  CMP     (R1)+,#125252    ; . WAS THE TRANSFER CORRECT ?
 4981 021146  001401                        BEQ     20$              ; . YES,THEN GO SEE IF WE ARE DONE CHECKING
 4982 021150  104033                        ERROR   +33              ; . NO,THEN ERROR IN THE TRANSFER
 4983 021152  077205                  20$:  SOB     R2,15$           ; . HAVE WE CHECKED ALL THE XFERS
 4984
 4985
```

```
                        .SBTTL TEST - UNIBUS DEVICE I/O PAGE READ CYCLE

                        ;* THIS TEST  WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE
                        ;* A UNIBUS DEVICE I/O PAGE READ CYCLE. THIS CONSISTS OF
                        ;* FOUR DIFFERENT TYPES OF READS :
                        ;*
                        ;*      1. UNIBUS DEVICE PMI I/O PAGE READ CYCLE
                        ;*      2. UNIBUS DEVICE TO UNIBUS DEVICE I/O PAGE READ CYCLE
                        ;*      3. UNIBUS DEVICE BOOT ROM READ CYCLE
                        ;*      4. UNIBUS DEVICE MAP REGISTER READ CYCLE.
                        ;*
                        ;* IT ALSO WILL CHECK THAT A UNIBUS DEVICE READ CYCLE NOT
                        ;* OF THE ABOVE THREE TYPES SHOULD CAUSE A TIMEOUT.
                        ;*
                        ;
                        ;  BGNTST
                        ;*
                        ;*  DO A UNIBUS DEVICE PMI I/O PAGE READ CYCLE
                        ;*
                        ;       LET BE1BA := ADDRESS OF CSR OF MEMORY BOARD
                        ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
                        ;       SET UBE FOR A NPR-DATI-1 DATA XFER
                        ;       SET OFF THE TRANSFER
                        ;       WAIT FOR THE TRANSFER TO BE COMPLETE
                        ;       IF BE1DB NEQ CONTENTS OF MEMORY CSR THEN
                        ;       .  ERROR UNIBUS DEVICE PMI I/O PAGE READ CYCLE DID NOT EXECUTE CORRECTLY
                        ;       ENDIF
                        ;*
                        ;*  DO A UNIBUS DEVICE TO UNIBUS DEVICE I/O PAGE READ CYCLE
                        ;*
                        ;       LET BE1BA := ADDRESS OF BE1BA
                        ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
                        ;       SET UBE FOR A NPR-DATI-1 DATA XFER
                        ;       SET OFF THE TRANSFER
                        ;       WAIT FOR THE TRANSFER TO BE COMPLETE
                        ;       IF BE1DB NEQ ADDRESS OF BE1BA
                        ;       .  ERROR UNIBUS DEVICE TO UNIBUS DEVICE I/O PAGE READ CYCLE DID NOT EXECUTE CORRECTL
Y
                        ;       ENDIF
                        ;*
                        ;*  DO A UNIBUS DEVICE BOOT ROM READ CYCLE
                        ;*
                        ;       LET BE1BA := 773000
                        ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
                        ;       SET UBE FOR A NPR-DATI-1 DATA XFER
                        ;       SET OFF THE TRANSFER
                        ;       WAIT FOR THE TRANSFER TO BE COMPLETE
                        ;       IF BE1DB NEQ @#173000 THEN
                        ;       .  ERROR UNIBUS DEVICE BOOT ROM READ CYCLE DID NOT EXECUTE CORRECTLY
                        ;       ENDIF
                        ;*
                        ;*  DO A UNIBUS DEVICE MAP REGISTER READ CYCLE
                        ;*
                        ;       LET BE1BA := 770200                     ;UNIBUS MAP REGISTER #0
                        ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
                        ;       SET UBE FOR A NPR-DATI-1 DATA XFER
                        ;       SET OFF THE TRANSFER
                        ;       WAIT FOR THE TRANSFER TO BE COMPLETE
```

TEST - UNIBUS DEVICE I/O PAGE READ CYCLE

```
                                ;       IF BE1DB NEQ @#770200 THEN
                                ;       .  ERROR UNIBUS DEVICE MAP REGISTER READ CYCLE DID NOT EXECUTE CORRECTLY
                                ;       ENDIF
                                ;*
                                ;*    DO AN ILLEGAL UNIBUS DEVICE I/O PAGE READ CYCLE
                                ;*
                                ;       LET BE1BA := 777730,777732,777734       ;DCSR,DDR,KMCR ADDRESS
                                ;       LET BE1CC := -1                         ;1 DATA TRANSFER
                                ;       SET UBE FOR NPR-DATI-1 DATA XFER
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR THE TRANSFER TO BE COMPLETE
                                ;       IF TRANSFER DID NOT TIMEOUT THEN
                                ;       . ERROR AN ILLEGAL UNIBUS DEVICE CYCLE HAS OCCURED
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 62       UNIBUS DEVICE I/O PAGE READ CYCLE
                                ;;*****************************************************************
021154  000004                  TST62:  SCOPE

021156  004737  002502                  JSR     PC,IUBE         ; INITIALIZE THE UBE

                                ;
                                ; DO A UNIBUS DEVICE PMI I/O PAGE CYCLE
                                ;
021162  013777  001732  161016          MOV     MCSR,@BE1BA     ; GET ADDRESS OF MEMORY CSR ADDRESS
021170  012777  000003  161016          MOV     #3,@BE1CR2      ; SET THE UPPER TWO ADDRESS BITS
021176  012777  177777  161000          MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
021204  012777  002041  160776          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
021212  032777  000200  160770  5$:     BIT     #BIT7,@BE1CR1   ; ARE WE DONE THE TRANSFER ?
021220  001774                          BEQ     5$              ; NO,THEN FOR WAIT FOR IT TO
                                ;
                                ; CHECK OUT THE TRANSFER
                                ;
021222  027777  160504  160752          CMP     @MCSR,@BE1DB    ; WAS THE TRANSFER CORRECT
021230  001401                          BEQ     6$              ; YES,THEN GO DO BOOT ROM READ
021232  104033                          ERROR   +33             ; NO,THEN ERROR IN READ CYCLE
                                ;
                                ; DO A UNIBUS DEVICE UNIBUS DEVICE I/O PAGE CYCLE
                                ;
021234  013777  002206  160744  6$:     MOV     BE1BA,@BE1BA    ; GET AN ADDRESS IN I/O PAGE
021242  012777  000003  160744          MOV     #3,@BE1CR2      ; SET THE UPPER TWO ADDRESS BITS
021250  012777  177777  160726          MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
021256  012777  002041  160724          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
021264  032777  000200  160716  8$:     BIT     #BIT7,@BE1CR1   ; ARE WE DONE THE TRANSFER ?
021272  001774                          BEQ     8$              ; NO,THEN FOR WAIT FOR IT TO
                                ;
                                ; CHECK OUT THE TRANSFER
                                ;
021274  023777  002206  160700          CMP     BE1BA,@BE1DB    ; WAS THE TRANSFER CORRECT
021302  001401                          BEQ     10$             ; YES,THEN GO DO BOOT ROM READ
021304  104033                          ERROR   +33             ; NO,THEN ERROR IN READ CYCLE
                                ;
```

T62 UNIBUS DEVICE I/O PAGE READ CYCLE

```
                                        ; DO A UNIBUS DEVICE BOOT ROM READ CYCLE
                                        ;
021306  012777  173000  160672  10$:    MOV     #173000,@BE1BA  ; GET ADDRESS OF OF THE BOOT ROM
021314  012777  000003  160672          MOV     #3,@BE1CR2      ; SET THE UPPER TWO ADDRESS BITS
021322  012777  177777  160654          MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
021330  012777  002041  160652          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
021336  032777  000200  160644  15$:    BIT     #BIT7,@BE1CR1   ; ARE WE DONE THE TRANSFER ?
021344  001774                          BEQ     15$             ; NO,THEN FOR WAIT FOR IT TO
                                        ;
                                        ; CHECK OUT THE TRANSFER
                                        ;
021346  052737  000200  177520          BIS     #BIT07,BCSR     ; SELECT RIGHT ROM
021354  023777  173000  160620          CMP     @#173000,@BE1DB ; WAS THE TRANSFER CORRECT
021362  001401                          BEQ     20$             ; YES,THEN GO DO UNIBUS DEVICE MAP REGISTER READ
021364  104033                          ERROR   +33             ; NO,THEN ERROR IN READ CYCLE
                                        ;
                                        ; DO A UNIBUS DEVICE MAP REGISTER READ
                                        ;
021366  012777  170200  160612  20$:    MOV     #170200,@BE1BA  ; GET ADDRESS OF THE MAP REGISTER
021374  012777  000003  160612          MOV     #3,@BE1CR2      ; SET THE UPPER TWO ADDRESS BITS
021402  012777  177777  160574          MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
021410  012777  002041  160572          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
021416  032777  000200  160564  25$:    BIT     #BIT7,@BE1CR1   ; ARE WE DONE THE TRANSFER ?
021424  001774                          BEQ     25$             ; NO,THEN FOR WAIT FOR IT TO
                                        ;
                                        ; CHECK OUT THE TRANSFER
                                        ;
021426  023777  170200  160546          CMP     @#170200,@BE1DB ; WAS THE TRANSFER CORRECT
021434  001401                          BEQ     30$             ; YES,THEN GO DO ILLEGAL UNIBUS DEVICE I/O READ
021436  104033                          ERROR   +33             ; NO,THEN ERROR IN READ CYCLE
                                        ;
                                        ; DO AN ILLEGAL UNIBUS DEVICE I/O PAGE READ
                                        ;
021440  012777  021542  160550  30$:    MOV     #40$,@BE1VEC    ; SET UP INTERRUPT VECTOR
021446  012777  000340  160544          MOV     #340,@BE1PSW    ;
021454  012701  000003                  MOV     #3,R1           ; DO FOR 3 REGISTERS
021460  012702  177730                  MOV     #177730,R2      ; STARTING WITH DCSR (THEN DDR, KMCR)
021464  010277  160516          31$:    MOV     R2,@BE1BA       ; GET ADDRESS OF THE DIAGNOSTIC REGISTER
021470  012777  000003  160516          MOV     #3,@BE1CR2      ; SET THE UPPER TWO ADDRESS BITS
021476  012777  177777  160500          MOV     #-1,@BE1CC      ; SET FOR 1 TRANSFER
021504  012777  002041  160476          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
021512  106427  000140                  MTPS    #140            ; LOWER PRIORITY
021516  032777  000200  160464  35$:    BIT     #BIT7,@BE1CR1   ; ARE WE DONE THE TRANSFER ?
021524  001774                          BEQ     35$             ; NO,THEN FOR WAIT FOR IT TO
021526  000240                          NOP                     ; WAIT FOR INTERRUPT
021530  000240                          NOP                     ;
021532  104033                          ERROR   +33             ; ERROR KTJ11 RESPONDED TO AN ILLEGAL ADDRESS
021534  106427  000340                  MTPS    #340            ; RAISE PRIORITY BACK
021540  000407                          BR      45$             ;
021542  062706  000004          40$:    ADD     #4,SP           ; CLEAN UP THE STACK AND THEN GO DO NEXT TEST
021546  032777  000400  160440          BIT     #BIT08,@BE1CR2  ; NXM SET?
021554  001001                          BNE     45$             ; IF SET, BRANCH
021556  104033                          ERROR   +33             ; NXM NOT SET ON ILLEGAL REFERENCE
021560  005722                  45$:    TST     (R2)+           ; GET ADDRESS OF NEXT REGISTER
021562  004737  002502                  JSR     PC,IUBE         ; CLEAN UP UBE
021566  077142                          SOB     R1,31$          ; DO FOR ALL 3 REGISTERS
```

```
5156                            .SBTTL TEST - UNIBUS DEVICE I/O PAGE WRITE CYCLE
5157
5158                            ;* THIS TEST  WILL SEE IF THE KTJ11-B MODULE CAN EXECUTE
5159                            ;* A UNIBUS DEVICE I/O PAGE WRITE CYCLE. THIS CONSISTS OF
5160                            ;* TWO DIFFERENT TYPES OF WRITES :
5161                            ;*
5162                            ;*      1. UNIBUS DEVICE PMI I/O PAGE WRITE CYCLE
5163                            ;*      2. UNIBUS DEVICE UNIBUS DEVICE I/O PAGE WRITE CYCLE
5164                            ;*      3. UNIBUS DEVICE MAP REGISTER WRITE CYCLE.
5165                            ;*
5166                            ;* IT ALSO WILL CHECK THAT A UNIBUS DEVICE WRITE CYCLE NOT
5167                            ;* OF THE ABOVE THREE TYPES SHOULD CAUSE A TIMEOUT.
5168                            ;*
5169                            ;
5170                            ;  BGNTST
5171                            ;
5172                            ;*
5173                            ;*  DO A UNIBUS DEVICE PMI I/O PAGE WRITE CYCLE
5174                            ;*
5175                            ;       LET BE1DB := 52525
5176                            ;       LET BE1BA := ADDRESS OF CSR OF MEMORY BOARD
5177                            ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
5178                            ;       SET UBE FOR A NPR-DATO-1 DATA XFER
5179                            ;       SET OFF THE TRANSFER
5180                            ;       WAIT FOR THE TRANSFER TO BE COMPLETE
5181                            ;       IF CONTENTS OF MEMORY CSR NEQ 52525 THEN
5182                            ;       .  ERROR UNIBUS DEVICE PMI I/O PAGE WRITE CYCLE DID NOT EXECUTE CORRECTLY
5183                            ;       ENDIF
5184                            ;*
5185                            ;*  DO A UNIBUS DEVICE TO UNIBUS DEVICE WRITE CYCLE
5186                            ;*
5187                            ;       IF 2 UBE'S THEN
5188                            ;          LET BE2DB := 125252                  ;DATA PATTERN
5189                            ;          LET BE2BA := ADDR. OF BE2DB          ;UNIBUS I/O PAGE ADDRESS
5190                            ;          LET BE2CC := -1                      ;SET FOR 1 TRANSFER
5191                            ;          SET UBE FOR A NPR-DATO-1 DATA XFER
5192                            ;          SET OFF THE TRANSFER
5193                            ;          WAIT FOR THE TRANSFER TO BE COMPLETE
5194                            ;          IF BE1DB NEQ #125252 THEN
5195                            ;          .  ERROR UNIBUS DEVICE TO UNIBUS DEVICE WRITE CYCLE DID NOT EXECUTE CORRECTLY
5196                            ;          ENDIF
5197                            ;       ENDIF
5198                            ;*
5199                            ;*  DO A UNIBUS DEVICE MAP REGISTER WRITE CYCLE
5200                            ;*
5201                            ;       LET BE1DB := 52525                      ;DATA PATTERN
5202                            ;       LET BE1BA := 770200                     ;UNIBUS MAP REGISTER #0
5203                            ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
5204                            ;       SET UBE FOR A NPR-DATO-1 DATA XFER
5205                            ;       SET OFF THE TRANSFER
5206                            ;       WAIT FOR THE TRANSFER TO BE COMPLETE
5207                            ;       IF MAP REGISTER 0 NEQ #52525 THEN
5208                            ;       .  ERROR UNIBUS DEVICE MAP REGISTER WRITE CYCLE DID NOT EXECUTE CORRECTLY
5209                            ;       ENDIF
5210                            ;*
5211                            ;*  DO A UNIBUS DEVICE TO BOOT ROM WRITE CYCLE
5212                            ;*
```

TEST - UNIBUS DEVICE I/O PAGE WRITE CYCLE

```
                                ;       LET BE1BA := 773000
                                ;       LET BE1CC := -1                         ;SET FOR 1 TRANSFER
                                ;       SET UBE FOR A NPR-DATO-1 DATA XFER
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR THE TRANSFER TO BE COMPLETE
                                ;       IF NO TIMEOUT THEN
                                ;       . ERROR UNIBUS DEVICE BOOT ROM WRITE CYCLE DID NOT EXECUTE CORRECTLY
                                ;       ENDIF
                                ;*
                                ;*  DO AN ILLEGAL UNIBUS DEVICE I/O PAGE WRITE CYCLE
                                ;*
                                ;       LET BE1DB := 52525                      ;DATA PATTERN
                                ;       LET BE1BA := 777730,777732,777734       ;DCSR, DDR, KMCR ADDRESSES
                                ;       LET BE1CC := -1                         ;1 DATA TRANSFER
                                ;       SET UBE FOR NPR-DATO-1 DATA XFER
                                ;       SET OFF THE TRANSFER
                                ;       WAIT FOR THE TRANSFER TO BE COMPLETE
                                ;       IF TRANSFER DID NOT TIMEOUT THEN
                                ;       . ERROR AN ILLEGAL UNIBUS DEVICE CYCLE HAS OCCURED
                                ;       ENDIF
                                ;       DISABLE UNIBUS MAPPING
                                ;
                                ;  ENDTST
                                ;
                                ;-----------------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 63       UNIBUS DEVICE I/O PAGE WRITE CYCLE
                                ;;*****************************************************************
    021570  000004              TST63:  SCOPE

                                        JSR     PC,IUBE         ; INITIALIZE THE UBE
                                ;
                                ; DO A UNIBUS DEVICE PMI I/O PAGE CYCLE
                                ;
021576  017737  160130  001160          MOV     @MCSR,$TMPO     ; STORE MEMORY CSR
021604  013777  001732  160374          MOV     MCSR,@BE1BA     ; GET ADDRESS OF MEMORY CSR
021612  012777  000003  160374          MOV     #3,@BE1CR2      ; SET UPPER TWO ADDRESS BITS
021620  012777  040000  160354          MOV     #BIT14,@BE1DB   ; GET WRITE PATTERN
021626  012777  177777  160350          MOV     #-1,@BE1CC      ; SET FOR 1 XFER
021634  012777  003041  160346          MOV     #3041,@BE1CR1   ; SET UBE FOR NPR-DATO-1 XFER
021642  032777  000200  160340  5$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE ?
021650  001774                          BEQ     5$              ; NO,THEN WAIT FOR IT TO COMPLETE
                                ;
                                ; CHECK THE TRANSFER
                                ;
021652  032777  040000  160052          BIT     #BIT14,@MCSR    ; WAS THE TRANSFER CORRECT ?
021660  001001                          BNE     6$              ; YES,THEN GO DO A MAP REGISTER WRITE
021662  104033                          ERROR   +33             ; NO,THEN ERROR IN THE TRANSFER
                                ;
                                ; DO A UNIBUS DEVICE TO UNIBUS DEVICE WRITE CYCLE
                                ;
021664  013777  001160  160040  6$:     MOV     $TMPO,@MCSR     ; RESTORE MEMORY CSR
021672  022737  000002  001722          CMP     #2,UBECT        ; 2 UBE'S?
021700  001030                          BNE     10$             ; NO, SKIP SUBTEST
021702  013777  002202  160316          MOV     BE1DB,@BE2BA    ; GET ADDRESS OF TARGET UBE REGISTER
021710  012777  000003  160316          MOV     #3,@BE2CR2      ; SET UPPER TWO ADDRESS BITS
```

T63 UNIBUS DEVICE I/O PAGE WRITE CYCLE

```
5267 021716  012777  125252  160276          MOV     #125252,@BE2DB  ; GET WRITE PATTERN
5268 021724  012777  177777  160272          MOV     #-1,@BE2CC      ; SET FOR 1 XFER
5269 021732  012777  003041  160270          MOV     #3041,@BE2CR1   ; SET UBE FOR NPR-DATO-1 XFER
5270 021740  032777  000200  160262  8$:     BIT     #BIT7,@BE2CR1   ; IS THE TRANSFER COMPLETE ?
5271 021746  001774                          BEQ     8$              ; NO,THEN WAIT FOR IT TO COMPLETE
5272                                 ;
5273                                 ; CHECK THE TRANSFER
5274                                 ;
5275 021750  027727  160226  125252          CMP     @BE1DB,#125252  ; WAS THE TRANSFER CORRECT ?
5276 021756  001401                          BEQ     10$             ; YES,THEN GO DO A MAP REGISTER WRITE
5277 021760  104033                          ERROR   +33             ; NO,THEN ERROR IN THE TRANSFER
5278                                 ;
5279                                 ; DO A UNIBUS DEVICE MAP REGISTER WRITE CYCLE
5280                                 ;
5281 021762  005037  170200          10$:    CLR     MAPLOO          ; CLEAR MAP REGISTER PAIR
5282 021766  005037  170202                  CLR     MAPHOO          ;
5283 021772  012777  170200  160206          MOV     #MAPLOO,@BE1BA  ; GET ADDRESS OF MAP REGISTER
5284 022000  012777  000003  160206          MOV     #3,@BE1CR2      ; SET UPPER TWO ADDRESS BITS
5285 022006  012777  052525  160166          MOV     #52525,@BE1DB   ; GET WRITE PATTERN
5286 022014  012777  177776  160162          MOV     #-2,@BE1CC      ; SET FOR 2 XFER
5287 022022  012777  003041  160160          MOV     #3041,@BE1CR1   ; SET UBE FOR NPR-DATO-1 XFER
5288 022030  032777  000200  160152  15$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE ?
5289 022036  001774                          BEQ     15$             ; NO,THEN WAIT FOR IT TO COMPLETE
5290                                 ;
5291                                 ; CHECK THE TRANSFER
5292                                 ;
5293 022040  023727  170200  052524          CMP     MAPLOO,#52524   ; WAS THE TRANSFER CORRECT ?
5294 022046  001401                          BEQ     16$             ; YES,THEN GO DO A MAP REGISTER WRITE
5295 022050  104033                          ERROR   +33             ; NO,THEN ERROR IN THE TRANSFER
5296 022052  022737  000025  170202  16$:     CMP     #25,MAPHOO      ; SECOND WORD OK TOO?
5297 022060  001401                          BEQ     17$             ; IF SO, BRANCH
5298 022062  104033                          ERROR   +33             ; NO,THEN ERROR IN THE TRANSFER
5299                                 ;
5300                                 ; DO A WRITE CYCLE TO BOOT ROM THAT SHOULD CAUSE A TIMEOUT
5301                                 ;
5302 022064  012777  173000  160114  17$:     MOV     #173000,@BE1BA  ; ADDRESS TO WRITE TO
5303 022072  012777  177777  160104          MOV     #-1,@BE1CC      ; 1 CYCLE
5304 022100  012777  022146  160110          MOV     #19$,@BE1VEC    ; POINT INTERRUPT VECTOR TO PROGRAM
5305 022106  012777  000340  160104          MOV     #340,@BE1PSW    ; AT PRIORITY 7
5306 022114  012777  003041  160066          MOV     #3041,@BE1CR1   ; 1 DATO-NPR
5307 022122  106427  000140                  MTPS    #140            ; LOWER PRIRITY
5308 022126  105777  160056          18$:    TSTB    @BE1CR1         ; DONE?
5309 022132  100375                          BPL     18$             ; WAIT TILL DONE
5310 022134  000240                          NOP
5311 022136  104033                          ERROR   +33             ; DIDN'T TIMEOUT ON BOOT ROM WRITE
5312 022140  106427  000340                  MTPS    #340            ; RAISE PRIORITY
5313 022144  000407                          BR      20$             ;
5314 022146  062706  000004          19$:    ADD     #4,SP           ; ADJUST STACK
5315 022152  032777  000400  160034          BIT     #BIT08,@BE1CR2  ; NXM SET?
5316 022160  001001                          BNE     20$             ; IF SET, BRANCH
5317 022162  104033                          ERROR   +33             ; NXM NOT SET ON BOOT ROM WRITE
5318                                 ;
5319                                 ; DO AN ILLEGAL UNIBUS DEVICE I/O PAGE WRITE CYCLE
5320                                 ;
5321 022164  004737  002502          20$:    JSR     PC,IUBE         ; CLEAN UP UBE
5322 022170  012701  000003                  MOV     #3,R1           ; DO FOR DCSR,DDR,KMCR
5323 022174  012702  177730                  MOV     #177730,R2      ; START WITH DCSR
```

T63 UNIBUS DEVICE I/O PAGE WRITE CYCLE

```
 5324 022200  012777  022306  160010          MOV     #30$,@BE1VEC    ; SET UP TIMEOUT VECTOR
 5325 022206  012777  000340  160004          MOV     #340,@BE1PSW    ;
 5326 022214  010277  157766          21$:    MOV     R2,@BE1BA       ; GET ADDRESS OF THE DIAGN. REGISTER
 5327 022220  012777  000003  157766          MOV     #3,@BE1CR2      ; SET UPPER TWO ADDRESS BITS
 5328 022226  012777  052525  157746          MOV     #52525,@BE1DB   ; GET WRITE PATTERN
 5329 022234  012777  177777  157742          MOV     #-1,@BE1CC      ; SET FOR 1 XFER
 5330 022242  052737  000040  172516          BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
 5331 022250  012777  003041  157732          MOV     #3041,@BE1CR1   ; SET UBE FOR NPR-DATO-1 XFER
 5332 022256  005037  177776                  CLR     PSW             ; LOWER PRIORITY
 5333 022262  032777  000200  157720  25$:    BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE ?
 5334 022270  001774                          BEQ     25$             ; NO,THEN WAIT FOR IT TO COMPLETE
 5335 022272  000240                          NOP                     ; WAIT FOR INTERRUPT
 5336 022274  000240                          NOP                     ;
 5337 022276  104033                          ERROR   +33             ; ERROR - AN ILLEGAL CYCLE DID NOT TIMEOUT
 5338 022300  106427  000340                  MTPS    #340            ; RAISE PRIORITY BACK
 5339 022304  000407                          BR      35$             ;
 5340 022306  062706  000004          30$:    ADD     #4,SP           ; ADJUST THE STACK AND GO TO NEXT TEST
 5341 022312  032777  000400  157674          BIT     #BIT08,@BE1CR2  ; NXM SET?
 5342 022320  001001                          BNE     35$             ; IF SET, BRANCH
 5343 022322  104033                          ERROR   +33             ; NXM NOT SET ON ILLEGAL REFERENCE
 5344 022324  005722                  35$:    TST     (R2)+           ; GET NEXT DIAGNOSTIC REGISTER
 5345 022326  004737  002502                  JSR     PC,IUBE         ; INITIALISE UBE
 5346 022332  077150                          SOB     R1,21$          ; DO FOR ALL OF THEM
```

```
                                .SBTTL TEST - MAPPING REGISTERS TEST USING UBE

                                ;* THIS TEST WRITES DIFFERENT PATTERNS TO MAPPING REGISTERS USING
                                ;* DATI AND DATO CYCLES THRU UBE.
                                ;
                                ;  BGNTST
                                ;
                                ;       ENABLE UNIBUS MAPPING
                                ;       WRITE ALL MAPPING REGISTERS WITH "10" PATTERN
                                ;       READ ALL REGISTERS BACK CLEARING THE ONE JUST READ
                                ;       IF ANY REGISTER DOES NOT HAVE THE PATTERN
                                ;       .  ERROR IN WRITING TO MAP REGISTERS
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------

                                ;;*****************************************************************
                                ;*TEST 64       MAPPING REGISTERS TEST USING UBE
                                ;;*****************************************************************
                                TST64:  SCOPE
                                        JSR     PC,IUBE         ; CLEAN UP UBE
                                ;
                                ; DO DATO TO ALL 100 REGISTERS WITH 125252 AS PATTERN
                                ;
                                        MOV     #MAPL00,@BE1BA  ; THE STARTING ADDRESS
                                        MOV     #-100,@BE1CC    ; 64 WORDS TO WRITE TO
                                        MOV     #125252,@BE1DB  ; THE PATTERN TO BE WRITTEN
                                        MOV     #3,@BE1CR2      ; ADDRESS <17-16>
                                        MOV     #3041,@BE1CR1   ; GO DO DATO'S
                                1$:     TSTB    @BE1CR1         ; DONE BIT SET?
                                        BPL     1$              ; WAIT
                                ;
                                ; CHECK THAT ALL REGISTERS WRITTEN OK
                                ;
                                        MOV     #MAPL00,R1      ; START WITH MAP REGISTER 1
                                        MOV     R1,@BE1BA       ; STARTING ADDRESS
                                2$:     MOV     #-1,@BE1CC      ; . DO JUST 1 CYCLE
                                        MOV     #2041,@BE1CR1   ; . DATI FROM LOW MAP REGISTER
                                3$:     TSTB    @BE1CR1         ; . DONE BIT SET?
                                        BPL     3$              ; . IF NOT, WAIT
                                        CMP     #125252,@BE1DB  ; . READ OK?
                                        BEQ     4$              ; . IF SO, BRANCH
                                        ERROR   +33             ; . ERROR IN WRITING AND READING MAP REGISTERS
                                4$:     MOV     #-1,@BE1CC      ; . NOW DO HIGH MAP REGISTER
                                        MOV     #2041,@BE1CR1   ; . DATI FROM HIGH REGISTER
                                5$:     TSTB    @BE1CR1         ; . DONE BIT SET?
                                        BPL     5$              ; . IF NOT, WAIT
                                        CMP     #52,@BE1DB      ; . READ OK?
                                        BEQ     6$              ; . IF SO, BRANCH
                                        ERROR   +33             ; . ERROR IN WRITING AND READING MAP REGISTERS
                                6$:     CLR     (R1)+           ; . CLEAR REGISTER JUST WRITTEN
                                        CLR     (R1)+           ;
                                        CMP     #MAPH37,R1      ; . ALL DONE?
                                        BHI     2$              ; . IF NOT, BRANCH
```

```
5402                            .SBTTL TEST - UNIBUS DEVICE DATI CYCLE WITH CACHE ENABLED
5403
5404                            ;* THIS TEST WILL SEE IF THE CACHE OPERATES CORRECTLY
5405                            ;* WHEN A UNIBUS DEVICE READ CYCLE IS DONE
5406                            ;*
5407                            ;
5408                            ;  BGNTST
5409                            ;
5410                            ;       ENABLE THE CACHE
5411                            ;       ENABLE UNIBUS MAPPING
5412                            ;*
5413                            ;*  CHECK INITIAL SETTING OF THE CACHE VALID BITS
5414                            ;*
5415                            ;       SELECT THE CACHE VALID BITS
5416                            ;       IF KMCR <15-9> NEQ ↑B00000000 THEN
5417                            ;       .  ERROR IN THE CACHE
5418                            ;       ENDIF
5419                            ;*
5420                            ;*  CHECK INITIAL SETTING OF THE CACHE AVAILABILITY BITS
5421                            ;*
5422                            ;       SELECT THE CACHE AVAILABLE SET BITS
5423                            ;       IF KMCR <14-9> NEQ ↑B111111 THEN
5424                            ;       .  ERROR IN THE CACHE
5425                            ;       ENDIF
5426                            ;*
5427                            ;*  GO DO TWO CONSECUTIVE READS
5428                            ;*  THE FIRST WILL ALLOCATE SET A
5429                            ;*  THE SECOND WILL CAUSE A CACHE HIT IN SET A
5430                            ;*
5431                            ;       LET MAP REGISTER 1 POINT TO LOCATION 2000
5432                            ;       LET BE1BA := 20000                      ;OCTAL BOUNDARY READ
5433                            ;       LET BE1CR2 := 0                         ;CLEAR UPPER 2 ADDRESS BITS
5434                            ;       LET BE1CC := -2                         ;SET FOR TWO TRANSFERS
5435                            ;       SET UBE FOR NPR-DATI-1 XFER
5436                            ;       SET OFF THE TRANSFER
5437                            ;       WAIT FOR THE TRANSFER TO COMPLETE
5438                            ;       DISABLE UNIBUS MAPPING
5439                            ;       TURN OFF THE CACHE
5440                            ;       SELECT THE CACHE VALID BITS
5441                            ;*
5442                            ;*  CHECK IF THE CACHE OPERATED CORRECTLY
5443                            ;*
5444                            ;       IF KMCR <15-9> NEQ ↑B1001000 THEN
5445                            ;       .  ERROR CACHE DID NOT GET UPDATED CORRECTLY
5446                            ;       ENDIF
5447                            ;       SELECT THE CACHE AVAILBILITY BITS
5448                            ;       IF KMCR <15-9> NEQ ↑B1000111 THEN
5449                            ;       .  ERROR CACHE DID NOT OPERATE CORRECTLY
5450                            ;       ENDIF
5451                            ;
5452                            ;  ENDTST
5453                            ;
5454                            ;-----------------------------------------------
5455
5456                            ;;*****************************************************************
                                ;*TEST 65       UNIBUS DEVICE CYCLE WITH CACHE ENABLED
                                ;;*****************************************************************
```

T65 UNIBUS DEVICE CYCLE WITH CACHE ENABLED

```
        022520  000004                  TST65:  SCOPE
 5457
 5458 022522  004737  002502                  JSR     PC,IUBE         ; INITIALIZE THE UBE
 5459 022526  052737  000100  177734          BIS     #BIT6,KMCR      ; ENABLE THE DMA CACHE
 5460 022534  032737  000100  177734          BIT     #BIT6,KMCR      ; IS THE CACHE PRESENT ?
 5461 022542  001002                          BNE     1$              ; IF YES, CONTINUE WITH TEST
 5462 022544  000137  023122                  JMP     UBEM            ; OTHERWISE, DO END OF PASS
 5463 022550  012737  160000  170374  1$:     MOV     #160000,MAPL37  ; INITIALIZE MAP REGISTERS
 5464 022556  012737  000077  170376          MOV     #77,MAPH37      ;
 5465 022564  005037  170200                  CLR     MAPL00          ;
 5466 022570  005037  170202                  CLR     MAPH00          ;
 5467 022574  052737  000040  172516          BIS     #BIT5,MMR3      ; ENABLE UNIBUS MAPPING
 5468 022602  052737  000400  177730          BIS     #BIT08,DCSR     ; ENABLE DIAGNOSTIC MODE
 5469 022610  042737  000400  177734          BIC     #BIT08,KMCR     ; MAKE SURE THAT VALID BITS SET
 5470 022616  042737  000400  177730          BIC     #BIT08,DCSR     ; DISABLE DIAGNOSTIC MODE
 5471 022624                          5$:
 5472                                 ;
 5473                                 ; GO DO TWO CONSECUTIVE READS STARTING AT A OCTAL BOUNDARY.
 5474                                 ; THE FIRST READ WILL ALLOCATE CACHE SET A. THE SECOND READ
 5475                                 ; WILL CAUSE A CACHE HIT IN SET A
 5476                                 ;
 5477 022624  012737  000200  170204  10$:     MOV     #200,MAPL01     ; POINT MAP REGISTER TO LOCATION 200
 5478 022632  005037  170206                  CLR     MAPH01
 5479 022636  012777  020000  157342          MOV     #20000,@BE1BA   ; SET TRANSFER ADDRESS TO OCTAL BOUNDARY
 5480 022644  012777  000000  157342          MOV     #0,@BE1CR2      ; CLEAR UPPER 2 ADDRESS BITS
 5481 022652  012777  177776  157324          MOV     #-2,@BE1CC      ; SET UBE FOR TWO TRANSFERS
 5482                                 ;
 5483                                 ; GO DO THE TRANSFER
 5484                                 ;
 5485 022660  012777  002041  157322          MOV     #2041,@BE1CR1   ; SET UBE FOR NPR-DATI-1 XFER
 5486 022666  032777  000200  157314  15$:     BIT     #BIT7,@BE1CR1   ; IS THE TRANSFER COMPLETE ?
 5487 022674  001774                          BEQ     15$             ; NO,THEN WAIT FOR IT TO BE COMPLETE
 5488                                 ;
 5489                                 ; CHECK THE VALID BITS IN THE KMCR
 5490                                 ;
 5491 022676  013703  177734                  MOV     KMCR,R3         ; PUT KMCR INTO R3 FOR MASKING
 5492 022702  042703  000777                  BIC     #777,R3         ; MASK OUT BITS 0-8
 5493 022706  022703  110000                  CMP     #110000,R3      ; ARE THE BITS SET CORRECTLY ?
 5494 022712  001401                          BEQ     20$             ; YES,THEN GO CHECK THE AVAILIBILITY BITS
 5495 022714  104033                          ERROR   .33             ; NO,THEN ERROR IN DMA CACHE
 5496 022716  005037  172516          20$:    CLR     MMR3            ; DISABLE MAPPING
 5497 022722  042737  000100  177734          BIC     #BIT06,KMCR     ; AND CACHE
 5498 022730  023777  000202  157244          CMP     @#202,@BE1DB    ; DATA READ OK?
 5499 022736  001401                          BEQ     TST66           ;;IF OK, EXIT TEST
 5500 022740  104033                          ERROR   .33             ; OTHERWISE ERROR IN CACHE
 5501
```

```
                                .SBTTL TEST - WRONG PARITY AND CACHE

                                ;* THIS TEST VERIFIES THAT IF DATA RECIEVED HAS BAD PARITY IT DOES NOT
                                ;* GET ALLOCATED IN CACHE.
                                ;
                                ;  BGNTST
                                ;
                                ;       WRITE LOCATION WITH BAD PARITY
                                ;       USING UBE DO DATI FROM THAT LOCATION
                                ;       IF KMCR BITS ARE NOT IN RESET CONDITION THEN
                                ;       .  ERROR
                                ;       ENDIF
                                ;
                                ;  ENDTST
                                ;
                                ;-------------------------------------------------------------------------
                                ;;*********************************************************************
                                ;*TEST 66        WRONG PARITY AND CACHE
                                ;;*********************************************************************
     022742  000004             TST66:  SCOPE

                                        JSR     PC,IUBE                 ; CLEAR UBE
                                        BIS     #BIT02!BIT00,@#172100   ; SET WRONG PARITY IN MEMORY CSR
                                        BIC     #3740,@#172100          ; CLEAR CHECK BITS
                                        CLR     @#0                     ; WRITE LOCATION 0 WITH WRONG PARITY
                                        BIC     #BIT02,@#172100         ; CLEAR WRONG PARITY
                                        BIS     #BIT05,MMR3             ; ENABLE MEMORY MAPPING
                                        BIC     #BIT06,KMCR             ; DISABLE JUST TO MAKE SURE
                                        BIS     #BIT06,KMCR             ; ENABLE CACHE
                                        MOV     #0,MAPL01               ; POINT MAP REGISTER TO LOCATION 200
                                        CLR     MAPH01
                                        MOV     #20000,@BE1BA           ; SET TRANSFER ADDRESS TO OCTAL BOUNDARY
                                        MOV     #0,@BE1CR2              ; CLEAR UPPER 2 ADDRESS BITS
                                        MOV     #-1,@BE1CC              ; SET UBE FOR TWO TRANSFERS
                                ;
                                ; GO DO THE TRANSFER
                                ;
                                        MOV     #2041,@BE1CR1           ; SET UBE FOR NPR-DATI-1 XFER
                                15$:    BIT     #BIT7,@BE1CR1           ; IS THE TRANSFER COMPLETE ?
                                        BEQ     15$                     ; NO,THEN WAIT FOR IT TO BE COMPLETE
                                        BIT     #177000,KMCR            ; WAS ALLOCATED?
                                        BEQ     16$                     ; IF NOT, BRANCH
                                        ERROR   +32                     ; IF WAS, REPORT ERROR
                                16$:    CLR     @#0                     ; REWRITE 0 WITH RIGHT PARITY
                                        CLR     MMR3                    ; CLEAR MAPPING ENABLED
                                        BIC     #BIT00,@#172100

                                UBEM:
                                ;;*********************************************************************
                                ;*TEST 67        DUMMY TEST
                                ;;*********************************************************************
     023122  000004             TST67:  SCOPE
                                        TST     $PASS                   ; FIRST PASS?
                                        BNE     $EOP                    ; IF NOT, GOTO $EOP
                                        TST     PMIS                    ; IF NO PMI MEMORY
                                        BEQ     $EOP                    ; PRINT MESSAGE EVERY PASS
```

```
 5553 023140  012737  000024  023220          MOV     #24,$ENDCT                      ; PRINT EVERY 20 PASSES
 5554 023146  032737  000017  177734          BIT     #17,@#KMCR
 5555 023154  001403                          BEQ     $EOP                            ; ONLY IF NO UNIBUS MEMORY
 5556 023156  012737  000012  023220          MOV     #12,$ENDCT                      ; PRINT EVERY 10TH
 5557                                 ;
 5558                                 ; END OF PASS ROUTINE
 5559                                 ;
 5560
 5561                                 .SBTTL  END OF PASS ROUTINE
                                      ;;*****************************************************************
                                      ;*INCREMENT THE PASS NUMBER ($PASS)
                                      ;*INDICATE END-OF-PROGRAM AFTER 1 PASSES THRU THE PROGRAM
                                      ;*IF THERES A MONITOR GO TO IT
                                      ;*IF THERE ISN'T JUMP TO RESTART
      023164                          $EOP:
      023164  000004                          SCOPE
      023166  005037  001102                  CLR     $TSTNM          ;;ZERO THE TEST NUMBER
      023172  005037  001164                  CLR     $TIMES          ;;ZERO THE NUMBER OF ITERATIONS
      023176  005237  001206                  INC     $PASS           ;;INCREMENT THE PASS NUMBER
      023202  042737  100000  001206          BIC     #100000,$PASS   ;;DON'T ALLOW A NEG. NUMBER
      023210  005327                          DEC     (PC)+           ;;LOOP?
      023212  000001                  $EOPCT: .WORD   1
      023214  003055                          BGT     $DOAGN          ;;YES
      023216  012737                          MOV     (PC)+,@(PC)+    ;;RESTORE COUNTER
      023220  000001                  $ENDCT: .WORD   1
      023222  023212                          $EOPCT
      023224  005737  002624                  TST     UQUIET          ;NO MESSAGE IF RUNNING UFD QUIET MODE
      023230  001037                          BNE     1$
      023232  104401  023240                  TYPE    ,30009$         ;;TYPE ASCIZ STRING
      023236  000407                          BR      30008$          ;;GET OVER THE ASCIZ
                                      ;;30009$:       .ASCIZ  <12><15>/END PASS #/
      023256                          30008$:
      023256  013746  001206                  MOV     $PASS,-(SP)     ;;SAVE $PASS FOR TYPEOUT
                                                                      ;;TYPE PASS NUMBER
      023262  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
      023264  104401  023272                  TYPE    ,30011$         ;;TYPE ASCIZ STRING
      023270  000412                          BR      30010$          ;;GET OVER THE ASCIZ
                                      ;;30011$:       .ASCIZ  /     TOTAL ERRORS:/
      023316                          30010$:
      023316  013746  001112                  MOV     $ERTTL,-(SP)    ;;SAVE $ERTTL FOR TYPEOUT
                                                                      ;;TOTAL NUMBER OF ERRORS
      023322  104405                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
      023324  104401  001175                  TYPE    ,$CRLF          ;;TYPE CARRIAGE RETURN, LINE FEED
      023330                          1$:
      023330  013700  000042          $GET42: MOV     @#42,R0         ;;GET MONITOR ADDRESS
      023334  001405                          BEQ     $DOAGN          ;;BRANCH IF NO MONITOR
      023336  000005                          RESET                   ;;CLEAR THE WORLD
      023340  004710                  $ENDAD: JSR     PC,(R0)         ;;GO TO MONITOR
      023342  000240                          NOP                     ;;SAVE ROOM
      023344  000240                          NOP                     ;;FOR
      023346  000240                          NOP                     ;;ACT11
      023350                          $DOAGN:
      023350  000137                          JMP     @(PC)+          ;;RETURN
      023352  003320                  $RTNAD: .WORD   RESTART
      023354     377     377     000  $ENULL: .BYTE   -1,-1,0          ;;NULL CHARACTER STRING
                                              .EVEN
 5562                                 ;
```

END OF PASS ROUTINE

```
 5563                                   ; SYSMAC ROUTINES
 5564                                   ;
 5565
 5566                                   ;SCOPE - ENABLE HALT-ON-BREAK BETWEEN TESTS, SO APT CAN CATCH IT. DISABLE HOB
 5567                                   ;AT END SO TESTS WILL NOT BE INTERRUPTED BY APT BREAKS WHICH CAUSES CERTAIN
 5568                                   ;TESTS TO REPORT ERRORS WHEN THERE ARE REALLY NONE.
 5569
 5570                                   .SBTTL  SCOPE HANDLER ROUTINE
                                        ;;*****************************************************************
                                        ;*THIS ROUTINE CONTROLS THE LOOPING OF SUBTESTS. IT WILL INCREMENT
                                        ;*AND LOAD THE TEST NUMBER($TSTNM) INTO THE DISPLAY REG.(DISPLAY<7:0>)
                                        ;*AND LOAD THE ERROR FLAG ($ERFLG) INTO DISPLAY<15:08>
                                        ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                        ;*SW14=1         LOOP ON TEST
                                        ;*SW11=1         INHIBIT ITERATIONS
                                        ;*SW09=1         LOOP ON ERROR
                                        ;*SW08=1         LOOP ON TEST IN SWR<5:0>
                                        ;*CALL
                                        ;*      SCOPE             ;;SCOPE=IOT
 023360                                 $SCOPE:
 023360  104407                                 CKSWR                       ;;TEST  FOR CHANGE IN SOFT-SWR
 023362  052737  001000  177520                 BIS     #BIT09,BCSR         ;ENABLE HOB
 023370  032777  040000  155542         1$:     BIT     #BIT14,@SWR         ;;LOOP ON PRESENT TEST?
 023376  001117                                 BNE     $OVER               ;;YES IF SW14=1
                                        ;#####START OF CODE FOR THE XOR TESTER#####
 023400  000416                         $XTSTR: BR      6$                  ;;IF RUNNING ON THE "XOR" TESTER CHANGE
                                                                            ;;THIS INSTRUCTION TO A "NOP" (NOP=240)
 023402  013746  000004                         MOV     @#ERRVEC,-(SP)      ;;SAVE THE CONTENTS OF THE ERROR VECTOR
 023406  012737  023426  000004                 MOV     #5$,@#ERRVEC        ;;SET FOR TIMEOUT
 023414  005737  177060                         TST     @#177060            ;;TIME OUT ON XOR?
 023420  012637  000004                         MOV     (SP)+,@#ERRVEC      ;;RESTORE THE ERROR VECTOR
 023424  000466                                 BR      $SVLAD              ;;GO TO THE NEXT TEST
 023426  022626                         5$:     CMP     (SP)+,(SP)+         ;;CLEAR THE STACK AFTER A TIME OUT
 023430  012637  000004                         MOV     (SP)+,@#ERRVEC      ;;RESTORE THE ERROR VECTOR
 023434  000426                                 BR      7$                  ;;LOOP ON THE PRESENT TEST
 023436                                 6$:;#####END OF CODE FOR THE XOR TESTER#####
 023436  032777  000400  155474                 BIT     #BIT08,@SWR         ;;LOOP ON SPEC. TEST?
 023444  001407                                 BEQ     2$                  ;;BR IF NO
 023446  017746  155466                         MOV     @SWR,-(SP)          ;;SET DESIRED TEST NUM. FROM SWR
 023452  042716  000300                         BIC     #$SWRMK,(SP)        ;;STRIP AWAY UNDESIRED BITS
 023456  122637  001102                         CMPB    (SP)+,$TSTNM        ;;ON THE RIGHT TEST?
 023462  001465                                 BEQ     $OVER               ;;BR IF YES
 023464  105737  001103                 2$:     TSTB    $ERFLG              ;;HAS AN ERROR OCCURRED?
 023470  001421                                 BEQ     3$                  ;;BR IF NO
 023472  123737  001115  001103                 CMPB    $ERMAX,$ERFLG       ;;MAX. ERRORS FOR THIS TEST OCCURRED?
 023500  101015                                 BHI     3$                  ;;BR IF NO
 023502  032777  001000  155430                 BIT     #BIT09,@SWR         ;;LOOP ON ERROR?
 023510  001404                                 BEQ     4$                  ;;BR IF NO
 023512  013737  001110  001106         7$:     MOV     $LPERR,$LPADR       ;;SET LOOP ADDRESS TO LAST SCOPE
 023520  000446                                 BR      $OVER
 023522  105037  001103                 4$:     CLRB    $ERFLG              ;;ZERO THE ERROR FLAG
 023526  005037  001164                         CLR     $TIMES              ;;CLEAR THE NUMBER OF ITERATIONS TO MAKE
 023532  000415                                 BR      1$                  ;;ESCAPE TO THE NEXT TEST
 023534  032777  004000  155376         3$:     BIT     #BIT11,@SWR         ;;INHIBIT ITERATIONS?
 023542  001011                                 BNE     1$                  ;;BR IF YES
 023544  005737  001206                         TST     $PASS               ;;IF FIRST PASS OF PROGRAM
 023550  001406                                 BEQ     1$                  ;;      INHIBIT ITERATIONS
```

SCOPE HANDLER ROUTINE

```
023552  005237  001104                 INC     $ICNT           ;;INCREMENT ITERATION COUNT
023556  023737  001164  001104         CMP     $TIMES,$ICNT    ;;CHECK THE NUMBER OF ITERATIONS MADE
023564  002024                         BGE     $OVER           ;;BR IF MORE ITERATION REQUIRED
023566  012737  000001  001104  1$:    MOV     #1,$ICNT        ;;REINITIALIZE THE ITERATION COUNTER
023574  013737  023710  001164         MOV     $MXCNT,$TIMES   ;;SET NUMBER OF ITERATIONS TO DO
023602  105237  001102          $SVLAD: INCB    $TSTNM          ;;COUNT TEST NUMBERS
023606  113737  001102  001204         MOVB    $TSTNM,$TESTN   ;;SET TEST NUMBER IN APT MAILBOX
023614  011637  001106                 MOV     (SP),$LPADR     ;;SAVE SCOPE LOOP ADDRESS
023620  011637  001110                 MOV     (SP),$LPERR     ;;SAVE ERROR LOOP ADDRESS
023624  005037  001166                 CLR     $ESCAPE         ;;CLEAR THE ESCAPE FROM ERROR ADDRESS
023630  112737  000001  001115         MOVB    #1,$ERMAX       ;;ONLY ALLOW ONE(1) ERROR ON NEXT TEST
023636  013777  001102  155276  $OVER: MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER
023644  013716  001106                 MOV     $LPADR,(SP)     ;;FUDGE RETURN ADDRESS
023650  123727  001102  000022         CMPB    $TSTNM,#18.
023656  103413                         BLO     1$
023660  123727  001102  000033         CMPB    $TSTNM,#27.
023666  103404                         BLO     2$
023670  123727  001102  000065         CMPB    $TSTNM,#53.
023676  103403                         BLO     1$
023700  042737  001000  177520  2$:    BIC     #1000,@#BCSR    ;TESTS 18-26 AND 53-54 REQUIRE HALT-ON BREAK TO
                                                               ;BE DISABLED TO PREVENT ERRONEOUS ERROR REPORTS
023706  000002                  1$:    RTI
023710  000001                  $MXCNT: 1                       ;;MAX. NUMBER OF ITERATIONS
```

5571

```
                        .SBTTL  TYPE ROUTINE
                        ;;**************************************************************
                        ;*ROUTINE TO TYPE ASCIZ 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 ASCIZ STRING
                        ;*OR
                        ;*      TYPE
                        ;*      MESADR
                        ;*
023712  105737  001157  $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
023716  100002                  BPL     1$              ;;BR IF YES
023720  000000                  HALT                    ;;HALT HERE IF NO TERMINAL
023722  000430                  BR      3$              ;;LEAVE
023724  010046          1$:     MOV     R0,-(SP)        ;;SAVE R0
023726  017600  000002          MOV     @2(SP),R0       ;;GET ADDRESS OF ASCIZ STRING
023732  122737  000001  001220  CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
023740  001011                  BNE     62$             ;;NO,GO CHECK FOR APT CONSOLE
023742  132737  000100  001221  BITB    #APTSPOOL,$ENVM ;;SPOOL MESSAGE TO APT
023750  001405                  BEQ     62$             ;;NO,GO CHECK FOR CONSOLE
023752  010037  023762          MOV     R0,61$          ;;SETUP MESSAGE ADDRESS FOR APT
023756  004737  026376          JSR     PC,$ATY3        ;;SPOOL MESSAGE TO APT
023762  000000          61$:    .WORD   0               ;;MESSAGE ADDRESS
023764  132737  000040  001221  62$:    BITB    #APTCSUP,$ENVM  ;;APT CONSOLE SUPPRESSED
023772  001003                  BNE     60$             ;;YES,SKIP TYPE OUT
023774  112046          2$:     MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
023776  001005                  BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
024000  005726                  TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
024002  012600          60$:    MOV     (SP)+,R0        ;;RESTORE R0
```

TYPE ROUTINE

```
024004  062716  000002          3$:     ADD     #2,(SP)         ;;ADJUST RETURN PC
024010  000002                          RTI                     ;;RETURN
024012  122716  000011          4$:     CMPB    #HT,(SP)        ;;BRANCH IF <HT>
024016  001430                          BEQ     8$
024020  122716  000200                  CMPB    #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
024024  001006                          BNE     5$
024026  005726                          TST     (SP)+           ;;POP  <CR><LF> EQUIV
024030  104401                          TYPE                    ;;TYPE A CR AND LF
024032  001175                          $CRLF
024034  105037  024242                  CLRB    $CHARCNT        ;;CLEAR CHARACTER COUNT
024040  000755                          BR      2$              ;;GET NEXT CHARACTER
024042  004737  024124          5$:     JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
024046  123726  001156          6$:     CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
024052  001350                          BNE     2$              ;;IF NO GO GET NEXT CHAR.
024054  013746  001154                  MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
                                                                ;;AND THE NULL CHAR.
024060  105366  000001          7$:     DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
024064  002770                          BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
024066  004737  024124                  JSR     PC,$TYPEC       ;;GO TYPE A NULL
024072  105337  024242                  DECB    $CHARCNT        ;;DO NOT COUNT AS A COUNT
024076  000770                          BR      7$              ;;LOOP
                                ;HORIZONTAL TAB PROCESSOR
024100  112716  000040          8$:     MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
024104  004737  024124          9$:     JSR     PC,$TYPEC       ;;TYPE A SPACE
024110  132737  000007  024242          BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
024116  001372                          BNE     9$              ;;TAB STOP
024120  005726                          TST     (SP)+           ;;POP SPACE OFF STACK
024122  000724                          BR      2$              ;;GET NEXT CHARACTER
024124                          $TYPEC:
024124  105777  155014                  TSTB    @$TKS           ;;CHAR IN KYBD BUFFER?          ;MJD001
024130  100022                          BPL     10$             ;;BR IF NOT                     ;MJD001
024132  017746  155010                  MOV     @$TKB,-(SP)     ;;GET CHAR                      ;MJD001
024136  042716  177600                  BIC     #177600,(SP)    ;;STRIP EXTRANEOUS BITS         ;MJD001
024142  122716  000023                  CMPB    #$XOFF,(SP)     ;;WAS CHAR XOFF                 ;MJD001
024146  001012                          BNE     102$            ;;BR IF NOT                     ;MJD001
024150                          101$:                                                           ;MJD001
024150  105777  154770                  TSTB    @$TKS           ;;WAIT FOR CHAR                 ;MJD001
024154  100375                          BPL     101$                                            ;MJD001
024156  117716  154764                  MOVB    @$TKB,(SP)      ;;GET CHAR                      ;MJD001
024162  042716  177600                  BIC     #177600,(SP)    ;;STRIP IT                      ;MJD001
024166  122716  000021                  CMPB    #$XON,(SP)      ;;WAS IT XON?                   ;MJD001
024172  001366                          BNE     101$            ;;BR IF NOT                     ;MJD001
024174                          102$:                                                           ;MJD001
024174  005726                          TST     (SP)+           ;;FIX STACK                     ;MJD001
024176                          10$:                                                            ;MJD001
024176  105777  154746                  TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
024202  100375                          BPL     10$                                             ;MJD001
024204  116677  000002  154740          MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.
024212  122766  000015  000002          CMPB    #CR,2(SP)       ;;IS CHARACTER A CARRIAGE RETURN?
024220  001003                          BNE     1$              ;;BRANCH IF NO
024222  105037  024242                  CLRB    $CHARCNT        ;;YES--CLEAR CHARACTER COUNT
024226  000406                          BR      $TYPEX          ;;EXIT
024230  122766  000012  000002  1$:     CMPB    #LF,2(SP)       ;;IS CHARACTER A LINE FEED?
024236  001402                          BEQ     $TYPEX          ;;BRANCH IF YES
024240  105227                          INCB    (PC)+           ;;COUNT THE CHARACTER
024242  000000          $CHARCNT:.WORD  0                       ;;CHARACTER COUNT STORAGE
024244  000207          $TYPEX: RTS     PC
```

BINARY TO OCTAL (ASCII) AND TYPE

```
5572                                    .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE
                                        ;;*****************************************************************
                                        ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
                                        ;*OCTAL (ASCII) NUMBER AND TYPE IT.
                                        ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
                                        ;*CALL:
                                        ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                        ;*      TYPOS                   ;;CALL FOR TYPEOUT
                                        ;*      .BYTE   N               ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
                                        ;*      .BYTE   M               ;;M=1 OR 0
                                        ;*                                      ;;1=TYPE LEADING ZEROS
                                        ;*                                      ;;0=SUPPRESS LEADING ZEROS
                                        ;*
                                        ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
                                        ;*$TYPOS OR $TYPOC
                                        ;*CALL:
                                        ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                        ;*      TYPON                   ;;CALL FOR TYPEOUT
                                        ;*
                                        ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
                                        ;*CALL:
                                        ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
                                        ;*      TYPOC                   ;;CALL FOR TYPEOUT
024246  017646  000000          $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
024252  116637  000001  024471         MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
024260  112637  024473                 MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
024264  062716  000002                 ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
024270  000406                         BR      $TYPON
024272  112737  000001  024471 $TYPOC: MOVB    #1,$OFILL       ;;SET THE ZERO FILL SWITCH
024300  112737  000006  024473         MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
024306  112737  000005  024470 $TYPON: MOVB    #5,$OCNT        ;;SET THE ITERATION COUNT
024314  010346                         MOV     R3,-(SP)        ;;SAVE R3
024316  010446                         MOV     R4,-(SP)        ;;SAVE R4
024320  010546                         MOV     R5,-(SP)        ;;SAVE R5
024322  113704  024473                 MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
024326  005404                         NEG     R4
024330  062704  000006                 ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
024334  110437  024472                 MOVB    R4,$OMODE       ;;SAVE IT FOR USE
024340  113704  024471                 MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
024344  016605  000012                 MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
024350  005003                         CLR     R3              ;;CLEAR THE OUTPUT WORD
024352  006105                 1$:     ROL     R5              ;;ROTATE MSB INTO "C"
024354  000404                         BR      3$              ;;GO DO MSB
024356  006105                 2$:     ROL     R5              ;;FORM THIS DIGIT
024360  006105                         ROL     R5
024362  006105                         ROL     R5
024364  010503                         MOV     R5,R3
024366  006103                 3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
024370  105337  024472                 DECB    $OMODE          ;;TYPE THIS DIGIT?
024374  100016                         BPL     7$              ;;BR IF NO
024376  042703  177770                 BIC     #177770,R3      ;;GET RID OF JUNK
024402  001002                         BNE     4$              ;;TEST FOR 0
024404  005704                         TST     R4              ;;SUPPRESS THIS 0?
024406  001403                         BEQ     5$              ;;BR IF YES
024410  005204                 4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
024412  052703  000060                 BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
024416  052703  000040         5$:     BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
```

BINARY TO OCTAL (ASCII) AND TYPE

```
024422  110337  024466                  MOVB    R3,8$           ;;SAVE FOR TYPING
024426  104401  024466                  TYPE    ,8$             ;;GO TYPE THIS DIGIT
024432  105337  024470          7$:     DECB    $OCNT           ;;COUNT BY 1
024436  003347                          BGT     2$              ;;BR IF MORE TO DO
024440  002402                          BLT     6$              ;;BR IF DONE
024442  005204                          INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
024444  000744                          BR      2$              ;;GO DO THE LAST DIGIT
024446  012605                  6$:     MOV     (SP)+,R5        ;;RESTORE R5
024450  012604                          MOV     (SP)+,R4        ;;RESTORE R4
024452  012603                          MOV     (SP)+,R3        ;;RESTORE R3
024454  016666  000002  000004          MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
024462  012616                          MOV     (SP)+,(SP)
024464  000002                          RTI                     ;;RETURN
024466     000                  8$:     .BYTE   0               ;;STORAGE FOR ASCII DIGIT
024467     000                          .BYTE   0               ;;TERMINATOR FOR TYPE ROUTINE
024470     000                  $OCNT:  .BYTE   0               ;;OCTAL DIGIT COUNTER
024471     000                  $OFILL: .BYTE   0               ;;ZERO FILL SWITCH
024472  000000                  $OMODE: .WORD   0               ;;NUMBER OF DIGITS TO TYPE
  5573                          .SBTTL  CONVERT BINARY TO DECIMAL AND TYPE ROUTINE
                              ;;**************************************************************
                              ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 5-DIGIT
                              ;*SIGNED DECIMAL (ASCII) NUMBER AND TYPE IT. DEPENDING ON WHETHER THE
                              ;*NUMBER IS POSITIVE OR NEGATIVE A SPACE OR A MINUS SIGN WILL BE TYPED
                              ;*BEFORE THE FIRST DIGIT OF THE NUMBER. LEADING ZEROS WILL ALWAYS BE
                              ;*REPLACED WITH SPACES.
                              ;*CALL:
                              ;*      MOV     NUM,-(SP)       ;;PUT THE BINARY NUMBER ON THE STACK
                              ;*      TYPDS                   ;;GO TO THE ROUTINE
024474                        $TYPDS:
024474  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
024476  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
024500  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
024502  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
024504  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
024506  012746  020200                  MOV     #20200,-(SP)    ;;SET BLANK SWITCH AND SIGN
024512  016605  000020                  MOV     20(SP),R5       ;;GET THE INPUT NUMBER
024516  100004                          BPL     1$              ;;BR IF INPUT IS POS.
024520  005405                          NEG     R5              ;;MAKE THE BINARY NUMBER POS.
024522  112766  000055  000001          MOVB    #'-,1(SP)       ;;MAKE THE ASCII NUMBER NEG.
024530  005000                  1$:     CLR     R0              ;;ZERO THE CONSTANTS INDEX
024532  012703  024710                  MOV     #$DBLK,R3       ;;SETUP THE OUTPUT POINTER
024536  112723  000040                  MOVB    #' ,(R3)+       ;;SET THE FIRST CHARACTER TO A BLANK
024542  005002                  2$:     CLR     R2              ;;CLEAR THE BCD NUMBER
024544  016001  024700                  MOV     $DTBL(R0),R1    ;;GET THE CONSTANT
024550  160105                  3$:     SUB     R1,R5           ;;FORM THIS BCD DIGIT
024552  002402                          BLT     4$              ;;BR IF DONE
024554  005202                          INC     R2              ;;INCREASE THE BCD DIGIT BY 1
024556  000774                          BR      3$
024560  060105                  4$:     ADD     R1,R5           ;;ADD BACK THE CONSTANT
024562  005702                          TST     R2              ;;CHECK IF BCD DIGIT=0
024564  001002                          BNE     5$              ;;FALL THROUGH IF 0
024566  105716                          TSTB    (SP)            ;;STILL DOING LEADING 0'S?
024570  100407                          BMI     7$              ;;BR IF YES
024572  106316                  5$:     ASLB    (SP)            ;;MSD?
024574  103003                          BCC     6$              ;;BR IF NO
024576  116663  000001  177777          MOVB    1(SP),-1(R3)    ;;YES--SET THE SIGN
024604  052702  000060          6$:     BIS     #'0,R2          ;;MAKE THE BCD DIGIT ASCII
```

CONVERT BINARY TO DECIMAL AND TYPE ROUTINE

```
024610  052702  000040          7$:     BIS     #' ,R2          ;;MAKE IT A SPACE IF NOT ALREADY A DIGIT
024614  110223                          MOVB    R2,(R3)+        ;;PUT THIS CHARACTER IN THE OUTPUT BUFFER
024616  005720                          TST     (R0)+           ;;JUST INCREMENTING
024620  020027  000010                  CMP     R0,#10          ;;CHECK THE TABLE INDEX
024624  002746                          BLT     2$              ;;GO DO THE NEXT DIGIT
024626  003002                          BGT     8$              ;;GO TO EXIT
024630  010502                          MOV     R5,R2           ;;GET THE LSD
024632  000764                          BR      6$              ;;GO CHANGE TO ASCII
024634  105726                  8$:     TSTB    (SP)+           ;;WAS THE LSD THE FIRST NON-ZERO?
024636  100003                          BPL     9$              ;;BR IF NO
024640  116663  177777  177776        MOVB    -1(SP),-2(R3)   ;;YES--SET THE SIGN FOR TYPING
024646  105013                  9$:     CLRB    (R3)            ;;SET THE TERMINATOR
024650  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
024652  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
024654  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
024656  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
024660  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
024662  104401  024710                  TYPE    ,$DBLK          ;;NOW TYPE THE NUMBER
024666  016666  000002  000004        MOV     2(SP),4(SP)     ;;ADJUST THE STACK
024674  012616                          MOV     (SP)+,(SP)
024676  000002                          RTI                     ;;RETURN TO USER
024700  023420                  $DTBL:  10000.
024702  001750                          1000.
024704  000144                          100.
024706  000012                          10.
024710                          $DBLK:  .BLKW   4
  5574                          .SBTTL  TTY INPUT ROUTINE
                                ;;******************************************************************
                                .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.
024720  022737  000176  001140  $CKSWR: CMP     #SWREG,SWR      ;;IS THE SOFT-SWR SELECTED?
024726  001074                          BNE     15$             ;;BRANCH IF NO
024730  105777  154210                  TSTB    @$TKS           ;;CHAR THERE?
024734  100071                          BPL     15$             ;;IF NO, DON'T WAIT AROUND
024736  117746  154204                  MOVB    @$TKB,-(SP)     ;;SAVE THE CHAR
024742  042716  177600                  BIC     #^C177,(SP)     ;;STRIP-OFF THE ASCII
024746  022726  000007                  CMP     #7,(SP)+        ;;IS IT A CONTROL G?
024752  001062                          BNE     15$             ;;NO, RETURN TO USER
024754  123727  001134  000001          CMPB    $AUTOB,#1       ;;ARE WE RUNNING IN AUTO-MODE?
024762  001456                          BEQ     15$             ;;BRANCH IF YES
024764  104401  025455                  TYPE    ,$CNTLG         ;;ECHO THE CONTROL-G (^G)
024770  104401  025462          $GTSWR: TYPE    ,$MSWR          ;;TYPE CURRENT CONTENTS
024774  013746  000176                  MOV     SWREG,-(SP)     ;;SAVE SWREG FOR TYPEOUT
025000  104402                          TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
025002  104401  025473                  TYPE    ,$MNEW          ;;PROMPT FOR NEW SWR
025006  005046                  19$:    CLR     -(SP)           ;;CLEAR COUNTER
025010  005046                          CLR     -(SP)           ;;THE NEW SWR
025012  105777  154126          7$:     TSTB    @$TKS           ;;CHAR THERE?
025016  100375                          BPL     7$              ;;IF NOT TRY AGAIN
025020  117746  154122                  MOVB    @$TKB,-(SP)     ;;PICK UP CHAR
025024  042716  177600                  BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII
025030  021627  000025          9$:     CMP     (SP),#25        ;;IS IT A CONTROL-U?
025034  001005                          BNE     10$             ;;BRANCH IF NOT
```

```
025036  104401  025450                  TYPE    ,$CNTLU         ;;YES, ECHO CONTROL-U (↑U)
025042  062706  000006          20$:    ADD     #6,SP           ;;IGNORE PREVIOUS INPUT
025046  000757                  19$:    BR      19$             ;;LET'S TRY IT AGAIN
025050  021627  000015          10$:    CMP     (SP),#15        ;;IS IT A <CR>?
025054  001022                          BNE     16$             ;;BRANCH IF NO
025056  005766  000004                  TST     4(SP)           ;;YES, IS IT THE FIRST CHAR?
025062  001403                          BEQ     11$             ;;BRANCH IF YES
025064  016677  000002  154046          MOV     2(SP),@SWR      ;;SAVE NEW SWR
025072  062706  000006          11$:    ADD     #6,SP           ;;CLEAR UP STACK
025076  104401  001175          14$:    TYPE    ,$CRLF          ;;ECHO <CR> AND <LF>
025102  123727  001135  000001          CMPB    $INTAG,#1       ;;RE-ENABLE TTY KBD INTERRUPTS?
025110  001003                          BNE     15$             ;;BRANCH IF NOT
025112  012777  000100  154024          MOV     #100,@$TKS      ;;RE-ENABLE TTY KBD INTERRUPTS
025120  000002          15$:    RTI                             ;;RETURN
025122  004737  024124          16$:    JSR     PC,$TYPEC       ;;ECHO CHAR
025126  021627  000060                  CMP     (SP),#60        ;;CHAR < 0?
025132  002420                          BLT     18$             ;;BRANCH IF YES
025134  021627  000067                  CMP     (SP),#67        ;;CHAR > 7?
025140  003015                          BGT     18$             ;;BRANCH IF YES
025142  042726  000060                  BIC     #60,(SP)+       ;;STRIP-OFF ASCII
025146  005766  000002                  TST     2(SP)           ;;IS THIS THE FIRST CHAR
025152  001403                          BEQ     17$             ;;BRANCH IF YES
025154  006316                          ASL     (SP)            ;;NO, SHIFT PRESENT
025156  006316                          ASL     (SP)            ;;    CHAR OVER TO MAKE
025160  006316                          ASL     (SP)            ;;    ROOM FOR NEW ONE.
025162  005266  000002          17$:    INC     2(SP)           ;;KEEP COUNT OF CHAR
025166  056616  177776                  BIS     -2(SP),(SP)     ;;SET IN NEW CHAR
025172  000707                          BR      7$              ;;GET THE NEXT ONE
025174  104401  001174          18$:    TYPE    ,$QUES          ;;TYPE ?<CR><LF>
025200  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
                                ;
025202  011646          $RDCHR: MOV     (SP),-(SP)      ;;PUSH DOWN THE PC
025204  016666  000004  000002          MOV     4(SP),2(SP)     ;;SAVE THE PS
025212  105777  153726          1$:     TSTB    @$TKS           ;;WAIT FOR
025216  100375                          BPL     1$              ;;A CHARACTER
025220  117766  153722  000004          MOVB    @$TKB,4(SP)     ;;READ THE TTY
025226  042766  177600  000004          BIC     #↑C<177>,4(SP)  ;;GET RID OF JUNK IF ANY
025234  026627  000004  000023          CMP     4(SP),#23       ;;IS IT A CONTROL-S?
025242  001013                          BNE     3$              ;;BRANCH IF NO
025244  105777  153674          2$:     TSTB    @$TKS           ;;WAIT FOR A CHARACTER
025250  100375                          BPL     2$              ;;LOOP UNTIL ITS THERE
025252  117746  153670                  MOVB    @$TKB,-(SP)     ;;GET CHARACTER
025256  042716  177600                  BIC     #↑C177,(SP)     ;;MAKE IT 7-BIT ASCII
025262  022627  000021                  CMP     (SP)+,#21       ;;IS IT A CONTROL-Q?
025266  001366                          BNE     2$              ;;IF NOT DISCARD IT
025270  000750                          BR      1$              ;;YES, RESUME
025272  026627  000004  000021  3$:     CMP     4(SP),#$XON     ;;IS IT A RANDOM XON?           ;RAN001
025300  001744                          BEQ     1$              ;;BRANCH IF YES                 ;RAN001
025302  026627  000004  000140          CMP     4(SP),#140      ;;IS IT UPPER CASE?
025310  002407                          BLT     4$              ;;BRANCH IF YES
```

```
025312  026627  000004  000175          CMP     4(SP),#175      ;;IS IT A SPECIAL CHAR?
025320  003003                          BGT     4$              ;;BRANCH IF YES
025322  042766  000040  000004          BIC     #40,4(SP)       ;;MAKE IT UPPER CASE
025330  000002                  4$:     RTI                     ;;GO BACK TO USER
                                ;;**************************************************************
                                ;*THIS ROUTINE WILL INPUT A STRING FROM THE TTY
                                ;*CALL:
                                ;*      RDLIN                   ;;INPUT A STRING FROM THE TTY
                                ;*      RETURN HERE             ;;ADDRESS OF FIRST CHARACTER WILL BE ON THE STACK
                                ;*                              ;;TERMINATOR WILL BE A BYTE OF ALL 0'S
025332  010346                 $RDLIN: MOV     R3,-(SP)        ;;SAVE R3
025334  012703  025440          1$:     MOV     #$TTYIN,R3      ;;GET ADDRESS
025340  022703  025450          2$:     CMP     #$TTYIN+8.,R3   ;;BUFFER FULL?
025344  101405                          BLOS    4$              ;;BR IF YES
025346  104410                          RDCHR                   ;;GO READ ONE CHARACTER FROM THE TTY
025350  112613                          MOVB    (SP)+,(R3)      ;;GET CHARACTER
025352  122713  000177          10$:    CMPB    #177,(R3)       ;;IS IT A RUBOUT
025356  001003                          BNE     3$              ;;SKIP IF NOT
025360  104401  001174          4$:     TYPE    ,$QUES          ;;TYPE A '?'
025364  000763                          BR      1$              ;;CLEAR THE BUFFER AND LOOP
025366  111337  025436          3$:     MOVB    (R3),9$         ;;ECHO THE CHARACTER
025372  104401  025436                  TYPE    ,9$
025376  122723  000015                  CMPB    #15,(R3)+       ;;CHECK FOR RETURN
025402  001356                          BNE     2$              ;;LOOP IF NOT RETURN
025404  105063  177777                  CLRB    -1(R3)          ;;CLEAR RETURN (THE 15)
025410  104401  001176                  TYPE    ,$LF            ;;TYPE A LINE FEED
025414  012603                          MOV     (SP)+,R3        ;;RESTORE R3
025416  011646                          MOV     (SP),-(SP)      ;;ADJUST THE STACK AND PUT ADDRESS OF THE
025420  016666  000004  000002          MOV     4(SP),2(SP)     ;;      FIRST ASCII CHARACTER ON IT
025426  012766  025440  000004          MOV     #$TTYIN,4(SP)
025434  000002                          RTI                     ;;RETURN
025436     000                  9$:     .BYTE   0               ;;STORAGE FOR ASCII CHAR. TO TYPE
025437     000                          .BYTE   0               ;;TERMINATOR
025440                          $TTYIN: .BLKB   8.              ;;RESERVE 8 BYTES FOR TTY INPUT
025450     136     125     015  $CNTLU: .ASCIZ  /↑U/<15><12>    ;;CONTROL "U"
025453     012     000
025455     136     107     015  $CNTLG: .ASCIZ  /↑G/<15><12>    ;;CONTROL "G"
025460     012     000
025462     015     012     123  $MSWR:  .ASCIZ  <15><12>/SWR = /
025465     127     122     040
025470     075     040     000
025473     040     040     116  $MNEW:  .ASCIZ  /  NEW = /
025476     105     127     040
025501     075     040     000
5575                            .SBTTL  READ AN OCTAL NUMBER FROM THE TTY
                                ;;**************************************************************
                                ;*THIS ROUTINE WILL READ AN OCTAL (ASCII) NUMBER FROM THE TTY AND
                                ;*CHANGE IT TO BINARY.
                                ;*CALL:
                                ;*      RDOCT                   ;;READ AN OCTAL NUMBER
                                ;*      RETURN HERE             ;;LOW ORDER BITS ARE ON TOP OF THE STACK
                                ;*                              ;;HIGH ORDER BITS ARE IN $HIOCT
025504  011646                 $RDOCT: MOV     (SP),-(SP)      ;;PROVIDE SPACE FOR THE
025506  016666  000004  000002          MOV     4(SP),2(SP)     ;;INPUT NUMBER
025514  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
025516  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
025520  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
```

READ AN OCTAL NUMBER FROM THE TTY

```
025522  104411                  1$:     RDLIN                   ;;READ AN ASCIZ LINE
025524  012600                          MOV     (SP)+,R0        ;;GET ADDRESS OF 1ST CHARACTER
025526  005001                          CLR     R1              ;;CLEAR DATA WORD
025530  005002                          CLR     R2
025532  112046                  2$:     MOVB    (R0)+,-(SP)     ;;PICKUP THIS CHARACTER
025534  001412                          BEQ     3$              ;;IF ZERO GET OUT
025536  006301                          ASL     R1              ;;*2
025540  006102                          ROL     R2
025542  006301                          ASL     R1              ;;*4
025544  006102                          ROL     R2
025546  006301                          ASL     R1              ;;*8
025550  006102                          ROL     R2
025552  042716  177770                  BIC     #^C7,(SP)       ;;STRIP THE ASCII JUNK
025556  062601                          ADD     (SP)+,R1        ;;ADD IN THIS DIGIT
025560  000764                          BR      2$              ;;LOOP
025562  005726                  3$:     TST     (SP)+           ;;CLEAN TERMINATOR FROM STACK
025564  010166  000012                  MOV     R1,12(SP)       ;;SAVE THE RESULT
025570  010237  025604                  MOV     R2,$HIOCT
025574  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
025576  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
025600  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
025602  000002                          RTI                     ;;RETURN
025604  000000                  $HIOCT: .WORD   0               ;;HIGH ORDER BITS GO HERE
  5576                          .SBTTL  READ A DECIMAL NUMBER FROM THE TTY
                                ;;**************************************************************
                                ;*THIS ROUTINE WILL READ A DECIMAL (ASCII) NUMBER FROM THE TTY AND
                                ;*CHANGE IT TO BINARY. IF TOO MANY CHARACTERS OR ANY ILLEGAL CHARACTERS
                                ;*ARE READ A "?" FOLLOWED BY A CARRIAGE RETURN-LINE FEED WILL BE TYPED.
                                ;*THE COMPLETE NUMBER MUST BE RETYPED. THE INPUT IS TERMINATED BY THE
                                ;*USER TYPING A CARRIAGE RETURN. THE RANGE OF THE INPUT NUMBER IS
                                ;*POSITIVE 32767 TO NEGATIVE 32768.
                                ;*CALL:
                                ;*      RDDEC                   ;;READ A DECIMAL NUMBER
                                ;*      RETURN HERE             ;;NUMBER IS ON TOP OF THE STACK
                                ;
025606  011646                  $RDDEC: MOV     (SP),-(SP)      ;;PROVIDE SPACE FOR
025610  016666  000004  000002          MOV     4(SP),2(SP)     ;;THE INPUT NUMBER
025616  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
025620  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
025622  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
025624  104411                  1$:     RDLIN                   ;;READ AN ASCIZ LINE
025626  012600                          MOV     (SP)+,R0        ;;ADDRESS OF 1ST CHAR.
025630  010037  025754                  MOV     R0,6$           ;;SAVE INCASE OF BAD INPUT
025634  005046                          CLR     -(SP)           ;;CLEAR DATA WORD
025636  005002                          CLR     R2              ;;SIGN SET POSITIVE
025640  122710  000055                  CMPB    #'-,(R0)        ;;SEE IF A MINUS SIGN WAS TYPED
025644  001001                          BNE     2$              ;;BR IF NO MINUS SIGN
025646  112002                          MOVB    (R0)+,R2        ;;SAVE FOR LATER USE
025650  112001                  2$:     MOVB    (R0)+,R1        ;;PICKUP THIS CHARACTER
025652  001424                          BEQ     3$              ;;GET OUT IF ZERO
025654  122701  000060                  CMPB    #'0,R1          ;;MAKE SURE THIS CHARACTER
025660  003032                          BGT     5$              ;;IS A DIGIT BETWEEN 0 & 9
025662  122701  000071                  CMPB    #'9,R1
025666  002427                          BLT     5$
025670  032716  170000                  BIT     #^C7777,(SP)    ;;DON'T LET NUMBER GET TO BIG
025674  001024                          BNE     5$              ;;BR IF NUMBER WOULD OVERFLOW
025676  006316                          ASL     (SP)            ;;*2
```

READ A DECIMAL NUMBER FROM THE TTY

```
025700  011646                          MOV     (SP),-(SP)      ;;SAVE FOR LATER
025702  006316                          ASL     (SP)            ;;*4
025704  006316                          ASL     (SP)            ;;*8.
025706  062616                          ADD     (SP)+,(SP)      ;;*10.
025710  102416                          BVS     5$              ;;OVERFLOW ISN'T ALLOWED
025712  162701  000060                  SUB     #'0,R1          ;;STRIP AWAY THE ASCII JUNK
025716  060116                          ADD     R1,(SP)         ;;ADD IN THIS DIGIT
025720  102412                          BVS     5$              ;;OVERFLOW ISN'T ALLOWED
025722  000752                          BR      2$              ;;LOOP
025724  005702                  3$:     TST     R2              ;;CHECK IF NUMBER IS NEG
025726  001401                          BEQ     4$              ;;BR IF NO
025730  005416                          NEG     (SP)            ;;YES--NEGATE THE NUMBER
025732  012666  000012          4$:     MOV     (SP)+,12(SP)    ;;SAVE THE RESULT
025736  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
025740  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
025742  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
025744  000002                          RTI                     ;;RETURN
025746  005726                  5$:     TST     (SP)+           ;;CLEAN PARTIAL NUMBER FROM STACK
025750  105010                          CLRB    (R0)            ;;SET A TERMINATOR
025752  104401                          TYPE                    ;;TYPE THE INPUT UP TO BAD CHAR.
025754  000000                  6$:     .WORD   0               ;;POINTER GOES HERE
025756  104401  001174                  TYPE    ,$QUES          ;;"?" "CR" &"LF"
025762  000720                          BR      1$              ;;TRY AGAIN
5577
5578                                    ;ENABLE HOB IN ERROR ROUTINE SINCE MOST LIKELY IT IS CURRENTLY DISABLED.
5579
5580                                    .SBTTL  ERROR HANDLER ROUTINE
                                        ;;**********************************************************************
                                        ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
                                        ;*SAVE THE ERROR ITEM NUMBER AND THE ADDRESS OF THE ERROR CALL
                                        ;*AND GO TO ERTYPE ON ERROR
                                        ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                        ;*SW15=1         HALT ON ERROR
                                        ;*SW13=1         INHIBIT ERROR TYPEOUTS
                                        ;*SW10=1         BELL ON ERROR
                                        ;*SW09=1         LOOP ON ERROR
                                        ;*CALL
                                        ;*      ERROR   +N      ;;ERROR=EMT AND N=ERROR ITEM NUMBER
025764                                  $ERROR:
025764  005737  002624                  TST     UQUIET          ;;TEST FOR USER-QUIET MODE
025770  001403                          BEQ     9$              ;;BRANCH IF FIELD-SERVICE MODE
025772  005000                          CLR     R0              ;;IN CASE R0 HAS A #3 IN IT (↑C)
025774  004737  026206                  JSR     PC,ABORT        ;;TEST FOR ABORT CONDITION
026000                                  9$:
026000  104407                          CKSWR                   ;;TEST FOR CHANGE IN SOFT-SWR
026002  052737  001000  177520          BIS     #BIT09,BCSR     ;ENABLE
026010  105237  001103          7$:     INCB    $ERFLG          ;;SET THE ERROR FLAG
026014  001775                          BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
026016  013777  001102  153116          MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER AND ERROR FLAG
026024  032777  002000  153106          BIT     #BIT10,@SWR     ;;BELL ON ERROR?
026032  001402                          BEQ     1$              ;;NO - SKIP
026034  104401  001170                  TYPE    ,$BELL          ;;RING BELL
026040  005237  001112          1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
026044  011637  001116                  MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
026050  162737  000002  001116          SUB     #2,$ERRPC
026056  117737  153034  001114          MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
026064  032777  020000  153046          BIT     #BIT13,@SWR     ;;SKIP TYPEOUT IF SET
```

ERROR HANDLER ROUTINE

```
026072  001004                          BNE     20$             ;;SKIP TYPEOUTS
026074  004737  026346                  JSR     PC,ERTYPE       ;;GO TO USER ERROR ROUTINE
026100  104401  001175                  TYPE    ,$CRLF
026104                          20$:
026104  122737  000001  001220          CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
026112  001007                          BNE     2$              ;;NO,SKIP APT ERROR REPORT
026114  113737  001114  026126          MOVB    $ITEMB,21$      ;;SET ITEM NUMBER AS ERROR NUMBER
026122  004737  026406                  JSR     PC,$ATY4        ;;REPORT FATAL ERROR TO APT
026126     000                  21$:    .BYTE   0
026127     000                          .BYTE   0
026130  000777                  22$:    BR      22$             ;;APT ERROR LOOP
026132  005777  153002          2$:     TST     @SWR            ;;HALT ON ERROR
026136  100002                          BPL     3$              ;;SKIP IF CONTINUE
026140  000000                          HALT                    ;;HALT ON ERROR!
026142  104407                          CKSWR                   ;;TEST FOR CHANGE IN SOFT-SWR
026144  032777  001000  152766  3$:     BIT     #BIT09,@SWR     ;;LOOP ON ERROR SWITCH SET?
026152  001402                          BEQ     4$              ;;BR IF NO
026154  013716  001110                  MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
026160  005737  001166          4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
026164  001402                          BEQ     5$              ;;BR IF NONE
026166  013716  001166                  MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
026172                          5$:
026172  022737  023340  000042          CMP     #$ENDAD,@#42    ;;ACT-11 AUTO-ACCEPT?
026200  001001                          BNE     6$              ;;BRANCH IF NO
026202  000000                          HALT                    ;;YES
026204                          6$:
026204  000002                          RTI                     ;;RETURN
                        .SBTTL  ABORT ROUTINE FOR LCP/ORION UFD MODE
026206  005737  002622          ABORT:  TST     UFDFLG          ;TEST FOR USER FRIENDLY MODE
026212  001454                          BEQ     NOABRT          ;IF NOT UFD THEN CONTINUE NORMAL OPERATION
026214  020027  000032                  CMP     R0,#32          ;IS IT A ↑Z ?
026220  001443                          BEQ     ABORTZ          ;JUST GO BACK TO CHAIN IF IT IS (NO ERROR)
026222  020027  000003                  CMP     R0,#3           ;IS IS A ↑C ?
026226  001404                          BEQ     ABORTC          ;BR TO LOAD ↑C ON XXDP+ STACK (NO ERROR)
026230  005737  002624                  TST     UQUIET          ;TEST FOR USER-QUIET MODE
026234  001443                          BEQ     NOABRT          ;IF FIELD-SERVICE MODE, CONTINUE NORMAL OPERATION
                                                                ; BECAUSE FIELD-SERVICE MODE DOES NOT QUIT ON ERROR
026236  000422                          BR      ABORTE          ;SET DRSERR THEN LEAVE
026240  013737  002616  000030  ABORTC: MOV     SAV30,30        ;RESTORE EMT LOCATION (30)
026246  013737  002620  000032          MOV     SAV32,32        ;RESTORE EMT PRIORITY LOCATION (32)
026254  104043                          EMT     +43             ;GET XXDP STACK LOC. INTO R0 FROM MONITOR
026256  005720                  1$:     TST     (R0)+           ;FIND END OF STACK
026260  001376                          BNE     1$
026262  112760  000057  177777          MOVB    #'/,-1(R0)      ;LOAD SLASH OVER ZERO
026270  112720  000136                  MOVB    #'↑,(R0)+       ;LOAD UPARROW
026274  112720  000103                  MOVB    #'C,(R0)+       ;LOAD C
026300  105010                          CLRB    (R0)            ;MAKE NEW END TO STACK
026302  000412                          BR      ABORTZ          ;NOW LEAVE
026304  013737  002616  000030  ABORTE: MOV     SAV30,30        ;RESTORE EMT LOCATION (30)
026312  013737  002620  000032          MOV     SAV32,32        ;RESTORE EMT PRIORITY LOCATION (32)
026320  104042                          EMT     +42             ;GET DCA LOCATION INTO R0 FROM MONITOR
026322  012760  177777  000042          MOV     #-1,42(R0)      ;SET A -1 INTO LOCATION DRSERR IN MONITOR
026330  013700  000042          ABORTZ: MOV     @#42,R0         ;AND PUT THE MONITOR RETURN ADDRESS IN R0
026334  005037  000042                  CLR     @#42            ;CLEAR MONITOR RETURN FLAG
026340  000137  023340                  JMP     $ENDAD          ;RETURN TO MONITOR-DO NOT PUSH STACK HERE
026344  000207                  NOABRT: RTS     PC              ;IF NOTUFD RETURN TO MAINLINE
5581                            ;* THIS ROUTINE LOADS TEST NUMBER AND ERROR NUMBER AND THEN CALLS $ERRTYP
```

ABORT ROUTINE FOR LCP/ORION UFD MODE

```
5582 026346  113737  001102  001716  ERTYPE: MOVB    $TSTNM,TEST                     ;;LOAD TEST NUMBER
5583 026354  113737  001114  001714          MOVB    $ITEMB,ERRNUM                   ;;AND ERROR NUMBER
5584 026362  004737  026636              	JSR     PC,$ERRTYP                      ;;GO REPORT ERRORS
5585 026366  000207                      	RTS     PC                              ;;RETURN
5586                                     .SBTTL  APT COMMUNICATIONS ROUTINE
                                         ;;**************************************************************************
     026370  112737  000001  026634  $ATY1:  MOVB    #1,$FFLG        ;;TO REPORT FATAL ERROR
     026376  112737  000001  026632  $ATY3:  MOVB    #1,$MFLG        ;;TO TYPE A MESSAGE
     026404  000403                  	BR      $ATYC
     026406  112737  000001  026634  $ATY4:  MOVB    #1,$FFLG        ;;TO ONLY REPORT FATAL ERROR
     026414                          $ATYC:
     026414  010046                  	MOV     R0,-(SP)        ;;PUSH R0 ON STACK
     026416  010146                  	MOV     R1,-(SP)        ;;PUSH R1 ON STACK
     026420  105737  026632          	TSTB    $MFLG           ;;SHOULD TYPE A MESSAGE?
     026424  001450                  	BEQ     5$              ;;IF NOT:  BR
     026426  122737  000001  001220  	CMPB    #APTENV,$ENV    ;;OPERATING UNDER APT?
     026434  001031                  	BNE     3$              ;;IF NOT:  BR
     026436  132737  000100  001221  	BITB    #APTSPOOL,$ENVM ;;SHOULD SPOOL MESSAGES?
     026444  001425                  	BEQ     3$              ;;IF NOT:  BR
     026446  017600  000004          	MOV     @4(SP),R0       ;;GET MESSAGE ADDR.
     026452  062766  000002  000004  	ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
     026460  005737  001200          1$:     TST     $MSGTYPE        ;;SEE IF DONE W/ LAST XMISSION?
     026464  001375                  	BNE     1$              ;;IF NOT:  WAIT
     026466  010037  001214          	MOV     R0,$MSGAD       ;;PUT ADDR IN MAILBOX
     026472  105720                  2$:     TSTB    (R0)+           ;;FIND END OF MESSAGE
     026474  001376                  	BNE     2$
     026476  163700  001214          	SUB     $MSGAD,R0       ;;SUB START OF MESSAGE
     026502  006200                  	ASR     R0              ;;GET MESSAGE LNGTH IN WORDS
     026504  010037  001216          	MOV     R0,$MSGLGT      ;;PUT LENGTH IN MAILBOX
     026510  012737  000004  001200  	MOV     #4,$MSGTYPE     ;;TELL APT TO TAKE MSG.
     026516  000413                  	BR      5$
     026520  017637  000004  026544  3$:     MOV     @4(SP),4$       ;;PUT MSG ADDR IN JSR LINKAGE
     026526  062766  000002  000004  	ADD     #2,4(SP)                ;;BUMP RETURN ADDRESS
     026534  013746  177776          	MOV     177776,-(SP)    ;;PUSH 177776 ON STACK
     026540  004737  023712          	JSR     PC,$TYPE        ;;CALL TYPE MACRO
     026544  000000                  4$:     .WORD   0
     026546                          5$:
     026546  105737  026634          10$:    TSTB    $FFLG           ;;SHOULD REPORT FATAL ERROR?
     026552  001416                  	BEQ     12$             ;;IF NOT:  BR
     026554  005737  001220          	TST     $ENV            ;;RUNNING UNDER APT?
     026560  001413                  	BEQ     12$             ;;IF NOT:  BR
     026562  005737  001200          11$:    TST     $MSGTYPE        ;;FINISHED LAST MESSAGE?
     026566  001375                  	BNE     11$             ;;IF NOT:  WAIT
     026570  017637  000004  001202  	MOV     @4(SP),$FATAL   ;;GET ERROR #
     026576  062766  000002  000004  	ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
     026604  005237  001200          	INC     $MSGTYPE        ;;TELL APT TO TAKE ERROR
     026610  105037  026634          12$:    CLRB    $FFLG           ;;CLEAR FATAL FLAG
     026614  105037  026633          	CLRB    $LFLG           ;;CLEAR LOG FLAG
     026620  105037  026632          	CLRB    $MFLG           ;;CLEAR MESSAGE FLAG
     026624  012601                  	MOV     (SP)+,R1        ;;POP STACK INTO R1
     026626  012600                  	MOV     (SP)+,R0        ;;POP STACK INTO R0
     026630  000207                  	RTS     PC              ;;RETURN
     026632     000                  $MFLG:  .BYTE   0               ;;MESSG. FLAG
     026633     000                  $LFLG:  .BYTE   0               ;;LOG FLAG
     026634     000                  $FFLG:  .BYTE   0               ;;FATAL FLAG
                                             .EVEN
           000200                    APTSIZE=200
```

```
                000001                  APTENV=001
                000100                  APTSPOOL=100
                000040                  APTCSUP=040
   5587                                 .SBTTL  ERROR MESSAGE TYPEOUT ROUTINE
                                        ;;*****************************************************************
                                        ;*THIS ROUTINE USES THE "ITEM CONTROL BYTE" ($ITEMB) TO DETERMINE WHICH
                                        ;*ERROR IS TO BE REPORTED. IT THEN OBTAINS, FROM THE "ERROR TABLE" ($ERRTB),
                                        ;*AND REPORTS THE APPROPRIATE INFORMATION CONCERNING THE ERROR.
        026636                          $ERRTYP:
        026636  104401  001175                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
        026642  010046                          MOV     R0,-(SP)        ;;SAVE R0
        026644  005000                          CLR     R0              ;;PICKUP THE ITEM INDEX
        026646  153700  001114                  BISB    @#$ITEMB,R0
        026652  001004                          BNE     1$              ;;IF ITEM NUMBER IS ZERO, JUST
                                                                        ;;TYPE THE PC OF THE ERROR
        026654  013746  001116                  MOV     $ERRPC,-(SP)    ;;SAVE $ERRPC FOR TYPEOUT
                                                                        ;;ERROR ADDRESS
        026660  104402                          TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
        026662  000426                          BR      6$              ;;GET OUT
        026664  005300                  1$:     DEC     R0              ;;ADJUST THE INDEX SO THAT IT WILL
        026666  006300                          ASL     R0              ;;      WORK FOR THE ERROR TABLE
        026670  006300                          ASL     R0
        026672  006300                          ASL     R0
        026674  062700  001324                  ADD     #$ERRTB,R0      ;;FORM TABLE POINTER
        026700  012037  026710                  MOV     (R0)+,2$        ;;PICKUP "ERROR MESSAGE" POINTER
        026704  001404                          BEQ     3$              ;;SKIP TYPEOUT IF NO POINTER
        026706  104401                          TYPE                    ;;TYPE THE "ERROR MESSAGE"
        026710  000000                  2$:     .WORD   0               ;;"ERROR MESSAGE" POINTER GOES HERE
        026712  104401  001175                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
        026716  012037  026726          3$:     MOV     (R0)+,4$        ;;PICKUP "DATA HEADER" POINTER
        026722  001404                          BEQ     5$              ;;SKIP TYPEOUT IF 0
        026724  104401                          TYPE                    ;;TYPE THE "DATA HEADER"
        026726  000000                  4$:     .WORD   0               ;;"DATA HEADER" POINTER GOES HERE
        026730  104401  001175                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
        026734  011000                  5$:     MOV     (R0),R0         ;;PICKUP "DATA TABLE" POINTER
        026736  001004                          BNE     7$              ;;GO TYPE THE DATA
        026740  012600                  6$:     MOV     (SP)+,R0        ;;RESTORE R0
        026742  104401  001175                  TYPE    ,$CRLF          ;;"CARRIAGE RETURN" & "LINE FEED"
        026746  000207                          RTS     PC              ;;RETURN
        026750                          7$:
        026750  013046                          MOV     @(R0)+,-(SP)    ;;SAVE @(R0)+ FOR TYPEOUT
        026752  104402                          TYPOC                   ;;GO TYPE--OCTAL ASCII(ALL DIGITS)
        026754  005710                          TST     (R0)            ;;IS THERE ANOTHER NUMBER?
        026756  001770                          BEQ     6$              ;;BR IF NO
        026760  104401  026766                  TYPE    ,8$             ;;TYPE TWO(2) SPACES
        026764  000771                          BR      7$              ;;LOOP
        026766     040     040     000  8$:     .ASCIZ  /  /            ;;TWO(2) SPACES
                                                .EVEN
   5588                                 .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.
        026772  010046                  $TRAP:  MOV     R0,-(SP)        ;;SAVE R0
        026774  016600  000002                  MOV     2(SP),R0        ;;GET TRAP ADDRESS
        027000  005740                          TST     -(R0)           ;;BACKUP BY 2
```

TRAP DECODER

```
        027002  111000                          MOVB    (R0),R0         ;;GET RIGHT BYTE OF TRAP
        027004  006300                          ASL     R0              ;;POSITION FOR INDEXING
        027006  016000  027026                  MOV     $TRPAD(R0),R0   ;;INDEX TO TABLE
        027012  000200                          RTS     R0              ;;GO TO ROUTINE
                                        ;;THIS IS USE TO HANDLE THE "GETPRI" MACRO
        027014  011646                  $TRAP2: MOV     (SP),-(SP)      ;;MOVE THE PC DOWN
        027016  016666  000004  000002          MOV     4(SP),2(SP)     ;;MOVE THE PSW DOWN
        027024  000002                          RTI                     ;;RESTORE THE PSW
                                        .SBTTL  TRAP TABLE
                                        ;*THIS TABLE CONTAINS THE STARTING ADDRESSES OF THE ROUTINES CALLED
                                        ;*BY THE "TRAP" INSTRUCTION.
                                        ;       ROUTINE
                                        ;       -------
        027026  027014                  $TRPAD: .WORD   $TRAP2
        027030  023712                          $TYPE   ;;CALL=TYPE     TRAP+1(104401)  TTY TYPEOUT ROUTINE
        027032  024272                          $TYPOC  ;;CALL=TYPOC    TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
        027034  024246                          $TYPOS  ;;CALL=TYPOS    TRAP+3(104403)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
        027036  024306                          $TYPON  ;;CALL=TYPON    TRAP+4(104404)  TYPE OCTAL NUMBER (AS PER LAST CALL)
        027040  024474                          $TYPDS  ;;CALL=TYPDS    TRAP+5(104405)  TYPE DECIMAL NUMBER (WITH SIGN)
        027042  024770                          $GTSWR  ;;CALL=GTSWR    TRAP+6(104406)  GET SOFT-SWR SETTING
        027044  024720                          $CKSWR  ;;CALL=CKSWR    TRAP+7(104407)  TEST FOR CHANGE IN SOFT-SWR
        027046  025202                          $RDCHR  ;;CALL=RDCHR    TRAP+10(104410) TTY TYPEIN CHARACTER ROUTINE
        027050  025332                          $RDLIN  ;;CALL=RDLIN    TRAP+11(104411) TTY TYPEIN STRING ROUTINE
        027052  025504                          $RDOCT  ;;CALL=RDOCT    TRAP+12(104412) READ AN OCTAL NUMBER FROM TTY
        027054  025606                          $RDDEC  ;;CALL=RDDEC    TRAP+13(104413) READ A DECIMAL NUMBER FROM TTY
  5589                                  .SBTTL  POWER DOWN AND UP ROUTINES
                                        ;;**************************************************************
                                        ;POWER DOWN ROUTINE
        027056  012737  027216  000024  $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
        027064  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
        027072  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
        027074  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
        027076  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
        027100  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
        027102  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
        027104  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
        027106  017746  152026                  MOV     @SWR,-(SP)      ;;PUSH @SWR ON STACK
        027112  010637  027222                  MOV     SP,$SAVR6       ;;SAVE SP
        027116  012737  027130  000024          MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
        027124  000000                          HALT
        027126  000776                          BR      .-2             ;;HANG UP
                                        ;;**************************************************************
                                        ;POWER UP ROUTINE
        027130  012737  027216  000024  $PWRUP: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST DOWN
        027136  013706  027222                  MOV     $SAVR6,SP       ;;GET SP
        027142  005037  027222                  CLR     $SAVR6          ;;WAIT LOOP FOR THE TTY
        027146  005237  027222          1$:     INC     $SAVR6          ;;WAIT FOR THE INC
        027152  001375                          BNE     1$              ;;OF  WORD
        027154  012677  151760                  MOV     (SP)+,@SWR      ;;POP STACK INTO @SWR
        027160  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
        027162  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
        027164  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
        027166  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
        027170  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
        027172  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
        027174  012737  027056  000024          MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
        027202  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
```

POWER DOWN AND UP ROUTINES

```
        027210  104401                          TYPE                    ;REPORT THE POWER FAILURE
        027212  027224                  $PWRMG: .WORD   $POWER          ;;POWER FAIL MESSAGE POINTER
        027214  000002                          RTI
        027216  000000                  $ILLUP: HALT                    ;;THE POWER UP SEQUENCE WAS STARTED
        027220  000776                          BR      .-2             ;; BEFORE THE POWER DOWN WAS COMPLETE
        027222  000000                  $SAVR6: 0                       ;;PUT THE SP HERE
        027224     015     012     120  $POWER: .ASCIZ  <15><12>"POWER"
        027227     117     127     105
        027232     122     000
                                                .EVEN
   5590
   5591                                 ;
   5592                                 ; ERROR MESSAGES
   5593                                 ;
   5594
   5595 027234     124     111     115  EM1:    .ASCIZ  /TIMEOUT ON ACCESSING A MAP REGISTER/
        027237     105     117     125
        027242     124     040     117
        027245     116     040     101
        027250     103     103     105
        027253     123     123     111
        027256     116     107     040
        027261     101     040     115
        027264     101     120     040
        027267     122     105     107
        027272     111     123     124
        027275     105     122     000
   5596 027300     115     101     120  EM2:    .ASCIZ  /MAP REGISTER COULD NOT BE CLEARED/
        027303     040     122     105
        027306     107     111     123
        027311     124     105     122
        027314     040     103     117
        027317     125     114     104
        027322     040     116     117
        027325     124     040     102
        027330     105     040     103
        027333     114     105     101
        027336     122     105     104
        027341     000
   5597 027342     115     101     120  EM3:    .ASCIZ  /MAP REGISTER COULD NOT HOLD PATTERN/
        027345     040     122     105
        027350     107     111     123
        027353     124     105     122
        027356     040     103     117
        027361     125     114     104
        027364     040     116     117
        027367     124     040     110
        027372     117     114     104
        027375     040     120     101
        027400     124     124     105
        027403     122     116     000
   5598 027406     115     101     120  EM4:    .ASCIZ  /MAP REGISTER HAS NOT BEEN ADDRESSED CORRECTLY/
        027411     040     122     105
        027414     107     111     123
        027417     124     105     122
        027422     040     110     101
        027425     123     040     116
```

POWER DOWN AND UP ROUTINES

```
        027430  117  124  040
        027433  102  105  105
        027436  116  040  101
        027441  104  104  122
        027444  105  123  123
        027447  105  104  040
        027452  103  117  122
        027455  122  105  103
        027460  124  114  131
        027463  000
  5599  027464  124  110  105  EM5:    .ASCIZ  /THERE WAS NO DIFFERENCE FOUND BETWEEN HI AND LO MAP REGISTERS/
        027467  122  105  040
        027472  127  101  123
        027475  040  116  117
        027500  040  104  111
        027503  106  106  105
        027506  122  105  116
        027511  103  105  040
        027514  106  117  125
        027517  116  104  040
        027522  102  105  124
        027525  127  105  105
        027530  116  040  110
        027533  111  040  101
        027536  116  104  040
        027541  114  117  040
        027544  115  101  120
        027547  040  122  105
        027552  107  111  123
        027555  124  105  122
        027560  123  000
  5600  027562  105  122  122  EM6:    .ASCIZ  /ERROR IN BITS 3-6,9-14 IN THE DCSR/
        027565  117  122  040
        027570  111  116  040
        027573  102  111  124
        027576  123  040  063
        027601  055  066  054
        027604  071  055  061
        027607  064  040  111
        027612  116  040  124
        027615  110  105  040
        027620  104  103  123
        027623  122  000
  5601  027625  104  103  123  EM7:    .ASCIZ  /DCSR DID NOT RESPOND PROPORLY ON RESET/
        027630  122  040  104
        027633  111  104  040
        027636  116  117  124
        027641  040  122  105
        027644  123  120  117
        027647  116  104  040
        027652  120  122  117
        027655  120  117  122
        027660  114  131  040
        027663  117  116  040
        027666  122  105  123
        027671  105  124  000
  5602  027674  124  111  115  EM10:   .ASCIZ  /TIMEOUT HAS OCCURED ON ACCESS TO THE DCSR/
```

```
        027677  105     117     125
        027702  124     040     110
        027705  101     123     040
        027710  117     103     103
        027713  125     122     105
        027716  104     040     117
        027721  116     040     101
        027724  103     103     105
        027727  123     123     040
        027732  124     117     040
        027735  124     110     105
        027740  040     104     103
        027743  123     122     000
5603    027746  113     115     103     EM11:   .ASCIZ  /KMCR BITS 0-5,8 DID NOT GET SET CORRECTLY/
        027751  122     040     102
        027754  111     124     123
        027757  040     060     055
        027762  065     054     070
        027765  040     104     111
        027770  104     040     116
        027773  117     124     040
        027776  107     105     124
        030001  040     123     105
        030004  124     040     103
        030007  117     122     122
        030012  105     103     124
        030015  114     131     000
5604    030020  124     111     115     EM12:   .ASCIZ  /TIMEOUT HAS OCCURED ON ACCESS TO THE KMCR/
        030023  105     117     125
        030026  124     040     110
        030031  101     123     040
        030034  117     103     103
        030037  125     122     105
        030042  104     040     117
        030045  116     040     101
        030050  103     103     105
        030053  123     123     040
        030056  124     117     040
        030061  124     110     105
        030064  040     113     115
        030067  103     122     000
5605    030072  105     122     122     EM13:   .ASCIZ  /ERROR IN DATA PATH PERFORMING DATA OUT/
        030075  117     122     040
        030100  111     116     040
        030103  104     101     124
        030106  101     040     120
        030111  101     124     110
        030114  040     120     105
        030117  122     106     117
        030122  122     115     111
        030125  116     107     040
        030130  104     101     124
        030133  101     040     117
        030136  125     124     000
5606    030141  105     122     122     EM14:   .ASCIZ  /ERROR IN DATA OUT CYCLE/
        030144  117     122     040
        030147  111     116     040
```

```
        030152  104  101  124
        030155  101  040  117
        030160  125  124  040
        030163  103  131  103
        030166  114  105  000
  5607  030171  105  122  122  EM15:   .ASCIZ  /ERROR IN DATA IN CYCLE/
        030174  117  122  040
        030177  111  116  040
        030202  104  101  124
        030205  101  040  111
        030210  116  040  103
        030213  131  103  114
        030216  105  000
  5608  030220  104  104  122  EM16:   .ASCIZ  /DDR IS NOT 0, WHEN DCRS<2-1> SELECTS UNIBUS LINES/
        030223  040  111  123
        030226  040  116  117
        030231  124  040  060
        030234  054  040  127
        030237  110  105  116
        030242  040  104  103
        030245  122  123  074
        030250  062  055  061
        030253  076  040  123
        030256  105  114  105
        030261  103  124  123
        030264  040  125  116
        030267  111  102  125
        030272  123  040  114
        030275  111  116  105
        030300  123  000
  5609  030302  104  103  123  EM17:   .ASCIZ  /DCSR<07> DOES NOT BECOME 1/
        030305  122  074  060
        030310  067  076  040
        030313  104  117  105
        030316  123  040  116
        030321  117  124  040
        030324  102  105  103
        030327  117  115  105
        030332  040  061  000
  5610  030335  111  116  104  EM20:   .ASCIZ  /INDIRECT ADDRESSING OF MAPPING REGISTER PAIRS/
        030340  111  122  105
        030343  103  124  040
        030346  101  104  104
        030351  122  105  123
        030354  123  111  116
        030357  107  040  117
        030362  106  040  115
        030365  101  120  120
        030370  111  116  107
        030373  040  122  105
        030376  107  111  123
        030401  124  105  122
        030404  040  120  101
        030407  111  122  123
        030412  000
  5611  030413  122  105  107  EM21:   .ASCIZ  /REGISTER PAIR 40 PERFORMS RELOCATION/
        030416  111  123  124
```

```
        030421  105     122     040
        030424  120     101     111
        030427  122     040     064
        030432  060     040     120
        030435  105     122     106
        030440  117     122     115
        030443  123     040     122
        030446  105     114     117
        030451  103     101     124
        030454  111     117     116
        030457  000
  5612  030460  116     130     115  EM22:   .ASCIZ  /NXM CONDITION COULD NOT BE CREATED THRU ALU/
        030463  040     103     117
        030466  116     104     111
        030471  124     111     117
        030474  116     040     103
        030477  117     125     114
        030502  104     040     116
        030505  117     124     040
        030510  102     105     040
        030513  103     122     105
        030516  101     124     105
        030521  104     040     124
        030524  110     122     125
        030527  040     101     114
        030532  125     000
  5613  030534  101     114     125  EM23:   .ASCIZ  /ALU ERROR/
        030537  040     105     122
        030542  122     117     122
        030545  000
  5614  030546  103     120     125  EM24:   .ASCIZ  /CPU CACHE ERROR/
        030551  040     103     101
        030554  103     110     105
        030557  040     105     122
        030562  122     117     122
        030565  000
  5615  030566  113     115     103  EM25:   .ASCIZ  /KMCR<4-0> DON'T DISABLE MEMORY RESPONSE/
        030571  122     074     064
        030574  055     060     076
        030577  040     104     117
        030602  116     047     124
        030605  040     104     111
        030610  123     101     102
        030613  114     105     040
        030616  115     105     115
        030621  117     122     131
        030624  040     122     105
        030627  123     120     117
        030632  116     123     105
        030635  000
  5616  030636  113     115     103  EM26:   .ASCIZ  /KMCR DOES NOT REFLECT EXPECTED STATUS OF THE CACHE/
        030641  122     040     104
        030644  117     105     123
        030647  040     116     117
        030652  124     040     122
        030655  105     106     114
        030660  105     103     124
```

```
                030663  040     105     130
                030666  120     105     103
                030671  124     105     104
                030674  040     123     124
                030677  101     124     125
                030702  123     040     117
                030705  106     040     124
                030710  110     105     040
                030713  103     101     103
                030716  110     105     000
5617            030721  105     122     122     EM27:   .ASCIZ  /ERROR IN CACHE TAG REGISTERS/
                030724  117     122     040
                030727  111     116     040
                030732  103     101     103
                030735  110     105     040
                030740  124     101     107
                030743  040     122     105
                030746  107     111     123
                030751  124     105     122
                030754  123     000
5618            030756  105     122     122     EM30:   .ASCIZ  /ERROR IN THE DMA CACHE DATA RAMS/
                030761  117     122     040
                030764  111     116     040
                030767  124     110     105
                030772  040     104     115
                030775  101     040     103
                031000  101     103     110
                031003  105     040     104
                031006  101     124     101
                031011  040     122     101
                031014  115     123     000
5619            031017  105     122     122     EM31:   .ASCIZ  /ERROR IN THE M9312 BOOT ROM SECTION/
                031022  117     122     040
                031025  111     116     040
                031030  124     110     105
                031033  040     115     071
                031036  063     061     062
                031041  040     102     117
                031044  117     124     040
                031047  122     117     115
                031052  040     123     105
                031055  103     124     111
                031060  117     116     000
5620            031063  105     122     122     EM32:   .ASCIZ  /ERROR IN ARBITRATION LOGIC USING UBE/
                031066  117     122     040
                031071  111     116     040
                031074  101     122     102
                031077  111     124     122
                031102  101     124     111
                031105  117     116     040
                031110  114     117     107
                031113  111     103     040
                031116  125     123     111
                031121  116     107     040
                031124  125     102     105
                031127  000
5621            031130  105     122     122     EM33:   .ASCIZ  /ERROR TRYING TO EXECUTE DMA CYCLES THRU UBE/
```

```
        031133  117     122     040
        031136  124     122     131
        031141  111     116     107
        031144  040     124     117
        031147  040     105     130
        031152  105     103     125
        031155  124     105     040
        031160  104     115     101
        031163  040     103     131
        031166  103     114     105
        031171  123     040     124
        031174  110     122     125
        031177  040     125     102
        031202  105     000
  5622  031204  105     122     122     EM34:   .ASCIZ  /ERROR IN THE UNIBUS MEMORY TEST/
        031207  117     122     040
        031212  111     116     040
        031215  124     110     105
        031220  040     125     116
        031223  111     102     125
        031226  123     040     115
        031231  105     115     117
        031234  122     131     040
        031237  124     105     123
        031242  124     000
  5623  031244  125     116     105     EM35:   .ASCIZ  /UNEXPECTED TIMEOUT HAS OCCURED/
        031247  130     120     105
        031252  103     124     105
        031255  104     040     124
        031260  111     115     105
        031263  117     125     124
        031266  040     110     101
        031271  123     040     117
        031274  103     103     125
        031277  122     105     104
        031302  000
  5624  031303  125     116     111     EM36:   .ASCIZ  /UNIBUS TIMEOUT DID NOT WORK CORRECTLY/
        031306  102     125     123
        031311  040     124     111
        031314  115     105     117
        031317  125     124     040
        031322  104     111     104
        031325  040     116     117
        031330  124     040     127
        031333  117     122     113
        031336  040     103     117
        031341  122     122     105
        031344  103     124     114
        031347  131     000
  5625  031351  104     103     123     EM37:   .ASCIZ  /DCSR<3> DID NOT DISABLE UBA ROM RESPONSE/
        031354  122     074     063
        031357  076     040     104
        031362  111     104     040
        031365  116     117     124
        031370  040     104     111
        031373  123     101     102
        031376  114     105     040
```

POWER DOWN AND UP ROUTINES

```
        031401  125     102     101
        031404  040     122     117
        031407  115     040     122
        031412  105     123     120
        031415  117     116     123
        031420  105     000
  5626
  5627  031422  124     105     123   DH1:    .ASCII  /TEST   ERROR   ERROR   ADDRESS/<12><15>
        031425  124     011     105
        031430  122     122     117
        031433  122     011     105
        031436  122     122     117
        031441  122     011     101
        031444  104     104     122
        031447  105     123     123
        031452  012     015
  5628  031454  040     040     043           .ASCIZ  /  #      PC      #/
        031457  011     040     040
        031462  120     103     011
        031465  040     040     043
        031470  000
  5629  031471  124     105     123   DH2:    .ASCII  /TEST   ERROR   ERROR   GOOD    BAD/<12><15>
        031474  124     011     105
        031477  122     122     117
        031502  122     011     105
        031505  122     122     117
        031510  122     011     107
        031513  117     117     104
        031516  011     102     101
        031521  104     012     015
  5630  031524  040     040     043           .ASCIZ  /  #      PC      #     DATA    DATA    ADDRESS/
        031527  011     040     040
        031532  120     103     011
        031535  040     040     043
        031540  011     104     101
        031543  124     101     011
        031546  104     101     124
        031551  101     011     101
        031554  104     104     122
        031557  105     123     123
        031562  000
  5631  031563  124     105     123   DH3:    .ASCII  /TEST   ERROR   ERROR   GOOD    BAD/<12><15>
        031566  124     011     105
        031571  122     122     117
        031574  122     011     105
        031577  122     122     117
        031602  122     011     107
        031605  117     117     104
        031610  011     102     101
        031613  104     012     015
  5632  031616  040     040     043           .ASCIZ  /  #      PC      #     ADDRESS ADDRESS/
        031621  011     040     040
        031624  120     103     011
        031627  040     040     043
        031632  011     101     104
        031635  104     122     105
        031640  123     123     011
```

POWER DOWN AND UP ROUTINES

```
                031643  101     104     104
                031646  122     105     123
                031651  123     000
     5633       031653  124     105     123     DH4:    .ASCII  /TEST   ERROR   ERROR   HI      LOW/<12><15>
                031656  124     011     105
                031661  122     122     117
                031664  122     011     105
                031667  122     122     117
                031672  122     011     110
                031675  111     011     114
                031700  117     127     012
                031703  015
     5634       031704  040     040     043             .ASCIZ  /  #      PC      #      MAP     MAP/
                031707  011     040     040
                031712  120     103     011
                031715  040     040     043
                031720  011     115     101
                031723  120     011     115
                031726  101     120     000
     5635       031731  124     105     123     DH5:    .ASCII  /TEST   ERROR   ERROR   GOOD    BAD/<12><15>
                031734  124     011     105
                031737  122     122     117
                031742  122     011     105
                031745  122     122     117
                031750  122     011     107
                031753  117     117     104
                031756  011     102     101
                031761  104     012     015
     5636       031764  040     040     043             .ASCIZ  /  #      PC      #      DATA    DATA/
                031767  011     040     040
                031772  120     103     011
                031775  040     040     043
                032000  011     104     101
                032003  124     101     011
                032006  104     101     124
                032011  101     000
     5637       032013  124     105     123     DH13:   .ASCII  /TEST   ERROR   ERROR   DDR     PATTERN/<12><15>
                032016  124     011     105
                032021  122     122     117
                032024  122     011     105
                032027  122     122     117
                032032  122     011     104
                032035  104     122     011
                032040  120     101     124
                032043  124     105     122
                032046  116     012     015
     5638       032051  040     040     043             .ASCIZ  /  #      PC      #/
                032054  011     040     040
                032057  120     103     011
                032062  040     040     043
                032065  000
     5639       032066  124     105     123     DH16:   .ASCII  /TEST   ERROR   ERROR/<12><15>
                032071  124     011     105
                032074  122     122     117
                032077  122     011     105
                032102  122     122     117
                032105  122     012     015
```

POWER DOWN AND UP ROUTINES

```
5640 032110  040  040  043          .ASCIZ / #      PC      #/
     032113  011  040  040
     032116  120  103  011
     032121  040  040  043
     032124  000
5641 032125  124  105  123  DH20:   .ASCII /TEST   ERROR   ERROR   KMCR PAIR/<12><15>
     032130  124  011  105
     032133  122  122  117
     032136  122  011  105
     032141  122  122  117
     032144  122  011  113
     032147  115  103  122
     032152  040  120  101
     032155  111  122  012
     032160  015
5642 032161  040  040  043          .ASCIZ / #      PC      #     FAILED/
     032164  011  040  040
     032167  120  103  011
     032172  040  040  043
     032175  011  106  101
     032200  111  114  105
     032203  104  000
5643 032205  124  105  123  DH23:   .ASCII /TEST   ERROR   ERROR   GOOD    BAD     ADDRESS/<12><15>
     032210  124  011  105
     032213  122  122  117
     032216  122  011  105
     032221  122  122  117
     032224  122  011  107
     032227  117  117  104
     032232  011  102  101
     032235  104  011  101
     032240  104  104  122
     032243  105  123  123
     032246  012  015
5644 032250  040  040  043          .ASCIZ / #      PC      #     DATA    DATA    <22-16> <13-0>/
     032253  011  040  040
     032256  120  103  011
     032261  040  040  043
     032264  011  104  101
     032267  124  101  011
     032272  104  101  124
     032275  101  011  074
     032300  062  062  055
     032303  061  066  076
     032306  011  074  061
     032311  063  055  060
     032314  076  000
5645 032316  124  105  123  DH27:   .ASCII /TEST   ERROR   ERROR   ADDRESS ADDRESS/<12><15>
     032321  124  011  105
     032324  122  122  117
     032327  122  011  105
     032332  122  122  117
     032335  122  011  101
     032340  104  104  122
     032343  105  123  123
     032346  011  101  104
     032351  104  122  105
```

POWER DOWN AND UP ROUTINES

```
        032354  123     123     012
        032357  015
 5646   032360  040     040     043             .ASCIZ  /  #      PC      #     <22-16> <15-0>/
        032363  011     040     040
        032366  120     103     011
        032371  040     040     043
        032374  011     074     062
        032377  062     055     061
        032402  066     076     011
        032405  074     061     065
        032410  055     060     076
        032413  000
 5647                                   .EVEN
 5648   032414  001716  001116  001714  DT1:    .WORD   TEST,$ERRPC,ERRNUM,$BDADR,0
        032422  001122  000000
 5649   032426  001716  001116  001714  DT2:    .WORD   TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,$BDADR,0
        032434  001124  001126  001122
        032442  000000
 5650   032444  001716  001116  001714  DT3:    .WORD   TEST,$ERRPC,ERRNUM,$GDADR,$BDADR,0
        032452  001120  001122  000000
 5651   032460  001716  001116  001714  DT4:    .WORD   TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,0
        032466  001124  001126  000000
 5652   032474  001716  001116  001714  DT16:   .WORD   TEST,$ERRPC,ERRNUM,0
        032502  000000
 5653   032504  001716  001116  001714  DT20:   .WORD   TEST,$ERRPC,ERRNUM,KMCR,$BDADR,0
        032512  177734  001122  000000
 5654   032520  001716  001122  001714  DT21:   .WORD   TEST,$BDADR,ERRNUM,0
        032526  000000
 5655   032530  001716  001116  001714  DT23:   .WORD   TEST,$ERRPC,ERRNUM,$GDDAT,$BDDAT,KIPAR6,$BDADR,0
        032536  001124  001126  172354
        032544  001122  000000
 5656   032550  001716  001116  001714  DT27:   .WORD   TEST,$ERRPC,ERRNUM,MAPH01,MAPL01,0
        032556  170206  170204  000000
 5657   032564  001716  001116  001714  DT30:   .WORD   TEST,$ERRPC,ERRNUM,MAPL00,0
        032572  170200  000000
 5658           000001                  .END
```

Symbol table

```
ABASE = 000000        BE1BA   002206        DH1     031422        ERROR = 104000        MAPH16= 170272
ABORT   026206        BE1CC   002204        DH13    032013        ERRVEC= 000004        MAPH17= 170276
ABORTC  026240        BE1CLR  002212        DH16    032066        ERTYPE  026346        MAPH2 = 170212
ABORTE  026304        BE1CR1  002210        DH2     031471        GTSWR = 104406        MAPH20= 170302
ABORTZ  026330        BE1CR2  002214        DH20    032125        HT    = 000011        MAPH21= 170306
ACDW1 = 000000        BE1DB   002202        DH23    032205        IOTVEC= 000020        MAPH22= 170312
ACDW2 = 000000        BE1INT  001724        DH27    032316        IUBE    002502        MAPH23= 170316
ACPUOP= 000000        BE1PSW  002220        DH3     031563        KDPAR0= 172360        MAPH24= 170322
ADDW0 = 000000        BE1SV   015512        DH4     031653        KDPAR1= 172362        MAPH25= 170326
ADDW1 = 000000        BE1VEC  002216        DH5     031731        KDPAR2= 172364        MAPH26= 170332
ADDW10= 000000        BE2BA   002226        DISPLA  001142        KDPAR3= 172366        MAPH27= 170336
ADDW11= 000000        BE2CC   002224        DISPRE  000174        KDPAR4= 172370        MAPH3 = 170216
ADDW12= 000000        BE2CLR  002232        DSWR  = 177570        KDPAR5= 172372        MAPH30= 170342
ADDW13= 000000        BE2CR1  002230        DT1     032414        KDPAR6= 172374        MAPH31= 170346
ADDW14= 000000        BE2CR2  002234        DT16    032474        KDPAR7= 172376        MAPH32= 170352
ADDW15= 000000        BE2DB   002222        DT2     032425        KDPDR0= 172320        MAPH33= 170356
ADDW2 = 000000        BE2INT  001726        DT20    032504        KDPDR1= 172322        MAPH34= 170362
ADDW3 = 000000        BE2PSW  002240        DT21    032520        KDPDR2= 172324        MAPH35= 170366
ADDW4 = 000000        BE2SV   015532        DT23    032530        KDPDR3= 172326        MAPH36= 170372
ADDW5 = 000000        BE2VEC  002236        DT27    032550        KDPDR4= 172330        MAPH37= 170376
ADDW6 = 000000        BIT0  = 000001        DT3     032444        KDPDR5= 172332        MAPH4 = 170222
ADDW7 = 000000        BIT00 = 000001        DT30    032564        KDPDR6= 172334        MAPH5 = 170226
ADDW8 = 000000        BIT01 = 000002        DT4     032460        KDPDR7= 172336        MAPH6 = 170232
ADDW9 = 000000        BIT02 = 000004        EMTSAV  002530        KIPAR0= 172340        MAPH7 = 170236
ADEVCT= 000000        BIT03 = 000010        EMTVEC= 000030        KIPAR1= 172342        MAPL0 = 170200
ADEVM = 000000        BIT04 = 000020        EM1     027234        KIPAR2= 172344        MAPL00= 170200
AENV  = 000000        BIT05 = 000040        EM10    027674        KIPAR3= 172346        MAPL01= 170204
AENVM = 000000        BIT06 = 000100        EM11    027746        KIPAR4= 172350        MAPL02= 170210
AFATAL= 000000        BIT07 = 000200        EM12    030020        KIPAR5= 172352        MAPL03= 170214
AMADR1= 000000        BIT08 = 000400        EM13    030072        KIPAR6= 172354        MAPL04= 170220
AMADR2= 000000        BIT09 = 001000        EM14    030141        KIPAR7= 172356        MAPL05= 170224
AMADR3= 000000        BIT1  = 000002        EM15    030171        KIPDR0= 172300        MAPL06= 170230
AMADR4= 000000        BIT10 = 002000        EM16    030220        KIPDR1= 172302        MAPL07= 170234
AMAMS1= 000000        BIT11 = 004000        EM17    030302        KIPDR2= 172304        MAPL1 = 170204
AMAMS2= 000000        BIT12 = 010000        EM2     027300        KIPDR3= 172306        MAPL10= 170240
AMAMS3= 000000        BIT13 = 020000        EM20    030335        KIPDR4= 172310        MAPL11= 170244
AMAMS4= 000000        BIT14 = 040000        EM21    030413        KIPDR5= 172312        MAPL12= 170250
AMSGAD= 000000        BIT15 = 100000        EM22    030460        KIPDR6= 172314        MAPL13= 170254
AMSGLG= 000000        BIT2  = 000004        EM23    030534        KIPDR7= 172316        MAPL14= 170260
AMSGTY= 000000        BIT3  = 000010        EM24    030546        KMCR  = 177734        MAPL15= 170264
AMTYP1= 000000        BIT4  = 000020        EM25    030566        LF    = 000012        MAPL16= 170270
AMTYP2= 000000        BIT5  = 000040        EM26    030636        MAPH0 = 170202        MAPL17= 170274
AMTYP3= 000000        BIT6  = 000100        EM27    030721        MAPH00= 170202        MAPL2 = 170210
AMTYP4= 000000        BIT7  = 000200        EM3     027342        MAPH01= 170206        MAPL20= 170300
APASS = 000000        BIT8  = 000400        EM30    030756        MAPH02= 170212        MAPL21= 170304
APRIOR= 000000        BIT9  = 001000        EM31    031017        MAPH03= 170216        MAPL22= 170310
APTCSU= 000040        BPTVEC= 000014        EM32    031063        MAPH04= 170222        MAPL23= 170314
APTENV= 000001        CCR   = 177746        EM33    031130        MAPH05= 170226        MAPL24= 170320
APTSIZ= 000200        CKSWR = 104407        EM34    031204        MAPH06= 170232        MAPL25= 170324
APTSPO= 000100        CR    = 000015        EM35    031244        MAPH07= 170236        MAPL26= 170330
ASWREG= 000000        CRLF  = 000200        EM36    031303        MAPH1 = 170206        MAPL27= 170334
ATESTN= 000000        CTBLE   002054        EM37    031351        MAPH10= 170242        MAPL3 = 170214
AUNIT = 000000        DCSR  = 177730        EM4     027406        MAPH11= 170246        MAPL30= 170340
AUSWR = 000000        DDIN    002254        EM5     027464        MAPH12= 170252        MAPL31= 170344
AVECT1= 000000        DDISP = 177570        EM6     027562        MAPH13= 170256        MAPL32= 170350
AVECT2= 000000        DDOUT   002242        EM7     027625        MAPH14= 170262        MAPL33= 170354
BCSR  = 177520        DDR   = 177732        ERRNUM  001714        MAPH15= 170266        MAPL34= 170360
```

Symbol table

```
MAPL35= 170364   SWREG   000176   TST30   012134   $BASE   001254   $GDADR  001120
MAPL36= 170370   SW0    = 000001   TST31   012350   $BDADR  001122   $GDDAT  001124
MAPL37= 170374   SW00   = 000001   TST32   012772   $BDDAT  001126   $GET42  023330
MAPL4 = 170220   SW01   = 000002   TST33   013224   $BELL   001170   $GTSWR  024770
MAPL5 = 170224   SW02   = 000004   TST34   013650   $CDW1   001260   $HD   = 000001
MAPL6 = 170230   SW03   = 000010   TST35   014050   $CDW2   001262   $HIBTS  000232
MAPL7 = 170234   SW04   = 000020   TST36   014236   $CHARC  024242   $HIOCT  025604
MAPPR   002276   SW05   = 000040   TST37   014340   $CKSWR  024720   $ICNT   001104
MCSR    001732   SW06   = 000100   TST4    004006   $CMTAG  001100   $ILLUP  027216
MEMSIZ  002364   SW07   = 000200   TST40   014620   $CM3  = 000000   $INTAG  001135
MMR0  = 177572   SW08   = 000400   TST41   015160   $CM4  = 000002   $ITEMB  001114
MMR1  = 177574   SW09   = 001000   TST42   015314   $CNTLG  025455   $LF     001176
MMR2  = 177576   SW1    = 000002   TST43   015552   $CNTLU  025450   $LFLG   026633
MMR3  = 172516   SW10   = 002000   TST44   015756   $CPUOP  001226   $LPADR  001106
MMVEC = 000250   SW11   = 004000   TST45   016050   $CRLF   001175   $LPERR  001110
NOABRT  026344   SW12   = 010000   TST46   016130   $DBLK   024710   $MADR1  001232
NOCAH   007706   SW13   = 020000   TST47   016230   $DDW0   001264   $MADR2  001236
NROM    013612   SW14   = 040000   TST5    004064   $DDW1   001266   $MADR3  001242
OBADR   002172   SW15   = 100000   TST50   016444   $DDW10  001310   $MADR4  001246
PCR   = 177522   SW2    = 000004   TST51   016542   $DDW11  001312   $MAIL   001200
PIRQ  = 177772   SW3    = 000010   TST52   016710   $DDW12  001314   $MAMS1  001230
PIRQVE= 000240   SW4    = 000020   TST53   017022   $DDW13  001316   $MAMS2  001234
PMIS    001720   SW5    = 000040   TST54   017452   $DDW14  001320   $MAMS3  001240
POLY  = 120001   SW6    = 000100   TST55   017616   $DDW15  001322   $MAMS4  001244
PR0   = 000000   SW7    = 000200   TST56   017766   $DDW2   001270   $MBADR  000234
PR1   = 000040   SW8    = 000400   TST57   020414   $DDW3   001272   $MFLG   026632
PR2   = 000100   SW9    = 001000   TST6    004250   $DDW4   001274   $MNEW   025473
PR3   = 000140   TBITVE= 000014   TST60   020766   $DDW5   001276   $MSGAD  001214
PR4   = 000200   TBLMH    012732   TST61   021050   $DDW6   001300   $MSGLG  001216
PR5   = 000240   TBLML    012672   TST62   021154   $DDW7   001302   $MSGTY  001200
PR6   = 000300   TEST     001716   TST63   021570   $DDW8   001304   $MSWR   025462
PR7   = 000340   TIMOUT   002266   TST64   022334   $DDW9   001306   $MTYP1  001231
PS    = 177776   TKVEC  = 000060   TST65   022520   $DEVCT  001210   $MTYP2  001235
PSW   = 177776   TOPTBL   010564   TST66   022742   $DEVM   001256   $MTYP3  001241
PTRN16  001774   TOUT     001730   TST67   023122   $DOAGN  023350   $MTYP4  001245
PTRN6   002024   TPVEC  = 000064   TST7    004426   $DTBL   024700   $MXCNT  023710
PWRVEC= 000024   TRAPVE= 000034   TYPDS  = 104405   $ENDAD  023340   $NULL   001154
RDCHR = 104410   TRTVEC= 000014   TYPE   = 104401   $ENDCT  023220   $NWTST= 000001
RDDEC = 104413   TST1     003324   TYPOC  = 104402   $ENULL  023354   $OCNT   024470
RDLIN = 104411   TST10    004510   TYPON  = 104404   $ENV    001220   $OMODE  024472
RDOCT = 104412   TST11    004642   TYPOS  = 104403   $ENVM   001221   $OVER   023636
RESTAR  003320   TST12    004744   UBECT   001722   $EOP    023164   $PASS   001206
RESVEC= 000010   TST13    005066   UBEM    023122   $EOPCT  023212   $PASTM  000240
R6    =%000006   TST14    005472   UBETST  013224   $ERFLG  001103   $POWER  027224
R7    =%000007   TST15    005670   UFDFLG  002622   $ERMAX  001115   $PWRDN  027056
SAV30   002616   TST16    006074   UFDSET= 000001   $ERROR  025764   $PWRMG  027212
SAV32   002620   TST17    006264   UMSIZ   002456   $ERRPC  001116   $PWRUP  027130
SCOPE = 000004   TST2     003450   UQUIET  002624   $ERRTB  001324   $QUES   001174
SIMLGO= 170014   TST20    006536   VALTBL  010550   $ERRTY  026636   $RDCHR  025202
SR0   = 177572   TST21    007136   VMKOR   002626   $ERTTL  001112   $RDDEC  025606
SR1   = 177574   TST22    007616   WRTBUF  001734   $ESCAP  001166   $RDLIN  025332
SR2   = 177576   TST23    007726   $APTHD  000232   $ETABL  001220   $RDOCT  025504
SR3   = 172516   TST24    010120   $ATYC   026414   $ETEND  001324   $RDSZ = 000010
STACK = 001100   TST25    010600   $ATY1   026370   $FATAL  001202   $RTNAD  023352
START   002530   TST26    011310   $ATY3   026376   $FFLG   026634   $SAVR6  027222
STKLMT= 177774   TST27    011452   $ATY4   026406   $FILLC  001156   $SCOPE  023360
SWR     001140   TST3     003664   $AUTOB  001134   $FILLS  001155   $SETUP= 000137
```

```
Symbol table

$STUP = 177777          $TKS    001144          $TRAP2  027014          $TYPEC  024124          $VECT1  001250
$SVLAD  023602          $TMPO   001160          $TRP  = 000014          $TYPEX  024244          $VECT2  001252
$SVPC = 000232          $TMP1   001162          $TRPAD  027026          $TYPOC  024272          $XOFF = 000023
$SWR  = 167400          $TN   = 000070          $TSTM   000236          $TYPON  024306          $XON  = 000021
$SWREG  001222          $TPB    001152          $TSTNM  001102          $TYPOS  024246          $XTSTR  023400
$SWRMK= 000300          $TPFLG  001157          $TTYIN  025440          $UNIT   001212          $$GET4= 000000
$TESTN  001204          $TPS    001150          $TYPDS  024474          $UNITM  000242          $OFILL  024471
$TIMES  001164          $TRAP   026772          $TYPE   023712          $USWR   001224          .$X   = 000232
$TKB    001146

. ABS.  032576    000   (RW,I,GBL,ABS,OVR)
        000000    001   (RW,I,LCL,REL,CON)
Errors detected:  0

*** Assembler statistics


Work  file  reads: 428
Work  file writes: 330
Size of work file: 56656 Words  ( 222 Pages)
Size of core pool: 19402 Words  ( 74 Pages)
Operating  system: RSX-11M/PLUS (Under VAX/VMS)

Elapsed time: 00:05:59.63
OKTACO.BIC,COKTACO/CR/-SP/NL:TOC=ORION.MLB/ML,COKTACO/DS:GBL
```

F13

SEQ 0161

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES							
ABASE	= 000000	9-393	9-393						
ABORT	026206	64-5580	#64-5580						
ABORTC	026240	64-5580	#64-5580						
ABORTE	026304	64-5580	#64-5580						
ABORTZ	026330	64-5580	64-5580	#64-5580					
ACDW1	= 000000	9-393	9-393						
ACDW2	= 000000	9-393	9-393						
ACPUOP	= 000000	9-393	9-393						
ADDW0	= 000000	9-393	9-393						
ADDW1	= 000000	9-393	9-393						
ADDW10	= 000000	9-393	9-393						
ADDW11	= 000000	9-393	9-393						
ADDW12	= 000000	9-393	9-393						
ADDW13	= 000000	9-393	9-393						
ADDW14	= 000000	9-393	9-393						
ADDW15	= 000000	9-393	9-393						
ADDW2	= 000000	9-393	9-393						
ADDW3	= 000000	9-393	9-393						
ADDW4	= 000000	9-393	9-393						
ADDW5	= 000000	9-393	9-393						
ADDW6	= 000000	9-393	9-393						
ADDW7	= 000000	9-393	9-393						
ADDW8	= 000000	9-393	9-393						
ADDW9	= 000000	9-393	9-393						
ADEVCT	= 000000	9-393	9-393						
ADEVM	= 000000	9-393	9-393						
AENV	= 000000	9-393	9-393						
AENVM	= 000000	9-393	9-393						
AFATAL	= 000000	9-393	9-393						
AMADR1	= 000000	9-393	9-393						
AMADR2	= 000000	9-393	9-393						
AMADR3	= 000000	9-393	9-393						
AMADR4	= 000000	9-393	9-393						
AMAMS1	= 000000	9-393	9-393						
AMAMS2	= 000000	9-393	9-393						
AMAMS3	= 000000	9-393	9-393						
AMAMS4	= 000000	9-393	9-393						
AMSGAD	= 000000	9-393	9-393						
AMSGLG	= 000000	9-393	9-393						
AMSGTY	= 000000	9-393	9-393						
AMTYP1	= 000000	9-393	9-393						
AMTYP2	= 000000	9-393	9-393						
AMTYP3	= 000000	9-393	9-393						
AMTYP4	= 000000	9-393	9-393						
APASS	= 000000	9-393	9-393						
APRIOR	= 000000	9-393							
APTCSU	= 000040	64-5571	#64-5586						
APTENV	= 000001	10-834	28-2187	37-3086	45-3856	64-5571	64-5580	64-5586	#64-5586
APTSIZ	= 000200	10-831	#64-5586						
APTSPO	= 000100	64-5571	64-5586	#64-5586					
ASWREG	= 000000	9-393	9-393						
ATESTN	= 000000	9-393	9-393						

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
AUNIT	= 000000	9-393	9-393							
AUSWR	= 000000	9-393	9-393							
AVECT1	= 000000	9-393	9-393							
AVECT2	= 000000	9-393	9-393							
BCSR	= 177520	#8-374	*37-3068	*45-3860	*45-3861	*60-5109	*64-5570	*64-5570	*64-5580	
BE1BA	002206	#10-633	40-3411	46-3919	48-3984	49-4056	50-4146	51-4221	52-4302	53-4426
		53-4459	54-4554	55-4626	56-4709	56-4755	57-4822	58-4898	59-4967	60-5070
		60-5085	60-5085	60-5094	60-5100	60-5116	60-5135	61-5246	61-5283	61-5302
		61-5326	62-5371	62-5382	63-5479	64-5531				
BE1CC	002204	#10-632	40-3410	40-3415	46-3918	48-3983	49-4058	50-4148	51-4224	52-4305
		53-4429	53-4462	54-4557	55-4629	56-4713	57-4823	58-4897	59-4969	60-5072
		60-5087	60-5102	60-5118	60-5137	61-5249	61-5286	61-5303	61-5329	62-5372
		62-5383	62-5390	63-5481	64-5533					
BE1CLR	002212	#10-635								
BE1CR1	002210	#10-634	40-3412	40-3413	41-3493	41-3496	41-3504	41-3508	41-3519	41-3523
		41-3534	41-3538	42-3619	42-3622	42-3636	42-3639	42-3653	42-3656	42-3670
		42-3673	43-3711	43-3722	44-3787	44-3790	44-3816	46-3921	47-3955	48-3987
		48-3988	49-4059	49-4065	50-4149	50-4155	51-4233	51-4234	52-4314	52-4315
		53-4438	53-4439	53-4471	53-4472	54-4566	54-4567	55-4636	55-4637	56-4722
		56-4723	56-4761	56-4762	57-4824	57-4825	58-4902	58-4903	59-4970	59-4971
		60-5073	60-5074	60-5088	60-5089	60-5103	60-5104	60-5119	60-5120	60-5138
		60-5140	61-5250	61-5251	61-5287	61-5288	61-5306	61-5308	61-5331	61-5333
		62-5375	62-5376	62-5384	62-5385	62-5391	62-5392	63-5485	63-5486	64-5537
		64-5538								
BE1CR2	002214	#10-636	45-3873	45-3878	46-3920	46-3924	47-3953	47-3958	47-3961	49-4057
		50-4147	51-4222	52-4303	53-4427	53-4460	54-4555	55-4627	55-4639	56-4710
		56-4711	56-4725	56-4756	57-4827	59-4968	60-5071	60-5086	60-5101	60-5117
		60-5136	60-5148	61-5247	61-5284	61-5315	61-5327	61-5341	62-5374	63-5480
		64-5532								
BE1DB	002202	#10-631	10-818	39-3332	48-3991	49-4055	50-4145	50-4162	51-4223	52-4304
		52-4323	53-4428	53-4450	53-4452	53-4461	53-4483	53-4485	54-4556	54-4575
		54-4577	55-4628	56-4712	56-4760	56-4764	58-4896	60-5079	60-5094	60-5110
		60-5125	61-5248	61-5265	61-5275	61-5285	61-5328	62-5373	62-5387	62-5394
		63-5498								
BE1INT	001724	#10-599	44-3796	*44-3803	*44-3812	*44-3818				
BE1PSW	002220	#10-638	41-3488	42-3612	43-3712	44-3780	55-4625	56-4717	57-4816	60-5132
		61-5305	61-5325							
BE1SV	015512	44-3779	#44-3811							
BE1VEC	002216	#10-637	41-3492	41-3502	41-3517	41-3532	42-3616	42-3633	42-3650	42-3667
		44-3779	48-3985	55-4624	56-4716	57-4815	60-5131	61-5304	61-5324	
BE2BA	002226	#10-646	61-5265							
BE2CC	002224	#10-645	61-5268							
BE2CLR	002232	#10-648	44-3808							
BE2CR1	002230	#10-647	44-3789	44-3791	44-3811	61-5269	61-5270			
BE2CR2	002234	#10-649	61-5266							
BE2DB	002222	#10-644	61-5267							
BE2INT	001726	#10-600	44-3800	*44-3804	*44-3813	*44-3817				
BE2PSW	002240	#10-651	44-3782							
BE2SV	015532	44-3781	#44-3816							
BE2VEC	002236	#10-650	44-3781							
BIT0	= 000001	#8-277	12-989							
BIT00	= 000001	#8-277	8-277	10-697	19-1428	44-3790	44-3791	57-4801	57-4804	64-5522

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		64-5545								
BIT01	= 000002	#8-277	8-277	18-1379	19-1425	20-1463	20-1477	21-1551	22-1664	24-1808
		25-1874	26-1959	49-4053	49-4076	49-4079				
BIT02	= 000004	#8-277	8-277	18-1379	19-1425	21-1551	22-1664	24-1808	25-1874	26-1959
		64-5522	64-5525							
BIT03	= 000010	#8-277	8-277	16-1282	33-2698	33-2711	37-3067	37-3151	37-3158	45-3858
		47-3953								
BIT04	= 000020	#8-277	8-277	10-842	25-1876	26-1961	27-2119	33-2711	35-2832	38-3235
		45-3873	45-3878	57-4802						
BIT05	= 000040	#8-277	8-277	10-792	10-842	21-1545	21-1547	21-1566	21-1575	21-1612
		21-1616	22-1656	22-1658	22-1667	22-1685	23-1736	23-1738	23-1743	23-1747
		23-1757	23-1758	24-1800	24-1802	24-1811	24-1823	25-1866	25-1868	25-1876
		26-1953	26-1961	27-2074	27-2096	27-2123	27-2152	28-2189	29-2228	29-2230
		29-2247	30-2319	30-2384	31-2487	32-2601	33-2651	33-2715	34-2747	34-2774
		35-2827	35-2852	37-3088	38-3231	39-3324	45-3854	45-3861	53-4411	56-4744
		57-4851	57-4855	64-5526						
BIT06	= 000100	#8-277	8-277	28-2182	28-2183	29-2231	30-2316	30-2385	31-2488	32-2599
		32-2615	33-2650	33-2679	33-2680	33-2714	34-2748	34-2773	35-2849	35-2850
		45-3860	45-3864	63-5497	64-5527	64-5528				
BIT07	= 000200	#8-277	8-277	18-1383	27-2104	37-3068	45-3862	60-5109		
BIT08	= 000400	#8-277	8-277	16-1281	18-1378	19-1424	19-1439	20-1462	21-1550	22-1663
		24-1807	25-1873	26-1958	27-2066	29-2232	29-2239	30-2329	30-2336	30-2350
		30-2358	30-2366	30-2374	31-2504	31-2511	31-2521	31-2528	31-2538	31-2545
		31-2555	31-2562	31-2564	32-2600	32-2602	32-2609	32-2616	33-2649	33-2654
		33-2656	33-2664	33-2670	33-2694	33-2716	34-2746	34-2756	34-2758	34-2762
		34-2767	34-2775	35-2829	35-2851	35-2886	36-2964	36-3019	37-3067	37-3143
		37-3149	37-3158	39-3323	55-4639	56-4693	56-4695	56-4725	56-4746	56-4748
		56-4767	56-4769	57-4810	57-4812	57-4827	57-4849	57-4853	57-4856	57-4858
		60-5148	61-5315	61-5341	63-5468	63-5469	63-5470	64-5570		
BIT09	= 001000	#8-277	8-277	64-5570	64-5570	64-5580	64-5580			
BIT1	= 000002	#8-277								
BIT10	= 002000	#8-277	29-2233	29-2237	32-2605	64-5580				
BIT11	= 004000	#8-277	29-2233	29-2237	32-2605	33-2708	64-5570			
BIT12	= 010000	#8-277	29-2233	29-2237	32-2605	33-2695	46-3920			
BIT13	= 020000	#8-277	25-1900	26-1984	26-1993	64-5580				
BIT14	= 040000	#8-277	25-1900	26-1984	26-1993	61-5248	61-5256	64-5570		
BIT15	= 100000	#8-277	23-1753	25-1900	26-1984	26-1993	27-2140	33-2688	33-2704	35-2880
		36-3010								
BIT2	= 000004	#8-277								
BIT3	= 000010	#8-277								
BIT4	= 000020	#8-277								
BIT5	= 000040	#8-277	10-830	11-892	11-903	11-907	36-2980	49-4045	50-4132	51-4227
		51-4241	52-4308	52-4317	53-4432	53-4441	53-4465	53-4474	54-4560	54-4569
		55-4632	55-4652	56-4699	57-4808	61-5330	63-5467			
BIT6	= 000100	#8-277	10-830	36-2983	63-5459	63-5460				
BIT7	= 000200	#8-277	15-1217	15-1225	49-4065	50-4155	51-4234	52-4315	53-4439	53-4472
		54-4567	55-4637	56-4723	57-4825	58-4903	59-4971	60-5074	60-5089	60-5104
		60-5120	60-5140	61-5251	61-5270	61-5288	61-5333	63-5486	64-5538	
BIT8	= 000400	#8-277	17-1327	17-1344	18-1398	20-1479	21-1617	22-1687	23-1729	23-1761
		24-1824	25-1916	26-2017	27-2160	29-2227	29-2249	30-2315	30-2386	31-2486
		36-2982								
BIT9	= 001000	#8-277	29-2233	29-2237	32-2605					

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES
BPTVEC	= 000014	#8-277
CCR	= 177746	#8-378
CKSWR	= 104407	64-5570 64-5580 64-5580 #64-5588
CR	= 000015	#8-277 64-5571 64-5571
CRLF	= 000200	#8-277 10-836 10-836 64-5571 64-5571
CTBLE	002054	#10-618 36-2965
DCSR	= 177730	#8-375 *10-697 15-1201 *15-1206 15-1207 15-1209 15-1218 *15-1223 15-1225
		15-1228 15-1230 15-1235 *16-1281 *17-1327 *17-1344 *18-1378 *18-1379 18-1383
		*18-1398 *19-1424 *19-1425 *19-1428 *19-1439 *20-1462 *20-1463 *20-1477 *20-1479
		*21-1550 *21-1551 *21-1617 *22-1663 *22-1664 *22-1687 *23-1729 23-1753 *23-1761
		*24-1807 *24-1808 *24-1824 *25-1873 *25-1874 *25-1916 *26-1958 *26-1959 *26-2017
		*27-2066 27-2140 *27-2160 *29-2227 *29-2249 *30-2315 *30-2386 *31-2486 *31-2564
		*32-2600 *32-2616 *33-2649 *33-2716 *34-2746 *34-2775 *35-2829 *35-2886 *36-2964
		*36-2982 *36-3019 *37-3067 37-3143 *37-3149 *37-3151 *37-3158 *39-3323 *49-4053
		*49-4076 49-4077 *49-4079 *56-4693 *56-4695 *56-4746 *56-4748 *56-4767 *56-4769
		*57-4810 *57-4812 *57-4849 *57-4853 *57-4856 *57-4858 *63-5468 *63-5470
DDIN	002254	#10-697 20-1467 25-1893 26-1978 27-2139 30-2328 30-2351 30-2367 31-2496
		31-2505 31-2522 31-2539 31-2556 33-2682 33-2684 34-2752 34-2761 35-2862
		35-2879 36-2999 36-3009
DDISP	= 177570	#8-277 9-393 10-831
DDOUT	002242	#10-672 18-1387 21-1592 24-1821 26-1988 33-2663 33-2687
DDR	= 177732	#8-376 *10-672 18-1388 18-1390 19-1433 19-1435 20-1470 20-1473 20-1475
		*22-1678 *23-1751 25-1896 25-1899 26-1980 26-1982 36-3013 49-4067 49-4071
		49-4073
DH1	031422	10-399 10-447 10-460 10-548 #64-5627
DH13	032013	10-466 10-479 #64-5637
DH16	032066	10-492 10-504 10-510 10-523 10-529 10-554 10-560 10-566 10-572
		10-578 10-584 10-590 #64-5639
DH2	031471	10-405 10-412 10-453 #64-5629
DH20	032125	10-498 #64-5641
DH23	032205	10-516 #64-5643
DH27	032316	10-542 #64-5645
DH3	031563	10-419 #64-5631
DH4	031653	10-426 #64-5633
DH5	031731	10-433 10-440 10-472 10-485 10-535 #64-5635
DISPLA	001142	#9-393 *10-831 *10-831 64-5570 64-5580
DISPRE	000174	#8-383 10-831
DSWR	= 177570	#8-277 9-393 10-831
DT1	032414	10-400 10-448 10-461 #64-5648
DT16	032474	10-493 10-505 10-511 10-524 10-530 10-555 10-561 10-567 10-573
		10-585 10-591 #64-5652
DT2	032426	10-407 10-414 10-455 #64-5649
DT20	032504	10-499 #64-5653
DT21	032520	10-579 #64-5654
DT23	032530	10-518 #64-5655
DT27	032550	10-543 #64-5656
DT3	032444	10-421 #64-5650
DT30	032564	10-549 #64-5657
DT4	032460	10-428 10-435 10-442 10-467 10-474 10-480 10-487 10-537 #64-5651
EMTSAV	002530	#10-830
EMTVEC	= 000030	#8-277 *10-831 *10-831
EM1	027234	10-398 #64-5595

SYMBOL CROSS REFERENCE CREF V02

SYMBOL VALUE REFERENCES

EM10 027674 10-446 #64-5602
EM11 027746 10-452 #64-5603
EM12 030020 10-459 #64-5604
EM13 030072 10-465 #64-5605
EM14 030141 10-471 #64-5606
EM15 030171 10-478 #64-5607
EM16 030220 10-484 #64-5608
EM17 030302 10-491 #64-5609
EM2 027300 10-404 #64-5596
EM20 030335 10-497 #64-5610
EM21 030413 10-503 #64-5611
EM22 030460 10-509 #64-5612
EM23 030534 10-515 #64-5613
EM24 030546 10-522 #64-5614
EM25 030566 10-528 #64-5615
EM26 030636 10-534 #64-5616
EM27 030721 10-541 #64-5617
EM3 027342 10-411 #64-5597
EM30 030756 10-547 #64-5618
EM31 031017 10-553 #64-5619
EM32 031063 10-559 #64-5620
EM33 031130 10-565 #64-5621
EM34 031204 10-571 #64-5622
EM35 031244 10-577 #64-5623
EM36 031303 10-583 #64-5624
EM37 031351 10-589 #64-5625
EM4 027406 10-418 #64-5598
EM5 027464 10-425 #64-5599
EM6 027562 10-432 #64-5600
EM7 027625 10-439 #64-5601
ERRNUM 001714 #10-595 *64-5583 64-5648 64-5649 64-5650 64-5651 64-5652 64-5653 64-5654
64-5655 64-5656 64-5657
ERROR = 104000 #8-277 10-716 11-917 12-985 12-995 12-1008 12-1018 13-1072 13-1083
14-1138 15-1213 15-1227 15-1231 15-1236 16-1290 16-1296 17-1334 18-1385
18-1391 18-1395 19-1436 20-1476 21-1599 21-1603 22-1680 23-1755 24-1829
25-1901 26-1985 26-1994 27-2086 27-2111 27-2132 27-2142 29-2238 29-2246
30-2335 30-2342 30-2357 30-2364 30-2373 30-2380 31-2510 31-2516 31-2527
31-2533 31-2544 31-2550 31-2561 31-2568 32-2608 32-2614 33-2669 33-2675
33-2693 33-2700 33-2707 33-2713 34-2766 34-2772 35-2868 35-2882 36-3012
36-3015 37-3106 37-3131 37-3139 37-3154 38-3246 38-3250 40-3417 41-3498
41-3510 41-3525 41-3540 42-3623 42-3640 42-3657 42-3674 43-3727 44-3798
44-3802 45-3876 45-3883 46-3923 47-3960 48-3993 48-3996 49-4075 49-4092
50-4164 51-4246 52-4325 53-4455 53-4488 54-4580 55-4641 55-4645 56-4727
56-4732 56-4766 57-4829 57-4834 58-4910 59-4982 60-5081 60-5096 60-5112
60-5127 60-5144 60-5150 61-5258 61-5277 61-5295 61-5298 61-5311 61-5317
61-5337 61-5343 62-5389 62-5396 63-5495 63-5500 64-5542
ERRVEC = 000004 #8-277 10-767 *10-768 *10-769 *10-783 10-831 *10-831 *10-831 37-3136
*37-3137 *37-3152 *37-3159 64-5570 *64-5570 *64-5570 *64-5570
ERTYPE 026346 64-5580 #64-5582
GNS = ****** 8-383 8-383 10-836 64-5561 64-5561 64-5588 64-5588 64-5588 64-5588
64-5588 64-5588 64-5588 64-5588 64-5588 64-5588 64-5588 64-5588 64-5588
64-5588 64-5588 64-5588 64-5588 64-5588 64-5588 64-5588 64-5588 64-5588

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES
GTSWR	= 104406	10-836 #64-5588
HT	= 000011	#8-277 64-5571 64-5571
IOTVEC	= 000020	#8-277 *10-831 *10-831
IUBE	002502	#10-817 40-3408 41-3486 42-3611 42-3632 42-3649 42-3666 43-3710 44-3773
		45-3866 46-3914 47-3952 48-3982 49-4040 50-4131 51-4214 52-4295 53-4415
		54-4547 55-4619 56-4703 57-4821 58-4893 59-4952 60-5065 60-5152 61-5241
		61-5321 61-5345 62-5367 63-5458 64-5521
KDPAR0	= 172360	#8-278
KDPAR1	= 172362	#8-278
KDPAR2	= 172364	#8-278
KDPAR3	= 172366	#8-278
KDPAR4	= 172370	#8-278
KDPAR5	= 172372	#8-278
KDPAR6	= 172374	#8-278
KDPAR7	= 172376	#8-278
KDPDR0	= 172320	#8-278
KDPDR1	= 172322	#8-278
KDPDR2	= 172324	#8-278
KDPDR3	= 172326	#8-278
KDPDR4	= 172330	#8-278
KDPDR5	= 172332	#8-278
KDPDR6	= 172334	#8-278
KDPDR7	= 172336	#8-278
KIPAR0	= 172340	#8-278
KIPAR1	= 172342	#8-278
KIPAR2	= 172344	#8-278
KIPAR3	= 172346	#8-278
KIPAR4	= 172350	#8-278
KIPAR5	= 172352	#8-278
KIPAR6	= 172354	#8-278 *10-773 *10-775 10-777 10-847 *21-1568 21-1595 *21-1608 *22-1673
		*23-1740 *23-1744 *24-1815 *25-1889 25-1905 *25-1910 *25-1912 25-1913 *26-1972
		*26-1979 *26-1989 *26-1998 *27-2076 *27-2078 *27-2090 *27-2126 27-2146 *27-2154
		*38-3241 *38-3254 38-3255 *53-4414 *54-4546 *57-4817 57-4841 *57-4848 64-5655
KIPAR7	= 172356	#8-278
KIPDR0	= 172300	#8-278
KIPDR1	= 172302	#8-278
KIPDR2	= 172304	#8-278
KIPDR3	= 172306	#8-278
KIPDR4	= 172310	#8-278
KIPDR5	= 172312	#8-278
KIPDR6	= 172314	#8-278
KIPDR7	= 172316	#8-278
KMCR	= 177734	#8-377 10-791 16-1268 16-1278 *16-1283 16-1284 16-1286 16-1288 *16-1289
		16-1295 21-1547 21-1577 *21-1578 21-1581 *21-1614 22-1658 23-1738 23-1742
		*23-1743 *23-1760 24-1802 25-1868 26-1953 27-2069 27-2074 27-2098 *27-2100
		27-2101 27-2105 27-2108 27-2109 *27-2110 *27-2127 *27-2151 27-2152 *27-2157
		*28-2182 28-2183 *29-2231 *29-2232 29-2233 29-2235 29-2236 *29-2239 29-2240
		29-2243 29-2244 *30-2316 30-2322 *30-2329 30-2330 *30-2336 30-2337 *30-2350
		30-2352 *30-2358 30-2359 *30-2366 30-2368 *30-2374 30-2375 *30-2385 *31-2488
		31-2491 *31-2504 31-2506 *31-2511 31-2512 *31-2521 31-2523 *31-2528 31-2529
		*31-2538 31-2540 *31-2545 31-2546 *31-2555 31-2557 *31-2562 31-2563 *32-2599
		*32-2602 32-2603 32-2605 32-2607 *32-2609 32-2610 *32-2615 *33-2650 *33-2654

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		33-2655	*33-2656	33-2657	*33-2664	33-2665	33-2668	*33-2670	33-2671	33-2674
		*33-2679	*33-2680	33-2688	33-2690	33-2692	*33-2694	33-2695	33-2697	33-2699
		33-2701	33-2704	33-2706	33-2708	33-2710	33-2712	*33-2714	*34-2748	*34-2756
		34-2757	*34-2758	34-2759	*34-2762	34-2763	34-2765	*34-2767	34-2768	34-2771
		*34-2773	35-2827	*35-2849	*35-2850	*35-2851	35-2864	35-2880	*36-2983	36-3010
		37-3145	38-3213	38-3218	38-3231	51-4209	53-4411	56-4685	56-4686	*56-4694
		56-4744	*56-4747	*56-4768	57-4809	*57-4811	*57-4850	57-4851	*57-4857	*63-5459
		63-5460	*63-5469	63-5491	*63-5497	*64-5527	*64-5528	64-5540	64-5554	64-5653
LF	= 000012	#8-277	64-5571	64-5571						
MAPH0	= 170202	#8-351								
MAPH00	= 170202	#8-286	8-351	*23-1746	*24-1818	*26-1974	*26-2001	*26-2002	*27-2122	*27-2150
		*30-2321	*31-2490	*33-2653	*34-2750	*36-2981	*51-4226	*52-4307	*54-4559	*55-4631
		*57-4814	*57-4845	*61-5282	61-5296	*63-5466				
MAPH01	= 170206	#8-288	8-353	*35-2860	*35-2861	*35-2877	*35-2878	*63-5478	*64-5530	64-5656
MAPH02	= 170212	#8-290	8-355							
MAPH03	= 170216	#8-292	8-357							
MAPH04	= 170222	#8-294	8-359							
MAPH05	= 170226	#8-296	8-361							
MAPH06	= 170232	#8-298	8-363							
MAPH07	= 170236	#8-300	8-365							
MAPH1	= 170206	#8-353								
MAPH10	= 170242	#8-302								
MAPH11	= 170246	#8-304								
MAPH12	= 170252	#8-306								
MAPH13	= 170256	#8-308								
MAPH14	= 170262	#8-310								
MAPH15	= 170266	#8-312								
MAPH16	= 170272	#8-314								
MAPH17	= 170276	#8-316								
MAPH2	= 170212	#8-355								
MAPH20	= 170302	#8-318								
MAPH21	= 170306	#8-320								
MAPH22	= 170312	#8-322								
MAPH23	= 170316	#8-324								
MAPH24	= 170322	#8-326								
MAPH25	= 170326	#8-328								
MAPH26	= 170332	#8-330								
MAPH27	= 170336	#8-332								
MAPH3	= 170216	#8-357								
MAPH30	= 170342	#8-334								
MAPH31	= 170346	#8-336								
MAPH32	= 170352	#8-338								
MAPH33	= 170356	#8-340								
MAPH34	= 170362	#8-342								
MAPH35	= 170366	#8-344								
MAPH36	= 170372	#8-346	*56-4758							
MAPH37	= 170376	#8-348	*22-1677	62-5399	*63-5464					
MAPH4	= 170222	#8-359								
MAPH5	= 170226	#8-361								
MAPH6	= 170232	#8-363								
MAPH7	= 170236	#8-365								
MAPL0	= 170200	#8-350								

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
MAPL00	= 170200	#8-285	8-350	11-897	12-971	12-979	13-1057	13-1058	13-1066	13-1067
		14-1123	14-1130	21-1556	21-1567	*23-1745	*24-1817	25-1881	*26-1973	*26-2000
		26-2004	*27-2121	*27-2148	*30-2320	*31-2489	*33-2652	*34-2749	*36-2998	*36-3008
		*51-4225	*52-4306	53-4418	*54-4558	*55-4630	*57-4813	*57-4843	57-4846	*61-5281
		61-5283	61-5293	62-5371	62-5381	*63-5465	64-5657			
MAPL01	= 170204	#8-287	8-352	*35-2859	*35-2876	*63-5477	*64-5529	64-5656		
MAPL02	= 170210	#8-289	8-354							
MAPL03	= 170214	#8-291	8-356							
MAPL04	= 170220	#8-293	8-358							
MAPL05	= 170224	#8-295	8-360							
MAPL06	= 170230	#8-297	8-362							
MAPL07	= 170234	#8-299	8-364							
MAPL1	= 170204	#8-352								
MAPL10	= 170240	#8-301	56-4700							
MAPL11	= 170244	#8-303								
MAPL12	= 170250	#8-305								
MAPL13	= 170254	#8-307								
MAPL14	= 170260	#8-309								
MAPL15	= 170264	#8-311								
MAPL16	= 170270	#8-313								
MAPL17	= 170274	#8-315								
MAPL2	= 170210	#8-354								
MAPL20	= 170300	#8-317								
MAPL21	= 170304	#8-319								
MAPL22	= 170310	#8-321								
MAPL23	= 170314	#8-323								
MAPL24	= 170320	#8-325								
MAPL25	= 170324	#8-327								
MAPL26	= 170330	#8-329								
MAPL27	= 170334	#8-331								
MAPL3	= 170214	#8-356								
MAPL30	= 170340	#8-333								
MAPL31	= 170344	#8-335								
MAPL32	= 170350	#8-337								
MAPL33	= 170354	#8-339								
MAPL34	= 170360	#8-341								
MAPL35	= 170364	#8-343								
MAPL36	= 170370	#8-345	*56-4757							
MAPL37	= 170374	#8-347	*22-1676	56-4688	56-4753	*63-5463				
MAPL4	= 170220	#8-358								
MAPL5	= 170224	#8-360								
MAPL6	= 170230	#8-362								
MAPL7	= 170234	#8-364								
MAPPR	002276	#10-734	10-841	21-1564	22-1665	23-1730	24-1809	25-1875	26-1960	27-2067
		35-2830	38-3239	57-4800						
MCSR	001732	#10-602	60-5070	60-5079	61-5245	61-5246	61-5256	61-5262		
MEMSIZ	002364	#10-767	10-844							
MMR0	= 177572	#8-369	*10-843	*10-845	*21-1565	*21-1615	*22-1666	*22-1684	*23-1731	*23-1756
		*24-1810	*24-1822	*25-1877	*25-1915	*26-1962	*26-2016	*27-2068	*27-2159	*35-2831
		*35-2885	*38-3240	*38-3257	*57-4801	*57-4804				
MMR1	= 177574	#8-370								
MMR2	= 177576	#8-371								

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES
MMR3	= 172516	#8-372 *10-842 *10-846 *21-1566 *21-1616 *22-1667 *22-1685 *23-1747 *23-1757
		*24-1811 *24-1823 *25-1876 *26-1961 *27-2119 *27-2123 *27-2158 *29-2228 *29-2230
		29-2247 *30-2319 *30-2384 *31-2487 *32-2601 *33-2651 *33-2715 *34-2747 *34-2774
		*35-2832 *35-2852 *36-2980 *38-3235 *39-3324 *49-4045 *50-4132 *51-4227 *51-4241
		*52-4308 *52-4317 *53-4432 *53-4441 *53-4465 *53-4474 *54-4560 *54-4569 *55-4632
		*55-4652 *56-4699 *57-4802 *57-4808 *57-4855 *61-5330 *63-5467 *63-5496 *64-5526
		*64-5544
MMVEC	= 000250	#8-278
NOABRT	026344	64-5580 64-5580 #64-5580
NOCAH	007706	28-2191 #28-2195
NROM	013612	37-3091 #37-3162
OBADR	002172	#10-620 36-2972 36-2985 36-2995 36-3005
PCR	= 177522	#8-379 *37-3069
PIRQ	= 177772	#8-277 *43-3723 *43-3735
PIRQVE	= 000240	#8-277 *43-3713
PMIS	001720	#10-597 *10-847 *16-1273 17-1323 18-1376 19-1422 20-1460 21-1543 22-1654
		23-1727 24-1798 25-1864 26-1951 26-1963 27-2063 27-2120 28-2180 29-2225
		30-2312 31-2483 32-2597 33-2646 34-2740 35-2824 35-2833 35-2839 35-2841
		36-2959 53-4492 57-4795 57-4803 64-5551
POLY	= 120001	#8-380 37-3118 37-3120
PR0	= 000000	#8-277
PR1	= 000040	#8-277
PR2	= 000100	#8-277
PR3	= 000140	#8-277
PR4	= 000200	#8-277
PR5	= 000240	#8-277
PR6	= 000300	#8-277
PR7	= 000340	#8-277
PS	= 177776	#8-277 8-277
PSW	= 177776	#8-277 *40-3409 *40-3418 40-3419 *40-3421 *41-3487 *41-3505 *41-3520 *41-3535
		*42-3618 *42-3620 *42-3635 *42-3637 *42-3652 *42-3654 *42-3669 *42-3671 *43-3721
		*43-3724 *44-3786 *44-3792 *47-3954 *47-3962 *48-3986 *48-3990 *61-5332
PTRN16	001774	#10-604 12-986 18-1380 19-1426 36-2984 49-4047 49-4088 50-4138 51-4215
		52-4301
PTRN6	002024	#10-607 12-1009
PWRVEC	= 000024	#8-277 *10-831 *10-831 45-3870 *45-3871 45-3872 *45-3880 *45-3886 *64-5589
		*64-5589 *64-5589 *64-5589 *64-5589 *64-5589
RDCHR	= 104410	64-5574 #64-5588
RDDEC	= 104413	#64-5588
RDLIN	= 104411	64-5575 64-5576 #64-5588
RDOCT	= 104412	#64-5588
RESTAR	003320	#10-848 64-5561
RESVEC	= 000010	#8-277
R6	=%000006	#8-277 *10-831 *10-831 10-831
R7	=%000007	#8-277
SAV30	002616	10-830 *10-830 #10-830 64-5580 64-5580
SAV32	002620	*10-830 #10-830 64-5580 64-5580
SCOPE	= 000004	#8-277 11-881 12-966 13-1052 14-1118 15-1191 16-1260 17-1318 18-1374
		19-1420 20-1459 21-1541 22-1652 23-1725 24-1796 25-1862 26-1949 27-2062
		28-2178 29-2223 30-2310 31-2481 32-2595 33-2644 34-2738 35-2822 36-2958
		37-3062 38-3208 39-3321 40-3406 41-3484 42-3609 43-3709 44-3769 45-3848
		46-3912 47-3950 48-3980 49-4037 50-4129 51-4207 52-4293 53-4409 54-4544

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		55-4618	56-4683	57-4793	58-4891	59-4950	60-5063	61-5239	62-5366	63-5456
		64-5519	64-5548	64-5561						
SIMLGO	= 170014	#8-381								
SR0	= 177572	#8-278								
SR1	= 177574	#8-278								
SR2	= 177576	#8-278								
SR3	= 172516	#8-278	*11-892	*11-903	*11-907					
STACK	= 001100	#8-277	10-831							
START	002530	8-386	8-389	#10-830						
STKLMT	= 177774	#8-277								
SWR	001140	#9-393	10-831	*10-831	10-831	*10-831	*10-831	10-836	64-5570	64-5570
		64-5570	64-5570	64-5570	64-5574	64-5574	64-5580	64-5580	64-5580	64-5580
		64-5589	64-5589							
SWREG	000176	#8-383	10-831	10-836	64-5574	64-5574				
SW0	= 000001	#8-277								
SW00	= 000001	#8-277	8-277							
SW01	= 000002	#8-277	8-277							
SW02	= 000004	#8-277	8-277							
SW03	= 000010	#8-277	8-277							
SW04	= 000020	#8-277	8-277							
SW05	= 000040	#8-277	8-277							
SW06	= 000100	#8-277	8-277							
SW07	= 000200	#8-277	8-277							
SW08	= 000400	#8-277	8-277							
SW09	= 001000	#8-277	8-277							
SW1	= 000002	#8-277								
SW10	= 002000	#8-277								
SW11	= 004000	#8-277								
SW12	= 010000	#8-277								
SW13	= 020000	#8-277								
SW14	= 040000	#8-277								
SW15	= 100000	#8-277								
SW2	= 000004	#8-277								
SW3	= 000010	#8-277								
SW4	= 000020	#8-277								
SW5	= 000040	#8-277								
SW6	= 000100	#8-277								
SW7	= 000200	#8-277								
SW8	= 000400	#8-277								
SW9	= 001000	#8-277								
TBITVE	= 000014	#8-277								
TBLMH	012732	35-2854	#35-2899							
TBLML	012672	35-2853	#35-2892							
TEST	001716	#10-596	*10-839	*64-5582	64-5648	64-5649	64-5650	64-5651	64-5652	64-5653
		64-5654	64-5655	64-5656	64-5657					
TIMOUT	002266	#10-715	10-837	15-1202	16-1269	17-1343	21-1563	22-1686	27-2092	27-2156
		39-3380								
TKVEC	= 000060	#8-277								
TOPTBL	010564	30-2318	#30-2403							
TOUT	001730	#10-601	*21-1590	21-1593						
TPVEC	= 000064	#8-277								
TRAPVE	= 000034	#8-277	*10-831	*10-831						

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES						
TRTVEC	= 000014	#8-277						
TST1	003324	#11-881						
TST10	004510	17-1324	#18-1374					
TST11	004642	18-1377	#19-1420					
TST12	004744	19-1423	#20-1459					
TST13	005066	20-1461	#21-1541					
TST14	005472	21-1544	#22-1652					
TST15	005670	22-1655	22-1659	#23-1725				
TST16	006074	23-1728	23-1759	#24-1796				
TST17	006264	24-1799	24-1803	24-1826	#25-1862			
TST2	003450	11-905	#12-966					
TST20	006536	25-1865	25-1869	#26-1949				
TST21	007136	26-1952	26-1954	#27-2062				
TST22	007616	27-2097	#28-2178					
TST23	007726	28-2181	28-2184	#29-2223				
TST24	010120	29-2226	#30-2310					
TST25	010600	30-2387	#31-2481					
TST26	011310	31-2566	#32-2595					
TST27	011452	32-2598	#33-2644					
TST3	003664	#13-1052						
TST30	012134	#34-2738						
TST31	012350	34-2741	#35-2822					
TST32	012772	35-2628	35-2887	#36-2958				
TST33	013224	36-2960	#37-3062					
TST34	013650	37-3160	#38-3208					
TST35	014050	38-3214	#39-3321					
TST36	014236	39-3382	#40-3406					
TST37	014340	#41-3484						
TST4	004006	#14-1118						
TST40	014620	#42-3609						
TST41	015160	#43-3709						
TST42	015314	#44-3769						
TST43	015552	44-3772	44-3809	#45-3848				
TST44	015756	45-3853	45-3855	45-3857	45-3859	45-3863	45-3865	#46-3912
TST45	016050	#47-3950						
TST46	016130	#48-3980						
TST47	016230	48-3992	48-3994	#49-4037				
TST5	004064	#15-1191						
TST50	016444	#50-4129						
TST51	016542	#51-4207						
TST52	016710	#52-4293						
TST53	017022	#53-4409						
TST54	017452	53-4493	#54-4544					
TST55	017616	54-4576	#55-4618					
TST56	017766	#56-4683						
TST57	020414	#57-4793						
TST6	004250	15-1229	#16-1260					
TST60	020766	57-4796	#58-4891					
TST61	021050	58-4909	#59-4950					
TST62	021154	#60-5063						
TST63	021570	#61-5239						
TST64	022334	#62-5366						

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
TST65	022520	#63-5456								
TST66	022742	63-5499	#64-5519							
TST67	023122	#64-5548								
TST7	004426	16-1274	16-1291	#17-1318						
TYPDS	= 104405	64-5561	64-5561	#64-5588						
TYPE	= 104401	10-836	28-2191	28-2192	37-3091	37-3095	64-5561	64-5561	64-5561	64-5571
		64-5572	64-5573	64-5574	64-5574	64-5574	64-5574	64-5574	64-5574	64-5574
		64-5574	64-5574	64-5576	64-5576	64-5580	64-5580	64-5587	64-5587	64-5587
		64-5587	64-5587	64-5587	64-5587	#64-5588	64-5589			
TYPOC	= 104402	64-5574	64-5587	64-5587	#64-5588					
TYPON	= 104404	#64-5588								
TYPOS	= 104403	37-3092	#64-5588							
UBECT	001722	#10-598	*39-3366	39-3372	39-3381	44-3771	61-5263			
UBEM	023122	39-3383	51-4213	63-5462	#64-5548					
UBETST	013224	28-2193	#37-3062							
UFDFLG	002622	*10-830	#10-830	64-5580						
UFDSET	= 000001	#8-373	10-830	64-5580	64-5580					
UMSIZ	002456	#10-791	38-3225							
UQUIET	002624	*10-830	#10-830	10-832	64-5561	64-5580	64-5580			
VALTBL	010550	30-2317	#30-2392							
VMKOR	002626	10-830	10-830	10-830	#10-830					
WRTBUF	001734	#10-603	49-4046	49-4087	51-4225	51-4242	58-4894	59-4958	59-4967	59-4978
$APTHD	000232	8-392	#8-392							
$ASTAT	= ******	64-5586	64-5586							
$ATYC	026414	64-5586	#64-5586							
$ATY1	026370	#64-5586								
$ATY3	026376	64-5571	#64-5586							
$ATY4	026406	64-5580	#64-5586							
$AUTOB	001134	#9-393	*10-836	64-5574	64-5574	64-5574				
$BASE	001254	#9-393								
$BDADR	001122	#9-393	*10-715	*11-915	*12-984	*12-994	*12-1007	*12-1017	*13-1071	*13-1082
		*15-1235	*16-1288	*16-1295	*21-1595	*21-1597	*24-1828	*25-1894	*25-1895	25-1896
		25-1898	*25-1900	*26-1976	26-1980	26-1983	*26-1984	26-1990	26-1992	*26-1993
		*26-2003	*26-2004	*26-2005	*26-2006	*27-2109	*53-4454	*53-4487	*54-4579	64-5648
		64-5649	64-5650	64-5653	64-5654	64-5655				
$BDDAT	001126	#9-393	*12-982	*12-992	*12-1005	*12-1015	*14-1137	*15-1211	*15-1230	*16-1287
		*18-1390	*18-1394	*19-1435	*20-1475	*21-1602	*24-1827	*25-1899	*26-1982	*26-1992
		*27-2108	*29-2235	*29-2243	*30-2330	30-2331	*30-2337	30-2338	*30-2352	30-2353
		*30-2359	30-2360	*30-2368	30-2369	*30-2375	30-2376	*31-2506	31-2507	*31-2512
		31-2513	*31-2523	31-2524	*31-2529	31-2530	*31-2540	31-2541	*31-2546	31-2547
		*31-2557	31-2558	*31-2563	31-2565	*32-2607	*32-2610	32-2611	*33-2668	*33-2674
		*33-2692	*33-2699	*33-2706	*33-2712	*34-2765	*34-2771	*49-4073	*53-4452	*53-4485
		*54-4577	64-5649	64-5651	64-5655					
$BELL	001170	#9-393	64-5580	64-5580	64-5580					
$CDW1	001260	#9-393								
$CDW2	001262	#9-393								
$CHARC	024242	*64-5571	*64-5571	64-5571	*64-5571	#64-5571				
$CKSWR	024720	#64-5574	64-5588	64-5588						
$CMTAG	001100	#9-393	10-831	10-831	10-831	10-831	10-831	10-831	10-831	
$CM3	= 000000	#9-393	9-393							
$CM4	= 000002	#9-393	9-393	9-393	#9-393	9-393	9-393	#9-393		
$CNTLG	025455	64-5574	#64-5574							

SEQ 0173

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES
$CNTLU	025450	64-5574 #64-5574
$CPUOP	001226	#9-393
$CRLF	001175	#9-393 28-2192 37-3095 64-5561 64-5571 64-5571 64-5571 64-5574 64-5574 64-5574 64-5576 64-5576 64-5580 64-5580 64-5580 64-5587 64-5587 64-5587 64-5587
$DBLK	024710	64-5573 64-5573 #64-5573
$DDW0	001264	#9-393
$DDW1	001266	#9-393
$DDW10	001310	#9-393
$DDW11	001312	#9-393
$DDW12	001314	#9-393
$DDW13	001316	#9-393
$DDW14	001320	#9-393
$DDW15	001322	#9-393
$DDW2	001270	#9-393
$DDW3	001272	#9-393
$DDW4	001274	#9-393
$DDW5	001276	#9-393
$DDW6	001300	#9-393
$DDW7	001302	#9-393
$DDW8	001304	#9-393
$DDW9	001306	#9-393
$DEVCT	001210	#9-393
$DEVM	001256	#9-393
$DOAGN	023350	64-5561 64-5561 #64-5561
$DTBL	024700	64-5573 #64-5573
$ENDAD	023340	8-391 10-836 #64-5561 64-5580 64-5580
$ENDCT	023220	10-831 *64-5553 *64-5556 #64-5561
$ENULL	023354	#64-5561
$ENV	001220	#9-393 10-834 10-836 28-2187 37-3086 45-3856 64-5571 64-5580 64-5586 64-5586
$ENVM	001221	#9-393 10-831 64-5571 64-5571 64-5586
$EOP	023164	64-5550 64-5552 64-5555 #64-5561
$EOPCT	023212	*10-831 #64-5561 64-5561
$ERFLG	001103	#9-393 64-5570 64-5570 64-5570 *64-5570 64-5570 64-5570 *64-5580 64-5580 64-5580
$ERMAX	001115	#9-393 *10-831 64-5570 *64-5570 64-5570 64-5570
$ERROR	025764	10-831 #64-5580
$ERRPC	001116	#9-393 *64-5580 *64-5580 64-5580 64-5580 64-5580 64-5587 64-5648 64-5649 64-5650 64-5651 64-5652 64-5653 64-5655 64-5656 64-5657
$ERRTB	001324	#10-393 64-5587
$ERRTY	026636	64-5584 #64-5587
$ERTTL	001112	#9-393 64-5561 *64-5580 64-5580 64-5580
$ESCAP	001166	#9-393 *10-831 *64-5570 64-5580 64-5580 64-5580 64-5580
$ETABL	001220	#9-393
$ETEND	001324	8-392 #9-393
$FATAL	001202	#9-393 *64-5586
$FFLG	026634	*64-5586 *64-5586 64-5586 *64-5586 #64-5586
$FILLC	001156	#9-393 64-5571 64-5571 64-5571
$FILLS	001155	#9-393 64-5571 64-5571
$GDADR	001120	#9-393 *13-1070 *13-1081 64-5650
$GDDAT	001124	#9-393 10-672 *12-983 *12-993 *12-1006 *12-1016 *14-1136 *15-1212 *15-1217

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		*15-1218	*16-1286	*18-1386	18-1388	18-1392	*19-1427	19-1429	19-1433	*20-1465
		*20-1472	*21-1591	21-1600	*22-1674	22-1678	*24-1819	*25-1898	*26-1977	*26-1983
		*26-1986	26-1990	*26-2013	*27-2103	*27-2104	27-2105	*27-2107	*29-2236	*29-2237
		*29-2244	*29-2245	*30-2322	*30-2323	*30-2334	*30-2341	*30-2356	*30-2363	*30-2372
		*30-2379	*31-2491	*31-2509	*31-2515	*31-2526	*31-2532	*31-2543	*31-2549	*31-2560
		*31-2567	*32-2603	*32-2604	*32-2613	*33-2662	*33-2667	*33-2673	*33-2686	*33-2690
		*33-2691	*33-2697	*33-2698	*33-2701	*33-2702	*33-2710	*33-2711	*34-2757	34-2763
		*34-2770	*49-4074	*53-4453	*53-4486	*54-4578	64-5649	64-5651	64-5655	
$GET42	023330	#64-5561								
$GTSWR	024770	#64-5574	64-5588	64-5588						
$HD	= 000001	8-274	8-274	8-274						
$HIBTS	000232	#8-392								
$HIOCT	025604	*64-5575	#64-5575							
$ICNT	001104	#9-393	*64-5570	64-5570	*64-5570	64-5570	64-5570			
$ILLUP	027216	64-5589	64-5589	#64-5589						
$INTAG	001135	#9-393	64-5574	64-5574	64-5574					
$ITEMB	001114	#9-393	*64-5580	64-5580	64-5580	64-5580	64-5583	64-5587		
$LF	001176	#9-393	64-5571	64-5571	64-5574	64-5574	64-5574	64-5576	64-5576	64-5580
		64-5580								
$LFLG	026633	*64-5586	#64-5586							
$LPADR	001106	#9-393	*10-831	*64-5570	*64-5570	64-5570	64-5570	64-5570		
$LPERR	001110	#9-393	*10-831	64-5570	*64-5570	64-5570	64-5570	64-5580		
$MADR1	001232	#9-393								
$MADR2	001236	#9-393								
$MADR3	001242	#9-393								
$MADR4	001246	#9-393								
$MAIL	001200	8-392	8-392	#9-393	10-831	10-836	64-5570	64-5571	64-5580	
$MAMS1	001230	#9-393								
$MAMS2	001234	#9-393								
$MAMS3	001240	#9-393								
$MAMS4	001244	#9-393								
$MBADR	000234	#8-392								
$MFLG	026632	*64-5586	64-5586	*64-5586	#64-5586					
$MNEW	025473	64-5574	#64-5574							
$MSGAD	001214	#9-393	*64-5586	64-5586						
$MSGLG	001216	#9-393	*64-5586							
$MSGTY	001200	#9-393	64-5586	*64-5586	64-5586	*64-5586				
$MSWR	025462	64-5574	#64-5574							
$MTYP1	001231	#9-393								
$MTYP2	001235	#9-393								
$MTYP3	001241	#9-393								
$MTYP4	001245	#9-393								
$MXCNT	023710	64-5570	64-5570	64-5570	#64-5570					
$NULL	001154	#9-393	64-5571	64-5571	64-5571					
$NWTST	= 000001	#11-881	11-881	#11-881	#12-966	12-966	#12-966	#13-1052	13-1052	#13-1052
		#14-1118	14-1118	#14-1118	#15-1191	15-1191	#15-1191	#16-1260	16-1260	#16-1260
		#17-1318	17-1318	#17-1318	#18-1374	18-1374	#18-1374	#19-1420	19-1420	#19-1420
		#20-1459	20-1459	#20-1459	#21-1541	21-1541	#21-1541	#22-1652	22-1652	#22-1652
		#23-1725	23-1725	#23-1725	#24-1796	24-1796	#24-1796	#25-1862	25-1862	#25-1862
		#26-1949	26-1949	#26-1949	#27-2062	27-2062	#27-2062	#28-2178	28-2178	#28-2178
		#29-2223	29-2223	#29-2223	#30-2310	30-2310	#30-2310	#31-2481	31-2481	#31-2481
		#32-2595	32-2595	#32-2595	#33-2644	33-2644	#33-2644	#34-2738	34-2738	#34-2738

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		#35-2822	35-2822	#35-2822	#36-2958	36-2958	#36-2958	#37-3062	37-3062	#37-3062
		#38-3208	38-3208	#38-3208	#39-3321	39-3321	#39-3321	#40-3406	40-3406	#40-3406
		#41-3484	41-3484	#41-3484	#42-3609	42-3609	#42-3609	#43-3709	43-3709	#43-3709
		#44-3769	44-3769	#44-3769	#45-3848	45-3848	#45-3848	#46-3912	46-3912	#46-3912
		#47-3950	47-3950	#47-3950	#48-3980	48-3980	#48-3980	#49-4037	49-4037	#49-4037
		#50-4129	50-4129	#50-4129	#51-4207	51-4207	#51-4207	#52-4293	52-4293	#52-4293
		#53-4409	53-4409	#53-4409	#54-4544	54-4544	#54-4544	#55-4618	55-4618	#55-4618
		#56-4683	56-4683	#56-4683	#57-4793	57-4793	#57-4793	#58-4891	58-4891	#58-4891
		#59-4950	59-4950	#59-4950	#60-5063	60-5063	#60-5063	#61-5239	61-5239	#61-5239
		#62-5366	62-5366	#62-5366	#63-5456	63-5456	#63-5456	#64-5519	64-5519	#64-5519
		#64-5548	64-5548	#64-5548						
$OCNT	024470	*64-5572	*64-5572	#64-5572						
$OMODE	024472	*64-5572	*64-5572	64-5572	*64-5572	*64-5572	#64-5572			
$OVER	023636	64-5570	64-5570	64-5570	64-5570	#64-5570				
$PASS	001206	#9-393	*10-831	28-2185	37-3084	39-3325	45-3852	64-5549	*64-5561	*64-5561
		64-5561	64-5561	64-5561	64-5570	64-5570	64-5570			
$PASTM	000240	#8-392								
$POWER	027224	64-5589	#64-5589							
$PWRDN	027056	10-831	#64-5589	64-5589						
$PWRMG	027212	#64-5589								
$PWRUP	027130	64-5589	#64-5589							
$QUES	001174	#9-393	64-5571	64-5571	64-5574	64-5574	64-5574	64-5574	64-5576	64-5576
		64-5576	64-5580	64-5580						
$RDCHR	025202	#64-5574	64-5588	64-5588						
$RDDEC	025606	#64-5576	64-5588	64-5588						
$RDLIN	025332	#64-5574	64-5588	64-5588						
$RDOCT	025504	#64-5575	64-5588	64-5588						
$RDSZ	= 000010	#64-5574	64-5574							
$RTNAD	023352	#64-5561								
$R2A	= ******	64-5588								
$SAVRE	= ******	64-5588								
$SAVR6	027222	*64-5589	64-5589	*64-5589	*64-5589	#64-5589				
$SCOPE	023360	10-831	#64-5570							
$SETUP	= 000137	#10-830	10-830	#10-830	10-830	#10-830	10-830	#10-830	10-830	#10-830
		10-830	#10-830	10-830	#10-830	10-831	10-831	10-831	10-831	10-831
		10-831	10-831	10-831	10-831	10-831	10-831	10-831	10-836	10-836
		10-836	64-5561	64-5561	64-5570	64-5574	64-5574	64-5580	64-5580	64-5580
		64-5580								
$STUP	= 177777	#10-830	#10-830	10-830	#10-830	#10-830	10-830	#10-830	#10-830	10-830
		#10-830	#10-830	10-830	#10-830	#10-830	10-830	#10-830	#10-830	10-830
$SVLAD	023602	64-5570	#64-5570							
$SVPC	= 000232	#8-391	8-391							
$SWR	= 167400	#8-272	8-274	8-275	8-275	8-275	8-275	8-275	8-275	8-275
		8-275	9-393	9-393	9-393	10-831	10-831	10-831	10-831	10-831
		11-881	12-966	13-1052	14-1118	15-1191	16-1260	17-1318	18-1374	19-1420
		20-1459	21-1541	22-1652	23-1725	24-1796	25-1862	26-1949	27-2062	28-2178
		29-2223	30-2310	31-2481	32-2595	33-2644	34-2738	35-2822	36-2958	37-3062
		38-3208	39-3321	40-3406	41-3484	42-3609	43-3709	44-3769	45-3848	46-3912
		47-3950	48-3980	49-4037	50-4129	51-4207	52-4293	53-4409	54-4544	55-4618
		56-4683	57-4793	58-4891	59-4950	60-5063	61-5239	62-5366	63-5456	64-5519
		64-5548	64-5561	64-5561	64-5561	64-5561	64-5561	64-5570	64-5570	64-5570
		64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5580
		64-5580	64-5580	64-5580	64-5580	64-5580	64-5580	64-5580	64-5580	64-5580
		64-5580	64-5589							
$SWREG	001222	#9-393	10-831							
$SWRMK	= 000300	#8-273	8-275	8-275	8-275	8-275	8-275	8-275	8-275	8-275
		8-275	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570	64-5570
		64-5570	64-5570	64-5570						
$TESTN	001204	#9-393	*64-5570							
$TIMES	001164	#9-393	*10-831	*64-5561	*64-5570	64-5570	*64-5570	64-5570	64-5570	
$TKB	001146	#9-393	64-5571	64-5571	64-5571	64-5571	64-5574	64-5574	64-5574	64-5574
		64-5574	64-5574							
$TKS	001144	#9-393	64-5571	64-5571	64-5571	64-5571	64-5574	64-5574	64-5574	64-5574
		64-5574	64-5574	64-5574						
$TMPO	001160	*8-385	*8-388	#9-393	*16-1268	*16-1270	16-1271	16-1289	18-1381	18-1392
		18-1394	*19-1429	*26-1964	26-2014	27-2110	*29-2240	29-2241	*35-2855	35-2861
		35-2878	*37-3071	*37-3096	*37-3136	37-3159	40-3411	*45-3870	45-3886	46-3919
		48-3984	48-3991	*53-4447	*53-4448	*53-4449	53-4450	53-4453	53-4454	*53-4480
		*53-4481	*53-4482	53-4483	53-4486	53-4487	*56-4688	*56-4691	56-4739	56-4753
		*57-4809	57-4857	*61-5245	61-5262					
$TMP1	001162	#9-393	*21-1577	21-1614	*23-1742	23-1760	*26-1975	26-1979	26-1989	*26-2009
		*26-2010	26-2011	26-2014	*27-2098	27-2157	*53-4421	*53-4499	53-4500	53-4501
		53-4502	*56-4685	56-4768						
$TN	= 000070	8-274	#8-274	11-881	11-881	#11-881	11-905	12-966	12-966	#12-966
		13-1052	13-1052	#13-1052	14-1118	14-1118	#14-1118	15-1191	15-1191	#15-1191
		15-1229	16-1260	16-1260	#16-1260	16-1274	16-1291	17-1318	17-1318	#17-1318
		17-1324	18-1374	18-1374	#18-1374	18-1377	19-1420	19-1420	#19-1420	19-1423
		20-1459	20-1459	#20-1459	20-1461	21-1541	21-1541	#21-1541	21-1544	22-1652
		22-1652	#22-1652	22-1655	22-1659	23-1725	23-1725	#23-1725	23-1728	23-1759
		24-1796	24-1796	#24-1796	24-1799	24-1803	24-1826	25-1862	25-1862	#25-1862
		25-1865	25-1869	26-1949	26-1949	#26-1949	26-1952	26-1954	27-2062	27-2062
		#27-2062	27-2097	28-2178	28-2178	#28-2178	28-2181	28-2184	29-2223	29-2223
		#29-2223	29-2226	30-2310	30-2310	#30-2310	30-2387	31-2481	31-2481	#31-2481
		31-2566	32-2595	32-2595	#32-2595	32-2598	33-2644	33-2644	#33-2644	34-2738
		34-2738	#34-2738	34-2741	35-2822	35-2822	#35-2822	35-2828	35-2887	36-2958
		36-2958	#36-2958	36-2960	37-3062	37-3062	#37-3062	37-3160	38-3208	38-3208
		#38-3208	38-3214	39-3321	39-3321	#39-3321	39-3382	40-3406	40-3406	#40-3406
		41-3484	41-3484	#41-3484	42-3609	42-3609	#42-3609	43-3709	43-3709	#43-3709
		44-3769	44-3769	#44-3769	44-3772	44-3809	45-3848	45-3848	#45-3848	45-3853
		45-3855	45-3857	45-3859	45-3863	45-3865	46-3912	46-3912	#46-3912	47-3950
		47-3950	#47-3950	48-3980	48-3980	#48-3980	48-3992	48-3994	49-4037	49-4037
		#49-4037	50-4129	50-4129	#50-4129	51-4207	51-4207	#51-4207	52-4293	52-4293
		#52-4293	53-4409	53-4409	#53-4409	53-4493	54-4544	54-4544	#54-4544	54-4576
		55-4618	55-4618	#55-4618	56-4683	56-4683	#56-4683	57-4793	57-4793	#57-4793
		57-4796	58-4891	58-4891	#58-4891	58-4909	59-4950	59-4950	#59-4950	60-5063
		60-5063	#60-5063	61-5239	61-5239	#61-5239	62-5366	62-5366	#62-5366	63-5456
		63-5456	#63-5456	63-5499	64-5519	64-5519	#64-5519	64-5548	64-5548	#64-5548
$TPB	001152	#9-393	64-5571	64-5571	64-5571					
$TPFLG	001157	#9-393	64-5571	64-5571	64-5571					
$TPS	001150	#9-393	64-5571	64-5571	64-5571					
$TRAP	026772	10-831	#64-5588							
$TRAP2	027014	#64-5588	64-5588							
$TRP	= 000014	#64-5588	64-5588	64-5588	64-5588	64-5588	#64-5588	64-5588	64-5588	64-5588

SEQ 0177

SYMBOL CROSS REFERENCE CREF V02

SYMBOL	VALUE	REFERENCES								
		64-5588	#64-5588	64-5588	64-5588	64-5588	64-5588	#64-5588	64-5588	64-5588
		64-5588	64-5588	#64-5588	64-5588	64-5588	64-5588	64-5588	#64-5588	64-5588
		64-5588	64-5588	64-5588	#64-5588	64-5588	64-5588	64-5588	64-5588	#64-5588
		64-5588	64-5588	64-5588	64-5588	#64-5588	64-5588	64-5588	64-5588	64-5588
		#64-5588	64-5588	64-5588	64-5588	64-5588	#64-5588	64-5588	64-5588	64-5588
		64-5588	#64-5588							
$TRPAD	027026	64-5588	#64-5588							
$TSTM	000236	#8-392								
$TSTNM	001102	#9-393	*64-5561	64-5570	64-5570	*64-5570	64-5570	64-5570	64-5570	64-5570
		64-5570	64-5570	64-5570	64-5580	64-5580	64-5580	64-5582		
$TTYIN	025440	64-5574	64-5574	64-5574	#64-5574					
$TYPBN	= ******	64-5588								
$TYPDS	024474	#64-5573	64-5588	64-5588						
$TYPE	023712	#64-5571	64-5586	64-5588	64-5588					
$TYPEC	024124	64-5571	64-5571	64-5571	#64-5571	64-5574				
$TYPEX	024244	64-5571	64-5571	#64-5571						
$TYPOC	024272	#64-5572	64-5588	64-5588						
$TYPON	024306	64-5572	#64-5572	64-5588						
$TYPOS	024246	#64-5572	64-5588							
$UNIT	001212	#9-393								
$UNITM	000242	#8-392								
$USWR	001224	#9-393								
$VECT1	001250	#9-393								
$VECT2	001252	#9-393								
$XOFF	= 000023	64-5571	64-5571							
$XON	= 000021	64-5571	64-5571	64-5574						
$XTSTR	023400	#64-5570								
$$GET4	= 000000	#64-5561	64-5561							
$0FILL	024471	*64-5572	*64-5572	64-5572	#64-5572					
$40CAT	= ******	64-5570	64-5580							
.$ASTA	= ******	64-5586	64-5586							
.$X	= 000232	#8-392	8-392							

MACRO CROSS REFERENCE CREF V02

MACRO NAME	REFERENCES									
COMMEN	#8-277									
ENDCOM	#8-277									
ENDPAS	#8-261	64-5561								
ESCAPE	#8-277									
GETPRI	#8-277									
GETSWR	#8-277	#10-836	10-836							
HOB	#8-249	64-5570								
MULT	#8-277									
NEWTST	#8-277	11-881	12-966	13-1052	14-1118	15-1191	16-1260	17-1318	18-1374	19-1420
	20-1459	21-1541	22-1652	23-1725	24-1796	25-1862	26-1949	27-2062	28-2178	29-2223
	30-2310	31-2481	32-2595	33-2644	34-2738	35-2822	36-2958	37-3062	38-3208	39-3321
	40-3406	41-3484	42-3609	43-3709	44-3769	45-3848	46-3912	47-3950	48-3980	49-4037
	50-4129	51-4207	52-4293	53-4409	54-4544	55-4618	56-4683	57-4793	58-4891	59-4950
	60-5063	61-5239	62-5366	63-5456	64-5519	64-5548				
POP	#8-247	#8-277	10-747	10-822	64-5573	64-5575	64-5576	64-5586	64-5586	64-5589
	64-5589									
PUSH	#8-247	#8-277	10-734	10-817	64-5573	64-5575	64-5576	64-5586	64-5586	64-5586
	64-5589	64-5589								
REPORT	#8-277									
SAVEMT	#10-830	10-830								
SETPRI	#8-277									
SETTRA	#64-5588	64-5588	64-5588	64-5588	64-5588	64-5588	64-5588	64-5588	64-5588	64-5588
	64-5588	64-5588								
SETUP	#8-277	10-831								
SKIP	#8-247	#8-277	11-905	15-1229	16-1274	16-1291	17-1324	18-1377	19-1423	20-1461
	21-1544	22-1655	22-1659	23-1728	23-1759	24-1799	24-1803	24-1826	25-1865	25-1869
	26-1952	26-1954	27-2097	28-2181	28-2184	29-2226	30-2387	31-2566	32-2598	34-2741
	35-2828	35-2887	36-2960	37-3160	38-3214	39-3382	44-3772	44-3809	45-3853	45-3855
	45-3857	45-3859	45-3863	45-3865	48-3992	48-3994	53-4493	54-4576	57-4796	58-4909
	63-5499									
SLASH	#8-277									
STARS	#8-277	8-391	8-392	8-392	8-392	9-393	9-393	9-393	11-881	11-881
	12-966	12-966	13-1052	13-1052	14-1118	14-1118	15-1191	15-1191	16-1260	16-1260
	17-1318	17-1318	18-1374	18-1374	19-1420	19-1420	20-1459	20-1459	21-1541	21-1541
	22-1652	22-1652	23-1725	23-1725	24-1796	24-1796	25-1862	25-1862	26-1949	26-1949
	27-2062	27-2062	28-2178	28-2178	29-2223	29-2223	30-2310	30-2310	31-2481	31-2481
	32-2595	32-2595	33-2644	33-2644	34-2738	34-2738	35-2822	35-2822	36-2958	36-2958
	37-3062	37-3062	38-3208	38-3208	39-3321	39-3321	40-3406	40-3406	41-3484	41-3484
	42-3609	42-3609	43-3709	43-3709	44-3769	44-3769	45-3848	45-3848	46-3912	46-3912
	47-3950	47-3950	48-3980	48-3980	49-4037	49-4037	50-4129	50-4129	51-4207	51-4207
	52-4293	52-4293	53-4409	53-4409	54-4544	54-4544	55-4618	55-4618	56-4683	56-4683
	57-4793	57-4793	58-4891	58-4891	59-4950	59-4950	60-5063	60-5063	61-5239	61-5239
	62-5366	62-5366	63-5456	63-5456	64-5519	64-5519	64-5548	64-5548	64-5561	64-5570
	64-5571	64-5572	64-5573	64-5574	64-5574	64-5574	64-5574	64-5575	64-5576	64-5580
	64-5586	64-5587	64-5588	64-5589	64-5589					
SWRSU	#8-277	#10-831	10-831							
TRMTRP	#64-5588									
TYPBIN	#8-277									
TYPDEC	#8-277	64-5561	64-5561							
TYPNAM	#8-277	10-836								
TYPNUM	#8-277									
TYPOCS	#8-277									

MACRO CROSS REFERENCE CREF V02

MACRO NAME	REFERENCES									
TYPOCT	#8-277	64-5574	64-5587	64-5587						
TYPTXT	#8-277	64-5561	64-5561							
$ABORT	#64-5580	64-5580								
$$CMRE	#8-393									
$$CMTM	#8-393	9-393	9-393							
$$ESCA	#8-277									
$$NEWT	#8-277	11-881	12-966	13-1052	14-1118	15-1191	16-1260	17-1318	18-1374	19-1420
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