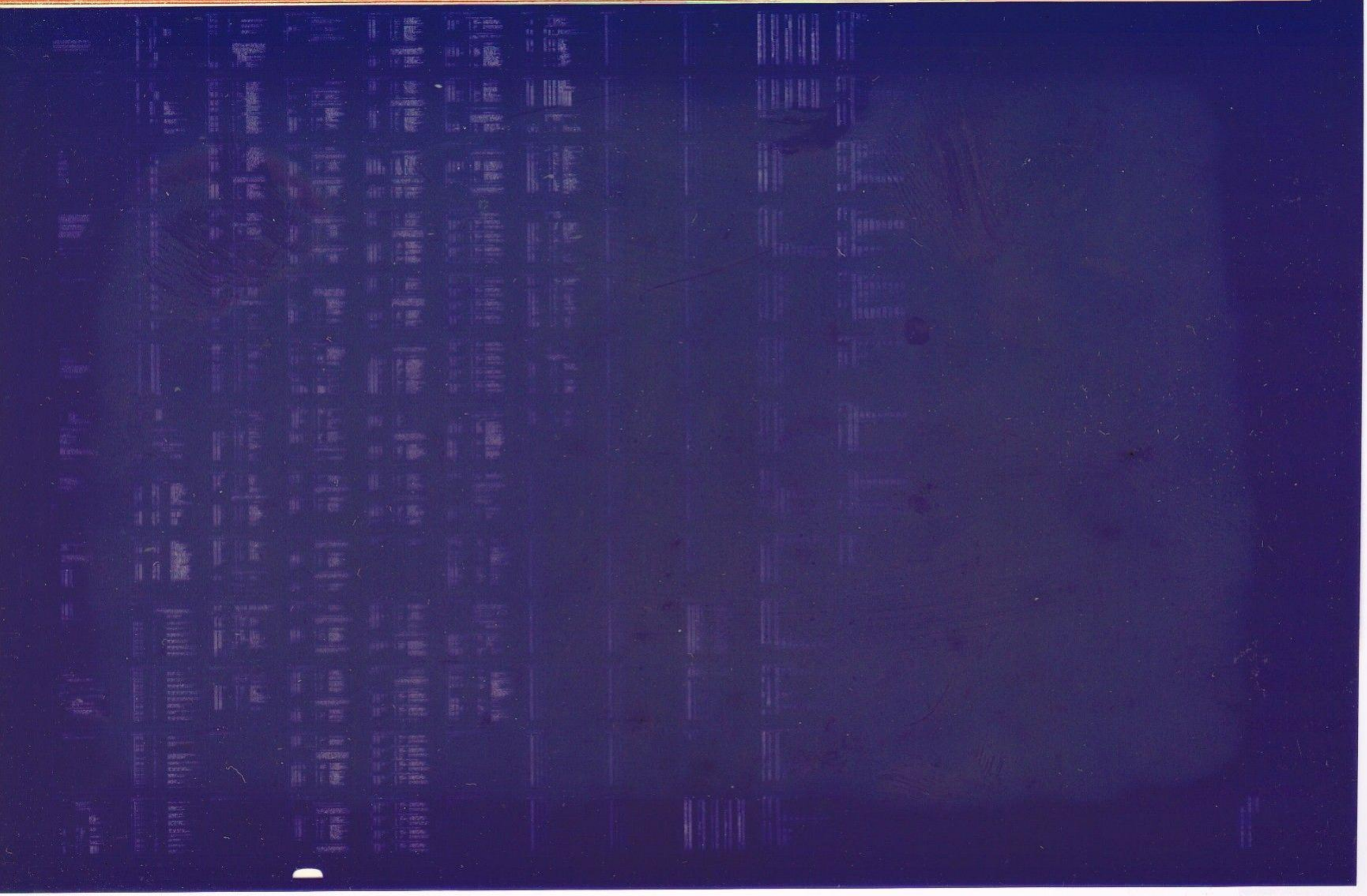
KD11-Z

11/44 UBI MAP
CKKUAA0

AH-F629A-MC

FICHE 1 OF 1

JAN 1980
digital
MADE IN USA



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IDENTIFICATION

PRODUCT CODE: AC-F627A-MC

PRODUCT NAME: CKKUAA0 11/44 UBI MAP

DATE CREATED: OCT 1979

MAINTAINER: DIAGNOSTIC ENGINEERING

AUTHORS: JOHN W. CIUKAJ

HISTORY SECTION

** JAAO WAS RELEASED OCT 1979

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ABSTRACT

THIS PROGRAM IS DESIGNED TO BE RUN ON A PDP11/44 ON WHICH
THE CPU, CACHE(IF APPLICABLE), AND MEMORY MANAGEMENT DIAGNOSTIC PROGRAMS
HAVE BEEN RUN. THE PROGRAM WILL DETECT ALL ERRORS THAT
ORIGINATE WITH THE MAP BOX AND PROVIDE LOOPING CAPABILITIES
SO THAT THE FIELD SERVICE ENGINEER CAN VERIFY THE FAILURES.
THERE MAY BE SOME CASES, SUCH AS THE CACHE REGISTER DATA
PATH, AND CACHE MEMORY DATA PATH, WHERE INTERACTION BETWEEN
MODULES PROHIBITS CLOSE ISOLATION, BUT THE FAILING FUNCTION
WILL BE CALLED OUT SO THE FIELD SERVICE ENGINEER CAN
COMPLETE THE ISOLATION PROCESS.

IF THE PROGRAM CATCHES AN ERROR IN AN EARLY TEST
AND IS ALLOWED TO CONTINUE RUNNING THROUGH THE
LATER TESTS THE ERROR INDICATIONS FROM THOSE LATER
TESTS MAY BE INVALID. THIS IS DUE TO THE STRUCTURE
OF THE PROGRAM, WHICH ASSUMES THAT ALL AREAS TESTED
PRIOR TO THE CURRENT TEST ARE FUNCTIONING PROPERLY.

THE ERROR TYPE OUTS WILL BE IN TABLE FORMAT, WITH
A MESSAGE INDICATING THE CLASS OF ERROR, A HEADER
IDENTIFYING EACH COLUMN AND A REPORT OF ALL
PERTINENT DATA. WHEN THE TEST CAN PRODUCE
MORE THAN ONE ERROR CONDITION, A SUMMARY OF
ERRORS WILL BE GIVEN AT THE END OF THAT TEST
CONSISTING OF: THE LOGICAL 'AND' AND 'OR' OF THE DATA
PREVIOUSLY REPORTED AND THE NUMBER OF ERRORS IN THIS
TEST.
(SEE SECTION 6.3 FOR AN EXAMPLE OF THE ERROR TYPEOUTS.)

2. REQUIREMENTS

2.1 EQUIPMENT

THE BASIC PDP-11/44 COMPUTER, INCLUDING THE CPU, CACHE, MEMORY
MANAGEMENT, AND AN LA-30 OR EQUIVALENT DEVICE FOR ERROR
MESSAGES.

2.2 STORAGE

THIS PROGRAM WILL REQUIRE 8K TO LOAD BUT WILL UTILIZE ALL
EXISTING CORE FOR A DUAL ADDRESSING TEST OF MEMORY
FROM THE UNIBUS.

PRELIMINARY PROGRAMS

THE CPU, CACHE(IF APPLICABLE), AND MEMORY MANAGEMENT DIAGNOSTICS SHOULD BE RUN
BEFORE THIS PROGRAM. THE MEMORY DIAGNOSTIC SHOULD AT LEAST,
MAKE A QUICK VERIFY OF THE AREA OF MEMORY THIS PROGRAM
WILL LOAD AND RUN IN.

3. LOADING PROCEDURE

3.1 METHOD.

THIS PROGRAM CAN BE LOADED FROM ANY DEVICE THAT IS SUPPORTED BY XXDP AND SHOULD BE LOADED USING THE XXDP PROCEDURE FOR THAT DEVICE.

4. STARTING PROCEDURE

4.1 STARTING ADDRESS

PROGRAM STARTS AT ADDRESS 200

4.2 PROGRAM AND/OR OPERATOR ACTION

PROGRAM WILL IDENTIFY ITSELF AND AT THE END OF EACH PASS WILL INDICATE THE TOTAL NUMBER OF ERRORS OCCURRING ON THAT PASS.

4.3 SPECIAL STARTING PROCEDURE

IF IT APPEARS THAT THE CACHE IS CAUSING SOME TROUBLE AND YOU STILL WANT TO RUN THIS PROGRAM, IT IS POSSIBLE TO RUN WITH THE CACHE DISABLED. SIMPLY LOAD THE CACHE CONTROL REGISTER (17777746) WITH THE DESIRED NUMBER. THEN LOAD THE PC (17777707) WITH THE STARTING ADDRESS (200) AND PRESS "CONTINUE". THE PROGRAM WILL NOW RUN NORMALLY EXCEPT THAT CERTAIN TESTS WILL BE SKIPPED SINCE THE CACHE IS DISABLED. THIS FACT IS INDICATED IN THE ABSTRACT OF EACH TEST THAT CHECKS THE CACHE CONTROL REGISTER.

DEFINITION OF THE BITS IN THE CACHE CONTROL REGISTER:
BIT00 -DISABLE TRAPS
BIT02 -FORCE MISS ON READ,WHERE ADDRESS BIT 12 IS 0
BIT03 -FORCE MISS ON READ,WHERE ADDRESS BIT 12 IS 1
BIT09 -UNCONDITIONAL CACHE BYPASS

5. OPERATING PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

SW15	1=	HALT ON ERROR
SW14	1=	LOOP ON TEST
SW13	1=	INHIBIT ERROR TYPEOUTS
SW12	1=	INHIBIT TRACE TRAP
SW11	1=	INHIBIT ITERATIONS
SW10	1=	BELL ON ERROR
SW09	1=	LOOP ON ERROR
SW08	1=	LOOP ON TEST IN SWR<05:00>
SW07	1=	INHIBIT MULTIPLE ERROR TYPE OUTS
SW06	1=	SELECT CACHE TESTS. THIS IS USED FOR MFG. QUICK VERIFY STATION AND CAN BE SELECTED BY APT SCRIPTING. THESE TESTS ASSUME THAT ALL MODULES EXCEPT UBI MODULE ARE KNOWN GOOD.

5.2 SUB-ROUTINE ABSTRACTS

ALL SUBROUTINE ABSTRACTS APPEAR IN THE CODE BEFORE THEIR EXPANSION AND IN THE DOCUMENT THAT IMMEDIATELY FOLLOWS THIS. BELOW IS A LIST OF THE SUBROUTINE TITLES.

5.2.1 MACRO LIBRARY SUBROUTINES (FOUND IN MOST PROGRAMS)

SCOPE HANDLER ROUTINE
ERROR HANDLER ROUTINE
ERROR MESSAGE TYPE OUT ROUTINE
CONVERT 16-BIT VIRTUAL ADDRESSES TO 22-BIT PHYSICAL ADDRESSES
SAVE AND RESTORE R0-R5 ROUTINES
TYPE ROUTINE
BINARY TO OCTAL (ASCII) AND TYPE
CONVERT BINARY TO DECIMAL AND TYPE ROUTINE
TRAP DECODER
POWER DOWN AND UP ROUTINES
DOUBLE LENGTH BINARY TO OCTAL ASCII CONVERT ROUTINE
END OF PASS ROUTINE

5.2.2 SUBROUTINES UNIQUE TO THIS PROGRAM

TURN OFF AND SAVE T-BIT
RESTORE T-BIT TO ITS PREVIOUS CONDITION
SUBROUTINE TO LOG AND REPORT TIMEOUTS OF MAP REGISTERS
SUBROUTINE TO REPORT MAP REGISTERS THAT WILL NOT HOLD ZERO
SUBROUTINE TO REPORT DUAL ADDRESSING WHEN LOADING A MAP REGISTER
SUBROUTINE TO REPORT COUNT PATTERN ERRORS IN MAP REGISTERS
SUBROUTINE TO REPORT COUNT PATTERN ERRORS ON UNIBUS DATA PATH
SUBROUTINE TO REPORT COUNT PATTERN ERRORS IN CACHE REGISTERS

5.2.3 TRAP AND ABORT HANDLER ROUTINES

CPU TRAP HANDLER ROUTINE
CACHE TRAPS AND ABORTS HANDLER ROUTINE
MEMORY MANAGEMENT TRAPS AND ABORTS HANDLER ROUTINE

5.3 RUNNING UNDER APT

THE EXECUTION TIMES PROVIDED IN THE APT SCRIPT THAT FOLLOWS ARE FOR EXECUTION WITH A 11/44 PROCESSOR, CACHE, 16K CORE MEMORY, AND 300 BAUD.

THE FOLLOWINC IS A PROGRAM LOAD FILE USED BY APT:

1. E TABLE 'A' IS USED FOR APT DUMP MODE.
   A. IN ADDITION TO NORMAL CPU DIAGNOSTIC TESTS THIS TABLE WILL SELECT THE OPTIONAL CACHE TESTS.($SWREG=100) AND INHIBIT ITERATIONS($SWREG=4000)

2. E TABLE 'B' IS USED FOR APT QV MODE WHILE RUNNING ON A MANUFACTURING QV STATION. IT ACCOMPLISHES WHAT ETABLE 'A' DOES BUT ADDITIONALLY SUPRESSES TYPEOUTS.($ENVM 240)

3. ETABLE 'C' IS USED FOR APT QV OR RUNTIME MODES WHILE RUNNING ON SYSTEMS OTHER THAN MFG. QV STATIONS. THIS TABLE DESELECTS THE OPTIONAL CACHE TESTS.

1ST PASS RUN TIME	LONGEST TEST TIME	ADDITIONAL RUN TIME
10	5	0

..... E TABLES .....

	A	B	C
E-MODE/S-MODE ($ENVM/$ENV)	200/000	240/001	240/001
SWITCH REGISTER 1 ($SWREG)	004100	0004100	004000
SWITCH REGISTER 2	000000	000000	000000
CPU TYPE/OPTIONS	00/0000	00/0000	0C/0000

6. ERRORS

6.1 ERROR HALTS AND DESCRIPTION

WHEN AN ERROR IS DETECTED AN 'ERROR' (EMT)
INSTRUCTION IS EXECUTED AND THE 'ERROR HANDLER ROUTINE'
CHECKS THE SWITCH REGISTER FOR MODE SELECTED.
THE PROGRAM WILL:

HALT ON ERROR	IF SW15 1
INHIBIT ERROR TYPE OUT	IF SW13-1
RING BELL ON ERROR	IF SW10 1
LOOP ON ERROR	IF SW9 1

6.2 ERROR RECOVERY

IF SW09=1, THE PROGRAM WILL LOOP BACK TO
THE POINT WHERE THE INSTRUCTION THAT CAUSED THE ERROR WAS
EXECUTED, WITHOUT ALLOWING ANY OF THE CONDITIONS TO CHANGE.
THIS WILL PROVIDE THE TIGHTEST POSSIBLE SCOPE LOOP.
IF SW09=0, EACH ERROR WILL BE REPORTED AND
LOGGED AND, AT THE END OF EACH TEST, A SUMMARY OF ALL ERRORS
OCCURRING IN THAT TEST WILL BE PROVIDED. THE SUMMARY
CONSISTS OF THE LOGICAL AND AND OR OF THE ADDRESS AND/OR
DATA THAT WAS WRONG.

6.3 SAMPLE ERROR TYPE OUTS

SEE '$ERRTB:' FOR SAMPLE ERROR TYPEOUTS.

6.3.1 MULTIPLE TYPE ERRORS

THE FOLLOWING REGISTERS TIMED OUT WHEN REFERENCED

REG.ADR	TESTNO	ERRORPC
170210	000001	015226
170212	000001	015232
170214	000001	015232
170216	000001	015232
170230	000001	015232
170232	000001	015232
170234	000001	015232
170236	000001	015232
170250	000001	015232
170252	000001	015232
170254	000001	015232
170256	000001	015232
170270	000001	015232
170272	000001	015232
170274	000001	015232
170276	000001	015232
170310	000001	015232
170312	000001	015232

170314	000001	015232
170316	000001	015232
170330	000001	015232
170332	000001	015232
170334	000001	015232
170336	000001	015232
170350	000001	015232
170352	000001	015232
170354	000001	015232
170356	000001	015232
170370	000001	015232
170372	000001	015232
170374	000001	015232
170376	000001	015232

SUMMARY OF MAP REGISTERS THAT TIMED OUT ON READ

REGADRS "OR"	REGADRS "AND"	#ERRORS	TESTNO	ERRORPC
170376	170210	32	000001	010530

7. RESTRICTIONS

7.1 STARTING RESTRICTIONS

NONE

7.2 OPERATING RESTRICTIONS

NONE

8. MISCELLANEOUS

8.1 EXECUTION TIME

THE RUN TIME FOR A SINGLE PASS WITH NO ITERATIONS IS APPROXIMATELY 10 SECONDS.

8.2 ADDRESS GENERATION IN THE PDP-11/44

THE FOLLOWING IS AN EXAMPLE OF HOW A MEMORY ADDRESS IS GENERATED BY THE UNIBUS MAP. THIS ASSUMES THAT THE ADDRESS ORIGINATES IN THE CPU BUT THE PROCESS CAN APPLY TO ANY UNIBUS ADDRESS, STARTING AT LINE C2.

```
A.  VIRTUAL ADDRESS                        15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00

A1. PAGE NUMBER (0-7)                      15 14 13

A2. OFFSET                                          12 11 10 09 08 07 06 05 04 03 02 01 00
B.  P.A.R.[PAGE NO.] +  15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00
                        ------------------------------------------------------------------
C.  PHYSICAL ADDR.      21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00

C1. 17XXXXXX=> U.B.ADR. 21 20 19 18
C2. MAPPING REG.NO.(0-36)           17 16 15 14 13

C3. OFFSET                                          12 11 10 09 08 07 06 05 04 03 02 01 00
D.  MAP REG.[NO.]    +  21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01
                        ------------------------------------------------------------------
E.  PHYSICAL ADDR.      21 20 19 18 17 16 15 14 13 12 11 10 09 08 07 06 05 04 03 02 01 00
```

DESCRIPTION OF LINES:

A: VIRTUAL ADDRESS (16 BITS)
- A1: UPPER 3 BITS OF VIRTUAL ADDRESS, USED TO SELECT A PAGE ADDRESS REGISTER (PAR)
- A2: LOWER 13 BITS OF VIRTUAL ADDRESS, ADDED TO SELECTED PAR

B: PAGE ADDRESS REGISTER (16 BITS), IN ADDITION PROCESS THIS GETS LEFT SHIFTED 6 BITS BEFORE ADDITION TO A2

C: PHYSICAL ADDRESS CREATED BY MEMORY MANAGEMENT, (22 BITS)
- C1: IF UPPER 4 BITS ARE ALL ONES THEN BITS <17:00> GO OUT ON UNIBUS
- C2: IF MAP RELOCATION IS ENABLED THEN BITS <17:13> SELECT ONE OF THE 36 (OCTAL) MAP REGISTERS.
- C3: LOWER 13 BITS OF UNIBUS ADDRESS, ADDED TO SELECTED MAP REGISTER

D: MAP REGISTER (22 BITS), ADDED TO BITS <12:00> OF UNIBUS ADDRESS

E: PHYSICAL ADDRESS GENERATED BY UNIBUS MAP AND SENT TO THE CACHE.

9. PROGRAM DESCRIPTION

SEQ 0012

THE ASSEMBLED LISTING,CKKUAA0.SEQ, HAS A PARAGRAPH DESCIRBING
EACH OF THE TESTS. THE PARAGRAPH WILL INDICATE IF THE TEST IS
RUN CONDITIONALLY ON THE STATUS ON THE CACHE CONTROL REGISTER.

.END

```
                        .TITLE  CKKUAA0 11/44 UBI MAP
                        ;*COPYRIGHT (C) OCT 1979
                        ;*DIGITAL EQUIPMENT CORP.
                        ;*MAYNARD, MASS. 01754
                        ;*
                        ;*PROGRAM BY JOHN W. CIUKAJ
                        ;*
                        ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                        ;*PACKAGE (MAINDEC-11-DZQAC-A5).
                        ;*
                        .SBTTL  OPERATIONAL SWITCH SETTINGS
                        ;*
                        ;*      SWITCH                  USE
                        ;*      ------          --------------------
                        ;*        15            HALT ON ERROR
                        ;*        14            LOOP ON TEST
                        ;*        13            INHIBIT ERROR TYPEOUTS
                        ;*        12            INHIBIT TRACE TRAP
                        ;*        11            INHIBIT ITERATIONS
                        ;*        10            BELL ON ERROR
                        ;*         9            LOOP ON ERROR
                        ;*         8            LOOP ON TEST IN SWR<5:0>
                        ;*         7            INHIBIT MULTIPLE ERROR TYPEOUTS
                        ;*         6            SELECT CACHE-CIS TESTS
                        .SBTTL  BASIC DEFINITIONS

                        ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
001100                  STACK=  1100            ;;FIRST ADDRESS OF THE STACK
001100                  KERSTK= STACK           ;;KERNEL STACK
000700                  SUPSTK= STACK-200       ;;SUPERVISOR STACK
000600                  USESTK= STACK-300       ;;USER STACK
104000                          ERROR=EMT
000004                          SCOPE=IOT
177776                  PS      177776          ;;PROCESSOR STATUS WORD
177776                          PSW=PS
177774                  STKLMT= 177774          ;;STACK LIMIT REGISTER
177772                  PIRQ=   177772          ;;PROGRAM INTERRUPT REQUEST REGISTER
                        ;SWR=   177570          ;;** SWITCH REGISTER
                        ;DISPLAY=SWR            ;;**

                        ;*MISCELLANEOUS DEFINITIONS
000011                  HT=     11              ;;CODE FOR HORIZONTAL TAB
000012                  LF=     12              ;;CODE LINE FEED
000015                  CR      15              ;;CODE CARRIAGE RETURN
000200                  CRLF=   200             ;;CODE FOR CARRIAGE RETURN-LINE FEED

                        ;*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
```

```
000000                          R10=R0
000001                          R11=R1
000002                          R12=R2
000003                          R13-R3
000004                          R14=R4
000005                          R15=R5
000006                          SP=R6
000006                          KSP-SP
000006                          SSP=SP
000006                          USP=SP
000007                          PC=R7

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

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

                        ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
100000                  BIT15=  100000
040000                  BIT14=  40000
020000                  BIT13=  20000
010000                  BIT12=  10000
004000                  BIT11=  4000
002000                  BIT10   2000
```

```
                        BIT09=  1000
                        BIT08=  400
                        BIT07=  200
                        BIT06=  100
                        BIT05=  40
                        BIT04=  20
                        BIT03=  10
                        BIT02=  4
                        BIT01=  2
                        BIT00=  1
001000                          BIT9=BIT09
000400                          BIT8=BIT08
000200                          BIT7=BIT07
000100                          BIT6=BIT06
000040                          BIT5=BIT05
000020                          BIT4=BIT04
000010                          BIT3=BIT03
000004                          BIT2=BIT02
000002                          BIT1=BIT01
000001                          BIT0=BIT00

                        ;*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
000114                  CACHVEC=114             ;;CACHE ERROR INTERRUPT VECTOR
000240                  PIRQVEC-240             ;;PROGRAM INTERRUPT REQUEST VECTOR
000250                  MMVEC=  250             ;;MEMORY MANAGEMENT VECTOR

                        .SBTTL  CACHE   REGISTER DEFINITIONS


177740                  LOADRS - 177740         ;;LOWER 16 BITS OF ADDRESS THAT CAUSED ERROR
177742                  HIADRS = 177742         ;;UPPER SIX BITS OF ADDRESS THAT CAUSED ERROR
177744                  MEMERR = 177744         ;;CACHE ERROR REGISTER
177746                  CONTRL = 177746         ;;MEMORY CONTROL REGISTER
177750                  MAINT  - 177750         ;;MEMORY MAINTENENCE REGISTER
177752                  HITMIS - 177752         ;;HIT MISS REGISTER ''1'' IMPLIES HIT IN CACHE


                        .SBTTL  CPU REGISTER DEFINITIONS


177760                  SIZELO = 177760         ;;MEMORY SIZE REGISTER NUMBER TO PUT INTO A PAR
                                                ;;TO GET TO THE LAST 32 WORDS OF MEMORY
177762                  SIZEHI = 177762         ;;HIGH SIZE REGISTER, RESERVED FOR FUTURE USE
                                                ;;CURRENTLY ALL ZERO
177764                  SYSTID = 177764         ;;SYSTEM ID REGISTER
177766                  CPUERR = 177766         ;;CPU ERROR REGISTER HOLDS CONDITION THAT CAUSED
```

```
                                        ;;THE TRAP TO ERRVEC (000004)



                        .SBTTL  MEMORY MANAGEMENT DEFINITIONS

                        ;*MEMORY MANAGEMENT STATUS REGISTER ADDRESSES

177572                  MMR0=   177572
177574                  MMR1=   177574
177576                  MMR2=   177576
172516                  MMR3=   172516
177572                          SR0=MMR0
177574                          SR1=MMR1
177576                          SR2=MMR2
172516                          SR3=MMR3

                        ;*USER ''I'' PAGE DESCRIPTOR REGISTERS

177600                  UIPDR0= 177600
177602                  UIPDR1= 177602
177604                  UIPDR2= 177604
177606                  UIPDR3= 177606
177610                  UIPDR4= 177610
177612                  UIPDR5= 177612
177614                  UIPDR6= 177614
177616                  UIPDR7= 177616

                        ;*USER 'D'' PAGE DESCRIPTOR REGISTORS

177620                  UDPDR0= 177620
177622                  UDPDR1= 177622
177624                  UDPDR2= 177624
177626                  UDPDR3= 177626
177630                  UDPDR4= 177630
177632                  UDPDR5= 177632
177634                  UDPDR6= 177634
177636                  UDPDR7= 177636

                        ,*USER ''I'' PAGE ADDRESS REGISTERS

177640                  UIPAR0= 177640
177642                  UIPAR1= 177642
177644                  UIPAR2= 177644
177646                  UIPAR3= 177646
177650                  UIPAR4= 177650
177652                  UIPAR5= 177652
177654                  UIPAR6= 177654
177656                  UIPAR7= 177656

                        ;*USFR 'D'' PAGE ADDRESS REGISTERS

177660                  UDPAR0= 177660
177662                  UDPAR1= 177662
177664                  UDPAR2- 177664
```

```
                177666          UDPAR3= 177666
                177670          UDPAR4= 177670
                177672          UDPAR5= 177672
                177674          UDPAR6= 177674
                177676          UDPAR7= 177676

                                ;*SUPERVISOR ''I'' PAGE DESCRIPTOR REGISTERS

                172200          SIPDR0= 172200
                172202          SIPDR1= 172202
                172204          SIPDR2= 172204
                172206          SIPDR3= 172206
                172210          SIPDR4= 172210
                172212          SIPDR5= 172212
                172214          SIPDR6= 172214
                172216          SIPDR7= 172216

                                :*SUPERVISOR 'D'' PAGE DESCRIPTOR REGISTERS

                172220          SDPDR0= 172220
                172222          SDPDR1= 172222
                172224          SDPDR2= 172224
                172226          SDPDR3= 172226
                172230          SDPDR4= 172230
                172232          SDPDR5= 172232
                172234          SDPDR6= 172234
                172236          SDPDR7= 172236

                                ;*SUPERVISOR ''I'' PAGE ADDRESS REGISTERS

                172240          SIPAR0= 172240
                172242          SIPAR1= 172242
                172244          SIPAR2= 172244
                172246          SIPAR3= 172246
                172250          SIPAR4= 172250
                172252          SIPAR5= 172252
                172254          SIPAR6= 172254
                172256          SIPAR7= 172256

                                ;*SUPERVISOR 'D'' PAGE ADDRESS REGISTERS

                172260          SDPAR0= 172260
                172262          SDPAR1= 172262
                172264          SDPAR2= 172264
                172266          SDPAR3= 172266
                172270          SDPAR4= 172270
                172272          SDPAR5= 172272
                172274          SDPAR6= 172274
                172276          SDPAR7= 172276

                                ;*KERNEL ''I'' PAGE DESCRIPTOR REGISTERS

                172300          KIPDR0= 172300
                172302          KIPDR1= 172302
                172304          KIPDR2= 172304
                172306          KIPDR3= 172306
                172310          KIPDR4= 172310
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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
172370                  KDPAR4= 172370
172372                  KDPAR5= 172372
172374                  KDPAR6= 172374
172376                  KDPAR7= 172376



                        .SBTTL  UNIBUS MAP REGISTER DEFINITIONS


                        ;*THE LOWER 16 BITS OF THE MAP REGISTERS ARE LABELED 'MAPLXX'
                        ;*THE UPPER 6 BITS OF THE MAP REGISTERS ARE LABELED 'MAPHXX'


170200                  MAPL00 = 170200
170202                  MAPH00 = 170202
170204                  MAPL01 = 170204
170206                  MAPH01 = 170206
170210                  MAPL02 = 170210
170212                  MAPH02 = 170212
170214                  MAPL03 = 170214
170216                  MAPH03 = 170216
170220                  MAPL04 = 170220
170222                  MAPH04 = 170222
```

```
170224          MAPL05   170224
170226          MAPH05   170226
170230          MAPL06   170230
170232          MAPH06 = 170232
170234          MAPL07 = 170234
170236          MAPH07 = 170236
170240          MAPL10 = 170240
170242          MAPH10 - 170242
170244          MAPL11 - 170244
170246          MAPH11 = 170246
170250          MAPL12 = 170250
170252          MAPH12   170252
170254          MAPL13 - 170254
170256          MAPH13 - 170256
170260          MAPL14 - 170260
170262          MAPH14 - 170262
170264          MAPL15 = 170264
170266          MAPH15 = 170266
170270          MAPL16 - 170270
170272          MAPH16 = 170272
170274          MAPL17 - 170274
170276          MAPH17 = 170276
170300          MAPL20 - 170300
170302          MAPH20 = 170302
170304          MAPL21 - 170304
170306          MAPH21 - 170306
170310          MAPL22 - 170310
170312          MAPH22 = 170312
170314          MAPL23 = 170314
170316          MAPH23 = 170316
170320          MAPL24 - 170320
170320          MAPH24 - 170320
170324          MAPL25 = 170324
170326          MAPH25 - 170326
170330          MAPL26 = 170330
170332          MAPH26 - 170332
170334          MAPL27 - 170334
170336          MAPH27 - 170336
170340          MAPL30 = 170340
170342          MAPH30 = 170342
170344          MAPL31 - 170344
170346          MAPH31 - 170346
170350          MAPL32 - 170350
170352          MAPH32 - 170352
170354          MAPL33 - 170354
170356          MAPH33 = 170356
170360          MAPL34 = 170360
170362          MAPH34 = 170362
170364          MAPL35 = 170364
170366          MAPH35 = 170366
170370          MAPL36 = 170370
170372          MAPH36 - 170372
170374          MAPL37   170374
170376          MAPH37 = 170376
170200                   MAPL0=MAPL00
170202                   MAPH0-MAPH00
170204                   MAPL1-MAPL01
```

```
                170206                          MAPH1=MAPH01
                170210                          MAPL2=MAPL02
                170212                          MAPH2=MAPH02
                170214                          MAPL3=MAPL03
                170216                          MAPH3=MAPH03
                170220                          MAPL4=MAPL04
                170222                          MAPH4=MAPH04
                170224                          MAPL5=MAPL05
                170226                          MAPH5=MAPH05
                170230                          MAPL6=MAPL06
                170232                          MAPH6=MAPH06
                170234                          MAPL7=MAPL07
                170236                          MAPH7=MAPH07



224
                                        .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

                                        .SBTTL  STARTING ADDRESS(ES)
                000200                          .=200

    000200      000137  010000                  JMP     @#START         ;;JUMP TO STARTING ADDRESS OF PROGRAM
225
                                        ;;**************************************************************

                                        .SBTTL          ACT11 HOOKS

                                        ;*THE FOLLOWING LOCATIONS ARE SETUP TO BE USED WITH ACT11
                                        ;*
                                        ;*LOCATION 46 WILL CONTAIN THE ADDRESS OF THE LOCICAL
                                        ;*END OF THE PROGRAM.
                                        ;*LOCATION 52 IS USED TO SPECIFY PROGRAM OPERATING REQUIREMENTS
                                        ;*AND/OR RESTRICTIONS. THIS IS ACCOMPLISHED BY SETTING VARIOUS BITS
                                        ;*TO A ONE OR A ZERO. THE BITS USED AND THERE MEANING ARE:
                                        ;*
                                        ;*      BIT 15=1 PROGRAM SHOULD BE POWER FAILED WHILE RUNNING
                                        ;*           -0 NO POWER FAIL DESIRED
                                        ;*
                                        ;*      BIT 14=1 PROGRAM RUN TIME IS MEMORY SIZE DEPENDENT
                                        ;*           =0 RUN TIME IS NOT MEMORY SIZE DEPENDENT
                                        ;*
                                        ;*      BITS 13-0  MUST BE ZERO'S

                000204                          $SVPC=.                 ;;SAVE LOCATION COUNTER
                000046                          .-46                    ;;SET LOCATION COUNTER
    000046      021472                  .WORD   $ENDAD                  ;;SET LOC.46 TO ADDRESS $ENDAD
                000052                  .=52                            ;;SET LOCATION COUNTER
    000052      000000                  .WORD   0                       ;;SET LOC.52 TO ZERO
                000204                  .-$SVPC                         ;; RESTORE LOCATION COUNTER
```

```
                        ;;*****************************************************************

                        .SBTTL  COMMON TAGS

                        ;*THIS TABLE CONTAINS VARIOUS COMMON STORAGE LOCATIONS
                        ;*USED IN THE PROGRAM.

                001100          .=1100

001100                  $CMTAG:                         ;;START OF COMMON TAGS
                        ;$PASS: .WORD   0               ;;** CONTAINS PASS COUNT
001100  000             $TSTNM: .BYTE   0               ;;CONTAINS THE TEST NUMBER
001101  000             $ERFLG: .BYTE   0               ;;CONTAINS ERROR FLAG
001102  000000          $ICNT:  .WORD   0               ;;CONTAINS SUBTEST ITERATION COUNT
001104  000000          $LPADR: .WORD   0               ;;CONTAINS SCOPE LOOP
001106  000000          $LPERR: .WORD   0               ;;CONTAINS SCOPE RETURN FOR ERRORS
001110  000000          $ERTTL: .WORD   0               ;;CONTAINS TOTAL ERRORS DETECTED
001112  000             $ITEMB: .BYTE   0               ;;CONTAINS ITEM CONTROL BYTE
001113  001             $ERMAX: .BYTE   1               ;;CONTAINS MAX. ERRORS PER TEST
001114  000000          $ERRPC: .WORD   0               ;;CONTAINS PC OF LAST ERROR INSTRUCTION
001116  000000          $GDADR: .WORD   0               ;;CONTAINS  OF 'GOOD' DATA
001120  000000          $BDADR: .WORD   0               ;;CONTAINS  OF 'BAD' DATA
001122  000000          $GDDAT: .WORD   0               ;;CONTAINS 'GOOD' DATA
001124  000000          $BDDAT: .WORD   0               ;;CONTAINS 'BAD' DATA
001126  000000  000000  000000          .WORD   0,0,0   ;;RESERVED--NOT TO BE USED
001134  177560          $TKS:   177560                  ;;TTY KBD STATUS
001136  177562          $TKB:   177562                  ;;TTY KBD BUFFER
001140  177564          $TPS:   177564                  ;;TTY PRINTER STATUS REG.
001142  177566          $TPB:   177566                  ;;TTY PRINTER BUFFER REG.
001144  000             $NULL:  .BYTE   0               ;;CONTAINS NULL CHARACTER FOR FILLS
001145  002             $FILLS: .BYTE   2               ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
001146  012             $FILLC: .BYTE   12              ;;INSERT FILL CHARS. AFTER A 'LINE FEED''
001147  000             $TPFLG: .BYTE   0               ;;''TERMINAL AVAILABLE'' FLAG (BIT<07>=0=YES)

001150  177570          SWR:    .WORD   177570          ;;**
001152  177570          DISPLAY: .WORD  177570          ;;**

001154  000000          $REGAD: .WORD   0               ;;CONTAINS THE  FROM
                                                        ;;WHICH  ($REG0) WAS OBTAINED
                000006                  .REPT   $CM3
001156  000000          $REG0:  .WORD   0               ;;CONTAINS (($REGAD)+0)
001160  000000          $REG1:  .WORD   0               ;;CONTAINS (($REGAD)+2)
001162  000000          $REG2:  .WORD   0               ;;CONTAINS (($REGAD)+4)
001164  000000          $REG3:  .WORD   0               ;;CONTAINS (($REGAD)+6)
001166  000000          $REG4:  .WORD   0               ;;CONTAINS (($REGAD)+10)
001170  000000          $REG5:  .WORD   0               ;;CONTAINS (($REGAD)+12)
                000006  .REPT   6
001172  000000          $TMP0:  .WORD   0               ;;USER DEFINED
001174  000000          $TMP1:  .WORD   0               ;;USER DEFINED
001176  000000          $TMP2:  .WORD   0               ;;USER DEFINED
001200  000000          $TMP3:  .WORD   0               ;;USER DEFINED
001202  000000          $TMP4:  .WORD   0               ;;USER DEFINED
001204  000000          $TMP5:  .WORD   0               ;;USER DEFINED
001206  000000          $TIMES: 0                       ;;MAX. NUMBER OF ITERATIONS
001210  000000          $ESCAPE:0                       ;;ESCAPE ON ERROR
001212  207     377     377   $BELL:  .ASCII  <207><377><377> ;;CODE FOR BELL
001215  000
```

```
001216     077              $QUES:  .ASCII  /?/          ;;QUESTION MARK
001217     015              $CRLF:  .ASCII  <15>         ;;CARRIAGE RETURN
001220     012     000      $LF:    .ASCIZ  <12>         ;;LINE FEED
001222  000000             PADRSL: .WORD   0            ;HOLDS THE LOWER 16 BITS OF A 22 BIT
                                                        ;ADDRESS GENERATED FOR TYPE OUT.
001224  000000             PADRSH: .WORD   0            ;HOLDS THE UPPER 6 BITS OF A 22 BIT
                                                        ;ADDRESS GENERATED FOR TYPE OUT
001226  000000             ADRAND: .WORD   0            ;LOGICAL AND OF FAILING ADDRESSES
001230  000000             ADDROR: .WORD   0            ;LOGICAL OR OF FAILING ADDRESSES
001232  000000             DATAND: .WORD   0            ;LOGICAL AND OF BAD DATA
001234  000000             DATAOR: .WORD   0            ;LOGICAL OR OF BAD DATA
001236  000000             PATAND: .WORD   0            ;LOGICAL AND OF PATTERN LOADED
001240  000000             PATOR:  .WORD   0            ;LOGICAL OR OF PATTERN LOADED
001242  000000             LOWEST: .WORD   0            ;HOLDS NUMBER TO PUT IN PAR TO CAUSE THE
                                                        ;LOWEST USEABLE MAP REGISTER TO RESPOND
001244  000000             HIGEST: .WORD   0            ;HOLDS NUMBER TO PUT IN PAR TO CAUSE THE
                                                        ;HIGHEST USEABLE MAP REGISTER TO RESPOND
001246  000000             LREGL:  .WORD   0            ;HOLDS I/O PAGE ADDR OF LOW 16 BITS OF
                                                        ;THE LOWEST USEABLE MAP REGISTER
001250  000000             LREGU:  .WORD   0            ;HOLDS I/O PAGE ADDR OF HIGH 16 BITS OF
                                                        ;OF THE LOWEST USEABLE MAP REGISTER
001252  000000             HREGL:  .WORD   0            ;HOLDS I/O PAGE ADDR OF LOW 16 BITS OF
                                                        ;THE HIGHEST USEABLE MAP REGISTER
001254  000000             HREGU:  .WORD   0            ;HOLDS I/O PAGE ADDR OF HIGH 16 BITS OF
                                                        ;THE HIGHEST USEABLE MAP REGISTER
001256  000000             ERRCNT: .WORD   0            ;MULTIPLE ERROR ERROR COUNTER
001260  000000             CNTR:   .WORD   0            ;AUXILIARY COUNTER
001262  000000             FLAG:   .WORD   0            ;FLAG TO INDICATE TO LAST PROGRAM PASS N
001264  000000             TESTNO: .WORD   0            ;HOLDS TEST NUMBER FOR ERROR TYPE OUTS
001266  000000             CPUEXP: .WORD   0            ;HOLDS THE EXPECTED CPU ERROR CODE
001270  000000             PCPUER: .WORD   0            ;HOLDS RECEIVED CPU ERROR CONDITION
001272  000000             PPARER: .WORD   0            ;HOLDS RECEIVED PARITY ERROR CONDITION
001274  000000             PCONTR: .WORD   0            ;HOLDS CONTENTS OF CONTROL REGISTER
001276  000000             PMAINT: .WORD   0            ;HOLDS CONTENTS OF MAINTENENCE REGISTER
001300  000000             BADPC:  .WORD   0            ;HOLDS PC OF INST THAT CAUSED TRAP
001302  000000             OLDPC:  .WORD   0            ;HOLDS THE RETURN ADDRESS AFTER A TRAP
001304  000000             OLDPS:  .WORD   0            ;HOLDS THE OLD PROCESSOR STATUS
001306  000000             OLDPSW: .WORD   0            ;HOLDS OLD PSW FOR TBITRESTORE
001310  000000             PMMR0:  .WORD   0            ;HOLDS CONTENTS OF MMR0 AFTER TRAP
001312  000000             PMMR1:  .WORD   0            ;HOLDS CONTENTS OF MMR1 AFTER TRAP
001314  000000             PMMR2:  .WORD   0            ;HOLDS CONTENTS OF MMR2 AFTER TRAP
001316  000000             RSIZE:  .WORD   0            ;WILL HOLD P.A.R. DATA FOR TOP OF MEMORY
001320  000000             RETRY:  .WORD   0            ;RETRY FLAG IN CASE OF PARITY ABORTS
001322  000000             NXTTST: .WORD   0            ;LOCATION TO HOLD ESCAPE ADDRESS ON
                                                        ;PARITY ERRORS.
001324  000200             DATA:   .WORD   200          ;PATTERN TO BE USED TO LOAD INTO MEMORY
```

```
                                ;;*****************************************************************

                                .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


    001326                      $ERRTB:
  227
  228 001326  021554            EM1                     ;NOT THE CORRECT CPU TRAP CONDITION THRU ERRVEC (#004)
  229 001330  030034            DH1                     ;RECEIVD EXPECTD TESTNO  PC AT ABORT
  230 001332  032562            DT1                     ;PCPUER,CPUEXP,TESTNO,BADPC,0
  231 001334  033266            DF1                     ; 0, 0, 0, 0
  232
  233                           ;ITEM 2
  234 001336  021636            EM2                     ;UNEXPECTED CPU TRAP THRU ERRVEC (#004)
  235 001340  030100            DH2                     ;RECEIVD TESTNO  PC AT ABORT
  236 001342  032574            DT2                     ;PCPUER,TESTNO,BADPC
  237 001344  033272            DF2                     ; 0, 0, 0
  238
  239                           ;ITEM 3
  240 001346  022115            EM5                     ;MEMORY MANAGEMENT TRAP, MEMORY MANAGEMENT STATUS REGISTERS
  241 001350  030264            DH5                     ;STATUS  AUTOI/D VIRTADR
  242                                                   ;REGISTR REGISTR REGISTR TESTNO  PC AT ABOR
  243 001352  032616            DT5                     ;PMMR0,PMMR1,PMMR2,TESTNO,BADPC,0
  244 001354  033303            DF5                     ; 0, 0, 0, 0, 0
  245
  246                           ;ITEM 4
  247 001356  022223            EM6                     ;SUMMARY OF MAP REGISTERS THAT TIMED OUT ON READ
  248 001360  030370            DH6                     ;REGADRS REGADRS
  249                                                   ; 'OR'    'AND'  #ERRORS TESTNO  ERRORPC
  250 001362  032632            DT6                     ;ADDROR,ADRAND,ERRCNT,TESTNO,$ERRPC,0
  251 001364  033310            DF6                     ; 0, 0, 1, 0, 0
  252
  253                           ;ITEM 5
  254 001366  022365            EM10                    ;SUMMARY OF MAP REGISTERS NOT HOLDING ZERO IN LOW 16 BITS
  255 001370  030460            DH10                    ;REGADRS REGADRS RECEIVD RECEIVD
  256                                                   ; 'OR'    'AND'   'OR'    'AND'  #ERRORS TESTNO  ERRORPC
  257 001372  032646            DT10                    ;ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO,$ERRPC,0
  258 001374  033315            DF10                    ; 0, 0, 0, 0, 1, 0, 0
  259
  260                           ;ITEM 6
  261 001376  022456            EM11                    ;SUMMARY OF MAP REGISTERS NOT HOLDING ZERO IN UPPER 6 BITS
  262 001400  030460            DH10                    ;REGADRS REGADRS RECEIVD RECEIVD
  263                                                   ; 'OR'    'AND'   'OR'    'AND'  #ERRORS TESTNO  ERRORPC
  264 001402  032646            DT10                    ;ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO,$ERRPC,0
  265 001404  033315            DF10                    ; 0, 0, 0, 0, 1, 0, 0
  266
```

```
                                ;ITEM 7
001406  022550                  EM12            ;POSSIBLE ERROR IN MAP REGISTER DATA PATH (MAP REG 00)
001410  030610                  DH12            ;COUNT    COUNT
                                                ;EXPECTD RECEIVD TESTNO  ERRORPC
001412  032666                  DT12            ;$REG2,$REG0,TESTNO,$ERRPC,0
001414  033324                  DF12            ; 0, 0, 0, 0

                                ;ITEM 10
001416  022636                  EM13            ;NOW PROBABLE ERROR IN MAP REGISTER DATA PATH (MAP REG 20)
001420  030610                  DH12            ;COUNT    COUNT
                                                ;EXPECTD RECEIVD TESTNO  ERRORPC
001422  032700                  DT13            ;$REG3,$REG1,TESTNO,$ERRPC,0
001424  033324                  DF12            ; 0, 0, 0, 0

                                ;ITEM 11
001426  022730                  EM14            ;SUMMARY OF DUAL ADDRESSING ERRORS ON LOADING MAP REGISTERS
001430  030666                  DH14            ;REGLOAD REGLOAD REGDUAL REGDUAL
                                                ; 'OR'    'AND'  'OR'    'AND'  #ERRORS TESTNO
001432  032712                  DT14            ;ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO,0
001434  033330                  DF14            ; 0, 0, 0, 0, 1, 0

                                ;ITEM 12
001436  023023                  EM15            ;SUMMARY OF COUNT PATTERN FAILURES IN LOWER 16 BITS OF MAP REGISTERS
001440  031005                  DH15            ;MAPREG  MAPREG  EXPECTD EXPECTD RECEIVD RECEIVD
                                                ; 'OR'    'AND'  'OR'    'AND'  'OR'    'AND'  #ERRORS TESTNO
001442  032730                  DT15            ;ADDROR,ADRAND,PATTOR,PATAND,DATAOR,DATAND,ERRCNT,TESTNO,0
001444  033336                  DF15            ; 0, 0, 0, 0, 0, 0, 1, 0

                                ;ITEM 13
001446  023127                  EM16            ;SUMMARY OF COUNT PATTERN FAILURES IN UPPER 6 BITS OF MAP REGISTERS
001450  031005                  DH15            ;MAPREG  MAPREG  EXPECTD EXPECTD RECEIVD RECEIVD
                                                ; 'OR'    'AND'  'OR'    'AND'  'OR'    'AND'  #ERRORS TESTNO
001452  032730                  DT15            ;ADDROR,ADRAND,PATTOR,PATAND,DATAOR,DATAND,ERRCNT,TESTNO,0
001454  033336                  DF15            ; 0, 0, 0, 0, 0, 0, 1, 0

                                ;ITEM 14
001456  024206                  EM25            ;REFERENCED MAP REGISTER 0 WITH ADDRESS ONE BIT
                                                ;DIFFERENT THAN 770200
001460  031333                  DH25            ;ADDRUSED  BITDIFF TESTNO  ERRORPC
001462  033010                  DT25            ;$REG4,$REG0,TESTNO,$ERRPC,0
001464  033357                  DF25            ;3, 4, 0, 0

                                ;ITEM 15
001466  024434                  EM30            ;CAN'T GET TO MAIN MEMORY FROM UNIBUS WITH THE MAP OFF
                                                ;SO I'LL JUMP TO THE SIZE JUMPER TEST FOR VERIFICATION
001470  031427                  DH30            ;TESTNO  ERRORPC
001472  033032                  DT30            ;TESTNO,$ERRPC,0
001474  033366                  DF30            ;0, 0

                                ;ITEM 16
001476  024610                  EM31            ;SUMMARY OF COUNT PATTERN FAILURES ON THE UNIBUS DATA  PATH
001500  031214                  DH23            ;EXPECTD EXPECTD RECEIVD RECEIVD
                                                ; 'OR'    'AND'  'OR'    'AND'  #ERRORS TESTNO
001502  032772                  DT23            ;PATTOR,PATAND,DATAOR,DATAND,FRRCTN,TESTNO,0
001504  033351                  DF23            ; 0, 0, 0, 0, 1, 0

                                ;ITEM 17
```

```
                                        ;ITEM 20
001516  024754                  EM33    ;CANNOT USE ANY OF THE MAP REGISTERS OR PHYSICAL
                                        ;ADDRESS BIT 4 IS STUCK LOW, MUST RESTART PROGRAM
                                        ;IF YOU DON'T LOOP ON THIS PROBLEM.
001520  031427                  DH30    ;TESTNO  ERRORPC
001522  033032                  DT30    ;TESTNO,$ERRPC,0
001524  033366                  DF30    ; 0, 0
                                NOP
001526  000240                  NOP
001530  000240                  NOP
001532  000240                  NOP
001534  000240                  NOP
                                        ;ITEM 22
001536  025166                  EM35    ;THE SIZE JUMPERS ON THE UNIBUS MAP ARE NOT SET
                                        ;IN THEIR DEFAULT POSITION.  THIS WOULD ALLOW UNIBUS
                                        ;ADDRESSES 000000 TO 757776 TO REFERNECE MAIN MEMORY
                                        ;THEIR CURRENT SETTING ALLOWS ONLY:
001540  031507                  DH35    ;LOWEST  HIGHEST TESTNO  ERRORPC
001542  033052                  DT35    ;LOWEST,HIGEST,TESTNO,$ERRPC,0
001544  033374                  DF35    ; 4, 4, 0, 0
                                        ;ITEM 23
001546  025736                  EM36    ;MAP REGISTER UNDER TEST DID NOT RESPOND IN DUAL MAPPING TEST
001550  031547                  DH36    ;TESTNO  ERRORPC UNIBUS ADDRESS OF MAP REGISTER UNDER TEST
001552  033064                  DT36    ;TESTNO,$ERRPC,$REG0,0
001554  033400                  DF36    ; 0, 0, 3
                                        ;ITEM 24
001556  026033                  EM37    ;SUMMARY OF UNIBUS ADDRESS ERRORS, WITH MAP RELOCATION DISABLED
001560  031214                  DH23    ;EXPECTD EXPECTD RECEIVD RECEIVD
                                        ; 'OR'   'AND'   'OR'   'AND'  #ERRORS TESTNO
001562  033074                  DT37    ;ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO
001564  033403                  DF37    ; 0, 0, 0, 0, 1, 0
                                        ;ITEM 25
001566  026136                  EM40    ;MAIN MEMORY TIME OUT OVER THE UNIBUS DID NOT OCCUR PROPERLY.
001570  031641                  DH40    ;CONDITN CONDITN
                                        ;EXPECTD RECEIVD TESTNO  ERRORPC
001572  033112                  DT40    ;CPUEXP,PCPUER,TESTNO,$ERRPC,0
001574  033411                  DF40    ; 0, 0, 0, 0
                                        ;ITEM 26
001576  026231                  EM41    ;RELOCATION THROUGH THE MAP WAS NOT CORRECT, FULL ADD.
001600  031721                  DH41    ;CORRECT ADDRESS
                                        ;ADDRESS FETCHED TESTNO  ERRORPC
001602  033124                  DT41    ;$REG2,$REG1,TESTNO,$ERRPC
001604  033415                  DF41    ; 0, 0, 0, 0
                                        ;ITEM 27
001606  026313                  EM42    ;RELOCATION THRU THE MAP WAS NOT CORRECT, CARRY PROPAGATION
001610  032001                  DH42    ;CORRECT   EXPECTD RECEIVD
```

```
                                                        ;ADDRESS   DATA    FROM UB TESTNO  ERRORPC
001612  033136                  DT42                    ;$REG1,$REG3,$REG2,TESTNO,$ERRPC
001614  033421                  DF42                    ; 3, 0, 0, 0, 0

                                ;ITEM 30
001616  026473                  EM45                    ;MAIN MEMORY TIME OUT OVER THE UNIBUS DID NOT OCCUR PROPERLY.
                                                        ;TEST BEING RUN OVER UNIBUS
001620  031641                  DH40                    ;CONDITN CONDITN
                                                        ;EXPECTD RECEIVD TESTNO  ERRORPC
001622  033112                  DT40                    ;CPUEXP,PCPUER,TESTNO,$ERRPC,0
001624  033411                  DF40                    ; 0, 0, 0, 0

                                ;ITEM 31
001626  026626                  EM46                    ;RELOCATION THROUGH THE MAP WAS NOT CORRECT, FULL ADD.
                                                        ;TEST BEING RUN OVER UNIBUS
001630  031721                  DH41                    ;CORRECT ADDRESS
                                                        ;ADDRESS FETCHED TESTNO  ERRORPC
001632  033124                  DT41                    ;$REG2,$REG1,TESTNO,$ERRPC
001634  033415                  DF41                    ; 0, 0, 0, 0

                                ;ITEM 32
001636  026750                  EM47                    ;RELOCATION THRU THE MAP WAS NOT CORRECT, CARRY PROPAGATION
                                                        ;TEST BEING RUN OVER UNIBUS
001640  032001                  DH42                    ;CORRECT   EXPECTD RECEIVD
                                                        ;ADDRESS   DATA    FROM UB TESTNO  ERRORPC
001642  033136                  DT42                    ;$REG1,$REG3,$REG2,TESTNO,$ERRPC
001644  033421                  DF42                    ; 3, 0, 0, 0, 0


                                ;ITEM 33
001646  027270                  EM52                    ;SUMMARY OF DUAL MAPPING ERRORS
001650  031214                  DH23                    ;EXPECTD EXPECTD RECEIVD RECEIVD
                                                        ; 'OR'    'AND'   'OR'    'AND'  #ERRORS TESTNO
001652  033074                  DT37                    ;ADDROR,ADRAND,DATAOR,DATAND,$ERRPC,TESTNO,0
001654  033403                  DF37                    ; 0, 0, 0, 0, 1, 0

001656                          ER200:                  ;THIS IS THE STARTING POINT FOR ERROR MESSAGES
                                                        ;201 THRU 377.  THEY ARE USED FOR MULTIPLE
                                                        ;ERROR MESSAGES.

                                ;ITEM 201
001656  027327                  EM201                   ;THE FOLLOWING REGISTERS TIMED OUT WHEN READ
001660  032101                  DH201                   ;REGADRS TESTNO ERRORPC
001662  033152                  DT201                   ;$REG0,TESTNO,$ERRPC,0
001664  033426                  DF201                   ; 0, 0, 0

                                ;ITEM 202
001666  027403                  EM202                   ;THE FOLLOWING MAP REGISTERS WILL NOT CLEAR
001670  032131                  DH202                   ;REGADRS DATAREC TESTNO  ERRORPC.
001672  033162                  DT202                   ;$REG0,$TMP0,TESTNO,$ERRPC,0
001674  033431                  DF202                   ; 0, 0, 0, 0

                                ;ITEM 203
001676  027456                  EM203                   ;THE FOLLOWING ARE DUAL ADDRESSING ERRORS IN THE UNIBUS MAP
001700  032171                  DH203                   ;MAPREG  MAPREG
                                                        ;TESTING DUALED  TESTNO  ERRORPC
001702  033174                  DT203                   ;$REG0,$REG1,$TESTNO,$ERRPC,0
```

```
                                DF203                   ; 0, 0, 0, 0
                                ;ITEM 204
                                EM204                   ;THE COUNT PATTERN THRU THE MAP REGISTERS FAILED
                                DH204                   ;REGADRS PATTERN EXPECTD RECEIVD TESTNO  ERRORPC
                                DT204                   ;$REG0,$REG2,$REG4,$REG3,TESTNO,$ERRPC,0
                                DF204                   ; 0, 0, 0, 0, 0, 0
                                ;ITEM 205
                                EM205                   ;UNIBUS DATA PATH COUNT PATTERN FAILURE
                                DH205                   ;EXPECTD RECEIVD ADDRSLOAD TESTNO  ERRORPC
                                DT205                   ;$REG1,$REG0,$REG2,TESTNO,$ERRPC,0
                                DF205                   ;0, 0, 3, 0, 0
                                ;ITEM 206
                                EM206                   ;UNIBUS ADDRESSING ERRORS, MAP RELOCATION DISABLED
                                DH206                   ;ADDRESS ADDRESS
                                                        ;EXPECTD RECEIVD TESTNO ERRORPC
                                DT206                   ;$REG0,$REG3,TESTNO,$ERRPC,0
                                DF206                   ; 0, 0, 0, 0
```

```
                                .SBTTL  ERROR MESSAGE TYPE OUT ROUTINE

                                ;*      THIS SUBROUTINE IS CALLED BY THE ERROR HANDLER TO TYPE
                                ;*      THE ERROR MESSAGES.  IT PICKS UP THE ITEM BYTE ($ITEMB) NUMBER
                                ;*      AND USES THAT TO INDEX THROUGH THE ERROR TABLE.  THE ERROR
                                ;*      TABLE STARTS AT '$ERRTB' AND HAS FOUR (4) POINTERS FOR EACH
                                ;*      ENTRY, 'EM', 'DH', 'DT', 'DF'.  THE 'EM' POINTS TO THE ERROR
                                ;*      MESSAGE WHICH IS AN ASCIZ STRING.  THE 'DH' POINTS TO THE DATA
                                ;*      HEADER WHICH IS ANOTHER ASCIZ STRING.  THE 'DT' POINTS TO THE
                                ;*      DATA TABLE WHICH IS A GROUP OF WORDS CONTAINING THE ADDRESSES
                                ;*      OF THE DATA TO BY TYPED.  THE FORMAT OF THIS DATA IS
                                ;*      CONTROLLED BY THE 'DF' WHICH IS THE POINTER TO THE DATA FORMAT.
                                ;*      THE DATA FORMAT IS A GROUP OF BYTES WHICH CONTAIN NUMBERS
                                ;*      THAT CORRESPOND TO DIFFERENT TYPING FORMATS.
                                ;*      0       -16 BIT OCTAL FORMAT
                                ;*      1       -DECIMAL FORMAT
                                ;*      2       -22 BIT OCTAL FORMAT.  DATA IS LOWER 16 BITS OF THE
                                ;*               PHYSICAL ADDRESS, UPPER 6 BITS ARE ADJACENT TO LOWER 16
                                ;*      3       -22 BIT OCTAL FORMAT.  DATA IS THE 16 BIT VIRTUAL
                                ;*               ADDRESS IN KERNEL I-SPACE.
                                ;*      4       -18 BIT OCTAL FORMAT.  DATA IS A 16 BIT NUMBER THAT
                                ;*               WILL BE CONVERTED INTO A UNIBUS ADDRESS BY LEFT
                                ;*               SHIFTING IT 6 BITS.
001736  010046          ERTYPE: MOV     R0,-(KSP)       ;SAVE R0 ON STACK
001740  005000                  CLR     R0              ;CLEAR R0
001742  113700  001112          MOVB    @#$ITEMB,R0     ;PUT ITEM NUMBER IN R0
001746  001004                  BNE     1$              ;BRANCH IF IT IS NON-ZERO
001750  016746  177140          MOV     $ERRPC,-(KSP)   ;PUT ERROR PC ON STACK FOR TYPING
001754  104402                  TYPOC                   ;TYPE FAILING PC
001756  000526                  BR      13$             ;GO TO RETURN
```

```
                                                ;ADJUST ITEM NUMBER TO BE A POINTER
                                                ;LEFT SHIFT ITEM NO. 3 PLACES
                                                ;BRANCH IF ITEM #LESS THAN 200
                                                ;SEE IF ITEM # WAS 3XX
                                                ;BRANCH IF ITEM # WAS 2XX
                                                ;AND TYPE ERROR MESSAGE
                                                ;SEE IF SWITCH 7 IS UP
                                                ;BRANCH IF SWITCH IS NOT UP
                                                ;AND TYPE DATA, ON MULTIPLE ERRORS
                                                ;SKIP 'TYPE  ,$CRLF' IF SW 7 IS UP
                                                ;INHIBIT MULTIPLE ERROR TYPEOUTS
                                                ;BRANCH TO EXIT
                                                ;CLEAR UPPER BYTE OF R0
                                                ;POINT TO DATA TABLE ENTRY
                                                ;GO TYPE DATA TABLE
                                                ;CLEAR UPPER BYTE OF R0
                                                ;ADD DIFFERENCE BETWEEN
                                                ;ITEM 1 AND ITEM 201
                                                ;
                                                ;  GET POINTER TO ERROR MESSAGE AND TYPE IT
                                                ;  IF THE POINTER IS NOT ZERO
                                                ;
                                                ;ADD BASE OF ERROR TABLE
                                                ;PUT MESSAGE POINTER IN TYPE STATEMENT
                                                ;BRANCH IF NO ERROR MESSAGE
                                                ;TYPE ERROR MESSAGE
                                                ;POINTER TO ERROR MESSAGE
                                                ;TYPE CRLF
                                                ;
                                                ;  GET THE POINTER TO THE DATA HEADER AND
                                                ;  TYPE IT IF THE POINTER IS NOT ZERO
                                                ;
                                                ;PUT HEADER POINTER IN TYPE STATEMENT
                                                ;BRANCH IF NO DATA HEADER
                                                ;TYPE THE DATA HEADER
                                                ;POINTER TO DATA HEADER
                                                ;TYPE CRLF
                                                ;
                                                ;  THIS IS THE START OF THE DATA OUTPUT IF THE
                                                ;  DATA POINTER IS NOT ZERO.  R0 POINTS TO THE
                                                ;  DATA FORMAT, R1 POINTS TO THE ADDRESS OF
                                                ;  THE DATA WORDS.
                                                ;
                                                ;SAVE R1 ON THE STACK
                                                ;PUT DATA TABLE POINTER IN R1
                                                ;BRANCH IF NO DATA TABLE
                                                ;PICK UP DATA FORMAT POINTER
                                                ;IS THIS WORD OCTAL
                                                ;BRANCH IF NOT 16-BIT OCTAL
                                                ;  THIS IS 16 BIT OCTAL FORMAT (DF = 0)
                                                ;PUT WORD ON STACK FOR TYPING
                                                ;TYPE THE WORD ON STACK AS 16 BIT OCTAL
                                                ;GET READY FOR NEXT WORD
                                                ;IS THE WORD DECIMAL
                                                ;BRANCH IF NOT DECIMAL
                                                ;  THIS IS DECIMAL FORMAT (DF = 1)
                                                ;PUT WORD ON STACK FOR TYPING
                                                ;TYPE THE WORD ON STACK AS DECIMAL
                                                ;GET READY FOR NEXT WORD
                                                ;IS WORD 22-BIT PHYSICAL ADDRESS
                                                ;BRANCH IF NOT 22-BIT PHYSICAL ADDR
                                                ;  THIS IS 22-BIT PHYSICAL FORMAT (DF = 2)
                                                ;PUT ADDR OF LOW WORD ON STACK
```

```
                                        JSR     PC,$DB2O        ;CONVERT NUMBER TO OCTAL ASCIZ
                                        ADD     #3,(KSP)                ;ONLY WANT 8 D'GITS
                                        MOV     (KSP)+,30$      ;PUT POINTER AFTER 'TYPE' CALL
                                        TYPE                    ;TYPE ASCIZ STRING
                                30$:    .WORD   0               ;WORD HOLDS POINTER TO ASCIZ STRING
                                        BR      11$             ;GET READY FOR NEXT WORD
                                9$:     CMPB    #3,(R0)         ;IS THIS A 16-BIT VIRTUAL ADDRESS
                                        BNE     10$             ;BRANCH IF NOT 16-BIT VIRT. ADDR.
                                ;;                      THIS IS 22-BIT VIRTUAL ADDRESS FORMAT
                                ;;                      KERNEL I-SPACE ASSUMED.  (DF = 3)
                                        MOV     @(R1)+,-(KSP)   ;PUT 16-BIT VIRTUAL ADDR ON STACK
                                        JSR     PC,TYPVAD       ;GO TYPE 22-BIT ADDRESS FROM 16-BIT V.A.
                                        BR      11$             ;GET READY FOR NEXT WORD
                                ;;                      THIS IS FORMAT 4.  DATA WORD IS A UNIBUS ADDRESS
                                ;;                      OUTPUT WILL BE 18-BITS WORD LEFT SHIFTED 6.
                                10$:    MOV     @(R1)+,-(KSP)   ;PUSH 16-BIT UNIBUS ADDRESS ON STACK
                                        JSR     PC,UBADDR       ;CONVERT TO 18-BIT UNIBUS ADDR AND TYPE
                                        BR      11$             ;GET READY FOR NEXT WORD
                                11$:    INC     R0              ;POINT TO NEXT FORMAT BYTE
                                        TYPE    ,32$            ;TYPE TWO SPACES
                                        TST     (R1)            ;IS THERE ANOTHER WORD?
                                        BEQ     12$             ;BRANCH IF ALL DONE
                                        BR      6$              ;GO BACK FOR NEXT NUMBER
                                12$:    MOV     (KSP)+,R1       ;RESTORE R1
                                13$:    MOV     (KSP)+,R0       ;RESTORE R0
                                        RTS     PC              ;RETURN TO ERROR ROUTINE
                                32$:    .ASCIZ  ? ?             ;TWO SPACES
                                        .EVEN


                                .SBTTL  CONVERT 16-BIT VIRTUAL ADDRESS TO 22-BIT PHYSICAL ADDRESS
                                ;*
                                ;*      THIS ROUTINE IS CALLED BY A 'JSR PC' AFTER THE VIRTUAL ADDRESS
                                ;*      IS PUSHED ON THE KERNEL STACK.  THE V.A. IS THEN LOADED INTO
                                ;*      R1 AND THE UPPER 3 BITS ARE SHIFTED INTO R0 TO SELECT THE
                                ;*      CORRECT KERNEL I-SPACE PAR.  THE LOWER 12 BITS OF THE VIRTUAL
                                ;*      ADDRESS ARE ADDED TO THE PAR AS THEY ARE BY MEMORY MANAGEMENT
                                ;*      AND THE PHYSICAL ADDRESS IS SAVED IN MEMORY TO BE CONVERTED
                                ;*      TO ASCIZ AND TYPED.
                                ;*
                                TYPVAD: SAVREG                  ;SAVE ALL REGISTERS
                                        MOV     2(KSP),R1       ;PUT VIRTUAL ADDR IN R1
                                        CLR     R0              ;CLEAR R0 FOR CALCULATIONS
                                        ASHC    #3,R0           ;LEFT SHIFT R0,R1 3 PLACES
                                        ASL     R0              ;LEFT SHIFT R0 ONE MORE PLACE
                                        ROR     R1              ;RIGHT SHIFT R1 SO OFFSET IS CORRECT
                                        ROR     R1              ;RIGHT SHIFT R1
                                        ROR     R1              ;RIGHT SHIFT R1
                                        ADD     #KIPAR0,R0      ;FORM DESIRED PAR ADDR IN R0
                                        MOV     (R0),R3         ;PUT CONTENTS OF PAR IN R3
                                        CLR     R2              ;CLEAR R2 FOR PHYSICAL ADDR CALCULATION
                                        ASHC    #6,R2           ;LEFT SHIFT <R2,R3> 6 PLACES
                                        ADD     R1,R3           ;ADD OFFSET IN R1 TO BASE IN R3
                                        ADC     R2              ;ADD ANY POSSIBLE CARRY TO UPPER 6 BITS
                                        MOV     R2,PADRSH       ;PUT UPPER 6 BITS OF ADDR IN CORE
                                        MOV     R3,PADRSL       ;PUT LOWER 16 BITS OF ADDR IN CORE
                                        MOV     #PADRSL,-(KSP)  ;PUT POINTER TO LOWER 16 BITS ON STACK
```

```
                        JSR     PC,$DB2O        ;CONVERT NUMBER TO OCTAL ASCIZ
                        ADD     #3,(KSP)        ;ONLY TYPE 8 DIGITS
                        MOV     (KSP)+,3$       ;PUT POINTER AFTER TYPE INST
                        TYPE                    ;TYPE THE 22-BIT VIRTUAL ADDRESS
                3$:     .WORD   0               ;THIS WORD HOLDS THE POINTER TO
                                                ;THE ASCIZ STRING
                        RESREG                  ;RESTORE ALL THE REGISTERS
                        MOV     (KSP)+,(KSP)    ;LEAVE ONLY RETURN ADDR ON STACK
                        RTS     PC              ;RETURN TO ERROR HANDLER


                ;*THIS SUBROUTINE IS USED TO CONVERT THE A WORD PUSHED
                ;*ON THE STACK INTO A UNIBUS ADDRESS AND TYPE IT AS A
                ;*6 DIGIT NUMBER.  IT USES R1 & R0 AND LEAVES
                ;*ALL OTHER REGISTERS UNCHANGED.
                UBADDR: SAVREG
                        MOV     2(KSP),R1       ;LOAD 16 BIT ADDRESS INTO R1
                        CLR     R0              ;CLEAR R0 FOR CALCULATIONS
                        ASHC    #6,R0           ;LEFT SHIFT <R0:R1> 6 PLACES
                        MOV     R1,PADRSL       ;PUT LOWER 16 BITS IN PADRSL
                        MOV     R0,PADRSH       ;PUT UPPER 6 BITS IN PADRSH
                        MOV     #PADRSL,-(KSP)  ;PUSH POINTER TO WORDS ON STACK
                        JSR     PC,$DB2O        ;JUMP TO CONVERT ROUTINE
                        ADD     #5,(KSP)        ;ONLY USE LOWER 6 CHARS.
                        MOV     (KSP)+,3$       ;PUT POINTER AFTER TYPE CALL.
                        TYPE
                3$:     .WORD   0               ;HOLDS POINTER TO FIRST CHAR.
                        RESREG
                        MOV     (KSP)+,(KSP)    ;LEAVE ONLY RETURN ADDRESS ON STACK
                        RTS     PC              ;RETURN TO ERROR TYPE ROUTINE.


                ;;*******************************************************************

                .SBTTL  SAVE AND RESTORE R0-R5 ROUTINES

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

        002430  $SAVREG:
        002430  010046          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
        002432  010146          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
        002434  010246          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
        002436  010346          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
        002440  010446          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
        002442  010546          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
```

```
        002444  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PS OF MAIN FLOW
        002450  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PC OF MAIN FLOW
        002454  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PS OF CALL
        002460  016646  000022                  MOV     22(SP),-(SP)    ;;SAVE PC OF CALL
        002464  000002                          RTI

                                        ;*RESTORE R0-R5
                                        ;*CALL:
                                        ;*      RESREG
        002466                          $RESREG:
        002466  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PC OF CALL
        002472  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PS OF CALL
        002476  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PC OF MAIN FLOW
        002502  012666  000022                  MOV     (SP)+,22(SP)    ;;RESTORE PS OF MAIN FLOW
        002506  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
        002510  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
        002512  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
        002514  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
        002516  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
        002520  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
        002522  000002                          RTI
64.)                                    ;;**************************************************************

                                        .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:        $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
                                        ;*
                                        ;*CALL:
                                        ;*1) USING A TRAP INSTRUCTION
                                        ;*      TYPE    ,MESADR         ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
                                        ;*OR
                                        ;*      TYPE
                                        ;*      MESADR
                                        ;*
                                        ;*2) USING A JSR INSTRUCTION
                                        ;*      MOV     PS,-(SP)        ;;PUSH PROCESSOR STATUS WORD ON THE STACK
                                        ;*      JSR     PC,$TYPE        ;;CALL TYPE ROUTINE
                                        ;*      MESADDR                 ;;FIRST ADRESS OF MESSAGE

        002524  105767  176417          $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
        002530  100002                          BPL     1$              ;;BR IF YES
        002532  000000                          HALT                    ;;HALT HERE IF NO TERMINAL
        002534  000413                          BR      3$              ;;LEAVE
        002536  010046                  1$:     MOV     R0,-(SP)        ;;SAVE R0
        002540  017600  000002                  MOV     @2(SP),R0       ;;GET ADDRESS OF ASCIZ STRING

        002544  132767  000040  015263          BITB    #40,$ENVM       ;;** SUPRESS TYPEOUTS?
        002552  001003                          BNE     60$             ;;** YES

        002554  112046                  2$:     MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
        002556  001005                          BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
        002560  005726                          TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
        002562  012600                  60$:    MOV     (SP)+,R0        ;;** RESTORE R0
```

```
002564  062716  000002          3$:     ADD     #2,(SP)         ;;ADJUST RETURN PC
002570  000002                          RTI                     ;;RETURN
002572  122716  000011          4$:     CMPB    #HT,(SP)        ;;BRANCH IF <HT>
002576  001426                          BEQ     8$
002600  122716  000200                  CMPB    #CRLF,(SP)      ;;BRANCH IF NOT
002604  001004                          BNE     5$
002606  005726                          TST     (SP)+           ;;POP  <CR><LF> EQUIV
002610  104400  001217                  TYPE    ,$CRLF
002614  000757                          BR      2$              ;;GET NEXT CHARACTER
002616  004767  000056          5$:     JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
002622  126726  176320          6$:     CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
002626  001352                          BNE     2$              ;;IF NO GO GET NEXT CHAR.
002630  016746  176310                  MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
                                                                ;;AND THE NULL CHAR.
002634  105366  000001          7$:     DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
002640  002770                          BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
002642  004767  000032                  JSR     PC,$TYPEC       ;;GO TYPE A NULL
002646  105367  000142                  DECB    $CHARCNT        ;;DON'T COUNT THE NULL AS A CHARACTER
002652  000770                          BR      7$              ;;LOOP

                                        ;;HORIZONTAL TAB PROCESSOR

002654  112716  000040          8$:     MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
002660  004767  000014          9$:     JSR     PC,$TYPEC       ;;TYPE A SPACE
002664  132767  000007  000122          BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
002672  001372                          BNE     9$              ;;TAB STOP
002674  005726                          TST     (SP)+           ;;POP SPACE OFF STACK
002676  000726                          BR      2$              ;;GET NEXT CHARACTER
002700  105777  176234          $TYPEC: TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
002704  100375                          BPL     $TYPEC
002706  116677  000002  176226          MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.

002714  105777  176214                  TSTB    @$TKS           ;;** SEE IF KEYBOARD IS TALKING
002720  100021                          BPL     2$              ;;**
002722  017746  176210                  MOV     @$TKB,-(SP)     ;;**
002726  042716  177600                  BIC     #177600,(SP)    ;;** BIT CLEAR TOP BYTE AND PARITY BIT
002732  022726  000023                  CMP     #23,(SP)+       ;;** SEE IF IT IS A ^S
002736  001012                          BNE     2$              ;;** BR IF IT ISN'T
002740  105777  176170          3$:     TSTB    @$TKS           ;;**
002744  100375                          BPL     3$              ;;** BR BACK IF NOT READY
002746  017746  176164                  MOV     @$TKB,-(SP)     ;;** PUSH NEXT CHARACTER ON STACK
002752  042716  177600                  BIC     #177600,(SP)    ;;**
002756  022726  000021                  CMP     #21,(SP)+       ;;** IS IT A ^Q
002762  001366                          BNE     3$              ;;** BR IF NOT

002764  122766  000015  000002  2$:     CMPB    #CR,2(SP)       ;;BRANCH IF
002772  001003                          BNE     1$              ;;NOT <CR>
002774  105067  000014                  CLRB    $CHARCNT        ;;
003000  000406                          BR      $TYPEX          ;;EXIT
003002  122766  000012  000002  1$:     CMPB    #LF,2(SP)       ;;BRANCH IF
003010  001402                          BEQ     $TYPEX          ;;<LF>
003012  105227                          INCB    (PC)+           ;;INC SPACE
003014  000000          $CHARCNT:.WORD  0                       ;;COUNT
003016  000207          $TYPEX: RTS     PC

                                        ;;******************************************************************
```

```
                                .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

003020  017646  000000          $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
003024  116667  000001  000211          MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
003032  112667  000207                  MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
003036  062716  000002                  ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
003042  000406                          BR      $TYPON
003044  112767  000001  000171  $TYPOC: MOVB    #1,$OFILL       ;;SET THE ZERO FILL SWITCH
003052  112767  000006  000165          MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
003060  112767  000005  000154  $TYPON: MOVB    #5,$OCNT        ;;SET THE ITERATION COUNT
003066  010346                          MOV     R3,-(SP)        ;;SAVE R3
003070  010446                          MOV     R4,-(SP)        ;;SAVE R4
003072  010546                          MOV     R5,-(SP)        ;;SAVE R5
003074  116704  000145                  MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
003100  005404                          NEG     R4
003102  062704  000006                  ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
003106  110467  000132                  MOVB    R4,$OMODE       ;;SAVE IT FOR USE
003112  116704  000125                  MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
003116  016605  000012                  MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
003122  005003                          CLR     R3              ;;CLEAR THE OUTPUT WORD
003124  006105                  1$:     ROL     R5              ;;ROTATE MSB INTO "C"
003126  000404                          BR      3$              ;;GO DO MSB
003130  006105                  2$:     ROL     R5              ;;FORM THIS DIGIT
003132  006105                          ROL     R5
003134  006105                          ROL     R5
003136  010503                          MOV     R5,R3
003140  006103                  3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
003142  105367  000076                  DECB    $OMODE          ;;TYPE THIS DIGIT?
003146  100016                          BPL     7$              ;;BR IF NO
003150  042703  177770                  BIC     #177770,R3      ;;GET RID OF JUNK
003154  001002                          BNE     4$              ;;TEST FOR 0
003156  005704                          TST     R4              ;;SUPPRESS THIS 0?
003160  001403                          BEQ     5$              ;;BR IF YES
003162  005204                  4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
003164  052703  000060                  BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
```

```
003170  052703  000040          5$:     BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
003174  110367  000040                  MOVB    R3,8$           ;;SAVE FOR TYPING
003200  104400  003240                  TYPE    ,8$             ;;GO TYPE THIS DIGIT
003204  105367  000032          7$:     DECB    $OCNT           ;;COUNT BY 1
003210  003347                          BGT     2$              ;;BR IF MORE TO DO
003212  002402                          BLT     6$              ;;BR IF DONE
003214  005204                          INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
003216  000744                          BR      2$              ;;GO DO THE LAST DIGIT
003220  012605                  6$:     MOV     (SP)+,R5        ;;RESTORE R5
003222  012604                          MOV     (SP)+,R4        ;;RESTORE R4
003224  012603                          MOV     (SP)+,R3        ;;RESTORE R3
003226  016666  000002  000004          MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
003234  012616                          MOV     (SP)+,(SP)
003236  000002                          RTI                     ;;RETURN
003240     000  8$:     .BYTE   0       ;;STORAGE FOR ASCII DIGIT
003241     000          .BYTE   0       ;;TERMINATOR FOR TYPE ROUTINE
003242     000  $OCNT:  .BYTE   0       ;;OCTAL DIGIT COUNTER
003243     000  $OFILL: .BYTE   0       ;;ZERO FILL SWITCH
003244  000000  $OMODE: .WORD   0       ;;NUMBER OF DIGITS TO TYPE
  644                   ;;*****************************************************************

                        .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

003246                  $TYPDS:
003246  010046                  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
003250  010146                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
003252  010246                  MOV     R2,-(SP)        ;;PUSH R2 ON STACK
003254  010346                  MOV     R3,-(SP)        ;;PUSH R3 ON STACK
003256  010546                  MOV     R5,-(SP)        ;;PUSH R5 ON STACK
003260  012746  020200          MOV     #20200,-(SP)    ;;SET BLANK SWITCH AND SIGN
003264  016605  000020          MOV     20(SP),R5       ;;GET THE INPUT NUMBER
003270  100004                  BPL     1$              ;;BR IF INPUT IS POS.
003272  005405                  NEG     R5              ;;MAKE THE BINARY NUMBER POS.
003274  112766  000055  000001  MOVB    #'-,1(SP)       ;;MAKE THE ASCII NUMBER NEG.
003302  005000          1$:     CLR     R0              ;;ZERO THE CONSTANTS INDEX
003304  012703  003462          MOV     #$DBLK,R3       ;;SETUP THE OUTPUT POINTER
003310  112723  000040          MOVB    #' ,(R3)+       ;;SET THE FIRST CHARACTER TO A BLANK
003314  005002          2$:     CLR     R2              ;;CLEAR THE BCD NUMBER
003316  016001  003452          MOV     $DTBL(R0),R1    ;;GET THE CONSTANT
003322  160105          3$:     SUB     R1,R5           ;;FORM THIS BCD DIGIT
003324  002402                  BLT     4$              ;;BR IF DONE
003326  005202                  INC     R2              ;;INCREASE THE BCD DIGIT BY 1
003330  000774                  BR      3$
003332  060105          4$:     ADD     R1,R5           ;;ADD BACK THE CONSTANT
003334  005702                  TST     R2              ;;CHECK IF BCD DIGIT 0
003336  001002                  BNE     5$              ;;FALL THROUGH IF 0
003340  105716                  TSTB    (SP)            ;;STILL DOING LEADING 0'S?
003342  100407                  BMI     7$              ;;BR IF YES
```

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003344  106316                  5$:     ASLB    (SP)            ;;MSD?
003346  103003                          BCC     6$              ;;BR IF NO
003350  116663  000001  177777          MOVB    1(SP),-1(R3)    ;;YES--SET THE SIGN
003356  052702  000060          6$:     BIS     #'0,R2          ;;MAKE THE BCD DIGIT ASCII
003362  052702  000040          7$:     BIS     #' ,R2          ;;MAKE IT A SPACE IF NOT ALREADY A DIGIT
003366  110223                          MOVB    R2,(R3)+        ;;PUT THIS CHARACTER IN THE OUTPUT BUFFER
003370  005720                          TST     (R0)+           ;;JUST INCREMENTING
003372  020027  000010                  CMP     R0,#10          ;;CHECK THE TABLE INDEX
003376  002746                          BLT     2$              ;;GO DO THE NEXT DIGIT
003400  003002                          BGT     8$              ;;GO TO EXIT
003402  010502                          MOV     R5,R2           ;;GET THE LSD
003404  000764                          BR      6$              ;;GO CHANGE TO ASCII
003406  105726                  8$:     TSTB    (SP)+           ;;WAS THE LSD THE FIRST NON-ZERO?
003410  100003                          BPL     9$              ;;BR IF NO
003412  116663  177777  177776          MOVB    -1(SP),-2(R3)   ;;YES--SET THE SIGN FOR TYPING
003420  105013                  9$:     CLRB    (R3)            ;;SET THE TERMINATOR
003422  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
003424  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
003426  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
003430  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
003432  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
003434  104400  003462                  TYPE    ,$DBLK          ;;NOW TYPE THE NUMBER
003440  016666  000002  000004          MOV     2(SP),4(SP)     ;;ADJUST THE STACK
003446  012616                          MOV     (SP)+,(SP)
003450  000002                          RTI                     ;;RETURN TO USER
003452  023420                  $DTBL:  10000.
003454  001750                          1000.
003456  000144                          100.
003460  000012                          10.
003462                          $DBLK:  .BLKW   4
645                             ;;*******************************************************************

                                .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.

003472  010046                  $TRAP:  MOV     R0,-(SP)        ;;SAVE R0
003474  016600  000002                  MOV     2(SP),R0        ;;GET TRAP ADDRESS
003500  005740                          TST     -(R0)           ;;BACKUP BY 2
003502  111000                          MOVB    (R0),R0         ;;GET RIGHT BYTE OF TRAP
003504  016000  003512                  MOV     $TRPAD(R0),R0   ;;INDEX TO TABLE
003510  000200                          RTS     R0              ;;GO TO ROUTINE


                                .SBTTL  TRAP TABLE

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

                                ;       ROUTINE
                                ;       -------
003512                          $TRPAD:
003512  002524                          $TYPE   ;;CALL=TYPE     TRAP+0(104400)  TTY TYPEOUT ROUTINE
003514  003044                          $TYPOC  ;;CALL=TYPOC    TRAP+2(104402)  TYPE OCTAL NUMBER (WITH LEADING ZEROS)
```

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        003516  003020                          $TYPOS  ;;CALL=TYPOS    TRAP+4(104404)  TYPE OCTAL NUMBER (NO LEADING ZEROS)
        003520  003060                          $TYPON  ;;CALL=TYPON    TRAP+6(104406)  TYPE OCTAL NUMBER (AS PER LAST CALL)
        003522  003246                          $TYPDS  ;;CALL=TYPDS    TRAP+10(104410) TYPE DECIMAL NUMBER (WITH SIGN)
        003524  002430                          $SAVREG ;;CALL=SAVREG   TRAP+12(104412) SAVE R0-R5 ROUTINE
        003526  002466                          $RESREG ;;CALL=RESREG   TRAP+14(104414) RESTORE R0-R5 ROUTINE
    646 003530  004054                          TBITOFF ;;CALL-TBITO    TRAP+16(104416) THIS WILL TURN OFF T BIT TRAPPING
    647 003532  004102                          TBITRESTORE     ;;CALL=TBITR    TRAP+20(104420) THIS WILL RETURN THE T BIT TO PREVIO
    648
    649                             ;;**************************************************************

                                    .SBTTL  POWER DOWN AND UP ROUTINES

                                    ;POWER DOWN ROUTINE
        003534  012737  003662  000024  $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
        003542  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
        003550  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
        003552  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
        003554  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
        003556  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
        003560  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
        003562  010546                          MOV     R5,-(SP)        ;;PUSH R5 ON STACK
        003564  010667  000076                  MOV     SP,$SAVR6       ;;SAVE SP
        003570  012737  003602  000024          MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
        003576  000000                          HALT
        003600  000776                          BR      .-2             ;;HANG UP

                                    ;POWER UP ROUTINE
        003602  016706  000060          $PWRUP: MOV     $SAVR6,SP       ;;GET SP
        003606  005067  000054                  CLR     $SAVR6          ;;WAIT LOOP FOR THE TTY
        003612  005267  000050          1$:     INC     $SAVR6          ;;WAIT FOR THE INC
        003616  001375                          BNE     1$              ;;OF  WORD
        003620  012605                          MOV     (SP)+,R5        ;;POP STACK INTO R5
        003622  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
        003624  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
        003626  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
        003630  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
        003632  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
        003634  012737  003534  000024          MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
        003642  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
        003650  104400                          TYPE                    ;;REPORT THE POWER FAILURE
        003652  003670                  $PWRMG: .WORD   PWRMSG           ;;POWER FAIL MESSAGE POINTER
        003654  012716                          MOV     (PC)+,(SP)      ;;RESTART AT START
        003656  010000                  $PWRAD: .WORD   START           ;;RESTART ADDRESS
        003660  000002                          RTI
        003662  000000                  $ILLUP: HALT                    ;;THE POWER UP SEQUENCE WAS STARTED
        003664  000776                          BR      .-2             ;; BEFORE THE POWER DOWN WAS COMPLETE
        003666  000000                  $SAVR6: 0                       ;;PUT THE SP HERE
    650 003670      012     015     120 PWRMSG: .ASCIZ   <12><15>?POWER FAILURE, RESTARTING PROGRAM?
        003673      117     127     105
        003676      122     040     106
        003701      101     111     114
        003704      125     122     105
        003707      054     040     122
        003712      105     123     124
        003715      101     122     124
        003720      111     116     107
        003723      040     120     122
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        003726     117     107     122
        003731     101     115     000
   651                                          .EVEN
   652
   653                                  ;;******************************************************************

                                        .SBTTL  DOUBLE LENGTH BINARY TO OCTAL ASCII CONVERT ROUTINE

                                        ;*THIS ROUTINE WILL CONVERT A 32-BIT UNSIGNED BINARY NUMBER TO AN
                                        ;*UNSIGNED OCTAL ASCIZ NUMBER.
                                        ;*CALL
                                        ;*      MOV     #PNTR,-(SP)     ;;POINTER TO LOW WORD OF BINARY NUMBER
                                        ;*      JSR     PC,@#$DB20      ;;CALL THE ROUTINE
                                        ;*      RETURN                  ;;THE ADDRESS OF THE FIRST ASCIZ CHAR. IS ON THE STACK


        003734  104412                  $DB20:  SAVREG                  ;;SAVE ALL REGISTERS
        003736  016601  000002                  MOV     2(SP),R1        ;;PICKUP THE POINTER TO LOW WORD
        003742  012705  004053                  MOV     #$OCTVL+13.,R5  ;;POINTER TO DATA TABLE
        003746  012704  000014                  MOV     #12.,R4         ;;DO ELEVEN CHARACTERS
        003752  012703  177770                  MOV     #^C7,R3         ;;MASK
        003756  012100                          MOV     (R1)+,R0        ;;LOWER WORD
        003760  012101                          MOV     (R1)+,R1        ;;HIGH WORD
        003762  005002                          CLR     R2              ;;TERMINATOR
        003764  110245                  1$:     MOVB    R2,-(R5)        ;;PUT CHARACTER IN DATA TABLE
        003766  010002                          MOV     R0,R2           ;;GET THIS DIGIT
        003770  005304                          DEC     R4              ;;COUNT THIS CHARACTER
        003772  003007                          BGT     3$              ;;BR IF NOT THE LAST DIGIT
        003774  001405                          BEQ     2$              ;;BR IF IT IS THE LAST DIGIT
        003776  005205                          INC     R5              ;;ALL DIGITS DONE-ADJUST POINTER FOR FIRST
        004000  010566  000002                  MOV     R5,2(SP)        ;;ASCIZ CHAR. & PUT IT ON THE STACK
        004004  104414                          RESREG                  ;;RESTORE ALL REGISTERS
        004006  000207                          RTS     PC              ;;RETURN TO USER
        004010  006203                  2$:     ASR     R3              ;;POSITION THE MASK FOR THE LAST DIGIT
        004012  006001                  3$:     ROR     R1              ;;POSITION THE BINARY NUMBER FOR
        004014  006000                          ROR     R0              ;;      THE NEXT OCTAL DIGIT
        004016  006001                          ROR     R1
        004020  006000                          ROR     R0
        004022  006001                          ROR     R1
        004024  006000                          ROR     R0
        004026  040302                          BIC     R3,R2           ;;MASK OUT ALL JUNK
        004030  062702  000060                  ADD     #'0,R2          ;;MAKE THIS CHAR. ASCII
        004034  000753                          BR      1$              ;;GO PUT IT IN THE DATA TABLE
        004036                  $OCTVL: .BLKB   14.                     ;;RESERVE DATA TABLE
```

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655
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657
658                                 .SBTTL  ************ SUBROUTINES UNIQUE TO THIS PROGRAM **************
659
660
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                                        .SBTTL  TURN OFF AND SAVE T-BIT
                                        ;*****************************************************************
                                        ;*
                                        ;*      THIS SUBROUTINE IS REACHED BY THE TRAP CALL 'TBITO', IT IS
                                        ;*      USED TO TURN OFF THE T-BIT IF IT IS ON.  THE PROCESSOR STATUS
                                        ;*      IS SAVED IN 'OLDPSW' SO THAT THE T-BIT CAN BE RESTORED TO ITS
                                        ;*      PREVIOUS STATUS WHEN CONDITIONS WARRANT.
                                        ;*
                                        ;*****************************************************************
            000020                      TBIT=BIT4
004054                                  TBITOFF:
004054  032766  000020  000002                BIT     #TBIT,2(KSP)    ;IS THE T-BIT ON?
004062  001406                            BEQ     1$              ;BRANCH TO EXIT IF IT IS NOT ON
004064  016667  000002  175214            MOV     2(KSP),OLDPSW   ;SAVE OLD PSW FOR RESTORING T BIT
004072  042766  000020  000002            BIC     #TBIT,2(KSP)    ;CLEAR T BIT IF IT IS ON
004100  000006                      1$:   RTT                     ;RETURN TO PROGRAM


                                        .SBTTL  RESTORE T-BIT TO ITS PREVIOUS CONDITION
                                        ;*****************************************************************
                                        ;*
                                        ;*      THIS SUBROUTINE CAN BE REACHED BY THE TRAP CALL 'TBITR', IT IS
                                        ;*      USED TO RESTORE THE T-BIT AFTER A PARTICULAR TES  THAT CANNOT
                                        ;*      BE RUN WITH THE T-BIT ON.  IT USES THE PROCESSOR STATUS STORED
                                        ;*      IN 'OLDPSW' BY 'TBITO', REPLACES THE PS ON THE STACK WITH IT
                                        ;*      AND DOES AN 'RTT'.
                                        ;*
                                        ;*****************************************************************
004102                                  TBITRESTORE:
004102  016766  175200  000002                MOV     OLDPSW,2(KSP)   ;PUT OLD PSW ON STACK
```

```
                                BIC     #TBIT,OLDPSW    ;CLEAR T-BIT IN 'OLDPSW' SO THAT
                                                        ;IT WON'T BE TURNED ON BY ACCIDENT
004116  000006                  RTT                     ;RETURN TO PROGRAM AND INHIBIT
                                                        ;T BIT TRAP AFTER THIS INSTRUCTION.


                        .SBTTL  SUBROUTINE TO CLEAR ALL OF THE MAP REGISTERS
                        ;;**************************************************************************
                        ;*
                        ;*      THIS SUBROUTINE CLEARS ALL OF THE MAP REGISTERS BY LOADING
                        ;*      THE ADDRESS OF MAPL00 INTO R3 AND THEN CLEARING THE
                        ;*      REGISTER POINTED TO BY R3 UNTIL R3 POINTS ABOVE MAPH37.
                        ;*
                        ;;**************************************************************************
004120  012703  170200  CLRMAP: MOV     #MAPL0,R3       ;PUT FIRST MAP ADDR IN R3
004124  005023          1$:     CLR     (R3)+           ;CLEAR MAP REGS
004126  022703  170376          CMP     #MAPH37,R3      ;SEE IF LAST ADDR IS IN R3
004132  103374                  BHIS    1$              ;BRANCH IF R3 LE THAN LAST ADDR
004134  000207                  RTS     PC              ;RETURN TO MAIN PROGRAM

                        .SBTTL  SUBROUTINE TO LOG AND REPORT TIMEOUTS OF MAP REGISTERS
                        ;;**************************************************************************
                        ;*
                        ;*      THIS SUBROUTINE IS USED TO LOG AND REPORT THE FACT THAT A
                        ;*      REFERENCE TO A MAPPING REGISTER TIMED OUT ON THE UNIBUS.  IT
                        ;*      KEEPS A 'LOGICAL AND' AND A 'LOGICAL OR' OF EACH ADDRESS THAT
                        ;*      TIMES OUT.
                        ;*
                        ;;**************************************************************************
004136                  TIMEOUT:                        ;STARTING ADDRESS OF SUBROUTINE
004136  0052.                   INC     (PC)+           ;INCREMENT ONE TIME GATE
004140  177777          TOFLAG: .WORD   -1              ;ONE TIME ENTANCE FLAG
004142  001401                  BEQ     10$             ;BRANCH IF FLAG IS NOW ZERO
004144  000000                  HALT                    ;I HAVE ENTERED THIS ROUTINE BEFORE
                                                        ;I FINISHED REPORTING THE FIRST ERROR
                                                        ;THE SECOND ENTRY ADDRESS IS ON THE
                                                        ;STACK AND THE FIRST ERROR CONDITION
                                                        ;IS PROBABLY STILL LOCKED UP .
004146  012667  175130  10$:     MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS
004152  012667  175126          MOV     (KSP)+,OLDPS    ;SAVE OLD PSW
004156  016767  173604  175104  MOV     CPUERR,PCPUER   ;SAVE CPU ERROR REGISTER
004164  016767  175100  173574  MOV     PCPUER,CPUERR   ;CLEAR CPU ERROR REGISTER
004172  026767  175072  175066  CMP     PCPUER,CPUEXP   ;SEE IF EXPECTEED CONDITION CAME UP.
004200  001402                  BEQ     1$              ;BRANCH IF IT WAS A TIMEOUT
004202  104001                  EMT+    1
004204  000414                  BR      3$              ;BRANCH TO EXIT
004206  050067  175016  1$:     BIS     R0,ADDROR       ;PERFORM LOGIAL OR OF FAILING ADDRESS
004212  005100                  COM     R0              ;GET R0 READY FOR AND
004214  040067  175006          BIC     R0,ADRAND               ;PERFORM LOGICAL AND
004220  005100                  COM     R0              ;PUT R0 BACK AS IT WAS
004222  005767  175030          TST     ERRCNT          ;IS THIS THE FIRST ERROR
004226  001002                  BNE     2$              ;BRANCH IF NOT FIRST ERROR
004230  104201                  EMT+    201
004232  000401                  BR      3$              ;BRANCH TO EXIT
004234                  2$.
004234  104301                  EMT+    301
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                                3$:     MOV     #-1,TOFLAG      ;RESET ONE TIME GATE
                                        MOV     OLDPS,-(KSP)    ;RESTORE OLD PSW
                                        MOV     OLDPC,-(KSP)    ;PUSH RETURN ADDRESS BACK ON THE STACK
                                        RTT                     ;RETURN TO THE TEST

                                .SBTTL  SUBROUTINE TO REPORT MAP REGISTERS THAT WILL NOT HOLD ZERO
                                ;*******************************************************************
                                ;*
                                ;*      THIS SUBROUTINE IS CALLED EVERY TIME A MAP REGISTER IS CLEARED
                                ;*      AND FOUND TO NOT BE ZERO.  IT KEEPS A LOGICAL ''AND'' AND ''OR'' OF
                                ;*      THE FAILING REGISTER'S ADDRESS AND DATA AND REPORTS ALL ERRORS.
                                ;*      AT THE END OF THE TEST A SUMMARY ERROR MESSAGE IS GIVEN WHICH
                                ;*      WILL REPORT THE LOGICAL ''AND'' AND ''OR'' OF THE ADDRESSES AND DATA.
                                ;*
                                ;*******************************************************************
004256                          WRITEERROR:
004256  012667  175020                MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS IN CASE OF ERROR LOOP
004262  050067  174742                BIS     R0,ADDROR       ;LOGICAL ''OR'' OF BAD ADDRESS
004266  005100                        COM     R0              ;GET R0 READY FOR AND
004270  040067  174732                BIC     R0,ADRAND               ;PERFORM LOGICAL AND
004274  005100                        COM     R0              ;PUT R0 BACK AS IT WAS
004276  056767  174670  174730        BIS     $TMP0,DATAOR    ;LOGICAL ''OR'' OF BAD DATA
004304  005167  174662                COM     $TMP0           ;GET $TMP0 READY FOR AND
004310  046767  174656  174714        BIC     $TMP0,DATAND            ;PERFORM LOGICAL AND
004316  005167  174650                COM     $TMP0           ;PUT $TMP0 BACK AS IT WAS
004322  005767  174730                TST     ERRCNT          ;SEE IF THIS IS FIRST ERROR
004326  001002                        BNE     1$              ;BRANCH IF NOT FIRST ERROR
004330  104202                        EMT+    202
004332  000401                        BR      2$              ;SKIP NEXT STATEMENT
004334                          1$:
004334  104302                        EMT+    302
004336  000177  174740        2$:     JMP     @OLDPC          ;RETURN TO THE TEST

                                .SBTTL  SUBROUTINE TO REPORT DUAL ADDRESSING WHEN LOADING A MAP REGISTER
                                ;*******************************************************************
                                ;*
                                ;*      THIS SUBROUTINE WILL LOG AND REPORT ALL DUAL ADDRESSING ERRORS
                                ;*      FOUND IN THE MAPPING REGISTERS.  A 'LOGICAL OR'' AND A
                                ;*      'LOGICAL AND'' OF THE WRITTEN ADDRESSES WILL BE MAINTAINED IN
                                ;*      'ADDROR' AND 'ADRAND'.  THE LOG ON THE ADDITIONAL OR FAILING,
                                ;*      ADDRESSES WILL BE MAINTAINED IN 'DATAOR' AND 'DATAND'.
                                ;*
                                ;*******************************************************************
004342                          DUALADR:                        ;STARTING LOCATION OF SUBROUTINE
004342  012667  174734                MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS IN CASE OF LOOP
004346  050067  174656                BIS     R0,ADDROR       ;LOGICAL OR OF WRITTEN ADDRESS
004352  005100                        COM     R0              ;GET R0 READY FOR AND
004354  040067  174646                BIC     R0,ADRAND               ;PERFORM LOGICAL AND
004360  005100                        COM     R0              ;PUT R0 BACK AS IT WAS
004362  050167  174646                BIS     R1,DATAOR       ;LOGICAL OR OF DUALED ADDRESS
004366  005101                        COM     R1              ;GET R1 READY FOR AND
004370  040167  174636                BIC     R1,DATAND               ;PERFORM LOGICAL AND
004374  005101                        COM     R1              ;PUT R1 BACK AS IT WAS
004376  005767  174654                TST     ERRCNT          ;SEE IF THIS IS FIRST ERROR
004402  001002                        BNE     1$              ;BRANCH IF NOT FIRST ERROR
004404  104203                        EMT+    203
004406  000401                        BR      2$              ;BRANCH TO EXIT
```

```
797 004410                          1$:
    004410  104303                          EMT+    303
798 004412  000177  174664          2$:     JMP     @OLDPC          ;RETURN TO TEST
799
800                                 .SBTTL  SUBROUTINE TO REPORT COUNT PATTERN ERRORS IN MAP REGISTERS
801                                 ;;*************************************************************************
802                                 ;*
803                                 ;*      THIS SUBROUTINE IS CALLED WHENEVER AN ERROR IS DISCOVERED IN
804                                 ;*      THE COUNT PATTERN IN THE MAP REGISTERS.  IT KEEPS THE LOGICAL
805                                 ;*      ''AND'' AND ''OR'' OF THE FAILING REGISTER'S ADDRESS, DATA RECEIVED,
806                                 ;*      AND PATTERN LOADED.  EVERY ERROR IS REPORTED AND AT THE END OF
807                                 ;*      A TEST AN ERROR SUMJMARY IS GIVEN.
808                                 ;*
809                                 ;;*************************************************************************
810 004416  012667  174660          COUNT:  MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS IN CASE OF ERROR LOOP
811 004422  050067  174602                  BIS     R0,ADDROR       ;LOGICAL OR OF BAD ADDRESSES
812 004426  005100                          COM     R0              ;GET R0 READY FOR AND
    004430  040067  174572                  BIC     R0,ADRAND               ;PERFORM LOGICAL AND
    004434  005100                          COM     R0              ;PUT R0 BACK AS IT WAS
813 004436  050367  174572                  BIS     R3,DATAOR       ;LOGICAL OR OF BAD DATA
814 004442  005103                          COM     R3              ;GET R3 READY FOR AND
    004444  040367  174562                  BIC     R3,DATAND               ;PERFORM LOGICAL AND
    004450  005103                          COM     R3              ;PUT R3 BACK AS IT WAS
815 004452  050467  174562                  BIS     R4,PATTOR       ;LOGICAL OR OF PATTERN LOADED
816 004456  005104                          COM     R4              ;GET R4 READY FOR AND
    004460  040467  174552                  BIC     R4,PATAND               ;PERFORM LOGICAL AND
    004464  005104                          COM     R4              ;PUT R4 BACK AS IT WAS
817 004466  005767  174564                  TST     ERRCNT          ;IS THIS FIRST ERROR
818 004472  001002                          BNE     1$              ;BRANCH IF NOT FIRST ERROR
819 004474  104204                          EMT+    204
820 004476  000401                          BR      2$              ,SKIP NEXT STATEMENT
821 004500                          1$:
    004500  104304                          EMT+    304
822 004502  000177  174574          2$:     JMP     @OLDPC          ;RETURN TO THE TEST
823
824
825                                 .SBTTL  SUBROUTINE TO REPORT COUNT PATTERN ERRORS ON UNIBUS DATA PATH
826                                 ;;*************************************************************************
827                                 ;*
828                                 ;*      THIS SUBROUTINE IS CALLED WHENEVER AN ERROR IS DISCOVERED IN THE
829                                 ;*      COUNT PATTERN THAT IS RUN OVER THE UNIBUS INTO MAIN MEMORY.  IT
830                                 ;*      KEEPS THE LOGICAL ''AND'' AND ''OR'' OF THE PATTERN LOADED AND THE
831                                 ;*      DATA RECEIVED, AND REPORTS ALL ERRORS.  AT THE END OF THE TEST
832                                 ;*      IT GIVES A SUMMARY MESSAGE OF ALL THE ERRORS.
833                                 ;*
834                                 ;;*************************************************************************
835 004506  012667  174570          UBCOUNT:MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS IN CASE OF ERROR LOOP
836 004512  050167  174522                  BIS     R1,PATTOR       ;LOGICAL OR OF COUNT LOADED
837 004516  005101                          COM     R1              ;GET R1 READY FOR AND
    004520  040167  174512                  BIC     R1,PATAND               ;PERFORM LOGICAL AND
    004524  005101                          COM     R1              ;PUT R1 BACK AS IT WAS
838 004526  050067  174502                  BIS     R0,DATAOR       ;LOGICAL OR OF DATA READ
839 004532  005100                          COM     R0              ;GET R0 READY FOR AND
    004534  040067  174472                  BIC     R0,DATAND               ;PERFORM LOGICAL AND
    004540  005100                          COM     R0              ;PUT R0 BACK AS IT WAS
840 004542  005767  174510                  TST     ERRCNT          ;IS THIS THE FIRST ERROR?
841 004546  001002                          BNE     1$              ;BRANCH IF NOT FIRST
```

```
                        004550  104205                  EMT+    205
                        004552  000401                  BR      2$              ;SKIP NEXT INSTRUCTION
                        004554                  1$:
                        004554  104305                  EMT+    305
                        004556  000177  174520 2$:     JMP     @OLDPC          ;RETURN TO THE TEST

                                               .SBTTL  ********** TRAP HANDLING ROUTINES **********

                                               .SBTTL  CPU TRAP HANDLER ROUTINE
                                               ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                                               ;*
                                               ;*      THIS SUBROUTINE WILL HANDLE ALL CPU TRAPS AND ABORTS, THRU
                                               ;*      "ERRVEC" (000004).  IF THIS SUBROUTINE IS ENTERED BY A SECOND
                                               ;*      TRAP BEFORE THE FIRST HAS BEEN PROCESSED A HALT IS EXECUTED.
                                               ;*      IF THE WORD 'CPUEXP' IS ZERO, NO TRAP WAS EXPECTED AND AN
                                               ;*      UNEXPECTED ERROR MESSAGE IS GIVEN.  IF THE WORD 'CPUEXP' IS
                                               ;*      NOT ZERO THEN THE CPU ERROR REGISTER 'CPUERR' IS COMPARED WITH
                                               ;*      'CPUEXP' TO SEE IF THE PROPER CONDITION OCCURRED.  'PCPUER' CAN
                                               ;*      BE USED AS A FLAG TO INDICATE THAT A TRAP HAS OCCURRED SINCE IT
                                               ;*      IS LOADED WITH THE ERROR REGISTER IF A TRAP VECTORS HERE
                                               ;*
                                               ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                        004562  005227          CPUER:  INC     (PC)+           ;MAKE FLAG ZERO IF FIRST TIME
                        004564  177777          CPFLAG: .WORD   -1              ;NEGATIVE ONE FOR A FLAG
                        004566  001401                  BEQ     10$             ;BRANCH IF FIRST TIME IN
                        004570  000000                  HALT                    ;I HAVE ENTERED THIS ROUTINE BEFORE
                                                                                ;I FINISHED REPORTING THE FIRST ERROR
                                                                                ;THE SECOND ENTRY ADDRESS IS ON THE
                                                                                ;STACK AND THE FIRST ERROR CONDITION
                                                                                ;IS PROBABLY STILL LOCKED UP .
                        004572  012667  174504  10$:     MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS IN CASE OF LOOP
                        004576  012667  174502          MOV     (KSP)+,OLDPS    ;SAVE OLD PSW IN CASE OF LOOP
                        004602  012706  001100          MOV     #KERSTK,KSP     ;MAKE SURE THAT THE KERNEL STACK POINTER
                                                                                ;IS AT 1100.
                        004606  016767  173154  174454  MOV     CPUERR,PCPUER   ;SAVE CPU ERROR REGISTER
                        004614  016767  174462  174456  MOV     OLDPC,BADPC     ;SAVE PC+2 AT TIME OF ABORT
                        004622  005767  174440          TST     CPUEXP          ;SEE IF ANY CONDITION WAS EXPECTED
                        004626  001406                  BEQ     2$              ;BRANCH IF NO TRAP WAS EXPECTED
                        004630  026767  174434  174430  CMP     PCPUER,CPUEXP   ;SEE IF EXPECTED ERROR OCCURED
                        004636  001403                  BEQ     1$              ;BRANCH IF ERROR CODES MATCH
                        004640  104001                  EMT+    1
                        004642  000401                  BR      1$              ;SKIP NEXT INSTRUCTION
                        004644                  2$:
                        004644  104002                  EMT+    2
                        004646  016767  174416  173112  1$:     MOV     PCPUER,CPUERR   ;CLEAR CPU ERROR REGISTER
                        004654  012767  177777  177702          MOV     #-1,CPFLAG      ;MAKE FLAG NEGATIVE ONE FOR NEXT TIME
                        004662  016746  174416          MOV     OLDPS,-(KSP)    ;PUSH OLD PSW BACK ON STACK
                        004666  016746  174410          MOV     OLDPC,-(KSP)    ;PUSH RETURN ADDRESS BACK ON STACK
                        004672  000006                  RTT                     ;RETURN FROM INTERRUPT OR ABORT


                                               .SBTTL  MEMORY MANAGEMENT TRAPS AND ABORTS HANDLER ROUTINE
                                               ;+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                                               ;*
                                               ;*      THIS  ROUTINE WILL HANDLE ALL SPURIOUS MEMORY MANAGEMENT TRAP
```

```
                                        ;*      AND ABORTS.  IT WILL REPORT THE CONDITION OF ALL THE MEMORY
                                        ;*      MAMAGEMENT STATUS REGISTERS, AND THEN RETURN TO THE TEST AND
                                        ;*      TRY TO CONTINUE RUNNING.
                                        ;*
                                        ;;*****************************************************************************
004674  005227                  MMTRAP: INC     (PC)+           ;MAKE FLAG ZERO IF FIRST TIME
004676   77777                  MMFLAG: .WORD   -1              ;FLAG SHOULD BE NEG ONE
004700  001401                          BEQ     10$             ;BRANCH IF FIRST TIME INTO ROUTINE
004702  000000                          HALT                    ;I HAVE ENTERED THIS ROUTINE BEFORE
                                                                ;I FINISHED REPORTING THE FIRST ERROR
                                                                ;THE SECOND ENTRY ADDRESS IS ON THE
                                                                ;STACK AND THE FIRST ERROR CONDITION
                                                                ;IS PROBABLY STILL LOCKED UP .
004704  011667  174370            10$:  MOV     (KSP),BADPC     ;SAVE PC AT TIME OF ABORT OR TRAP
004710  012667  174366                  MOV     (KSP)+,OLDPC    ;SAVE RETURN ADDRESS IN CASE OF LOOP
004714  012667  174364                  MOV     (KSP)+,OLDPS    ;SAVE OLD PSW IN CASE OF LOOP
004720  016767  172646  174362          MOV     MMR0,PMMR0      ;SAVE STATUS REGISTER
004726  016767  172642  174356          MOV     MMR1,PMMR1      ;SAVE AUTO INC/DEC REGISTER
004734  016767  172636  174352          MOV     MMR2,PMMR2      ;SAVE VIRTUAL ADDRESS REGISTER
004742  104003                          EMT+    3
004744  042737  177776  177572  1$:     BIC     #177776,@#MMR0  ;CLEAR ALL BITS EXCEPT 0
004752  012767  177777  177716          MOV     #-1,MMFLAG      ;RESTORE A NEGATIVE ONE TO FLAG
004760  016746  174320                  MOV     OLDPS,-(KSP)    ;PUSH OLD PSW ONTO STACK
004764  016746  174312                  MOV     OLDPC,-(KSP)    ;PUSH RETURN ADDRESS ON STACK
004770  000006                          RTT                     ;RETURN TO MAIN PROGRAM


                                        .SBTTL  ***************************************************************
                                        .SBTTL  ********************* START OF TEST CODE ********************
        010000                          .=10000         ;START TEST CODE AT ADDRESS 10000 (2K)

010000  132767  000200  010027  START:  BITB    #200,$ENVM      ;IS APT SIZING
010006  001403                          BEQ     1$              ;NO
010010  012767  020036  171132          MOV     #$SWREG,SWR     ;USE APT SWITCH REGISTER
010016                          1$:

010016  012737  000340  177776          MOV     #340,@#PS       ;;LOCK OUT ALL INTERRUPTS
010024  012706  001100                  MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
010030  005026                          CLR     (R6)+           ;;CLEAR MEMORY LOCATION
010032  022706  001134                  CMP     #$TKS,R6        ;;DONE?
010036  001374                          BNE     .-6             ;;LOOP BACK IF NO

010040  005067  007756                  CLR     $PASS           ;;** INITIALIZE PASS COUNT

010044  012706  001100                  MOV     #STACK,SP       ;;SETUP THE STACK POINTER
010050  012737  020140  000020          MOV     #$SCOPE,@#IOTVEC ;;IOT VECTOR FOR SCOPE ROUTINE
010056  012737  000340  000022          MOV     #340,@#IOTVEC+2 ;;LEVEL 7
010064  012737  020470  000030          MOV     #$ERROR,@#EMTVEC ;;EMT VECTOR FOR ERROR ROUTINE
010072  012737  000340  000032          MOV     #340,@#EMTVEC+2 ;;LEVEL 7
010100  012737  003472  000034          MOV     #$TRAP,@#TRAPVEC ;;TRAP VECTOR FOR TRAP CALLS
010106  012737  000340  000036          MOV     #340,@#TRAPVEC+2;LEVEL 7
010114  012737  003534  000024          MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
010122  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;LEVEL 7
010130  016767  011164  011154          MOV     $ENDCT,$EOPCT   ;;SETUP END-OF-PROGRAM COUNTER
010136  005067  171044                  CLR     $TIMES          ;;INITIALIZE NUMBER OF ITERATION
```

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        010142  005067  171042                  CLR     $ESCAPE         ;;CLEAR THE ESCAPE ON ERROR ADDRESS
        010146  112767  000001  170737          MOVB    #1,$ERMAX       ;;ALLOW ONE ERROR PER TEST
        010154  012737  021540  000014          MOV     #$RTRN,@#TBITVEC ;;SET 'T' BIT VECTOR TO $RTRN
        010162  012737  000340  000016          MOV     #340,@#TBITVEC+2 ;;LEVEL 7
        010170  012767  000002  011342          MOV     #RTI,$RTRN      ;;SET $RTRN TO A RTI
        010176  012737  010224  000010          MOV     #65$,@#RESVEC   ;;TRY TO DO A RTT
        010204  005046                          CLR     -(SP)           ;;DUMMY PS
        010206  012746  010214                  MOV     #64$,-(SP)      ;;AND PC
        010212  000006                          RTT                     ;;TRY THE RTT
        010214  012767  000006  011316  64$:    MOV     #RTT,$RTRN      ;;RTT IS LEGAL--SET $RTRN TO A RTT
        010222  000402                          BR      66$
        010224  062706  000010          65$:    ADD     #10,SP          ;;RTT ILLEGAL--CLEAN OFF THE STACK
        010230  012737  000012  000010  66$:    MOV     #RESVEC+2,@#RESVEC ;;RESTORE TRAP CATCHER
        010236  005067  011304                  CLR     $TBIT           ;;CLEAR 'T' BIT SWITCH
        010242  012767  010242  170634          MOV     #.,$LPADR       ;;INITIALIZE THE LOOP ADDRESS FOR SCOPE
        010250  012767  010250  170630          MOV     #.,$LPERR       ;;SETUP THE ERROR LOOP ADDRESS
936     010256  005227  177777                  INC     #-1             ;;FIRST TIME?
        010262  001023                          BNE     67$             ;;BRANCH IF NO
        010264  022737  021472  000042          CMP     #$ENDAD,@#42    ;;ACT-11?
        010272  001417                          BEQ     67$             ;;BRANCH IF YES
        010274  104400  010302                  TYPE    ,68$            ;;TYPE ASCIZ STRING
        010300  000414                          BR      67$             ;;GET OVER THE ASCIZ
                                        ;;68$:  .ASCIZ  <CRLF>?CKKUAA0 11/44 UBI MAP?<CRLF>
        010332                          67$:
937     010332                          LOOP:
938     010332  012767  004674  167710          MOV     #MMTRAP,MMVEC   ;LOAD MEMORY MANAGEMENT TRAP
939                                                                     ;SERVICE ROUTINE ADDRESS
940     010340  012767  000340  167704          MOV     #340,MMVEC+2    ;SET PRIORITY SEVEN
941     010346  012767  004562  167430          MOV     #CPUER,ERRVEC   ;LOAD CPU TRAP SERVICE ROUTINE ADDR
942     010354  012767  000340  167424          MOV     #340,ERRVEC+2   ;SET PRIORITY SEVEN
943     010362  005067  170700                  CLR     CPUEXP          ;NOT EXPECTING ANY CPU ERRORS
944     010366  005037  177572                  CLR     @#MMR0          ;START IN 16 BIT MAPPING
945     010372  005037  172516                  CLR     @#MMR3          ;DISABLE MAP AND 22-BIT MAPPING
946     010376  012700  177777                  MOV     #-1,R0          ;NEGATIVE ONE USED TO INITIALIZE FLAGS
947     010402  010067  174156                  MOV     R0,CPFLAG       ;INITIALIZE FLAGS
948     010406  010067  173526                  MOV     R0,TOFLAG       ;INITIALIZE FLAGS
949     010412  010067  174260                  MOV     R0,MMFLAG       ;INITIALIZE FLAGS
950     010416  010037  177766                  MOV     R0,@#CPUERR     ;CLEAR CPU ERROR REGISTER
951
952
962                                     ;;**********************************************************************
                                        ;*TEST 1         MAP REGISTER RESPONSE TEST
                                        ;*
                                        ;*      THIS TEST IS USED TO ENSURE THAT ALL THE UNIBUS MAP REGISTERS
                                        ;*      CAN BE REFERENCED UNDER PROGRAM CONTROL, WITHOUT TIMING OUT.
                                        ;*      THE ADDRESSES OF ANY MAP REGISTERS THAT TIME OUT WILL BE REPORTED
                                        ;*      AND, AT THE END OF THE TEST, A SUMMARY OF THOSE REGISTERS WILL
                                        ;*      BE GIVEN.
                                        ;*
                                        ;;**********************************************************************
        010422                          TST1:
        010422  000004                          SCOPE
        010424  012767  010506  170670          MOV     #TST2,NXTTST    ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                        ;FOR ESCAPE ON PARITY ERRORS
963     010432  012767  004136  167344  20$:    MOV     #TIMEOUT,ERRVEC ;LOAD ERRVEC WITH ROUTINE ADDR.
964     010440  012700  170200                  MOV     #MAPL0,R0       ;PUT FIRST MAP REG ADDR IN R0
965     010444  012767  010452  170434          MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
```

```
                        ;MAP REGISTER RESPONSE TEST

 966 010452  000240                    1$:     NOP
 967 010454  011002                            MOV     (R0),R2         ;READ MAP REGISTERS TO R2
 968 010456  062700  000002                    ADD     #2,R0           ;POINT TONEXT MAP REGISTER
 969 010462  022700  170376                    CMP     #MAPH37,R0      ;COMPARE LAST MAP REG ADDR WITH R0
 970 010466  103371                            BHIS    1$              ;CONTINUE READING IF NOT AT LAST REG.
 971 010470  012767  010432  170410            MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
 972                                                                   ;OF INTERMITTENT FAULTS.
 973 010476  005767  170554                    TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
 974 010502  001401                            BEQ     TST2            ;;NO ERRORS GO TO NEXT TEST
 975 010504  104004                            EMT+    4
 976
 988                                    ;;*****************************************************************
                                        ;*TEST 2         CLEAR AND READ LOW 20 REGISTERS LOWER 16 BITS
                                        ;*
                                        ;*      THIS TEST WILL ENSURE THAT MAPL00 - MAPL17 WILL ALL HOLD ZERO.
                                        ;*      IF ANY REGISTERS ARE NOT ZERO AFTER BEING CLEARED, THEIR ADDRESS AND
                                        ;*      CONTENTS ARE REPORTED.  IF ALL THE REGISTERS HAVE RANDOM DATA THEN
                                        ;*      PROBABLY NO WRITE PULSE IS BEING GENERATED, BUT IF THE ERROR IS IN
                                        ;*      ONLY ONE REGISTER OR IN ONE BIT IT MIGHT BE MORE DIFFICULT TO FIND.
                                        ;*      IT IS POSSIBLE THAT THE COUNT PATTERN TEST FOR MAPL00 - MAPL17 WILL
                                        ;*      GIVE MORE HELP.
                                        ;*
                                        ;*****************************************************************
      010506                            TST2:
      010506  000004                            SCOPE
      010510  012767  010604  170604            MOV     #TST3,NXTTST    ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                        ;FOR ESCAPE ON PARITY ERRORS
 989 010516  012767  004562  167260            MOV     #CPUER,ERRVEC   ;LOAD CPU TRAP SERVICE ROUTINE ADDR
 990 010524  012700  170200            20$:    MOV     #MAPL0,R0       ;LOAD STARTING MAP REGISTER ADDR
 991 010530  012767  010536  170350            MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER HERE
 992 010536  000240                    1$:     NOP
 993 010540  005010                            CLR     (R0)            ;CLEAR MAP REGISTER
 994 010542  011067  170424                    MOV     (R0),$TMP0      ;SEE IF MAP REGISTER IS ZERO
 995 010546  001402                            BEQ     2$              ;BRANCH IF REGISTER IS ZERO
 996 010550  004767  173502                    JSR     PC,WRITEERROR   ;REPORT AND LOG ERROR
 997 010554  062700  000004            2$:     ADD     #4,R0           ;POINT TO NEXT MAP REG LOWER 16 BITS
 998 010560  022700  170274                    CMP     #MAPL17,R0      ;SEE IF THIS SECTION IS TESTED
 999 010564  103364                            BHIS    1$              ;BRANCH IF NOT
1000 010566  012767  010524  170312            MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
1001                                                                    ;OF INTERMITTENT FAULTS.
1002 010574  005767  170456                    TST     ERRCNT          ;WERE THERE ANY ERRORS ON THIS TEST
1003 010600  001401                            BEQ     TST3            ;,BRANCH IF NO ERRORS
1004 010602  104005                            EMT+    5
1005                                                                    ;HOLD ZERO
1006
1007
```

```
1020                                    ;;*****************************************************************
                                        ;*TEST 3        CLEAR AND READ LOW 20 REGISTERS UPPER 6 BITS
                                        ;*
                                        ;*      THIS TEST WILL ENSURE THAT MAPH00 - MAPH17 WILL ALL HOLD ZERO.
                                        ;*      IF ANY REGISTERS ARE NOT ZERO AFTER BEING CLEARED, THEIR ADDRESS AND
                                        ;*      CONTENTS ARE REPORTED.  IF ALL THE REGISTERS HAVE RANDOM DATA THEN
                                        ;*      PROBABLY NO WRITE PULSE IS BEING GENERATED, BUT IF THE ERROR IS IN
                                        ;*      ONLY ONE REGISTER OR IN ONE BIT IT MIGHT BE MORE DIFFICULT TO FIND.
                                        ;*      IT IS POSSIBLE THAT THE COUNT PATTERN TEST FOR MAPH00 - MAPH17 WILL
                                        ;*      GIVE MORE HELP.
                                        ;*
                                        ;*****************************************************************
     010604                             TST3:
     010604  000004                             SCOPE
     010606  012767  010674  170506             MOV     #TST4,NXTTST    ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                         ;FOR ESCAPE ON PARITY ERRORS
1021 010614  012700  170202             20$:    MOV     #MAPH0,R0       ;LOAD STARTING MAP REGISTER ADDR
1022 010620  012767  010626  170260             MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER HERE
1023 010626  000240                     1$:     NOP
1024 010630  005010                             CLR     (R0)            ;CLEAR MAP REGISTER
1025 010632  011067  170334                     MOV     (R0),$TMP0      ;SEE IF MAP REGISTER IS ZERO
1026 010636  001402                             BEQ     2$              ;BRANCH IF REGISTER IS ZERO
1027 010640  004767  173412                     JSR     PC,WRITEERROR   ;REPORT AND LOG ERROR
1028 010644  062700  000004             2$:     ADD     #4,R0           ;POINT TO NEXT MAP REG UPPER 6 BITS
1029 010650  022700  170276                     CMP     #MAPH17,R0      ;SEE IF TESTING IS OVER
1030 010654  103364                             BHIS    1$              ;BRANCH IF MORE REGS TO TEST
1031 010656  012767  010614  170222             MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
1032                                                                     ;OF INTERMITTENT FAULTS.
1033 010664  005767  170366                     TST     ERRCNT          ;WHERE THERE ANY ERRORS ON THIS
1034 010670  001401                             BEQ     TST4            ;;BRANCH IF NO ERRORS
1035 010672  104006                             EMT+    6
1036                                                                     ;HOLD ZERO
1037
1038
1050                                    ;;*****************************************************************
                                        ;*TEST 4        CLEAR AND READ HIGH 20 REGISTERS LOWER 16 BITS
                                        ;*
                                        ;*      THIS TEST WILL ENSURE THAT MAPL20 - MAPL37 WILL ALL HOLD ZERO.
                                        ;*      IF ANY REGISTERS ARE NOT ZERO AFTER BEING CLEARED, THEIR ADDRESS AND
                                        ;*      CONTENTS ARE REPORTED.  IF ALL THE REGISTERS HAVE RANDOM DATA THEN
                                        ;*      PROBABLY NO WRITE PULSE IS BEING GENERATED, BUT IF THE ERROR IS IN
                                        ;*      ONLY ONE REGISTER OR IN ONE BIT IT MIGHT BE MORE DIFFICULT TO FIND.
                                        ;*      IT IS POSSIBLE THAT THE COUNT PATTERN TEST FOR MAPL20 - MAPL37 WILL
                                        ;*      GIVE MORE HELP.
                                        ;*
                                        ;*****************************************************************
     010674                             TST4:
     010674  000004                             SCOPE
     010676  012767  010764  170416             MOV     #TST5,NXTTST    ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                         ;FOR ESCAPE ON PARITY ERRORS
1051 010704  012700  170300             20$:    MOV     #MAPL20,R0      ;LOAD STARTING MAP REGISTER ADDR
1052 010710  012767  010716  170170             MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER HERE
1053 010716  000240                     1$:     NOP
1054 010720  005010                             CLR     (R0)            ;CLEAR MAP REGISTER
1055 010722  011067  170244                     MOV     (R0),$TMP0      ;SEE IF MAP REGISTER IS ZERO
1056 010726  001402                             BEQ     2$              ;BRANCH IF REGISTER IS ZERO
1057 010730  004767  173322                     JSR     PC,WRITEERROR   ;REPORT AND LOG ERROR
```

```
1058 010734  062700  000004          2$:     ADD     #4,R0           ;POINT TO NEXT REGISTER
1059 010740  022700  170374                  CMP     #MAPL37,R0      ;SEE IF THIS SECTION IS TESTED
1060 010744  103364                          BHIS    1$              ;BRANCH IF NOT
1061 010746  012767  010754  170132          MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
1062                                                                  ;OF INTERMITTENT FAULTS.
1063 010754  005767  170276                  TST     ERRCNT          ;WERE THERE ANY ERRORS ON THIS
1064 010760  001401                          BEQ     TST5            ;;BRANCH IF NO ERRORS
1065 010762  104005                          EMT+    5
1066                                                                  ;HOLD ZERO
1067
1068
1080                                ;;*****************************************************************
                                    ;*TEST 5        CLEAR AND READ HIGH 20 REGISTERS UPPER 6 BITS
                                    ;*
                                    ;*      THIS TEST WILL ENSURE THAT MAPH20 - MAPH37 WILL ALL HOLD ZERO.
                                    ;*      IF ANY REGISTERS ARE NOT ZERO AFTER BEING CLEARED, THEIR ADDRESS AND
                                    ;*      CONTENTS ARE REPORTED.  IF ALL THE REGISTERS HAVE RANDOM DATA THEN
                                    ;*      PROBABLY NO WRITE PULSE IS BEING GENERATED, BUT IF THE ERROR IS IN
                                    ;*      ONLY ONE REGISTER OR IN ONE BIT IT MIGHT BE MORE DIFFICULT TO FIND.
                                    ;*      IT IS POSSIBLE THAT THE COUNT PATTERN TEST FOR MAPH20 - MAPH37 WILL
                                    ;*      GIVE MORE HELP.
                                    ;*
                                    ;*****************************************************************
      010764                        TST5:
      010764  000004                        SCOPE
      010766  012767  011054  170326        MOV     #TST6,NXTTST    ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                    ;FOR ESCAPE ON PARITY ERRORS
1081 010774  012700  170302          20$:    MOV     #MAPH20,R0      ;LOAD STARTING MAP REGISTER ADDR
1082 011000  012767  011006  170100          MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER HERE
1083 011006  000240                  1$:     NOP
1084 011010  005010                          CLR     (R0)            ;CLEAR MAP REGISTER
1085 011012  011067  170154                  MOV     (R0),$TMP0      ;SEE IF MAP REGISTER IS ZERO
1086 011016  001402                          BEQ     2$              ;BRANCH IF REGISTER IS ZERO
1087 011020  004767  173232                  JSR     PC,WRITEERROR   ;REPORT AND LOG ERROR
1088 011024  062700  000004          2$:     ADD     #4,R0           ;POINT TO NEXT HIGH REGISTER
1089 011030  022700  170376                  CMP     #MAPH37,R0      ;SEE IF THERE ARE MORE REGS LEFT
1090 011034  103364                          BHIS    1$              ;BRANCH IF MORE REGS TO TEST
1091 011036  012767  010774  170042          MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
1092                                                                  ;OF INTERMITTENT FAULTS.
1093 011044  005767  170206                  TST     ERRCNT          ;WERE THERE ANY ERRORS ON THIS TEST
1094 011050  001401                          BEQ     TST6            ;;BRANCH IF NO ERRORS
1095 011052  104006                          EMT+    6
1096                                                                  ;HOLD ZERO
1097
1108                                ;;*****************************************************************
                                    ;*TEST 6        DATA PATH TEST TO MAP REGISTER LOWER 16 BITS
                                    ;*
                                    ;*      THIS TEST WILL ENSURE THAT THE DATA PATH TO AND FROM THE UNIBUS
                                    ;*      MAP REGISTERS IS FUNCTIONING PROPERLY.  IT RUNS A COUNT PATTERN
                                    ;*      THROUGH MAPL00, AND IF IT DETECTS AN ERROR THE EXPECTED COUNT
                                    ;*      AND THE RECEIVED COUNT ARE REPORTED.  THE TEST THEN TRIES TO RUN
                                    ;*      THE COUNT THROUGH MAPL20, IN CASE THE ERROR IS IN THE LOWER
                                    ;*      GROUP OF REGISTERS AND NOT IN THE DATA PATH.
                                    ;*
                                    ;*****************************************************************
      011054                        TST6:
      011054  000004                        SCOPE
```

```
        011056  012767  011200  170236          MOV     #TST7,NXTTST    ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                        ;FOR ESCAPE ON PARITY ERRORS
        011064  012767  000012  170114          MOV     #12,$TIMES      ;;DO 12 ITERATIONS
  1109  011072  005003                  20$:     CLR     R3              ;START COUNT PATTERN AT 0
  1110  011074  005002                          CLR     R2              ;START COUNT PATTERN AT 0
  1111  011076  012767  011104  170002          MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
  1112  011104  000240                  1$:     NOP
  1113  011106  010267  157066                  MOV     R2,MAPL00       ;LOAD MAP REG 0 LOW 16 BITS
  1114  011112  016700  157062                  MOV     MAPL00,R0       ;READ CONTENTS OF MAP REGISTER 0
  1115  011116  020200                          CMP     R2,R0           ;COMPARE DATA & PATTERN
  1116  011120  001402                          BEQ     2$              ;BRANCH IF DATA DOES NOT MATCH
  1117  011122  104007                          EMT+    7
  1118  011124  000404                          BR      3$              ;BRANCH TO TEST DATA PATH WITH
  1119                                                                  ;A REGISTER OF THE NEXT GROUP
  1120  011126  062702  000002          2$:     ADD     #2,R2           ;ADD 2 TO COUNT PATTERN
  1121  011132  001364                          BNE     1$              ;BRANCH IF COUNT NOT COMPLETE.
  1122  011134  000416                          BR      10$             ;DATA PATH OKAY FOR LOW 16 BITS
  1123  011136  012767  011144  167742  3$:     MOV     #12$,$LPERR     ;SET LOOP ON ERROR POINTER TO 12$
  1124  011144  000240                  12$:    NOP
  1125  011146  010367  157126                  MOV     R3,MAPL20       ;LOAD MAP REG 20 LOW 16 BITS
  1126  011152  016701  157122                  MOV     MAPL20,R1       ;READ DATA STORED IN MAP REGISTER 20
  1127  011156  020301                          CMP     R3,R1           ;COMPARE DATA & PATTERN
  1128  011160  001003                          BNE     4$              ;CAUGHT ERROR,NOW SEE IF SAME.
  1129  011162  062703  000002                  ADD     #2,R3           ;ADD 2 TO COUNT PATTERN
  1130  011166  001357                          BNE     2$              ;BRANCH IF COUNT NOT 0
  1131  011170                          4$:
        011170  104010                          EMT+    10
  1132  011172  012767  011072  167706  10$:     MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
  1133
  1134
  1145                                  ;;*****************************************************************
                                        ;*TEST 7        DATA PATH TEST TO MAP REGISTER UPPER 6 BITS
                                        ;*
                                        ;*      THIS TEST WILL ENSURE THAT THE DATA PATH TO AND FROM THE UNIBUS
                                        ;*      MAP REGISTERS IS FUNCTIONING PROPERLY.  IT RUNS A COUNT PATTERN
                                        ;*      THROUGH MAPH00, AND IF IT DETECTS AN ERROR THE EXPECTED COUNT
                                        ;*      AND THE RECEIVED COUNT ARE REPORTED.  THE TEST THEN TRIES TO RUN
                                        ;*      THE COUNT THROUGH MAPH20, IN CASE THE ERROR IS IN THE LOWER
                                        ;*      GROUP OF REGISTERS AND NOT IN THE DATA PATH.
                                        ;*
                                        ;*****************************************************************
        011200                          TST7:
        011200  000004                          SCOPE
        011202  012767  011322  170112          MOV     #TST10,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                        ;FOR ESCAPE ON PARITY ERRORS
  1146  011210  005002                  20$:     CLR     R2              ;START COUNT PATTERN AT 0
  1147  011212  005003                          CLR     R3              ;START COUNT PATTERN AT 0
  1148  011214  012767  011222  167664          MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
  1149  011222  000240                  1$:     NOP
  1150  011224  010237  170202                  MOV     R2,@#MAPH0      ;LOAD MAP REG0 HIGH 6 BITS
  1151  011230  016700  156746                  MOV     MAPH00,R0       ;READ BACK MAP REG 00 UPPER SIX BITS
  1152  011234  020200                          CMP     R2,R0           ;COMPARE DATA AND PATTERN LOADED
  1153  011236  001402                          BEQ     2$              ;BRANCH IF DATA IS CORRECT
  1154  011240  104007                          EMT+    7
  1155  011242  000405                          BR      3$              ;BRANCH TO TRY SECOND BANK OF MAP REGS
  1156  011244  005202                  2$:     INC     R2              ;CHANGE DATA PATTERN
  1157  011246  022702  000100                  CMP     #100,R2         ;HAS COUNT REACH MAXIMUM?
```

```
1158 011252  001363                        BNE     1$              ;BRANCH IF TEST NOT OVER
1159 011254  000417                        BR      10$             ;UPPER SIX BIT DATA PATH IS OKAY
1160 011256  012767  011264  167622  3$:   MOV     #12$,$LPERR     ;SET LOOP ON ERROR POINTER TO 12$
1161 011264  000240                 12$:   NOP
1162 011266  010337  170302                MOV     R3,@#MAPH20      LOAD MAP REG 20 HIGH 6 BITS
1163 011272  016701  157004                MOV     MAPH20,R1       ;READ BACK MAP REG 20 UPPER SIX BITS
1164 011276  020301                        CMP     R3,R1           ;COMPARE DATA AND PATTERN
1165 011300  001004                        BNE     4$              ;BRANCH IF DATA DOES NOT MATCH
1166 011302  005203                        INC     R3              ;CHANGE DATA PATTERN
1167 011304  022703  000100                CMP     #100,R3         ;HAS COUNT REACHED MAXIMUM?
1168 011310  001355                        BNE     2$              ;BRANCH IF TEST NOT OVER
1169 011312                         4$:
     011312  104010                        EMT+    10
1170 011314  012767  011210  167564  10$:   MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1171
1184                                ;;*****************************************************************
                                    ;*TEST 10       DUAL ADDRESS LOADS & READS MAP REG'S
                                    ;*
                                    ;*      THIS TEST ENSURES THAT ONLY ONE UNIBUS MAP REGISTER IS LOADED
                                    ;*      DURING A 'MOV   #DATA,@#MAPREG' INSTRUCTION.  ALL MAP REGISTERS
                                    ;*      ARE CLEARED AND ONE REGISTER AT A TIME, STARTING WITH MAPL00,
                                    ;*      IS LOADED A NEGATIVE ONE.  THEN, ALL MAP REGISTERS ARE READ,
                                    ;*      STARTING WITH MAPH37, AND VERIFIED TO BE ZERO.  ANY REGISTER
                                    ;*      THAT IS NOT ZERO AND WHOSE UNIBUS ADDRESS DOES NOT MATCH THAT
                                    ;*      OF THE REGISTER UNDER TEST IS REPORTED TO BE IN ERROR.  AT THE
                                    ;*      END OF THE TEST A SUMMARY OF ALL DUALED REGISTERS IS GIVEN.
                                    ;*
                                    ;;*****************************************************************
     011322                         TST10:
     011322  000004                        SCOPE
     011324  012767  011446  167770        MOV     #TST11,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                    ;FOR ESCAPE ON PARITY ERRORS
     011332  012767  000144  167646        MOV     #144,$TIMES     ;;DO 144 ITERATIONS
1185 011340  012700  170200         20$:   MOV     #MAPL0,R0       ;LOAD FIRST MAP REG ADDR INTO R0
1186 011344  012767  011352  167534        MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER HERE
1187 011352  012701  170376         1$:    MOV     #MAPH37,R1      ;PUT ADDRESS OF HIGHEST MAP REG IN R1
1188 011356  004767  172536                JSR     PC,CLRMAP       ;CLEAR ALL MAP REGISTERS IN CASE OF
1189                                                                ;A 'FLAKEY' PROBLEM
1190 011362  000240                        NOP
1191 011364  012710  177777                MOV     #177777,(R0)    ;LOAD MAP REGISTER UNDER TEST
1192 011370  011102                 2$:    MOV     (R1),R2         ;READ MAP REGS STARTING FROM TOP
1193 011372  001404                        BEQ     3$              ;GO TO 3$ IF ZERO
1194 011374  020100                        CMP     R1,R0           ;SEE IF NON-ZERO ADDRS MATCH
1195 011376  001402                        BEQ     3$              ;GO TO 3$ IF MATCH
1196 011400  004767  172736                JSR     PC,DUALADR      ;JUMP TO SUBROUTINE TO LOG ALL ERRORS
1197 011404  162701  000002         3$:    SUB     #2,R1           ;POINT TO NEXT MAP REGISTER
1198 011410  022701  170200                CMP     #MAPL0,R1       ;HAVE ALL REGISTERS BEEN READ
1199 011414  101765                        BLOS    2$              ;IF NOT CONTINUE TEST
1200 011416  062700  000002                ADD     #2,R0           ;POINT TO NEXT MAP REGISTER
1201 011422  022700  170376                CMP     #MAPH37,R0      ;SEE IF TEST IS OVER
1202 011426  103351                        BHIS    1$              ;CONTINUE TESTING
1203 011430  012767  011340  167450        MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
1204                                                                ;OF INTERMITTENT FAULTS.
1205 011436  005767  167614                TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
1206 011442  001401                        BEQ     TST11           ;;GOTO NEXT TEST IF NO ERRORS
1207 011444  104014                        EMT+    14
1208                                                                ;ON LOADING MAP REGISTERS
```

```
1209
1210
1211                            ;*THE NEXT FOUR(4) TESTS RUN A COUNT PATTERN THROUGH EACH
1212                            ;*MAP REGISTER, CHECKING FOR STUCK BITS, AND SHORTED PINS.
1213
1223                            ;;*****************************************************************
                                ;*TEST 11       CNT PATRN LOW 20 MAP REG'S LOW 16 BITS
                                ;*
                                ;*      THIS TEST WILL RUN A COUNT PATTERN THROUGH UNIBUS MAP REGISTERS
                                ;*      MAPL00 - MAPL17.  IF THE COUNT RECIEVED DOES NOT MATCH THE
                                ;*      EXPECTED PATTERN THEN THE MAP REGISTER ADDRESS, DATA RECEIVED,
                                ;*      PATTERN LOADED, AND PATTERN EXPECTED ARE REPORTED.  AT THE END
                                ;*      OF THE TEST A SUMMARY OF ALL ERRORS IS GIVEN SO THAT YOU CAN
                                ;*      DETERMINE IF THE ERROR IS BIT SENSITIVE OR REGISTER SENSITIVE.
                                ;;*****************************************************************
      011446                    TST11:
      011446  000004                    SCOPE
      011450  012767  011572  167644    MOV     #TST12,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                ;FOR ESCAPE ON PARITY ERRORS
      011456  012767  000012  167522    MOV     #12,$TIMES      ;;DO 12 ITERATIONS
1224  011464  005002            20$:    CLR     R2              ;START WITH AN ALL ZERO PATTERN
      011466  012767  011506  167412    MOV     #2$,$LPERR      ;SET LOOP ON ERROR POINTER TO 2$
      011474  010204            1$:     MOV     R2,R4           ;PUT COUNT IN R4 FOR MASK
      011476  042704  000001            BIC     #000001,R4      ;CLEAR BITS IN MASK FOR PROPER COMPARE
      011502  012700  170200            MOV     #MAPL00,R0      ;LOAD STARTING MAP REGISTER ADDRESS
      011506  000240            2$:     NOP
      011510  010210                    MOV     R2,(R0)         ;LOAD MAP REGISTER WITH COUNT PATTERN
      011512  011003                    MOV     (R0),R3         ;READ MAP REGISTER INTO R3
      011514  020403                    CMP     R4,R3           ;COMPARE MASK WITH DATA
      011516  001402                    BEQ     3$              ;BRANCH IF DATA MATCHES
      011520  004767  172672            JSR     PC,COUNT        ;JUMP TO COUNT TO LOG ALL ERRORS
      011524  005003            3$:     CLR     R3              ;CLEAR DATA HOLDER
      011526  062700  000004            ADD     #4,R0           ;POINT TO NEXT MAP REGISTER UNDER TEST
      011532  022700  170274            CMP     #MAPL17,R0      ;SEE IF ALL REGISTERS HAVE BEEN LOADED
      011536  103363                    BHIS    2$              ;BRANCH IF STILL MORE TO GO
      011540  022702  177777            CMP     #177777,R2      ;SEE IF COUNT HAS CYCLED
      011544  001403                    BEQ     4$              ;BRANCH IF TEST IS DONE
      011546  062702  000401            ADD     #401,R2         ;CHANGE COUNT PATTERN
      011552  000750                    BR      1$              ;CONTINUE TESTING
      011554  012767  011464  167324    MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
                                                                ;OF INTERMITTENT FAULTS.
      011562  005767  167470            TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
      011566  001401                    BEQ     TST12           ;;BRANCH IF NO ERRORS
      011570  104015                    EMT+    15
                                                                ;IN MAPPING REGISTERS
1225
1226
1236                            ;;*****************************************************************
                                ;*TEST 12       COUNT PATTERN LOW 20 MAP REGISTERS UPPER 6 BITS
                                ;*
                                ;*      THIS TEST WILL RUN A COUNT PATTERN THROUGH UNIBUS MAP REGISTERS
                                ;*      MAPH00 - MAPH17.  IF THE COUNT RECIEVED DOES NOT MATCH THE
                                ;*      EXPECTED PATTERN THEN THE MAP REGISTER ADDRESS, DATA RECEIVED,
                                ;*      PATTERN LOADED, AND PATTERN EXPECTED ARE REPORTED.  AT THE END
                                ;*      OF THE TEST A SUMMARY OF ALL ERRORS IS GIVEN SO THAT YOU CAN
                                ;*      DETERMINE IF THE ERROR IS BIT SENSITIVE OR REGISTER SENSITIVE.
                                ;;*****************************************************************
```

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        011572                          TST12:
        011572  000004                          SCOPE
        011574  012767  011716  167520          MOV     #TST13,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                        ;FOR ESCAPE ON PARITY ERRORS
        011602  012767  000144  167376          MOV     #144.,$TIMES    ;;DO 144 ITERATIONS
  1237  011610  005002                  20$:    CLR     R2              ;START WITH AN ALL ZERO PATTERN
        011612  012767  011632  167266          MOV     #2$,$LPERR      ;SET LOOP ON ERROR POINTER TO 2$
        011620  010204                  1$:     MOV     R2,R4           ;PUT COUNT IN R4 FOR MASK
        011622  042704  177700                  BIC     #177700,R4      ;CLEAR BITS IN MASK FOR PROPER COMPARE
        011626  012700  170202                  MOV     #MAPH00,R0      ;LOAD STARTING MAP REGISTER ADDRESS
        011632  000240                  2$:     NOP
        011634  010210                          MOV     R2,(R0)         ;LOAD MAP REGISTER WITH COUNT PATTERN
        011636  011003                          MOV     (R0),R3         ;READ MAP REGISTER INTO R3
        011640  020403                          CMP     R4,R3           ;COMPARE MASK WITH DATA
        011642  001402                          BEQ     3$              ;BRANCH IF DATA MATCHES
        011644  004767  172546                  JSR     PC,COUNT        ;JUMP TO COUNT TO LOG ALL ERRORS
        011650  005003                  3$:     CLR     R3              ;CLEAR DATA HOLDER
        011652  062700  000004                  ADD     #4,R0           ;POINT TO NEXT MAP REGISTER UNDER TEST
        011656  022700  170276                  CMP     #MAPH17,R0      ;SEE IF ALL REGISTERS HAVE BEEN LOADED
        011662  103363                          BHIS    2$              ;BRANCH IF STILL MORE TO GO
        011664  022702  000177                  CMP     #177,R2 ;SEE IF COUNT HAS CYCLED
        011670  001403                          BEQ     4$              ;BRANCH IF TEST IS DONE
        011672  062702  000001                  ADD     #1,R2           ;CHANGE COUNT PATTERN
        011676  000750                          BR      1$              ;CONTINUE TESTING
        011700  012767  011610  167200  4$:     MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
                                                                        ;OF INTERMITTENT FAULTS.
        011706  005767  167344                  TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
        011712  001401                          BEQ     TST13           ;;BRANCH IF NO ERRORS
        011714  104013                          EMT+    13
                                                                        ;IN MAPPING REGISTERS
  1238
  1239
  1240
  1250                                  ;;*****************************************************************
                                        ;*TEST 13       CNT PATRN HI 20 MAP REG'S LOW 16 BITS
                                        ;*
                                        ;*      THIS TEST WILL RUN A COUNT PATTERN THROUGH UNIBUS MAP REGISTERS
                                        ;*      MAPL20 - MAPL37.  IF THE COUNT RECIEVED DOES NOT MATCH THE
                                        ;*      EXPECTED PATTERN THEN THE MAP REGISTER ADDRESS, DATA RECEIVED,
                                        ;*      PATTERN LOADED, AND PATTERN EXPECTED ARE REPORTED.  AT THE END
                                        ;*      OF THE TEST A SUMMARY OF ALL ERRORS IS GIVEN SO THAT YOU CAN
                                        ;*      DETERMINE IF THE ERROR IS BIT SENSITIVE OR REGISTER SENSITIVE.
                                        ;;*****************************************************************
        011716                          TST13:
        011716  000004                          SCOPE
        011720  012767  012042  167374          MOV     #TST14,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                        ;FOR ESCAPE ON PARITY ERRORS
        011726  012767  000012  167252          MOV     #12.,$TIMES     ;;DO 12 ITERATIONS
  1251  011734  005002                  20$:    CLR     R2              ;START WITH AN ALL ZERO PATTERN
        011736  012767  011756  167142          MOV     #2$,$LPERR      ;SET LOOP ON ERROR POINTER TO 2$
        011744  010204                  1$:     MOV     R2,R4           ;PUT COUNT IN R4 FOR MASK
        011746  042704  000001                  BIC     #000001,R4      ;CLEAR BITS IN MASK FOR PROPER COMPARE
        011752  012700  170300                  MOV     #MAPL20,R0      ;LOAD STARTING MAP REGISTER ADDRESS
        011756  000240                  2$:     NOP
        011760  010210                          MOV     R2,(R0)         ;LOAD MAP REGISTER WITH COUNT PATTERN
        011762  011003                          MOV     (R0),R3         ;READ MAP REGISTER INTO R3
        011764  020403                          CMP     R4,R3           ;COMPARE MASK WITH DATA
```

```
011766  001402                          BEQ     3$              ;BRANCH IF DATA MATCHES
011770  004767  172422                  JSR     PC,COUNT        ;JUMP TO COUNT TO LOG ALL ERRORS
011774  005003                  3$:     CLR     R3              ;CLEAR DATA HOLDER
011776  062700  000004                  ADD     #4,R0           ;POINT TO NEXT MAP REGISTER UNDER TEST
012002  022700  170374                  CMP     #MAPL37,R0      ;SEE IF ALL REGISTERS HAVE BEEN LOADED
012006  103363                          BHIS    2$              ;BRANCH IF STILL MORE TO GO
012010  022702  177777                  CMP     #177777,R2      ;SEE IF COUNT HAS CYCLED
012014  001403                          BEQ     4$              ;BRANCH IF TEST IS DONE
012016  062702  000401                  ADD     #401,R2         ;CHANGE COUNT PATTERN
012022  000750                          BR      1$              ;CONTINUE TESTING
012024  012767  011734  167054  4$:     MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
                                                                ;OF INTERMITTENT FAULTS.
012032  005767  167220                  TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
012036  001401                          BEQ     TST14           ;;BRANCH IF NO ERRORS
012040  104012                          EMT+    12
                                                                ;IN MAPPING REGISTERS
1252
1253
1263                            ;;*****************************************************************
                                ;*TEST 14       CNT PATRN HI 20 MAP REG'S UPPER 6 BITS
                                ;*
                                ;*      THIS TEST WILL RUN A COUNT PATTERN THROUGH UNIBUS MAP REGISTERS
                                ;*      MAPH20 - MAPH37.  IF THE COUNT RECIEVED DOES NOT MATCH THE
                                ;*      EXPECTED PATTERN THEN THE MAP REGISTER ADDRESS, DATA RECEIVED,
                                ;*      PATTERN LOADED, AND PATTERN EXPECTED ARE REPORTED.  AT THE END
                                ;*      OF THE TEST A SUMMARY OF ALL ERRORS IS GIVEN SO THAT YOU CAN
                                ;*      DETERMINE IF THE ERROR IS BIT SENSITIVE OR REGISTER SENSITIVE.
                                ;;*****************************************************************
012042                          TST14:
012042  000004                          SCOPE
012044  012767  012330  167250          MOV     #TST15,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                ;FOR ESCAPE ON PARITY ERRORS
012052  012767  000144  167126          MOV     #144,$TIMES     ;;DO 144 ITERATIONS
1264 012060  005002             20$:    CLR     R2              ;START WITH AN ALL ZERO PATTERN
012062  012767  012102  167016          MOV     #2$,$LPERR      ;SET LOOP ON ERROR POINTER TO 2$
012070  010204                  1$:     MOV     R2,R4           ;PUT COUNT IN R4 FOR MASK
012072  042704  177700                  BIC     #177700,R4      ;CLEAR BITS IN MASK FOR PROPER COMPARE
012076  012700  170302                  MOV     #MAPH20,R0      ;LOAD STARTING MAP REGISTER ADDRESS
012102  000240                  2$:     NOP
012104  010210                          MOV     R2,(R0)         ;LOAD MAP REGISTER WITH COUNT PATTERN
012106  011003                          MOV     (R0),R3         ;READ MAP REGISTER INTO R3
012110  020403                          CMP     R4,R3           ;COMPARE MASK WITH DATA
012112  001402                          BEQ     3$              ;BRANCH IF DATA MATCHES
012114  004767  172276                  JSR     PC,COUNT        ;JUMP TO COUNT TO LOG ALL ERRORS
012120  005003                  3$:     CLR     R3              ;CLEAR DATA HOLDER
012122  062700  000004                  ADD     #4,R0           ;POINT TO NEXT MAP REGISTER UNDER TEST
012126  022700  170376                  CMP     #MAPH37,R0      ;SEE IF ALL REGISTERS HAVE BEEN LOADED
012132  103363                          BHIS    2$              ;BRANCH IF STILL MORE TO GO
012134  022702  000177                  CMP     #177,R2 ;SEE IF COUNT HAS CYCLED
012140  001403                          BEQ     4$              ;BRANCH IF TEST IS DONE
012142  062702  000001                  ADD     #1,R2           ;CHANGE COUNT PATTERN
012146  000750                          BR      1$              ;CONTINUE TESTING
012150  012767  012060  166730  4$:     MOV     #20$,$LPERR     ;INITIALIZE LOOPING POINTER IN CASE
                                                                ;OF INTERMITTENT FAULTS.
012156  005767  167074                  TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
012162  001401                          BEQ     RELC22          ;;BRANCH IF NO ERRORS
012164  104013                          EMT+    13
```

```
                                                        ;IN MAPPING REGISTERS

1265
1266
1267
1268                                    ;*      AT THIS POINT 22-BIT RELOCATION FROM MEMORY MANAGEMENT
1269                                    ;*      IS ENABLED, WITH THE KIPAR'S MAPPED TO PHYSICAL 0-24K.
1270                                    ;*      KIPAR6 IS MAPPED TO THE UNIBUS ('70000) AND
1271                                    ;*      KIPAR7 IS MAPPED TO THE I/O PAGE (177600).
1272
1273 012166  104420                    RELC22: TBITR                   ;RESTORE THE T BIT TO ITS CONDITION
1274                                                                    ;BEFORE THE LAST TEST
1275 012170  012700  077406                    MOV     #77406,R0       ;MAKE THE KERNEL I-SPACE PAGES ALL
1276                                                                    ;4K, UPWARD EXPANDABLE, READ/WRITE
1277 012174  010067  160100                    MOV     R0,KIPDR0       ;KERNEL I-SPACE PAGE 0
1278 012200  010067  160076                    MOV     R0,KIPDR1       ;KERNEL I-SPACE PAGE 1
1279 012204  010067  160074                    MOV     R0,KIPDR2       ;KERNEL I-SPACE PAGE 2
1280 012210  010067  160072                    MOV     R0,KIPDR3       ;KEPNEL I-SPACE PAGE 3
1281 012214  010067  160070                    MOV     R0,KIPDR4       ;KERNEL I-SPACE PAGE 4
1282 012220  010067  160066                    MOV     R0,KIPDR5       ;KERNEL I-SPACE PAGE 5
1283 012224  010067  160064                    MOV     R0,KIPDR6       ;KERNEL I-SPACE PAGE 6
1284 012230  010067  160062                    MOV     R0,KIPDR7       ;KERNEL I-SPACE PAGE 7
1285 012234  012767  000000  160076           MOV     #000,KIPAR0     ;MAP TO PHYSICAL 0
1286 012242  012767  000200  160072           MOV     #200,KIPAR1     ;MAP TO PHYSICAL 4K - 8K
1287 012250  012767  000400  160066           MOV     #400,KIPAR2     ;MAP TO PHYSICAL 8K - 12K
1288 012256  012767  000600  160062           MOV     #600,KIPAR3     ;MAP TO PHYSICAL 12K - 16K
1289 012264  012767  001000  160056           MOV     #1000,KIPAR4    ;MAP TO PHYSICAL 16K - 20K
1290 012272  012767  001200  160052           MOV     #1200,KIPAR5    ;MAP TO PHYSICAL 20K - 24K
1291 012300  012767  170000  160046           MOV     #170000,KIPAR6  ;MAP TO UNIBUS
1292 012306  012767  177600  160042           MOV     #177600,KIPAR7  ;MAP TO I/O PAGE
1293 012314  012767  000001  165250           MOV     #BIT0,MMR0      ;ENABLE FULL 18-BIT MAPPING
1294 012322  012767  000020  160166           MOV     #BIT4,MMR3      ;ENABLE 22-BIT MAPPING
1295
1306                                    ;;*****************************************************************
                                        ;*TEST 15       MAP REGISTER ADDRESS DECODE TEST
                                        ;*
                                        ;*      THIS TEST TRIES TO VERIFY THAT NONE OF THE INPUTS TO THE ADDRESS
                                        ;*      DECODER FOR THE UNIBUS MAP REGISTERS  IS STUCK TRUE.
                                        ;*      KIPAR6 IS SETUP TO HOLD 177702 AND R4 HAS THE VIRTUAL ADDRESS
                                        ;*      TO SELECT MAPL00, THRU KIPAR6.  THE TEST THEN CHANGES ONE BIT
                                        ;*      AT A TIME IN PAR6 SO THAT IT SHOULD NEVER REFERENCE MAPL00.  IF
                                        ;*      IT DOES AN ERROR IS REPORTED.
                                        ;*
                                        ;;*****************************************************************
     012330                             TST15:
     012330  012767  012360  166546             MOV     #20$,$LPADR     ;SET LOOP ON TEST POINTER TO 20$
     012336  012767  012360  166542             MOV     #20$,$LPERR     ;SET LOOP ON ERROR POINTER TO 20$
     012344  012767  000015  166526             MOV     #15,$TSTNM      ;SETUP TEST NUMBER AND CLR ERROR FLAG
     012352  016777  166522  166572             MOV     $TSTNM,@DISPLAY ;DISPLAY TEST NUMBER FOR ALL TO SEE
1307         000020                             TIMOUT=BIT4
1308 012360  012767  000020  166700  20$:      MOV     #TIMOUT,CPUEXP  ;EXPECTING CPU TIME OUT ON UNIBUS
1309 012366  012767  012426  166512           MOV     #10$,$LPERR     ;SET LOOP ON ERROR POINTER TO 10$
1310 012374  012767  177702  157752           MOV     #177702,KIPAR6  ;PUT MAP REG 0 ADDR IN PAR6
1311 012402  012702  175254                    MOV     #175254,R2      ;PATTERN FOR TESTING.
1312 012406  010237  170200                    MOV     R2,@#MAPL0      ;LOAD MAP REGISTER 0
1313 012412  012700  004000                    MOV     #BIT11,R0       ;SET BIT 11 TO FLOAT THRU PAR6
1314 012416  012704  140000                    MOV     #140000,R4      ;VIRT.ADDR. TO SELECT PAR6
1315 012422  074067  157726           '$:      XOR     R0,KIPAR6       ;CHANGE A BIT OF MAP REG 0'S ADDR
```

```
1316 012426  000240                    10$:    NOP
1317 012430  011401                            MOV     (R4),R1         ;READ LOCATION POINTED TO BY PAR6
1318 012432  020201                            CMP     R2,R1           ;SEE IF DATA FETCHED MATCHES PATTERN
1319 012434  001007                            BNE     3$              ;BRANCH IF NOT SAME
1320 012436  012714  000000                    MOV     #0,(R4)         ;TRY TO CLEAR THIS LOCATION
1321 012442  005737  170200                    TST     @#MAPLC         ;SEE IF MAP REG 0 GOT CLEARED
1322 012446  001001                            BNE     2$              ;BRANCH IF MAP REG NOT ZERO
1323 012450  104014                            EMT+    14
1324                                                                   ;DIFFERENT IN ADDRESS FROM 770200
1325 012452  010114                    2$:     MOV     R1,(R4)         ;RELOAD THE LOCATION
1326 012454  074067  157674            3$:     XOR     R0,KIPAR6       ;RESTORE BIT TO ORIGINAL STATUS
1327 012460  006200                            ASR     R0              ;RIGHT SHIFT ONE PLACE
1328 012462  020027  000001                    CMP     R0,#1           ;SEE IF TEST IS OVER
1329 012466  001355                            BNE     1$              ;BRANCH TO CONTINUE TEST
1330 012470  012767  012360  166410            MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1331 012476  005067  166564                    CLR     CPUEXP          ;ZERO EXPECTED CPU TRAP FLAG
1332
1345                                   ;;*****************************************************************
                                       ;*TEST 16       DATA PATH, UNIBUS TO MAIN MEMORY
                                       ;*
                                       ;*      THIS TEST RUNS A COUNT PATTERN THROUGH A MEMORY LOCATION VIA
                                       ;*      THE UNIBUS.  THE UNIBUS MAP IS LEFT OFF DURING THIS TEST SO
                                       ;*      THAT THE ADDRESS IS NOT RELOCATED.  THE TEST TRIES TO LOAD THE
                                       ;*      PATTERN INTO ADDRESS 040000 (8K) BUT IF THE MAP JUMPERS ARE
                                       ;*      SET NOT TO RESPOND TO THAT ADDRESS THE NEXT 4K IS TRIED UNTIL
                                       ;*      THE TEST GETS TO MAIN MEMORY FROM THE UNIBUS.  IF THIS TEST
                                       ;*      DETERMINES THAT IT CANNOT GET TO MAIN MEMORY FROM THE UNIBUS
                                       ;*      IT REPORTS THE FACT AND SKIPS THE NEXT TEST FOR VERIFICATION.
                                       ;*
                                       ;;*****************************************************************
012502                                 TST16:
012502  000004                                 SCOPE
012504  012767  012734  166670                MOV     #TST17,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                       ;FOR ESCAPE ON PARITY ERRORS
012512  012767  000012  166466                MOV     #12,$TIMES      ;;DO 12 ITERATIONS
1346 012520  004767  171374            20$:    JSR     PC,CLRMAP       ;CLEAR ALL MAP REGISTERS
1347 012524  012767  000020  166534            MOV     #TIMOUT,CPUEXP  ;TIMEOUTS MIGHT OCCUR IN THIS TEST.
1348 012532  012767  012540  166346            MOV     #10$,$LPERR     ;SET LOOP ON ERROR POINTER TO 10$
1349 012540  012767  170400  157606  10$:     MOV     #170400,KIPAR6  ;START WITH ADDRESS 8K FROM UNIBUS
1350 012546  005067  166516            1$:     CLR     PCPUER          ;CLEAR ERROR CONDITION LOCATION
1351 012552  000240                            NOP
1352 012554  013700  140000                    MOV     @#140000,R0     ;TRY TO READ ADDRESS POINTED TO BY PAR6
1353 012560  005767  166504                    TST     PCPUER          ;SEE IF READ OF ADDRESS TIMED OUT
1354 012564  001412                            BEQ     2$              ;BRANCH IF REFERENCE WAS GOOD
1355 012566  062767  000200  157560  4$:     ADD     #200,KIPAR6     ;TRY NEXT 4K BLOCK OF MEMORY
1356 012574  022767  177600  157552            CMP     #177600,KIPAR6 ;SEE IF YOU'VE POINTED TO I/O PAGE
1357 012602  001361                            BNE     1$              ;BRANCH IF NOT
1358 012604  104015                            EMT+    15
1359 012606  000167  000252                    JMP     SIZEJ           ;JUMP TO SIZE JUMPER TEST
1360 012612  016767  157536  157532  2$:     MOV     KIPAR6,KIPAR5   ;PUT PAR6 INTO PAR5
1361 012620  042767  170000  157524            BIC     #170000,KIPAR5  ;MAKE PAR5 A NON UNIBUS ADDRESS
1362 012626  012737  173214  120000            MOV     #173214,@#120000 ;PUT RANDOM NUMBER INTO TEST LOCATION BY FAST B
1363 012634  013701  140000                    MOV     @#140000,R1     ;READ TEST LOCATION VIA UNIBUS
1364 012640  022701  173214                    CMP     #173214,R1      ;SEE IF DATA WAS READ PROPERLY
1365 012644  001403                            BEQ     3$              ;DATA OKAY NOW VERIFY DATA PATH
1366 012646  020001                            CMP     R0,R1           ;SEE IF DATA CHANGED FROM FIRST REA
1367 012650  001001                            BNE     3$              ;BRANCH IF DATA CHANGED
```

```
                        DATA PATH, UNIBUS TO MAIN MEMORY

1368 012652 000745                          BR      4$              ;TRY NEXT 4K BLOCK
1369 012654 005001                  3$:     CLR     R1              ;CLEAR REGISTER TO HOLD COUNT
1370 012656 012767 012670 166222            MOV     #11$,$LPERR     ;SET LOOP ON ERROR POINTER TO 11$
1371 012664 012702 140000                   MOV     #140000,R2      ;LOAD VIRTUAL ADDRESS INTO R2
1372 012670 000240                  11$:    NOP
1373 012672 010112                  5$:     MOV     R1,(R2)         ;LOAD COUNT INTO TEST LOCATION VIA U.B.
1374 012674 011200                          MOV     (R2),R0         ;READ TEST LOCATION BACK VIA UNIBUS
1375 012676 020100                          CMP     R1,R0           ;COMPARE COUNT WITH DATA READ
1376 012700 001402                          BEQ     6$              ;BRANCH IF DATA MATCHES
1377 012702 004767 171600                   JSR     PC,UBCOUNT      ;COUNT FAILED REPORT ERROR
1378 012706 005201                  6$:     INC     R1              ;INCREASE COUNT
1379 012710 001370                          BNE     5$              ;BRANCH IF COUNT HASN'T CYCLED
1380 012712 005767 166340                   TST     ERRCNT          ;WERE THERE ANY ERRORS ON THIS TEST
1381 012716 001401                          BEQ     19$             ;BRANCH IF NO ERRORS ON THIS TEST
1382 012720 104016                          EMT+    16
1383                                                                ;DATA PATH
1384 012722 012767 012520 166156    19$.    MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1385 012730 005067 166332                   CLR     CPUEXP          ;ZERO EXPECTED CPU TRAP CONDITION
1386
1387
1401                                ;*********************************************************************
                                    ;*TEST 17       MAP DOESN'T RELOCATE IF NOT ENABLED
                                    ;*
                                    ;*      THIS TEST VERIFIES THAT THE UNIBUS MAP DOES NOT RELOCATE IF BIT5
                                    ;*      OF MMP3 IS NOT SET.  THE TEST ASSUMES THAT THE PREVIOUS TEST HAS
                                    ;*      RUN SUCCESSFULLY AND LEFT KIPAR6 POINTING TO THE FIRST UNIBUS
                                    ;*      MAPPING REGISTER THAT THE UNIBUS MAP WILL RESPOND TO GREATER
                                    ;*      THAN OR EQUAL TO MAPREG #2.  KIPAR5 IS ALSO POINTING TO THE
                                    ;*      SAME MEMORY BASE ADDRESS EXCEPT IT POINTS OVER THE FASTBUS.
                                    ;*      THE TEST THEN SETS ONE BIT IN EACH A.L.U. OF THE UNIBUS MAP
                                    ;*      AND TRIES TO REFERENCE MAIN MEMORY OVER THE UNIBUS.  SINCE THE
                                    ;*      MAP IS NOT ENABLED THE LOAD WILL GO TO MAIN MEMORY UNRELOCATED.
                                    ;*
                                    ;*********************************************************************
     012734                         TST17:
     012734 000004                          SCOPE
     012736 012767 013046 166356            MOV     #TST20,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                    ;FOR ESCAPE ON PARITY ERRORS
1402 012744 012767 000020 166314    20$:    MOV     #TIMOUT,CPUEXP  ;MIGHT TIME OUT OVER UNIBUS
1403 012752 012767 013010 166126            MOV     #10$,$LPERR     ;SET LOOP ON ERROR POINTER TO  0$
1404 012760 016700 157370                   MOV     KIPAR6,R0       ;PUT UNIBUS ADDRESS OF MAP REG IN R0
1405 012764 072027 177773                   ASH     #-5,R0          ;RIGHT SHIFT R0 5 PLACES
1406 012770 042700 007400                   BIC     #007400,R0      ;STRIP OFF EXTRANEOUS BITS.
1407 012774 012720 021042                   MOV     #021042,(R0)+   ;SET BOTTOM BIT IN EACH ALU
1408 013000 012710 000042                   MOV     #42,(R0)        ;SET BOTTOM BIT IN EACH ALU
1409 013004 005037 120000                   CLR     @#120000        ;CLEAR TEST LOCATION VIA FAST BUS
1410 013010 000240                  10$:    NOP
1411 013012 012737 043207 140000            MOV     #43207,@#140000 ;LOAD TEST LOCATION VIA UNIBUS
1412                                                                ;THIS LOAD SHOULD NOT BE RELOCATED
1413                                                                ;BY THE UNIBUS MAP, SINCE BIT05 OF
1414                                                                ;MMR3 IS CLEAR.
1415 013020 013703 120000                   MOV     @#120000,R3     ;READ TEST LOCATION VIA FAST BUS
1416 013024 022703 043207                   CMP     #43207,R3       ;SEE IF DATA MATCHES
1417 013030 001401                          BEQ     1$              ;BRANCH IF DATA GOOD
1418 013032 104017                          EMT+    17
1419 013034 012767 012744 166044    1$:     MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1420 013042 005067 166220                   CLR     CPUEXP          ;ZERO EXPECTED CPU TRAP CONDITION
```

```
                        ;*****************************************************************
                        ;*TEST 20       SIZE JUMPER LOCATION
                        ;*
                        ;*      THIS TEST DETERMINES THE SETTING OF THE JUMPERS ON THE UNIBUS
                        ;*      MAP WHICH ALLOW THE MAP TO RESPOND TO THOSE ADDRESSES BETWEEN
                        ;*      THE JUMPER RANGE.  THE DEFAULT SETTING ALLOWS THE MAP TO RESPOND
                        ;*      TO ADDRESSES 000000 - 757776 ON THE UNIBUS.  IF THE JUMPERS ARE
                        ;*      NOT SET IN THEIR DEFAULT POSITION AN ERROR MESSAGE IS GIVEN.
                        ;*
                        ;*****************************************************************
013046                  TST20:
013046  000004                  SCOPE
013050  012767  013420  166244          MOV     #TST21,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                ;FOR ESCAPE ON PARITY ERRORS
013056  012767  000001  166122          MOV     #1,$TIMES       ;;DO 1 ITERATION
1433 013064             SIZEJ:
013064  012767  013114  166012          MOV     #20$,$LPADR     ;SET LOOP ON TEST POINTER TO 20$
013072  012767  013114  166006          MOV     #20$,$LPERR     ;SET LOOP ON ERROR POINTER TO 20$
013100  012767  000020  165772          MOV     #20,$TSTNM      ;SETUP TEST NUMBER AND CLR ERROR FLAG
013106  016777  165766  166036          MOV     $TSTNM,@DISPLAY ;DISPLAY TEST NUMBER FOR ALL TO SEE
1434 013114  012767  000020  166144  20$:    MOV     #TIMOUT,CPUEXP  ;EXPECTING CPU TIME OUT ON UNIBUS
1435 013122  012700  170200          MOV     #MAPL0,R0       ;LOAD ADDRESS OF FIRST MAP REG
1436 013126  012720  020000          1$:     MOV     #20000,(R0)+    ;LOAD 4K INTO ALL MAP REGISTERS
1437 013132  005020                  CLR     (R0)+           ;INSURE THAT ALL REGS HAVE UPPER BITS CLR
1438 013134  022700  170374          CMP     #MAPL37,R0      ;SEE IF LAST REG IS LOADED
1439 013140  101372                  BHI     1$              ;BRANCH IF THERE ARE MORE TO LOAD
1440 013142  052737  000040  172516          BIS     #BIT5,@#MMR3    ;TURN ON MAP RELOCATION
1441 013150  012700  117776          MOV     #117776,R0      ;THIS WILL BE USED TO SELECT PAR 4
1442 013154  012767  170000  157166          MOV     #170000,KIPAR4 ;WE START TESTING WITH MAP 0
1443 013162  012701  000200          MOV     #200,R1         ;CONSTANT USED TO ADD TO PAR 4
1444 013166  012702  125252          MOV     #125252,R2      ;CONSTANT TO LOAD INTO LOCATION 37776
1445 013172  005037  037776          2$:     CLR     @#37776         ;CLEAR TEST LOCATION
1446 013176  010210                  MOV     R2,(R0)         ;TRY TO LOAD TEST CELL THROUGH MAP
1447 013200  023702  037776          CMP     @#37776,R2      ;SEE IF TEST LOCATION WAS LOADED
1448 013204  001411                  BEQ     3$              ;BRANCH IF IT WAS LOADED
1449 013206  060167  157136          ADD     R1,KIPAR4       ;CELL NOT LOADED, TEST NEXT MAP REG
1450 013212  022767  177600  157130          CMP     #177600,KIPAR4 ;SEE IF YOU'RE POINTING TO I/O PAGE
1451 013220  001364                  BNE     2$              ;GO TYPE NEXT MAP REGISTER
1452 013222  104020                  EMT+    20
1453 013224  000167  174550          JMP     START           ;RESTART PROGRAM
1454 013230  016767  157114  166004  3$:     MOV     KIPAR4,LOWEST   ;FOUND THE LOWEST USABLE MAP REG
1455 013236  016767  157106  166000  4$:     MOV     KIPAR4,HIGEST   ;THIS WILL END UP BEING LAST USABLE REG
1456 013244  060167  157100          ADD     R1,KIPAR4       ;TRY NEXT MAP REG TO SEE IF IT RESPONDS
1457 013250  022767  177600  157072          CMP     #177600,KIPAR4  ;SEE IF ALL MAP REGS HAVE BEEN TRIED
1458 013256  001406                  BEQ     7$              ;BRANCH IF ALL ARE DONE
1459 013260  005037  037776          CLR     @#37776         ;CLEAR TEST LOCATION
1460 013264  010210                  MOV     R2,(R0)         ;TRY TO LOAD TEST CELL THROUGH THE MAP
1461 013266  023702  037776          CMP     @#37776,R2      ;SEE IF TEST LOCATION WAS LOADED
1462 013272  001761                  BEQ     4$              ;BRANCH IF IT WAS LOADED
1463 013274  005067  165766          7$:     CLR     CPUEXP          ;NO CPU TRAPS EXPECTED IN NEXT TEST
1464 013300  005767  004516          TST     $PASS           ;SEE IF THIS IS FIRST PASS
1465 013304  001045                  BNE     TST21           ;;GO TO NEXT TEST IF NOT THE FIRST PASS
1466 013306  026727  165730  170000          CMP     LOWEST,#170000  ;SEE IF LOWER JUMPER IS DEFAULT
1467 013314  001004                  BNE     8$              ;BRANCH IF NOT.
1468 013316  026727  165722  177400          CMP     HIGEST,#177400  ;SEE IF UPPER JUMPER IS DEFAULT.
```

```
                                                BEQ     9$              ;BRANCH IF JUMPERS DEFAULT.
                                        8$:
                                                EMT+    22
1469 013324  000401                             ;:
1470 013326                                     ;*      SETUP POINTERS TO THE LOWEST AND THE HIGHEST USEABLE
     013326  104022                             ;*      MAPPING REGISTERS TO CONTINUE WITH TEST.
1471                                            ;:
1472                                            9$:     MOV     HIGEST,R0
1473                                                    MOV     LOWEST,R1
1474                                                    BIC     #170000,R0
1475 013330  016700  165710                             BIC     #170000,R1
1476 013334  016701  165702                             ASH     #-5,R0          ;RIGHT SHIFT R0 5 PLACES
1477 013340  042700  170000                             ASH     #-5,R1          ;RIGHT SHIFT R1 5 PLACES
1478 013344  042701  170000                             ADD     #170200,R1
1479 013350  072027  177773                             ADD     #170200,R0
1480 013354  072127  177773                             MOV     R1,LREGL
1481 013360  062701  170200                             ADD     #2,R1           ;POINT TO UPPER BITS OF MAP REG
1482 013364  062700  170200                             MOV     R1,LREGU
1483 013370  010167  165652                             MOV     R0,HREGL
1484 013374  062701  000002                             ADD     #2,R0           ;POINT TO UPPER BITS OF MAP REG
1485 013400  010167  165644                             MOV     R0,HREGU
1486 013404  010067  165642
1487 013410  062700  000002
1488 013414  010067  165634
1489
1490
1491
1504                                            ;;**********************************************************************
                                                ;*TEST 21        ENSURE THAT THERE IS NO DUAL MAPPING
                                                ;*
                                                ;*      THIS TEST VERIFIES THAT THERE IS NO DUAL MAPPING. IT CLEARS
                                                ;*      ALL THE MAP REGISTERS EXCEPT THE ONE UNDER TEST, AND LOADS
                                                ;*      THAT ONE WITH 00020000.  THE TEST THEN USES A VIRTUAL ADDRESS
                                                ;*      TO SELECT THAT MAP REGISTER AND ADD 17776, SO THAT IT SHOULD
                                                ;*      REFERENCE ADDRESS 00037776.  A REFERENCE IS MADE THROUGH EACH
                                                ;*      OF THE REGISTERS AND ANY THAT FETCH THE CORRECT DATA ARE CHECKED
                                                ;*      TO SEE THAT IT WAS THE MAP REGISTER UNDER TEST.  IF NOT BOTH THE
                                                ;*      MAP REGISTER UNDER TEST AND THE DUALED REGISTER ARE REPORTED.
                                                ;*
                                                ;;**********************************************************************
     013420                                     TST21:
     013420  000004                                     SCOPE
     013422  012767  013614  165672                     MOV     #TST22,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                                ;FOR ESCAPE ON PARITY ERRORS
     013430  012767  000144  165550                     MOV     #144,$TIMES     ;;DO 144 ITERATIONS
1505 013436  004767  170456                 20$:    JSR     PC,CLRMAP       ;CLEAR ALL MAP REGISTERS
1506 013442  005067  165524                         CLR     $TMP0           ;USED AS FLAG IN TEST
1507 013446  012703  100000                         MOV     #100000,R3      ;SELECT P.A.R. 4 OFFSET OF ZERO
1508 013452  012767  013504  165426                 MOV     #2$,$LPERR      ;SET LOOP ON ERROR POINTER TO 2$
1509 013460  016702  165562                         MOV     LREGL,R2        ;PUT ADDRESS OF LOWEST USABLE MAP REG IN R2
1510 013464  016700  165552                         MOV     LOWEST,R0       ;MAP REGISTER UNDER TEST IN R0
1511 013470  016701  165546                 1$:     MOV     LOWEST,R1       ;MAP REGISTER USED IN CURRENT REFERENCE
1512 013474  012712  040000                         MOV     #40000,(R2)     ;LOAD MAP REG UNDER TEST WITH 8K BASE
1513 013500  010237  040000                         MOV     R2,@#40000      ;LOAD TEST LOCATION WITH THE ADDRESS
1514                                                                        ;OF THE MAP REGISTER UNDER TEST
1515 013504  010167  156640                 2$:     MOV     R1,KIPAR4       ;LOAD PAR 4 WITH NEXT MAP REG UNIBUS ADDR
1516 013510  011304                                 MOV     (R3),R4         ;READ THROUGH THE MAP
1517 013512  020402                                 CMP     R4,R2           ;SEE IF CORRECT DATA WAS FETCHED
1518 013514  001010                                 BNE     4$              ;BRANCH IF NO MATCH
1519 013516  020001                                 CMP     R0,R1           ;SEE IF MAP REGS ARE THE SAME
```

```
                ;ENSURE THAT THERE IS NO DUAL MAPPING

1520 013520 001403                      BEQ     3$              ;BRANCH IF CORRECT MAP REG WAS SET
1521 013522 004767 170614               JSR     PC,DUALADR      ;LOG AND REPORT ALL ERRORS
1522 013526 000403                      BR      4$              ;SKIP NEXT INSTRUCTION
1523 013530 012767 000001 165434 3$:    MOV     #1,$TMP0        ;SET FLAG WHEN ADDRS MATCH
1524 013536 062701 000200        4$:    ADD     #200,R1         ;TRY NEXT MAP REG
1525 013542 026701 165476               CMP     HIGEST,R1       ;SEE IF ALL HAVE BEEN TRIED
1526 013546 103356                      BHIS    2$              ;BRANCH IF STILL MORE TO TRY
1527 013550 005767 165416               TST     $TMP0           ;SEE THAT THERE WAS A SUCCESSFUL MATCH
1528 013554 001001                      BNE     5$              ;BRANCH IF THERE WAS
1529 013556 104023                      EMT+    23
1530 013560 005067 165406        5$:    CLR     $TMP0           ;CLEAR FLAG FOR NEXT REG
1531 013564 005012                      CLR     (R2)            ;CLEAR MAP REG JUST TESTED
1532 013566 062702 000004               ADD     #4,R2           ;POINT TO NEXT MAP REG TO LOAD
1533 013572 062700 000200               ADD     #200,R0         ;POINT TO NEXT MAP REG UNDER TEST
1534 013576 026700 165442               CMP     HIGEST,R0       ;SEE IF ALL MAP REGS HAVE BEEN TESTED
1535 013602 103332                      BHIS    1$              ;BRANCH IF STILL MORE TO TEST
1536 013604 005767 165446               TST     ERRCNT          ;SEE IF THERE WERE ANY ERRORS
1537 013610 001401                      BEQ     TST22           ;;BRANCH TO NEXT TEST IF NO ERRORS
1538 013612 104010                      EMT+    10
1539
1540
1541
1542
1551

                ;;******************************************************************
                ;*TEST 22        LOAD LOC'S 40000-77776 WITH THEIR ADRES'S
                ;*
                ;*      THIS TEST IS USED TO LOAD MAIN MEMORY FROM ADDRESS 00040000 TO
                ;*      ADDRESS 000077776 WITH ITS OWN ADDRESS.  IT THEN CHECKS THAT
                ;*      MEMORY OVER THE UNIBUS AND LOGS ANG REPORTS ANY ERRORS THAT
                ;*      IT FINDS.
                ;*
                ;******************************************************************
     013614     TST22:
     013614 000004                      SCOPE
     013616 012767 014074 165476        MOV     #TST23,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                ;FOR ESCAPE ON PARITY ERRORS
1552 013624 042767 000040 156664        BIC     #BIT5,MMR3      ;TURN OFF MAP RELOCATION
1553 013632 012767 000400 156510        MOV     #400,KIPAR4     ;MAP PAGE 4 TO 8K
1554 013640 012700 040000               MOV     #40000,R0       ;STARTING ADDRESS FOR DATA PATTERN
1555 013644 012701 100000        1$:    MOV     #100000,R1      ;VIRTUAL ADDRESS
1556 013650 012702 010000               MOV     #^D4096,R2      ;LOAD 4096 LOCATIONS AT A TIME
1557 013654 010021               2$:    MOV     R0,(R1)+        ;LOAD PHY. ADDR. INTO EACH MEMORY LOC.
1558 013656 062700 000002               ADD     #2,R0           ;POINT TO NEXT PHYSICAL ADDRESS
1559 013662 077204                      SOB     R2,2$           ;BRANCH IF 4K OF MEMORY NOT LOADED
1560 013664 062767 000200 156456        ADD     #200,KIPAR4     ;POINT TO NEXT 4K BANK OF MEMORY
1561 013672 022767 001000 156450        CMP     #1000,KIPAR4    ;SEE IF 16K IS LOADED
1562 013700 101361                      BHI     1$              ;BRANCH IF MORE MEMORY TO LOAD
1563                            ;*
1564                            ;*      MEMORY FROM 8K - 16K IS NOW LOADED WITH ITS OWN ADDRESS
1565                            ;*
1566 013702 012767 013710 165174        MOV     #20$,$LPADR     ;SET LOOP ADDRESS TO 20$
1567 013710 012767 013746 165170 20$:   MOV     #4$,$LPERR      ;SET LOOP ON ERROR POINTER TO 4$
1568 013716 022767 171000 156430        CMP     #171000,KIPAR6  ;DID I USE ANY MAP REGISTER
1569                                                            ;BELOW REGISTER 6 (UB. ADDR 100000)
1570 013724 101463                      BLOS    TST23           ;;BRANCH TO NEXT TEST IF NOT
1571 013726 016700 156422               MOV     KIPAR6,R0       ;LOAD PAR6 INTO R0 TO GET
1572                                                            ;THE STARTING DATA PATTERN
```

```
1573 013732  072027  000006            ASH   #6,R0          ;R0 NOW HOLDS THE STARTING DATA PATTERN
1574 013736  012701  140000      3$:   MOV   #140000,R1      ;STARTING VIRTUAL ADDRESS
1575 013742  012702  010000            MOV   #^D4096,R2       ;PREPARE TO READ 4K AT A TIME
1576 013746  000240            4$:   NOP
1577 013750  011103                    MOV   (R1),R3          ;READ MAIN MEMORY THRU UNIBUS
1578 013752  020003                    CMP   R0,R3            ;SEE IF THE ADDRESSES MATCH
1579 013754  001015                    BNE   6$               ;BRANCH IF ERROR
1580 013756  062701  000002      5$:   ADD   #2,R1            ;CHANGE VIRTUAL ADDRESS
```

```
1582 013762  062700  000002                 ADD     #2,R0           ;CHANGE PHYSICAL ADDRESS
1583 013766  077211                         SOB     R2,4$           ;BRANCH IF 4K OF MEMORY NOT READ
1584 013770  062767  000200  156356         ADD     #200,KIPAR6     ;POINT TO NEXT BANK OF 4K THRU UNIBUS
1585 013776  022767  171000  156350         CMP     #171000,KIPAR6  ;SEE IF THIS POINTS TO 16K PLUS 2
1586 014004  101354                         BHI     3$              ;BRANCH IF 16K OF MEMORY NOT CHECKED
1587 014006  000423                         BR      10$             ;TEST FINISHED, BRANCH TO EXIT
1588
1589 014010                          6$:
     014010  005100                         COM     R0              ;GET R0 READY FOR AND
     014012  040067  165210                 BIC     R0,ADRAND               ;PERFORM LOGICAL AND
     014016  005100                         COM     R0              ;PUT R0 BACK AS IT WAS
1590 014020  005103                         COM     R3              ;GET R3 READY FOR AND
     014022  040367  165204                 BIC     R3,DATAND               ;PERFORM LOGICAL AND
     014026  005103                         COM     R3              ;PUT R3 BACK AS IT WAS
1591 014030  050067  165174                 BIS     R0,ADDROR       ;LOGICAL OR OF PHYSICAL ADDRESS
1592 014034  050367  165174                 BIS     R3,DATAOR       ;LOGICAL OR OF ADDRESS FETCHED
1593 014040  005767  165212                 TST     ERRCNT          ;IS THIS THE FIRST ERROR HERE?
1594 014044  001002                         BNE     7$              ;BRANCH IF NOT FIRST ERROR
1595 014046  104206                         EMT+    206
1596 014050  000742                         BR      5$              ;CONTINUE TESTING
1597 014052                          7$:
     014052  104306                         EMT+    306
1598 014054  000740                         BR      5$              ;CONTINUE WITH TEST
1599 014056  005767  165174          10$:   TST     ERRCNT          ;WERE THERE ANY ERRORS ON THIS TEST?
1600 014062  001401                         BEQ     19$             ;BRANCH IF NO ERRORS ON THIS TEST
1601 014064  104024                         EMT+    24
1602 014066  012767  013710  165012  19$:   MOV     #20$,$LPERR     ;SET LOOP POINTER TO 20$
1603
1604
1613                                 ;*****************************************************************
                                     ;*TEST 23       MAIN MEMORY TIMEOUT THROUGH MAP
                                     ;*
                                     ;*      THIS TEST GENERATES A TIME OUT THROUGH THE UNIBUS MAP BY TRYING
                                     ;*      TO REFERENCE ADDRESS 17000000 IN MAIN MEMORY.  IT USES THE LOWEST
                                     ;*      USEABLE MAP REGISTER, WHICH IN THE DEFAULT CASE IS MAP REGISTER
                                     ;*      ZERO.
                                     ;*
                                     ;*****************************************************************
     014074                          TST23:
     014074  000004                         SCOPE
     014076  012767  014206  165216         MOV     #TST24,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                    ;FOR ESCAPE ON PARITY ERRORS
1614 014104  052767  000040  156404  20$:   BIS     #BIT5,MMR3      ;TURN MAP RELOCATION BACK ON
1615 014112  012767  000020  165146         MOV     #TIMOUT,CPUEXP  ;EXPECTING TIMEOUT IN THIS TEST
1616 014120  016767  165116  156222         MOV     LOWEST,KIPAR4   ;LOAD PAR 4 WITH LOWEST USABLE MAP REG
1617 014126  012777  000074  165114         MOV     #74,@LREGU      ;LOAD UPPER 6 BITS OF LOWEST MAP REG
1618 014134  012777  000000  165104         MOV     #000000,@LREGL  ;LOAD LOWER 16 BITS OF LOWEST MAP REG
1619 014142  012767  014150  164736         MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
1620 014150  005067  165114          1$:    CLR     PCPUER          ;CPU ERROR REG LOCATION
1621 014154  000240                         NOP
1622 014156  013703  100000                 MOV     @#100000,R3     ;TRY TO READ THRU PAGE 4
1623                                                                 ;THIS REFERENCE WILL GO OUT ON THE
1624                                                                 ;UNIBUS TO SELECT THE LOWEST USEABLE
1625                                                                 ;MAP REGISTER (DEFAULT MAP REG. 0).
1626                                                                 ;PHYSICAL ADDRESS 17700000 IS THEN
1627                                                                 ;GENERATED, WHICH SHOULD TIME OUT SINCE
1628                                                                 ;IT IS THE FIRST NON-EXISTANT LOCATION.
```

```
1629 014162  022767  000020  165100          CMP     #TIMOUT,PCPUER  ;THE UNIBUS SHOULD HAVE TIMED OUT
1630 014170  001401                          BEQ     10$             ;BRANCH IF CONDITION WAS CORRECT
1631 014172  104025                          EMT+    25
1632 014174  012767  014104  164704  10$:    MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1633 014202  005067  165060                  CLR     CPUEXP          ;NO CPU TRAPS EXPECTED FOR AWHILE
1634
1635
1646                                 ;;*****************************************************************
                                     ;*TEST 24       RELOCATION TEST USING LOWEST USABLE MAPPING REG
                                     ;*
                                     ;*      THIS TEST CHECKS OUT THE FULL ADDITION PROPERTIES OF THE UNIBUS
                                     ;*      MAP A.L.U..  IN THE DEFAULT CASE IT USES MAP REGISTER ZERO BUT
                                     ;*      IF THE MAP JUMPERS HAVE BEEN ALTERED TO DE-SELECT SOME MAP REGISTERS
                                     ;*      THIS TEST WILL USE THE LOWEST USEABLE MAP REGISTER.
                                     ;*      IF AN ERROR OCCURS THE TEST WILL REPORT THE PHYSICAL ADDRESS
                                     ;*      THAT WAS DESIRED, AND THE DATA AT THE ADDRESS THAT WAS REFERENCED.
                                     ;*
                                     ;;*****************************************************************
     014206                          TST24:
     014206  000004                          SCOPE
     014210  012767  015114  165104          MOV     #TST25,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                     ;FOR ESCAPE ON PARITY ERRORS
1647                                 ;;
1648                                 ;*THE RELOCATION HERE USES A BASE OF 00060000 AND AN
1649                                 ;*OFFSET OF 00000 TO PRODUCE AN ADDRESS OF 00060000
1650                                 ;;
1651 014216  012767  014250  164662  100$:    MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
     014224  005077  165020                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
     014230  012777  060000  165010          MOV     #060000,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
     014236  016737  165000  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
     014244  012700  140000                  MOV     #140000,R0      ;SELECT PAR6, OFFSET IS 00000
     014250  000240                  1$:     NOP
     014252  011001                          MOV     (R0),R1         ;READ LOCATION 060000 THRU THE UNIBUS
     014254  012702  060000                  MOV     #060000,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 060000
     014260  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
     014262  001401                          BEQ     2$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
     014264  104026                          EMT+    26
1652                                 ;;
1653                                 ;*THE RELOCATION HERE USES A BASE OF 00052524 AND AN
1654                                 ;*OFFSET OF 05252 TO PRODUCE AN ADDRESS OF 00057776
1655                                 ;;
1656 014266  012767  014320  164612  2$:     MOV     #3$,$LPERR      ;SET LOOP ON ERROR POINTER TO 3$
     014274  005077  164750                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
     014300  012777  052524  164740          MOV     #052524,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
     014306  016737  164730  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
     014314  012700  145252                  MOV     #145252,R0      ;SELECT PAR6, OFFSET IS 05252
     014320  000240                  3$:     NOP
     014322  011001                          MOV     (R0),R1         ;READ LOCATION 057776 THRU THE UNIBUS
     014324  012702  057776                  MOV     #057776,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 057776
     014330  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
     014332  001401                          BEQ     4$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
     014334  104026                          EMT+    26
1657                                 ;;
1658                                 ;*THE RELOCATION HERE USES A BASE OF 00045252 AND AN
1659                                 ;*OFFSET OF 12524 TO PRODUCE AN ADDRESS OF 00057776
1660                                 ;;
1661 014336  012767  014370  164542  4$:     MOV     #5$,$LPERR      ;SET LOOP ON ERROR POINTER TO 5$
```

```
        014344  005077  164700                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        014350  012777  045252  164670          MOV     #045252,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        014356  016737  164660  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        014364  012700  152524                  MOV     #152524,R0      ;SELECT PAR6, OFFSET IS 12524
        014370  000240                  5$:     NOP
        014372  011001                          MOV     (R0),R1         ;READ LOCATION 057776 THRU THE UNIBUS
        014374  012702  057776                  MOV     #057776,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 057776
        014400  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        014402  001401                          BEQ     6$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        014404  104026                          EMT+    26
   1662                                 ;;
   1663                                 ;*THE RELOCATION HERE USES A BASE OF 00050420 AND AN
   1664                                 ;*OFFSET OF 10420 TO PRODUCE AN ADDRESS OF 00061040
   1665                                 ;;
   1666 014406  012767  014440  164472  6$:     MOV     #7$,$LPERR      ;SET LOOP ON ERROR POINTER TO 7$
        014414  005077  164630                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        014420  012777  050420  164620          MOV     #050420,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        014426  016737  164610  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        014434  012700  150420                  MOV     #150420,R0      ;SELECT PAR6, OFFSET IS 10420
        014440  000240                  7$:     NOP
        014442  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        014444  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        014450  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        014452  001401                          BEQ     8$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        014454  104026                          EMT+    26
   1667                                 ;;
   1668                                 ;*THE RELOCATION HERE USES A BASE OF 00054630 AND AN
   1669                                 ;*OFFSET OF 04210 TO PRODUCE AN ADDRESS OF 00061040
   1670                                 ;;
   1671 014456  012767  014510  164422  8$:     MOV     #9$,$LPERR      ;SET LOOP ON ERROR POINTER TO 9$
        014464  005077  164560                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        014470  012777  054630  164550          MOV     #054630,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        014476  016737  164540  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        014504  012700  144210                  MOV     #144210,R0      ;SELECT PAR6, OFFSET IS 04210
        014510  000240                  9$:     NOP
        014512  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        014514  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        014520  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        014522  001401                          BEQ     10$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        014524  104026                          EMT+    26
   1672                                 ;;
   1673                                 ;*THE RELOCATION HERE USES A BASE OF 00044210 AND AN
   1674                                 ;*OFFSET OF 14630 TO PRODUCE AN ADDRESS OF 00061040
   1675                                 ;;
   1676 014526  012767  014560  164352  10$:    MOV     #11$,$LPERR     ;SET LOOP ON ERROR POINTER TO 11$
        014534  005077  164510                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        014540  012777  044210  164500          MOV     #044210,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        014546  016737  164470  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        014554  012700  154630                  MOV     #154630,R0      ;SELECT PAR6, OFFSET IS 14630
        014560  000240                  11$:    NOP
        014562  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        014564  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        014570  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        014572  001401                          BEQ     12$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        014574  104026                          EMT+    26
   1677                                 ;;
   1678                                 ;*THE RELOCATION HERE USES A BASE OF 00056734 AND AN
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                                        ;*OFFSET OF 02104 TO PRODUCE AN ADDRESS OF 00061040
                                        ;;
014576  012767  014650  164302  12$:    MOV     #13$,$LPERR     ;SET LOOP ON ERROR POINTER TO 13$
014604  005077  164440                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
014610  012777  056734  164430          MOV     #056734,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
014616  016737  164420  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
014624  012700  142104                  MOV     #142104,R0      ;SELECT PAR6, OFFSET IS 02104
014630  000240                  13$:    NOP
014632  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
014634  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
014640  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
014642  001401                          BEQ     14$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
014644  104026                          EMT+    26
                                        ;;
                                        ;*THE RELOCATION HERE USES A BASE OF 00042104 AND AN
                                        ;*OFFSET OF 16734 TO PRODUCE AN ADDRESS OF 00061040
                                        ;;
014646  012767  014700  164232  14$:    MOV     #15$,$LPERR     ;SET LOOP ON ERROR POINTER TO 15$
014654  005077  164370                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
014660  012777  042104  164360          MOV     #042104,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
014666  016737  164350  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
014674  012700  156734                  MOV     #156734,R0      ;SELECT PAR6, OFFSET IS 16734
014700  000240                  15$:    NOP
014702  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
014704  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
014710  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
014712  001401                          BEQ     16$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
014714  104026                          EMT+    26
                                        ;;
                                        ;*THE RELOCATION HERE USES A BASE OF 00057776 AND AN
                                        ;*OFFSET OF 01042 TO PRODUCE AN ADDRESS OF 00061040
                                        ;;
014716  012767  014750  164162  16$:    MOV     #17$,$LPERR     ;SET LOOP ON ERROR POINTER TO 17$
014724  005077  164320                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
014730  012777  057776  164310          MOV     #057776,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
014736  016737  164300  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
014744  012700  141042                  MOV     #141042,R0      ;SELECT PAR6, OFFSET IS 01042
014750  000240                  17$:    NOP
014752  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
014754  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
014760  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
014762  001401                          BEQ     18$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
014764  104026                          EMT+    26
                                        ;;
                                        ;*THE RELOCATION HERE USES A BASE OF 00041042 AND AN
                                        ;*OFFSET OF 17776 TO PRODUCE AN ADDRESS OF 00061040
                                        ;;
014766  012767  015020  164112  18$:    MOV     #19$,$LPERR     ;SET LOOP ON ERROR POINTER TO 19$
014774  005077  164250                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
015000  012777  041042  164240          MOV     #041042,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
015006  016737  164230  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
015014  012700  157776                  MOV     #157776,R0      ;SELECT PAR6, OFFSET IS 17776
015020  000240                  19$:    NOP
015022  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
015024  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
015030  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
015032  001401                          BEQ     20$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
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                015034  104026                          EMT+    26
1697                                            ;;
1698                                            ;*THE RELOCATION HERE USES A BASE OF 00057776 AND AN
1699                                            ;*OFFSET OF 00002 TO PRODUCE AN ADDRESS OF 00060000
1700                                            ;;
1701            015036  012767  015070  164042  20$:    MOV     #21$,$LPERR     ;SET LOOP ON ERROR POINTER TO 21$
                015044  005077  164200                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
                015050  012777  057776  164170          MOV     #057776,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
                015056  016737  164160  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
                015064  012700  140002                  MOV     #140002,R0      ;SELECT PAR6, OFFSET IS 00002
                015070  000240                  21$:    NOP
                015072  011001                          MOV     (R0),R1         ;READ LOCATION 060000 THRU THE UNIBUS
                015074  012702  060000                  MOV     #060000,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 060000
                015100  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
                015102  001401                          BEQ     22$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
                015104  104026                          EMT+    26
1702            015106  012767  014216  163772  22$:    MOV     #100$,$LPERR    ;SET LOOP POINTER TO START OF TEST
1703
1704
1713                                            ;;*****************************************************************
                                                ;*TEST 25        TEST CARRY PROP OF MAP'S RELOC ADDER
                                                ;*
                                                ;*      EVERY ADDRESS OF THE FORM XXXX0000 IS GENERATED HERE STARTING
                                                ;*      WITH 00030000 UP TO 17000000.  THAT IS, THE FIRST OF EVERY 2K
                                                ;*      WORDS IS ADDRESSED, TO INSURE THAT THE ADDER IN THE MAP IS
                                                ;*      WORKING PROPERLY .
                                                ;*
                                                ;*****************************************************************
                015114                          TST25:
                015114  000004                          SCOPE
                015116  012767  015450  164176          MOV     #TST26,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                                ;FOR ESCAPE ON PARITY ERRORS
                015124  012767  000012  164054          MOV     #12,$TIMES      ;;DO 12 ITERATIONS
1714                    000040                  NEXMEM=BIT5
1715                                                                            ;THE CPU ERROR REGISTER
1716            015132  012767  177777  000126  20$:    MOV     #-1,4$          ;INITIALIZE FLAG AS NEGATIVE ONE
1717            015140  005077  164104                  CLR     @LREGU          ;CLEAR UPPER 6 BITS OF MAP REG
1718            015144  012777  020000  164074          MOV     #20000,@LREGL   ;LOAD 4K BASE INTO MAP REGISTER
1719            015152  012701  100100                  MOV     #100100,R1      ;LOAD BITS TO SELECT PAR 4, OFFSET 100
1720            015156  012700  150000                  MOV     #150000,R0      ;LOAD BITS TO SELECT PAR 6, OFFSET 2K
1721            015162  012767  000277  155160          MOV     #277,KIPAR4     ;START WITH PHYSICAL 6K
1722            015170  016767  164046  155156          MOV     LOWEST,KIPAR6   ;LOAD PAR 6 WITH MAP REG'S ADDR
1723            015176  012767  015236  163702          MOV     #10$,$LPERR     ;SET LOOP ON ERROR POINTER TO 10$
1724            015204  012767  000020  164054  3$:     MOV     #20,CPUEXP      ;EXPECTING A UNIBUS TIME OUT DURING TEST
1725            015212  005067  164052                  CLR     PCPUER          ;CLEAR TIME OUT FLAG
1726            015216  016710  164102                  MOV     DATA,(R0)       ;THIS LOAD WILL TIME OUT WHEN YOU
1727                                                                            ;HAVE REACHED THE TOP OF MEMORY
1728                                                                            ;IT SELECTS PAR 6 WHICH WILL PUT ADDR
1729                                                                            ;<XXX XX1>0000 ON THE UNIBUS.
1730                                                                            ;THE X'S WILL SELECT THE LOWEST USEABLE
1731                                                                            ;MAPPING REGISTER.  THE DEFAULT CASE IS
1732                                                                            ;010000,  SELECTING MAPPING REGISTER 0.
1733            015222  005767  164042                  TST     PCPUER          ;SEE IF THERE WAS MAIN MEMORY
1734            015226  001016                          BNE     1$              ;BRANCH IF NO MAIN MEMORY FROM UNIBUS
1735            015230  012767  000040  164030          MOV     #NEXMEM,CPUEXP  ;POSSIBLE CACHE NON-EXISTANT MEMORY
1736            015236  011103                  10$:    MOV     (R1),R3         ;READ TEST LOCATION VIA FASTBUS
1737            015240  022767  000040  164022          CMP     #NEXMEM,PCPUER  ;WAS THIS CACHE NON-EXISTANT MEMORY
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1738 015246  001414                          BEQ     2$              ;BRANCH IF NON-EXSITANT MEMORY
1739 015250  000240                          NOP
1740 015252  011002                          MOV     (R0),R2         ;READ TEST LOCATION VIA UNIBUS MAP
1741 015254  020203                          CMP     R2,R3           ;COMPARE TEST DATA R2-MAP DATA
1742                                                                 ;R3=FASTBUS DATA
1743 015256  001410                          BEQ     2$              ;BRANCH IF IT WAS THE SAME
1744 015260  104027                          EMT+    27
1745 015262  000406                          BR      2$              ;BRANCH TO UPDATE ROUTINE
1746 015264  005227                  1$:     INC     (PC)+           ;INCREMENT ONE TIME ENTRANCE FLAG
1747 015266  177777                  4$:     .WORD   -1              ;USE NEGATIVE ONE FOR FLAG
1748 015270  001003                          BNE     2$              ;BRANCH IF YOU'VE BEEN HERE BEFORE
1749 015272  016767  155052  164016         MOV     KIPAR4,RSIZE    ;SAVE UPPER LIMIT OF MEMORY
1750 015300  062767  000100  164016  2$:    ADD     #100,DATA       ;CHANGE PATTERN FOR NEXT LOAD
1751 015306  062767  000100  155034         ADD     #100,KIPAR4     ;ADD 2K TO PAR4
1752 015314  062777  010000  163724         ADD     #10000,@LREGL   ;ADD 2K TO MAP REGISTER
1753 015322  001330                          BNE     3$              ;BRANCH IF MAP REGISTER NOT ZERO
1754 015324  005277  163720                  INC     @LREGU          ;ADD ONE TO UPPER 6 BITS OF MAP REG
1755 015330  022777  000073  163712         CMP     #73,@LREGU      ;SEE IF TOP 128K BLOCK HAS BEEN PASSED
1756 015336  103322                          BHIS    3$              ;BRANCH IF NOT PAST IT
1757 015340  005267  163760                  INC     DATA            ;CHANGE DATA PATTERN FOR NEXT PASS
1758 015344  042767  177700  163752         BIC     #177700,DATA    ;CLEAR UPPER 10 BITS OF DATA PATTERN
1759 015352  052767  000300  163744         BIS     #300,DATA       ;START WITH 3XX IN DATA PATTERN
1760 015360  012767  015132  163520         MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1761 015366  005067  163674          19$:    CLR     CPUEXP          ;NO CPU TRAPS EXPECTED FOR AWHILE
1762
1763
1764
1765
1766
1767                                 .SBTTL  ******************************************************************
1768                                 .SBTTL  THE FOLLOWING TESTS ARE RUN THROUGH THE UNIBUS MAP
1769                                 .SBTTL  ******************************************************************
1770
1771
1772 015372  000004                  UBMAP:  SCOPE                   ;LOOP ON PREVIOUS TEST
1773 015374  104420                          TBITR                   ;RESTORE T-BIT IF IT WAS ON
1774                                 ;*
1775                                 ;*      THIS CODE SETS UP THE TWO MAP REGISTERS ABOVE THE LOWEST
1776                                 ;*      USEABLE ONE TO POINT TO PHYSICAL MEMORY FROM 0 - 8K.  IN THE
1777                                 ;*      DEFAULT CASE, IN MANUFACTURING AND IF THERE IS NO UNIBUS MEMORY,
1778                                 ;*      THIS WILL BE MAP REGISTERS 1 AND 2.  MAP REGISTER 1 WILL POINT
1779                                 ;*      TO PHYSICAL 4K - 8K SO "ACT-11" WILL WORK PROPERLY AND MAP
1780                                 ;*      REGISTER 2 WILL POINT TO PHYSICAL 0 - 4K.  THIS MEANS THAT
1781                                 ;*      KIPAR0 SHOULD GET 170400 SO IT PUTS ADDRESSES 040000 TO 057776
1782                                 ;*      ON THE UNIBUS AND KIPAR1 SHOULD GET 170200 SO IT PUTS ADDRESSES
1783                                 ;*      020000 TO 037776 ON THE UNIBUS.
1784                                 ;*
1785 015376  016701  163646                  MOV     LREGU,R1        ;PUT POINTER TO LOWEST MAP REG IN R1
1786 015402  005061  000004                  CLR     4(R1)           ;CLEAR UPPER 6 BITS OF (LOWEST + 1)
1787 015406  005061  000010                  CLR     10(R1)          ;CLEAR UPPER 6 BITS OF (LOWEST + 2)
1788 015412  012761  020000  000002          MOV     #20000,2(R1)    ;LOAD LOWER 16 BITS OF (LOWEST + 1)
1789                                                                 ;SO THAT IT POINTS TO 4K - 8K
1790 015420  005061  000006                  CLR     6(R1)           ;CLEAR LOWER 16 BITS OF (LOWEST + 2)
1791 015424  016701  163612                  MOV     LOWEST,R1       ;PREPARE TO LOAD PAR1
1792 015430  062701  000200                  ADD     #200,R1         ;POINTER TO (LOWEST + 1)
1793 015434  010167  154702                  MOV     R1,KIPAR1       ;LOAD PAR1 TO POINT TO LOWEST + 1
1794 015440  062701  000200                  ADD     #200,R1         ;ADJUST R1 FOR KIPAR0
```

```
1795 015444  010167  154670                  MOV     R1,KIPAR0       ;LOAD PAR0 TO POINT TO (LOWEST * 2)
1796
1797
1809                                ;*****************************************************************
                                    ;*TEST 26       MAIN MEM. T.O. THRU MAP, CODE RUN OVER U.B.
                                    ;*
                                    ;*      THIS TEST GENERATES A TIME OUT THROUGH THE UNIBUS MAP BY TRYING
                                    ;*      TO REFERENCE ADDRESS 17000000 IN MAIN MEMORY.  IT USES THE LOWEST
                                    ;*      USEABLE MAP REGISTER, WHICH IN THE DEFAULT CASE IS MAP REGISTER
                                    ;*      ZERO.
                                    ;*
                                    ;*      THIS TEST IS BEING RUN WITH ALL MEMORY REFERENCES GOING THRU
                                    ;*      THE UNIBUS MAP.
                                    ;*
                                    ;*****************************************************************
     015450                         TST26:
     015450  012767  015506  163426          MOV     #20$,$LPADR     ;SET LOOP ON TEST POINTER TO 20$
     015456  012767  015506  163422          MOV     #20$,$LPERR     ;SET LOOP ON ERROR POINTER TO 20$
     015464  012767  000026  163406          MOV     #26,$TSTNM      ;SETUP TEST NUMBER AND CLR ERROR FLAG
     015472  016777  163402  163452          MOV     $TSTNM,@DISPLAY ;DISPLAY TEST NUMBER FOR ALL TO SEE
1810 015500  012767  015602  163614          MOV     #TST27,NXTTST   ;SET UP ESCAPE VECTOR IN CASE OF PARITY ERRORS
1811 015506  012767  000020  163552  20$:    MOV     #20,CPUEXP      ;EXPECTING CPU TIMEOUT IN THIS TEST
1812 015514  016767  163522  154626          MOV     LOWEST,KIPAR4   ;LOAD PAR 4 WITH LOWEST USABLE MAP REG
1813 015522  012777  000074  163520          MOV     #74,@LREGU      ;LOAD UPPER 6 BITS OF LOWEST MAP REG
1814 015530  012777  000000  163510          MOV     #000000,@LREGL  ;LOAD LOWER 16 BITS OF LOWEST MAP REG
1815 015536  012767  015544  163342          MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
1816 015544  005067  163520          1$:     CLR     PCPUER          ;CPU ERROR REG LOCATION
1817 015550  000240                          NOP
1818 015552  013703  100000                  MOV     @#100000,R3     ;TRY TO READ THRU PAGE 4
1819                                                                 ;THIS REFERENCE WILL GO OUT ON THE
1820                                                                 ;UNIBUS TO SELECT THE LOWEST USEABLE
1821                                                                 ;MAP REGISTER (DEFAULT MAP REG. 0).
1822                                                                 ;PHYSICAL ADDRESS 17700000 IS THEN
1823                                                                 ;GENERATED, WHICH SHOULD TIME OUT SINCE
1824                                                                 ;IT IS THE FIRST NON-EXISTANT LOCATION.
1825 015556  022767  000020  163504          CMP     #20,PCPUER      ;THE UNIBUS SHOULD HAVE TIMED OUT
1826 015564  001401                          BEQ     10$             ;BRANCH IF UNIBUS TIMED OUT
1827 015566  104030                          EMT+    30
1828 015570  012767  015506  163310  10$:    MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1829 015576  005067  163464                  CLR     CPUEXP          ;NO CPU TRAPS EXPECTED IN NEXT TEST
1830
1851
1845                                ;*****************************************************************
                                    ;*TEST 27       RELOCATION TEST USING LOWEST USABLE MAPPING REG
                                    ;*
                                    ;*      THIS TEST CHECKS OUT THE FULL ADDITION PROPERTIES OF THE UNIBUS
                                    ;*      MAP A.L.U..  IN THE DEFAULT CASE IT USES MAP REGISTER ZERO BUT
                                    ;*      IF THE MAP JUMPERS HAVE BEEN ALTERED TO DE-SELECT SOME MAP REGISTERS
                                    ;*      THIS TEST WILL USE THE LOWEST USEABLE MAP REGISTER.
                                    ;*      IF AN ERROR OCCURS THE TEST WILL REPORT THE PHYSICAL ADDRESS
                                    ;*      THAT WAS DESIRED, AND THE DATA AT THE ADDRESS THAT WAS REFERENCED.
                                    ;*
                                    ;*      THIS TEST IS BEING RUN WITH ALL MEMORY REFERENCES GOING THRU
                                    ;*      THE UNIBUS MAP.
                                    ;*
                                    ;*****************************************************************
     015602                         TST27:
```

```
                015602  000004                          SCOPE
                015604  012767  016516  163510          MOV     #TST30,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                                ;FOR ESCAPE ON PARITY ERRORS
     1846       015612  012737  060000  060000          MOV     #060000,@#060000  ;MAKE SURE THAT ADDRESS 060000
     1847                                                                       ;CONTAINS ITS OWN ADDRESS AS DATA
     1848                                        ;;
     1849                                        ;*THE RELOCATION HERE USES A BASE OF 00060000 AND AN
     1850                                        ;*OFFSET OF 00000 TO PRODUCE AN ADDRESS OF 00060000
     1851                                        ;;
     1852       015620  012767  015652  163260  100$:   MOV     #1$,$LPERR      ;SET LOOP ON ERROR POINTER TO 1$
                015626  005077  163416                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
                015632  012777  060000  163406          MOV     #060000,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
                015640  016737  163376  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
                015646  012700  140000                  MOV     #140000,R0      ;SELECT PAR6, OFFSET IS 00000
                015652  000240                  1$:     NOP
                015654  011001                          MOV     (R0),R1         ;READ LOCATION 060000 THRU THE UNIBUS
                015656  012702  060000                  MOV     #060000,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 060000
                015662  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
                015664  001401                          BEQ     2$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
                015666  104031                          EMT+    31
     1853                                        ;;
     1854                                        ;*THE RELOCATION HERE USES A BASE OF 00052524 AND AN
     1855                                        ;*OFFSET OF 05252 TO PRODUCE AN ADDRESS OF 00057776
     1856                                        ;;
     1857       015670  012767  015722  163210  2$:     MOV     #3$,$LPERR      ;SET LOOP ON ERROR POINTER TO 3$
                015676  005077  163346                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
                015702  012777  052524  163336          MOV     #052524,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
                015710  016737  163326  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
                015716  012700  145252                  MOV     #145252,R0      ;SELECT PAR6, OFFSET IS 05252
                015722  000240                  3$:     NOP
                015724  011001                          MOV     (R0),R1         ;READ LOCATION 057776 THRU THE UNIBUS
                015726  012702  057776                  MOV     #057776,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 057776
                015732  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
                015734  001401                          BEQ     4$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
                015736  104031                          EMT+    31
     1858                                        ;;
     1859                                        ;*THE RELOCATION HERE USES A BASE OF 00045252 AND AN
     1860                                        ;*OFFSET OF 12524 TO PRODUCE AN ADDRESS OF 00057776
     1861                                        ;;
     1862       015740  012767  015772  163140  4$:     MOV     #5$,$LPERR      ;SET LOOP ON ERROR POINTER TO 5$
                015746  005077  163276                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
                015752  012777  045252  163266          MOV     #045252,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
                015760  016737  163256  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
                015766  012700  152524                  MOV     #152524,R0      ;SELECT PAR6, OFFSET IS 12524
                015772  000240                  5$:     NOP
                015774  011001                          MOV     (R0),R1         ;READ LOCATION 057776 THRU THE UNIBUS
                015776  012702  057776                  MOV     #057776,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 057776
                016002  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
                016004  001401                          BEQ     6$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
                016006  104031                          EMT+    31
     1863                                        ;;
     1864                                        ;*THE RELOCATION HERE USES A BASE OF 00050420 AND AN
     1865                                        ;*OFFSET OF 10420 TO PRODUCE AN ADDRESS OF 00061040
     1866                                        ;;
     1867       016010  012767  016042  163070  6$:     MOV     #7$,$LPERR      ;SET LOOP ON ERROR POINTER TO 7$
                016016  005077  163226                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
                016022  012777  050420  163216          MOV     #050420,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
```

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127     RELOCATION TEST USING LOWEST USABLE MAPPING REG

        016030  016737  163206  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP RE
        016036  012700  150420                  MOV     #150420,R0      ;SELECT PAR6, OFFSET IS 10420
        016042  000240                  7$:     NOP
        016044  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        016046  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        016052  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        016054  001401                          BEQ     8$              ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        016056  104031                          EMT+    31
   1868                                 ;;
   1869                                 ;*THE RELOCATION HERE USES A BASE OF 00054630 AND AN
   1870                                 ;*OFFSET OF 04210 TO PRODUCE AN ADDRESS OF 00061040
   1871                                 ;;
   1872 016060  012767  016112  163020  8$:     MOV     #9$,$LPERR      ;SET LOOP ON ERROR POINTER TO 9$
        016066  005077  163156                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        016072  012777  054630  163146          MOV     #054630,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        016100  016737  163136  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        016106  012700  144210                  MOV     #144210,R0      ;SELECT PAR6, OFFSET IS 04210
        016112  000240                  9$:     NOP
        016114  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        016116  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        016122  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        016124  001401                          BEQ     10$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        016126  104031                          EMT+    31
   1873                                 ;;
   1874                                 ;*THE RELOCATION HERE USES A BASE OF 00044210 AND AN
   1875                                 ;*OFFSET OF 14630 TO PRODUCE AN ADDRESS OF 00061040
   1876                                 ;;
   1877 016130  012767  016162  162750  10$:     MOV     #11$,$LPERR     ;SET LOOP ON ERROR POINTER TO 11$
        016136  005077  163106                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        016142  012777  044210  163076          MOV     #044210,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        016150  016737  163066  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        016156  012700  154630                  MOV     #154630,R0      ;SELECT PAR6, OFFSET IS 14630
        016162  000240                  11$:    NOP
        016164  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        016166  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        016172  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        016174  001401                          BEQ     12$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        016176  104031                          EMT+    31
   1878                                 ;;
   1879                                 ;*THE RELOCATION HERE USES A BASE OF 00056734 AND AN
   1880                                 ;*OFFSET OF 02104 TO PRODUCE AN ADDRESS OF 00061040
   1881                                 ;;
   1882 016200  012767  016232  162700  12$:     MOV     #13$,$LPERR     ;SET LOOP ON ERROR POINTER TO 13$
        016206  005077  163036                  CLR     @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
        016212  012777  056734  163026          MOV     #056734,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
        016220  016737  163016  172354          MOV     LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
        016226  012700  142104                  MOV     #142104,R0      ;SELECT PAR6, OFFSET IS 02104
        016232  000240                  13$:    NOP
        016234  011001                          MOV     (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
        016236  012702  061040                  MOV     #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
        016242  020102                          CMP     R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
        016244  001401                          BEQ     14$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
        016246  104031                          EMT+    31
   1883                                 ;;
   1884                                 ;*THE RELOCATION HERE USES A BASE OF 00042104 AND AN
   1885                                 ;*OFFSET OF 16734 TO PRODUCE AN ADDRESS OF 00061040
   1886                                 ;;
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```
 1887 016250 012767 016302 162630 14$:   MOV    #15$,$LPERR     ;SET LOOP ON ERROR POINTER TO 15$
      016256 005077 162766              CLR    @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
      016262 012777 042104 162756       MOV    #042104,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
      016270 016737 162746 172354       MOV    LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
      016276 012700 156734              MOV    #156734,R0      ;SELECT PAR6, OFFSET IS 16734
      016302 000240                     15$:  NOP
      016304 011001                     MOV    (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
      016306 012702 061040              MOV    #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
      016312 020102                     CMP    R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
      016314 001401                     BEQ    16$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
      016316 104031                     EMT+   31
 1888                                   ;;
 1889                                   ;*THE RELOCATION HERE USES A BASE OF 00057776 AND AN
 1890                                   ;*OFFSET OF 01042 TO PRODUCE AN ADDRESS OF 00061040
 1891                                   ;;
 1892 016320 012767 016352 162560 16$:   MOV    #17$,$LPERR     ;SET LOOP ON ERROR POINTER TO 17$
      016326 005077 162716              CLR    @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
      016332 012777 057776 162706       MOV    #057776,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
      016340 016737 162676 172354       MOV    LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
      016346 012700 141042              MOV    #141042,R0      ;SELECT PAR6, OFFSET IS 01042
      016352 000240                     17$:   NOP
      016354 011001                     MOV    (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
      016356 012702 061040              MOV    #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
      016362 020102                     CMP    R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
      016364 001401                     BEQ    18$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
      016366 104031                     EMT+   31
 1893                                   ;;
 1894                                   ;*THE RELOCATION HERE USES A BASE OF 00041042 AND AN
 1895                                   ;*OFFSET OF 17776 TO PRODUCE AN ADDRESS OF 00061040
 1896                                   ;;
 1897 016370 012767 016422 162510 18$:   MOV    #19$,$LPERR     ;SET LOOP ON ERROR POINTER TO 19$
      016376 005077 162646              CLR    @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
      016402 012777 041042 162636       MOV    #041042,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
      016410 016737 162626 172354       MOV    LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
      016416 012700 157776              MOV    #157776,R0      ;SELECT PAR6, OFFSET IS 17776
      016422 000240                     19$:   NOP
      016424 011001                     MOV    (R0),R1         ;READ LOCATION 061040 THRU THE UNIBUS
      016426 012702 061040              MOV    #061040,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 061040
      016432 020102                     CMP    R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
      016434 001401                     BEQ    20$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
      016436 104031                     EMT+   31
 1898                                   ;;
 1899                                   ;*THE RELOCATION HERE USES A BASE OF 00057776 AND AN
 1900                                   ;*OFFSET OF 00002 TO PRODUCE AN ADDRESS OF 00060000
 1901                                   ;;
 1902 016440 012767 016472 162440 20$:   MOV    #21$,$LPERR     ;SET LOOP ON ERROR POINTER TO 21$
      016446 005077 162576              CLR    @LREGU          ;CLEAR UPPER BITS OF MAPPING REG
      016452 012777 057776 162566       MOV    #057776,@LREGL  ;LOAD LOWER BITS OF MAPPING REG
      016460 016737 162556 172354       MOV    LOWEST,@#KIPAR6 ;LOAD PAR6 WITH ADDR OF LOWEST MAP REG
      016466 012700 140002              MOV    #140002,R0      ;SELECT PAR6, OFFSET IS 00002
      016472 000240                     21$:   NOP
      016474 011001                     MOV    (R0),R1         ;READ LOCATION 060000 THRU THE UNIBUS
      016476 012702 060000              MOV    #060000,R2      ;THE EXPECTED PHYSICAL ADDRESS IS 060000
      016502 020102                     CMP    R1,R2           ;SEE IF THE MAP'S FETCH WAS CORRECT
      016504 001401                     BEQ    22$             ;BRANCH IF FETCHED DATA MATCHES ADDRESS
      016506 104031                     EMT+   31
 1903 016510 012767 015620 162370 22$:   MOV    #100$,$LPERR    ;SET LOOP POINTER TO START OF TEST
```

```
                                ;*****************************************************************
                                ;*TEST 30       TEST CARRY PROP OF MAP'S RELOC ADDER
                                ;*
                                ;*      EVERY ADDRESS OF THE FORM XXXX0000 IS GENERATED HERE STARTING
                                ;*      WITH 00030000 UP TO 17000000.  THAT IS THE FIRST OF EVERY 2K
                                ;*      WORDS IS ADDRESSED, TO INSURE THAT THE ADDER IN THE MAP IS
                                ;*      WORKING PROPERLY .
                                ;*
                                ;*****************************************************************
016516                          TST30:
016516  000004                          SCOPE
016520  012767  016774  162574          MOV     #TST31,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                ;FOR ESCAPE ON PARITY ERRORS
016526  012767  000012  162452          MOV     #12.,$TIMES     ;;DO 12 ITERATIONS
1917 016534  012767  177777  000126  20$:   MOV     #-1,4$          ;INITIALIZE FLAG AS NEGATIVE ONE
1918 016542  005077  162502              CLR     @LREGU          ;CLEAR UPPER 6 BITS OF MAP REG
1919 016546  012777  020000  162472      MOV     #20000,@LREGL   ;LOAD 4K BASE INTO MAP REGISTER
1920 016554  012701  100100              MOV     #100100,R1      ;LOAD BITS TO SELECT PAR 4, OFFSET 100
1921 016560  012700  150000              MOV     #150000,R0      ;LOAD BITS TO SELECT PAR 6, OFFSET 2K
1922 016564  012767  000277  153556      MOV     #277,KIPAR4     ;START WITH PHYSICAL 6K
1923 016572  016767  162444  153554      MOV     LOWEST,KIPAR6   ;LOAD PAR 6 WITH MAP REG'S ADDR
1924 016600  012767  016640  162300      MOV     #10$,$LPERR     ;SET LOOP ON ERROR POINTER TO 10$
1925 016606  012767  000020  162452  3$:   MOV     #TIMOUT,CPUEXP  ;EXPECTING A UNIBUS TIME OUT DURING TEST
1926 016614  005067  162450              CLR     PCPUER          ;CLEAR TIME OUT FLAG
1927 016620  016710  162500              MOV     DATA,(R0)       ;THIS LOAD WILL TIME OUT WHEN YOU
1928                                                            ;HAVE REACHED THE TOP OF MEMORY
1929                                                            ;IT SELECTS PAR 6 WHICH WILL PUT ADDR
1930                                                            ;<XXX XX1>0000 ON THE UNIBUS.
1931                                                            ;THE X'S WILL SELECT THE LOWEST USEABLE
1932                                                            ;MAPPING REGISTER.  THE DEFAULT CASE IS
1933                                                            ;010000,  SELECTING MAPPING REGISTER 0.
1934 016624  005767  162440              TST     PCPUER          ;SEE IF THERE WAS MAIN MEMORY
1935 016630  001016                      BNE     1$              ;BRANCH IF NO MAIN MEMORY FROM UNIBUS
1936 016632  012767  000040  162426      MOV     #NEXMEM,CPUEXP  ;POSSIBLE CACHE NON-EXISTANT MEMORY
1937 016640  011103              10$:   MOV     (R1),R3         ;READ TEST LOCATION VIA FASTBUS
1938 016642  022767  000040  162420      CMP     #NEXMEM,PCPUER  ;WAS THERE CACHE NON-EXISTANT MEMORY
1939 016650  001414                      BEQ     2$              ;BRANCH IF NON-EXISTANT MEMORY
1940 016652  000240                      NOP
1941 016654  011002                      MOV     (R0),R2         ;READ TEST LOCATION VIA UNIBUS MAP
1942 016656  020203                      CMP     R2,R3           ;COMPARE TEST DATA R2=MAP DATA
1943                                                            ;R3 FASTBUS DATA
1944 016660  001410                      BEQ     2$              ;BRANCH IF IT WAS THE SAME
1945 016662  104032                      EMT+    32
1946 016664  000406                      BR      2$              ;BRANCH TO UPDATE ROUTINE
1947 016666  005227              1$:    INC     (PC)+           ;INCREMENT ONE TIME ENTRANCE FLAG
1948 016670  177777              4$:    .WORD   -1              ;USE NEGATIVE ONE FOR FLAG
1949 016672  001003                      BNE     2$              ;BRANCH IF YOU'VE BEEN HERE BEFORE
1950 016674  016767  153450  162414      MOV     KIPAR4,RSIZE    ;SAVE UPPER LIMIT OF MEMORY
1951 016702  062767  000100  162414  2$:   ADD     #100,DATA       ;CHANGE PATTERN FOR NEXT LOAD
1952 016710  062767  000100  153432      ADD     #100,KIPAR4     ;ADD 2K TO PAR4
1953 016716  062777  010000  162322      ADD     #10000,@LREGL   ;ADD 2K TO MAP REGISTER
1954 016724  001330                      BNE     3$              ;BRANCH IF MAP REGISTER NOT ZERO
1955 016726  005277  162316              INC     @LREGU          ;ADD ONE TO UPPER 6 BITS OF MAP RE
```

```
1956 016732  022777  000073  162310          CMP     #73,@LREGU      ;SEE IF TOP 128K BLOCK HAS BEEN PASSED
1957 016740  103322                          BHIS    3$              ;BRANCH IF NOT PAST IT
1958 016742  005267  162356                  INC     DATA            ;CHANGE DATA PATTERN FOR NEXT PASS
1959 016746  042767  177700  162350          BIC     #177700,DATA    ;CLEAR UPPER 10 BITS OF DATA PATTERN
1960 016754  052767  000300  162342          BIS     #300,DATA       ;START WITH 3XX IN DATA PATTERN
1961 016762  012767  016534  162116          MOV     #20$,$LPERR     ;SET LOOP POINTER TO START OF TEST
1962 016770  005067  162272          19$:    CLR     CPUEXP          ;NO CPU TRAPS EXPECTED IN NEXT TEST
1963
1964
1965
1990                                ;*********************************************************************
                                    ;*TEST 31       VERIFY TRAP DUE TO CACHE PARITY INTERRUPT
                                    ;*      THIS TEST IS OPTIONAL AND IS SELECTED BY SETTING MFM HARDWARE
                                    ;*      SWITCH REGISTER BIT 08 TO A 1 IN THE CASE OF STANDALONE OPERATION
                                    ;*      OF THE DIAGNOSTIC. IN THE CASE OF MANUFACTURING APT RUNTIME MODE
                                    ;*      THEN BIT 08 OF $SWREG IS SET TO 1 THRU APT SCRIPTING.
                                    ;*
                                    ;*       THE TEST VERIFIES THE SIGNAL GENERATED FROM THE CACHE
                                    ;*      TO THE UBI MODULE WHICH INDICATES TO THE UBI THAT A CACHE INTERRUPT
                                    ;*      IS BEING CALLED FOR(CACHE PE INTR L).
                                    ;*
                                    ;*      THIS TEST ASSUMES THAT ALL MODULES EXCEPT THE UBI MODULE ARE KNOWN
                                    ;*      GOOD MODULES.
                                    ;*
                                    ;*      THIS TEST TOGETHER WITH OTHER CACHE TESTS,ALLOW MFG. TO ELIMINATE
                                    ;*      HAVING TO RUN THE  CACHE  DIAGNOSTIC DURING QUICK
                                    ;*      VERIFY TESTING  OF THE UBI MODULE.
                                    ;*
                                    ;*      TEST DESCRIPTION:
                                    ;*      VERIFY INTERRUPT LOGIC BY ASSURING THAT A TRAP OCCURS TO LOCATION
                                    ;*      114 WHEN A LOCATION PREVIOUSLY WRITTEN
                                    ;*      WITH WRONG HI/LO BYTE PARITY IS ACCESSED.
                                    ;*              CONDITIONS:     PEA-0
                                    ;*                              DCPI-0
                                    ;*********************************************************************
      016774                        TST31:
      016774  000004                        SCOPE
      016776  012767  017324  162316        MOV     #TST32,NXTTST   ;SAVE STARTING ADDRESS OF NEXT TEST
                                                                    ;FOR ESCAPE ON PARITY ERRORS
1991 017004  012767  017020  162072        MOV #20$,$LPADR         ;SETUP LOOP ON TEST POINTER
1992 017012  012767  017020  162066        MOV #20$,$LPERR         ;SETUP LOOP ON ERROR POINTER
1993 017020                         20$:
1994 017020  132767  000200  001007        BITB    #200,$ENVM      ;IS APT SIZING?
1995 017026  001405                        BEQ     12$             ;NO;TRY HARDWARE SWITCH REGISTER
1996 017030  032767  000100  001000        BIT     #100,$SWREG     ;YES APT IS SIZING;DOES APT SAY TO DO
1997                                                                ;THIS TEST
1998 017036  001530                        BEQ     10$             ;NO;SKIP TEST
1999 017040  000404                        BR      1$              ;YES,DO TEST
2000 017042  032737  000100  177570  12$:  BIT     #100,@#177570   ;DOES HARDWARE SWITCH REGISTER SAY TO
2001                                                                ;TO DO TEST?
2002 017050  001523                        BEQ 10$                 ;NO,SKIP TEST
2003
2004 017052  042737  000001  177572        1$:     BIC #1,@#177572         ;TURN OFF RELOCATION
2005 017060  052737  000400  177746                BIS #400,@#177746       ;FLUSH CACHE TO INVALIDATE ALL CACHE LOCATIONS
```

```
2007 017066  032737  010000  177746          BIT #10000,@#177746     ;WAIT TILL DONE
2008 017074  001374                          BNE .-6
2009 017076  013702  000000                  MOV @#0,R2              ;SAVE ADDR. 0 CONTENTS
2010 017102  005037  000000                  CLR @#0                 ;0'S TO MAIN MEMORY LOCATION 0.
2011 017106  013700  000114                  MOV @#114,R0            ;SAVE VECTORS
2012 017112  013701  000116                  MOV @#116,R1
2013 017116  012737  017232  000114          MOV #4$,@#114           ;SETUP FOR CACHE TRAP
2014 017124  012737  000340  000116          MOV #340,@#116
2015
2016 017132  112737  000002  177750          MOVB #2,@#177750        ;HODC ALLOWS CACHE UPDATES
2017                                                                 ;AND CLOCKING OF PARITY INFO TO INTERRUPT LOGIC
2018                                                                 ; ONLY DURING THE DESTINATION ACCESS OF
2019                                                                 ;AN INSTRUCTION.
2020 017140  005003                          CLR R3                  ;CLEAR ERROR FLAG
2021 017142  012737  000015  177746          MOV #15,@#177746        ;NO UCB SO AS TO WRITE CACHE STORES
2022 017150  005737  000000                  TST @#0                 ;
2023 017154  005737  040000                  TST @#40000             ;UPDATE CACHE LOCATION 000C WITH CORRECT PARITY STOR
2024 017160  052737  000100  177746          BIS #100,@#177746       ;ALLOW WRITE WRONG PARITY DATA TO LO
2025                                                                 ;& HI BYTE PARITY STORE.
2026 017166  005737  000000                  TST @#0                 ;READ UPDATE TO CACHE LOCATION 0000;
2027                                                                 ;WRITE WRONG PARITY TO HI/LO BYTE PARITY STORES
2028 017172  042737  000100  177746          BIC #100,@#177746       ;DISABLE WWPD
2029 017200  005037  177744                  CLR @#177744            ;CLEAR CME AND PARITY DETECT LOGIC
2030 017204  042737  000005  177746          BIC #5,@#177746         ;ALLOW FOR INTERRUPT TO OCCUR
2031                                                                 ;AND ENABLE LOW CACHE
2032 017212  005737  000000                  TST @#0                 ;READ HIT;
2033                                                                 ;LO & HI BYTE PARITY CHECK GENERATORS WILL
2034                                                                 ; DETECT  WRONG PARITY AND THE PARITY
2035                                                                 ;ERROR WILL BE CLOCKED TO INTERRUPT
2036                                                                 ;LOGIC
2037 017216  000240                          NOP
2038 017220  005203                          INC R3                  ;INDICATE THAT TRAP DID NOT OCCUR
2039 017222  012737  001015  177746          MOV #1015,@#177746      ;DISABLE CACHE
2040 017230  000404                          BR 25$
2041 017232  012737  001015  177746  4$:     MOV #1015,@#177746      ;DISABLE CACHE
2042 017240  022626                          CMP (R6)+,(R6)+         ;READJUST STACK DUE TO INTERRUPT
2043 017242  000240                  25$:    NOP
2044 017244  000240                          NOP
2045 017246  105037  177750                  CLRB @#177750           ;DISABLE MAINT. MODE
2046 017252  010237  000000                  MOV R2,@#0              ;RESTORE LOCATION 0
2047 017256  010037  000114                  MOV R0,@#114            ;RESTORE CACHE INTERRUPT VECTORS
2048 017262  010137  000116                  MOV R1,@#116
2049 017266  052737  000400  177746          BIS #400,@#177746       ;BEFORE LEAVING TEST FLUSH CACHE TO
2050                                                                 ;ELIMINATE ANY EFFECTS OF WWPD
2051 017274  032737  010000  177746          BIT #10000,@#177746     ;WAIT TILL DONE
2052 017302  001374                          BNE .-6
2053 017304  012737  000000  177746          MOV #0,@#177746         ;TURN CACHE ON
2054 017312  005703                          TST R3                  ;DID TRAP OCCUR?
2055 017314  001401                          BEQ 10$                 ;YES
2056 017316  000000                          HALT                    ;INTERRUPT/ABORT LOGIC TESTS
2057                                                                 ;TRAP TO LOCATION 114 DID NOT OCCUR
2058 017320  000240                  10$:    NOP             ;END OF TEST
2059 017322  000240                          NOP
2060
2061
2062
2096                          ;;*****************************************************************
```

```
                        ;*TEST 32       VERIFY TRAP DUE TO CACHE PARITY ABORT
                        ;*      THIS TEST IS OPTIONAL AND IS SELECTED BY SETTING MFM HARDWARE
                        ;*      SWITCH REGISTER BIT 08 TO A 1 IN THE CASE OF STANDALONE OPERATION
                        ;*      OF THE DIAGNOSTIC. IN THE CASE OF MANUFACTURING APT RUNTIME MODE
                        ;*      THEN BIT 08 OF $SWREG IS SET TO 1 THRU APT SCRIPTING.

                        ;*       THE TEST VERIFIES THE SIGNAL GENERATED FROM THE CACHE(BUS PBL)
                        ;*      TO THE UBI MODULE WHICH INDICATES TO THE UBI THAT A CACHE ABORT
                        ;*      IS BEING CALLED FOR.
                        ;*
                        ;*      THIS TEST ASSUMES THAT ALL MODULES EXCEPT UBI ARE KNOWN GOOD  MODULES

                        ;*      THIS TEST TOGETHER WITH OTHER CACHE TESTS,ALLOW MFG. TO ELIMINATE
                        ;*      HAVING TO RUN THE  CACHE  DIAGNOSTIC DURING QUICK
                        ;*      VERIFY TESTING  OF THE UBI MODULE.

                        ;*      TEST DESCRIPTION:
                        ;*
                        ;*      VERIFY ABORT LOGIC BY THE FOLLOWING RESULTS WHEN A LOCATION
                        ;*      PREVIOUSLY WRITTEN WITH WRONG HI/LO BYTE PARITY IS ACCESSED.
                        ;*              1. INSTRUCTION CYCLE WILL BE ABORTED
                        ;*              2. THE ABORT CAUSES TRAP TO 114
                        ;*
                        ;*              PROCEDURE:      INHIBIT CLOCKING OF PARITY ERROR SIGNAL TO
                        ;*                              INTERRUPT LOGIC. ALLOW CME<15> TO BE SET
                        ;*                              BY ABORT SIGNAL WHICH IS ASSERTED BY PARITY
                        ;*                              ERROR SIGNAL TO ABORT LOGIC.

                        ;*
                        ;*              CONDITIONS:     PEA=1
                        ;*                              DCPI=1
                        ;*
                        ;;*****************************************************************
    017324  000004      TST32:  SCOPE
2097 017326  016767  001720  161766          MOV     $EOP,NXTTST     ;POINT TO ESCAPE VECTOR
2098 017334  012767  017350  161542          MOV     #20$,$LPADR     ;SETUP LOOP ON TEST VECTOR
2099 017342  012767  017350  161536          MOV     #20$,$LPERR     ;SETUP LOOP ON ERROR VECTOR
2100 017350                              20$:
2101 017350  132767  000200  000457          BITB    #200,$ENVM      ;IS APT SIZING?
2102 017356  001405                          BEQ     12$             ;NO;TRY HARDWARE SWITCH REGISTER
2103 017360  032767  000100  000450          BIT     #100,$SWREG     ;YES APT IS SIZING;DOES APT SAY TO DO
2104                                                                 ;THIS TEST
2105 017366  001534                          BEQ     10$             ;NO;SKIP TEST
2106 017370  000404                          BR      1$              ;YES,DO TEST
2107 017372  032737  000100  177570  12$:    BIT     #100,@#177570   ;DOES HARDWARE SWITCH REGISTER SAY TO
2108                                                                 ;TO DO TEST?
2109 017400  001527                          BEQ 10$                 ;NO,SKIP TEST
2110
2111 017402  042737  000001  177572          1$:     BIC #1,@#177572         ;TURN OFF RELOCATION
2112 017410  052737  000400  177746                  BIS #400,@#177746       ;FLUSH CACHE TO INVALIDATE ALL CACHE LOCATIONS
2113 017416  032737  010000  177746                  BIT #10000,@#177746     ;WAIT TILL DONE
2114 017424  001374                                  BNE .-6
2115 017426  013702  000000                          MOV @#0,R2              ;SAVE ADDRESS 0 CONTENTS
2116 017432  005037  000000                          CLR @#0                 ;ALL 0'S TO LOCATION 0
2117 017436  005003                                  CLR R3                  ;ADDRESS 0 TO R3
2118 017440  013700  000114                          MOV @#114,R0            ;SAVE VECTORS
2119 017444  013701  000116                          MOV @#116,R1
```

```
2120 017450  012737  017570  000114          MOV #4$,@#114          ;SETUP FOR TRAP
2121 017456  012737  000340  000116          MOV #340,@#116
2122
2123 017464  112737  000002  177750          MOVB #2,@#177750       ;HODO ALLOWS CACHE UPDATES
2124                                                                ;AND CLOCKING OF PARITY INFO TO INTERRUPT LOGIC
2125                                                                ; ONLY DURING THE DESTINATION ACCESS OF
2126                                                                ;AN INSTRUCTION.
2127 017472  005005                          CLR R5                 ;CLEAR ERROR FLAG
2128 017474  012704  177777                  MOV #-1,R4             ;ALL 1'S TO R4
2129 017500  012737  000015  177746          MOV #15,@#177746       ;NO UCB SO AS TO WRITE CACHE STORES
2130 017506  005713                          TST (R3)               ;
2131 017510  005737  040000                  TST @#40000            ;UPDATE CACHE LOCATION 0000 WITH CORRECT PARITY STOR
2132 017514  052737  000100  177746          BIS #100,@#177746      ;ALLOW WRITE WRONG PARITY DATA TO LO
2133                                                                ;& HI BYTE PARITY STORE.
2134 017522  005713                          TST (R3)               ;READ UPDATE TO CACHE LOCATION 0000
2135                                                                ;WRITE WRONG PARITY TO HI/LO BYTE PARITY STORES
2136 017524  042737  000100  177746          BIC #100,@#177746      ;DISABLE WWPD
2137 017532  005037  177744                  CLR @#177744           ;CLEAR CME AND PARITY DETECT LOGIC
2138 017536  042737  000004  177746          BIC #4,@#177746        ; ENABLE LOW CACHE
2139 017544  052737  000200  177746          BIS #200,@#177746      ;ALLOW FOR ABORT
2140 017552  011304                          MOV (R3),R4            ;READ HIT;
2141                                                                ;LO & HI BYTE PARITY CHECK GENERATORS WILL
2142                                                                ; DETECT  WRONG PARITY
2143                                                                ;USING HODO AND SOURCE MODE FOR READING
2144                                                                ;LOCATION 0 WILL INHIBIT PARITY ERROR
2145                                                                ;FROM BEING CLOCKED TO INTERRUPT LOGIC
2146                                                                ;HOWEVER, THE PARITY ERROR SIGNAL
2147                                                                ;WILL CAUSE THE ABORT SIGNAL TO BE
2148                                                                ;ASSERTED.THE ABORT SIGNAL WILL BE
2149                                                                ;CAUSE CME<15> TO BE SET.
2150                                                                ;THIS INSTRUCTION SHOULD BE ABORTED
2151 017554  000240                          NOP
2152 017556  005205                          INC R5                 ;INDICATE NO TRAP OCCURED
2153 017560  012737  001015  177746          MOV #1015,@#177746     ;DISABLE CACHE
2154 017566  000404                          BR 5$
2155 017570  012737  001015  177746  4$:     MOV #1015,@#177746     ;DISABLE CACHE
2156 017576  022626                          CMP (R6)+,(R6)+        ;READJUST STACK
2157
2158 017600  000240                  5$:     NOP
2159 017602  000240                          NOP
2160 017604  105037  177750                  CLRB @#177750          ;DISABLE MAINT. MODE
2161 017610  010237  000000                  MOV R2,@#0             ;RESTORE VECTORS
2162 017614  010037  000114                  MOV R0,@#114
2163 017620  010137  000116                  MOV R1,@#116
2164 017624  052737  000400  177746          BIS #400,@#177746      ;BEFORE LEAVING TEST FLUSH CACHE TO
2165                                                                ;ELIMINATE ANY EFFECTS OF WWPD
2166 017632  032737  010000  177746          BIT #10000,@#177746    ;WAIT TILL DONE
2167 017640  001374                          BNE .-6
2168 017642  022704  177777          8$:     CMP #-1,R4             ;WAS INSTRUCTION ABORTED LEAVING R4 INTACT?
2169 017646  001401                          BEQ 9$                 ;YES
2170 017650  000000                          HALT                   ;INTERRUPT/ABORT TESTS
2171                                                                ;R4 WAS OVERWRITTEN WITH DATA INDICATING
2172                                                                ;THAT INSTRUCTION WAS NOT ABORTED
2173 017652  005705                  9$:     TST R5                 ;DID TRAP OCCUR
2174 017654  001401                          BEQ 10$                ;YES;PASS
2175 017656  000000                          HALT                   ;INTERRUPT/ABORT TESTS
2176                                          .                      ;TRAP DID NOT OCCUR DUE TO ABORT
```

```
   2177 017660  000240                          10$:    NOP             ;END OF TEST
   2178 017662  000240                                  NOP
   2179
   2180
   2181
   2182
   2183
   2184
```

```
 2186 017664  000167  001362                JMP SEQP
 2187
 2188
 2189          020000                       .=20000
 2190
 2191
 2192
```

```
2194                                    .SBTTL  APT PARAMETER BLOCK

                                        ;;******************************************************************
                                        ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
                                        ;;******************************************************************
                 020000                         .$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 020000                         $APTHDR ;;POINT TO APT HEADER BLOCK
                 020000                         .-.$X   ;;RESET LOCATION COUNTER
                                        ;;******************************************************************
                                        ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
                                        ;INTERFACE SPEC.

          020000                        $APTHD:
          020000 000000                 $HIBTS: .WORD   0       ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
          020002 020014                 $MBADR: .WORD   $MAIL   ;;ADDRESS OF APT MAILBOX (BITS 0-15)
          020004 000005                 $TSTM:  .WORD   5       ;;RUN TIM OF LONGEST TEST
          020006 000010                 $PASTM: .WORD   10      ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
          020010 000000                 $UNITM: .WORD   0       ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
          020012 000052                         .WORD   $ETEND-$MAIL/2 ;;LENGTH MAILBOX-ETABLE(WORDS)
2195                                    .SBTTL  APT MAILBOX-ETABLE

                                        ;;******************************************************************
                                        .EVEN
          020014                        $MAIL:                  ;;APT MAILBOX
          020014 000000                 $MSGTY: .WORD   AMSGTY  ;;MESSAGE TYPE CODE
          020016 000000                 $FATAL: .WORD   AFATAL  ;;FATAL ERROR NUMBER
          020020 000000                 $TESTN: .WORD   ATESTN  ;;TEST NUMBER
          020022 000000                 $PASS:  .WORD   APASS   ;;PASS COUNT
          020024 000000                 $DEVCT: .WORD   ADEVCT  ;;DEVICE COUNT
          020026 000000                 $UNIT:  .WORD   AUNIT   ;;I/O UNIT NUMBER
          020030 000000                 $MSGAD: .WORD   AMSGAD  ;;MESSAGE ADDRESS
          020032 000000                 $MSGLG: .WORD   AMSGLG  ;;MESSAGE LENGTH
          020034                        $ETABLE:                ;;APT ENVIRONMENT TABLE
          020034      000               $ENV:   .BYTE   AENV    ;;ENVIRONMENT BYTE
          020035      000               $ENVM:  .BYTE   AENVM   ;;ENVIRONMENT MODE BITS
          020036 000000                 $SWREG: .WORD   ASWREG  ;;APT SWITCH REGISTER
          020040 000000                 $USWR:  .WORD   AUSWR   ;;USER SWITCHES
          020042 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
          020044      000               $MAMS1: .BYTE   AMAMS1  ;;HIGH ADDRESS,M.S. BYTE
          020045      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
          020046 000000                 $MADR1: .WORD   AMADR1  ;;HIGH ADDRESS,BLK#1
                                        ;*                        MEM.LAST ADDR.=3 BYTES,THIS WORD AND LOW OF "TYPE" ABOVE
          020050      000               $MAMS2: .BYTE   AMAMS2  ;;HIGH ADDRESS,M.S. BYTE
          020051      C                 $MTYP2: .BYTE   AMTYP2  ;;MEM.TYPE,BLK#2
```

```
020052  000000                  $MADR2: .WORD   AMADR2  ;;MEM.LAST ADDRESS,BLK#2
020054     000                  $MAMS3: .BYTE   AMAMS3  ;;HIGH ADDRESS,M.S.BYTE
020055     000                  $MTYP3: .BYTE   AMTYP3  ;;MEM.TYPE,BLK#3
020056  000000                  $MADR3: .WORD   AMADR3  ;;MEM.LAST ADDRESS,BLK#3
020060     000                  $MAMS4: .BYTE   AMAMS4  ;;HIGH ADDRESS,M.S.BYTE
020061     000                  $MTYP4: .BYTE   AMTYP4  ;;MEM.TYPE,BLK#4
020062  000000                  $MADR4: .WORD   AMADR4  ;;MEM.LAST ADDRESS,BLK#4
020064  000000                  $VECT1: .WORD   AVECT1  ;;INTERRUPT VECTOR#1,BUS PRIORITY#1
020066  000000                  $VECT2: .WORD   AVECT2  ;;INTERRUPT VECTOR#2BUS PRIORITY#2
020070  000000                  $BASE:  .WORD   ABASE   ;;BASE ADDRESS OF EQUIPMENT UNDER TEST
020072  000000                  $DEVM:  .WORD   ADEVM   ;;DEVICE MAP
020074  000000                  $CDW1:  .WORD   ACDW1   ;;CONTROLLER DESCRIPTION WORD#1
020076  000000                  $CDW2:  .WORD   ACDW2   ;;CONTROLLER DESCRIPTION WORD#2
020100  000000                  $DDW0:  .WORD   ADDW0   ;;DEVICE DESCRIPTOR WORD#0
020102  000000                  $DDW1:  .WORD   ADDW1   ;;DEVICE DESCRIPTOR WORD#1
020104  000000                  $DDW2:  .WORD   ADDW2   ;;DEVICE DESCRIPTOR WORD#2
020106  000000                  $DDW3:  .WORD   ADDW3   ;;DEVICE DESCRIPTOR WORD#3
020110  000000                  $DDW4:  .WORD   ADDW4   ;;DEVICE DESCRIPTOR WORD#4
020112  000000                  $DDW5:  .WORD   ADDW5   ;;DEVICE DESCRIPTOR WORD#5
020114  000000                  $DDW6:  .WORD   ADDW6   ;;DEVICE DESCRIPTOR WORD#6
020116  000000                  $DDW7:  .WORD   ADDW7   ;;DEVICE DESCRIPTOR WORD#7
020120  000000                  $DDW8:  .WORD   ADDW8   ;;DEVICE DESCRIPTOR WORD#8
020122  000000                  $DDW9:  .WORD   ADDW9   ;;DEVICE DESCRIPTOR WORD#9
020124  000000                  $DDW10: .WORD   ADDW10  ;;DEVICE DESCRIPTOR WORD#10
020126  000000                  $DDW11: .WORD   ADDW11  ;;DEVICE DESCRIPTOR WORD#11
020130  000000                  $DDW12: .WORD   ADDW12  ;;DEVICE DESCRIPTOR WORD#12
020132  000000                  $DDW13: .WORD   ADDW13  ;;DEVICE DESCRIPTOR WORD#13
020134  000000                  $DDW14: .WORD   ADDW14  ;;DEVICE DESCRIPTOR WORD#14
020136  000000                  $DDW15: .WORD   ADDW15  ;;DEVICE DESCRIPTOR WORD#15

020140                          $ETEND:

2196                            ;;**************************************** **********************

                                .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

020140                          $SCOPE:
020140  005067  161154                  CLR     RETRY           ;CLEAR RETRY FLAG AN THE START OF
                                                                ;EACH TEST
020144  005067  161106                  CLR     ERRCNT          ;CLEAR THE MULTIPLE ERROR COUNTER
020150  005067  161060                  CLR     DATAOR          ;LOCATION FOR LOGICAL OR OF BAD DATA
020154  005067  161050                  CLR     ADDROR          ;LOCATION FOR LOGICAL OR OF ADDRESS
020160  005067  161054                  CLR     PATTOR          ;LOCATION FOR LOGICAL OR OF PATTERN LOADED
020164  012700  177777                  MOV     #-1,R0          ;LOAD -1 INTO R0 TO INITIALIZE LOGICAL AND (
020170  010067  161036                  MOV     R0,DATAND       ;LOCATION FOR LOGICAL AND OF BAD DATA
```

```
020174  010067  161026                  MOV     R0,ADRAND       ;LOCATION FOR LOGICAL AND OF ADDRESS
020200  010067  161032                  MOV     R0,PATAND       ;LOCATION FOR LOGICAL AND OF PATTERN LOADED
020204  032777  040000  160736          BIT     #40000,@SWR     ;;** LOOP ON PRESENT TEST?
020212  001117                          BNE     $OVER           ;;** YES IF SW14=1
                        ;#####START OF CODE FOR THE XOR TESTER#####
020214  000416          $XTSTR: BR      6$                      ;;IF RUNNING ON THE "XOR" TESTER CHANGE
                                                                ;;THIS INSTRUCTION TO A "NOP" (NOP-240)
020216  013746  000004                  MOV     @#ERRVEC,-(SP)  ;;SAVE THE CONTENTS OF THE ERROR VECTOR
020222  012737  020242  000004          MOV     #5$,@#ERRVEC    ;;SET FOR TIMEOUT
020230  005737  177060                  TST     @#177060        ;;TIME OUT ON XOR?
020234  012637  000004                  MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
020240  000466                          BR      $SVLAD          ;;GO TO THE NEXT TEST
020242  022626          5$:     CMP     (SP)+,(SP)+             ;;CLEAR THE STACK AFTER A TIME OUT
020244  012637  000004                  MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
020250  000426                          BR      7$              ;;LOOP ON THE PRESENT TEST
020252                  6$:;#####END OF CODE FOR THE XOR TESTER#####
020252  032777  000400  160670          BIT     #BIT08,@SWR     ;;** LOOP ON SPEC. TEST?
020260  001407                          BEQ     2$              ;;BR IF NO
020262  017746  160662                  MOV     @SWR,-(SP)      ;;** SET DESIRED TEST NUM. FROM SWR
020266  042716  000300                  BIC     #$SWRMK,(SP)    ;;STRIP AWAY UNDESIRED BITS
020272  122667  160602                  CMPB    (SP)+,$TSTNM    ;;ON THE RIGHT TEST?
020276  001465                          BEQ     $CVER           ;;BR IF YES
020300  105767  160575          2$:     TSTB    $ERFLG          ;;HAS AN ERROR OCCURRED?
020304  001421                          BEQ     3$              ;;BR IF NO
020306  126767  160601  160565          CMPB    $ERMAX,$ERFLG   ;;MAX. ERRORS FOR THIS TEST OCCURRED?
020314  101015                          BHI     3$              ;;BR IF NO
020316  032777  001000  160624          BIT     #BIT09,@SWR     ;;** LOOP ON ERROR?
020324  001404                          BEQ     4$              ;;BR IF NO
020326  016767  160554  160550  7$:     MOV     $LPERR,$LPADR   ;;SET LOOP ADDRESS TO LAST SCOPE
020334  000446                          BR      $OVER
020336  105067  160537          4$:     CLRB    $ERFLG          ;;ZERO THE ERROR FLAG
020342  005067  160640                  CLR     $TIMES          ;;CLEAR THE NUMBER OF ITERATIONS TO MAKE
020346  000415                          BR      1$              ;;ESCAPE TO THE NEXT TEST
020350  032777  004000  160572  3$:     BIT     #BIT11,@SWR     ;;** INHIBIT ITERATIONS?
020356  001011                          BNE     1$              ;;BR IF YES
020360  005767  177436                  TST     $PASS           ;;IF FIRST PASS OF PROGRAM
020364  001406                          BEQ     1$              ;;      INHIBIT ITERATIONS
020366  005267  160510                  INC     $ICNT           ;;INCREMENT ITERATION COUNT
020372  026767  160610  160502          CMP     $TIMES,$ICNT    ;;CHECK THE NUMBER OF ITERATIONS MADE
020400  002024                          BGE     $OVER           ;;BR IF MORE ITERATION REQUIRED
020402  012767  000001  160472  1$.     MOV     #1,$ICNT        ;;REINITIALIZE THE ITERATION COUNTER
020410  016767  000052  160570          MOV     $MXCNT,$TIMES   ;;SET NUMBER OF ITERATIONS TO DO
020416  105267  160456          $SVLAD: INCB    $TSTNM          ;;COUNT TEST NUMBERS
020422  116767  160452  177370          MOVB    $TSTNM,$TESTN   ;;** SET TEST # IN APT MAILBOX
020430  011667  160450                  MOV     (SP),$LPADR     ;;SAVE SCOPE LOOP ADDRESS
020434  011667  160446                  MOV     (SP),$LPERR     ;;SAVE ERROR LOOP ADDRESS
020440  005067  160544                  CLR     $ESCAPE         ;;CLEAR THE ESCAPE FROM ERROR ADDRESS
020444  112767  000001  160441          MOVB    #1,$ERMAX       ;;ONLY ALLOW ONE(1) ERROR ON NEXT TEST
020452  016777  160422  160472  $OVER:  MOV     $TSTNM,@DISPLAY         ;;** DISPLAY TEST NUMBER
020460  016716  160420                  MOV     $LPADR,(SP)     ;;FUDGE RETURN ADDRESS
020464  000002                          RTI                     ;;FIXES PS
020466  000002          $MXCNT: 2.                              ;;MAX. NUMBER OF ITERATIONS
2197                    ;;**************************************************************

                        .SBTTL  ERROR HANDLER ROUTINE

                        ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
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                                        ;*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
                                        ;*              HALT CAN OCCUR BEFORE AND AFTER THE ERROR TYPEOUT
                                        ;*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

020470                                  $ERROR:
020470  116767  160404  160566          MOVB    $TSTNM,TESTNO   ;SAVE TEST NUMBER FOR ERROR TYPE OUT
020476  005267  160554                  INC     ERRCNT          ;COUNT ALL MULTIPLE ERRORS
020502  010067  160450                  MOV     R0,$REG0        ;SAVE R0 FOR POSSIBLE TYPE OUT
020506  010167  160446                  MOV     R1,$REG1        ;SAVE R1 FOR POSSIBLE TYPE OUT
020512  010267  160444                  MOV     R2,$REG2        ;SAVE R2 FOR POSSIBLE TYPE OUT
020516  010367  160442                  MOV     R3,$REG3        ;SAVE R3 FOR POSSIBLE TYPE OUT
020522  010467  160440                  MOV     R4,$REG4        ;SAVE R4 FOR POSSIBLE TYPE OUT
020526  010567  160436                  MOV     R5,$REG5        ;SAVE R5 FOR POSSIBLE TYPE OUT
020532  105267  160343          7$:     INCB    $ERFLG          ;;SET THE ERROR FLAG
020536  001775                  BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
020540  016777  160334  160404          MOV     $TSTNM,@DISPLAY ;;** DISPLAY TEST NUMBER AND ERROR FLAG
020546  005777  160376                  TST     @SWR            ;;** HALT ON ERROR = 1?
020552  100001                  BPL     8$              ;;BRANCH IF NO
020554  000000                  HALT                    ;;YES--HALT
020556  032777  002000  160364  8$:     BIT     #BIT10,@SWR     ;;** BELL ON ERROR?
020564  001402                  BEQ     1$              ;;NO - SKIP
020566  104400  001212                  TYPE    ,$BELL          ;;RING BELL
020572  005267  160312          1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
020576  011667  160312                  MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
020602  162767  000002  160304          SUB     #2,$ERRPC
020610  117767  160300  160274          MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
020616  032777  020000  160324          BIT     #BIT13,@SWR     ;;** SKIP TYPEOUT IF SET
020624  001017                  BNE     2$              ;;SKIP TYPEOUTS
020626  004767  161104                  JSR     PC,ERTYPE       ;;GO TO USER ERROR ROUTINE
020632  104400  001217                  TYPE    ,$CRLF

020636  122767  000001  177170          CMPB    #1,$ENV         ;;** IS THIS APT?
020644  001007                  BNE     2$              ;;** NO
020646  116767  160240  000004          MOVB    $ITEMB,21$      ;;**
020654  004767  000142                  JSR     PC,$ATY4        ;;**
020660     000          21$:    .BYTE   0               ;;**
020661     000                  .BYTE   0               ;;**
020662  000777          22$:    BR      22$             ;;**

020664  005777  160260          2$:     TST     @SWR            ;;** HALT ON ERROR
020670  100001                  BPL     9$              ;;SKIP IF CONTINUE
020672  000000                  HALT                    ;;HALT ON ERROR.
020674  022767  021472  157140  9$:     CMP     #$ENDAD,42      ;;ACT-11?
020702  001001                  BNE     3$              ;;BRANCH IF NO
020704  000000                  HALT                    ;;YES
020706  032777  001000  160234  3$:     BIT     #BIT09,@SWR     ;;** LOOP ON ERROR SWITCH SET?
020714  001402                  BEQ     4$              ;;BR IF NO
020716  016716  160164                  MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
020722  005767  160262          4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
020726  001402                  BEQ     5$              ;;BR IF NONE
```

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020730  016716  160254                  MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
020734                          5$:
020734  032777  001000  160206          BIT     #SW9,@SWR       ;ARE YOU LOOPING ON THIS ERROR?
020742  001417                          BEQ     EREXIT          ;BRANCH IF NOT LOOPING ON ERROR
020744  012737  177777  177766          MOV     #-1,@#CPUERR    ;CLEAR CPU ERROR REGISTER
020752  042737  177776  177572          BIC     #177776,@#MMR0  ;CLEAR MEMORY MANAGEMENT STATUS REGISTER
020760  012767  177777  163152          MOV     #-1,TOFLAG      ;INITIALIZE TRAP FLAG
020766  012767  177777  163570          MOV     #-1,CPFLAG      ;INITIALIZE CP TRAP FLAG
020774  012767  177777  163674          MOV     #-1,MMFLAG      ;INITIALIZE MEMORY MANAGEMENT TRAP FLAG
021002  000002                  EREXIT: RTI                     ;RETURN TO TEST
  2198                          .SBTTL  APT COMMUNICATIONS ROUTINE
                                ;;**************************************************************
021004  112767  000001  000236  $ATY1:  MOVB    #1,$FFLG        ;;TO REPORT FATAL ERROR
021012  112767  000001  000226  $ATY3:  MOVB    #1,$MFLG        ;;TO TYPE A MESSAGE
021020  000403                  BR      $ATYC
021022  112767  000001  000220  $ATY4:  MOVB    #1,$FFLG        ;;TO ONLY REPORT FATAL ERROR
021030                          $ATYC:
021030  010046                  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
021032  010146                  MOV     R1,-(SP)        ;;PUSH R1 ON STACK
021034  105767  000206          TSTB    $MFLG           ;;SHOULD TYPE A MESSAGE?
021040  001450                  BEQ     5$              ;;IF NOT:  BR
021042  122767  000001  176764  CMPB    #APTENV,$ENV    ;;OPERATING UNDER APT?
021050  001031                  BNE     3$              ;;IF NOT:  BR
021052  132767  000100  176755  BITB    #APTSPOOL,$ENVM ;;SHOULD SPOOL MESSAGES?
021060  001425                  BEQ     3$              ;;IF NOT:  BR
021062  017600  000004          MOV     @4(SP),R0       ;;GET MESSAGE ADDR.
021066  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
021074  005767  176714  1$:     TST     $MSGTYPE        ;;SEE IF DONE W/ LAST XMISSION?
021100  001375                  BNE     1$              ;;IF NOT:  WAIT
021102  010067  176722          MOV     R0,$MSGAD       ;;PUT ADDR IN MAILBOX
021106  105720          2$:     TSTB    (R0)+           ;;FIND END OF MESSAGE
021110  001376                  BNE     2$
021112  166700  176712          SUB     $MSGAD,R0       ;;SUB START OF MESSAGE
021116  006200                  ASR     R0              ;;GET MESSAGE LNGTH IN WORDS
021120  010067  176706          MOV     R0,$MSGLGT      ;;PUT LENGTH IN MAILBOX
021124  012767  000004  176662  MOV     #4,$MSGTYPE     ;;TELL APT TO TAKE MSG.
021132  000413                  BR      5$
021134  017667  000004  000016  3$:     MOV     @4(SP),4$       ;;PUT MSG ADDR IN JSR LINKAGE
021142  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDRESS
021150  016746  156622          MOV     177776,-(SP)    ;;PUSH 177776 ON STACK
021154  004767  161344          JSR     PC,$TYPE        ;;CALL TYPE MACRO
021160  000000          4$:     .WORD   0
021162                          5$:
021162  105767  000062  10$:    TSTB    $FFLG           ;;SHOULD REPORT FATAL ERROR?
021166  001416                  BEQ     12$             ;;IF NOT:  BR
021170  005767  176640          TST     $ENV            ;;RUNNING UNDER APT?
021174  001413                  BEQ     12$             ;;IF NOT:  BR
021176  005767  176612  11$:    TST     $MSGTYPE        ;;FINISHED LAST MESSAGE?
021202  001375                  BNE     11$             ;;IF NOT:  WAIT
021204  017667  000004  176604  MOV     @4(SP),$FATAL   ;;GET ERROR #
021212  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
021220  005267  176570          INC     $MSGTYPE        ;;TELL APT TO TAKE ERROR
021224  105067  000020  12$:    CLRB    $FFLG           ;;CLEAR FATAL FLAG
021230  105067  000013          CLRB    $LFLG           ;;CLEAR LOG FLAG
021234  105067  000006          CLRB    $MFLG           ;;CLEAR MESSAGE FLAG
021240  012601                  MOV     (SP)+,R1        ;;POP STACK INTO R1
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021242  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
021244  000207                          RTS     PC              ;;RETURN
021246     000          $MFLG:  .BYTE   0               ;;MESSG. FLAG
021247     000          $LFLG:  .BYTE   0               ;;LOG FLAG
021250     000          $FFLG:  .BYTE   0               ;;FATAL FLAG
                                .EVEN
            000200      APTSIZE=200
            000001      APTENV=001
            000100      APTSPOOL=100
            000040      APTCSUP=040
2136                    ;;**************************************************************

                        .SBTTL  END OF PASS ROUTINE

                        ;*INCREMENT THE PASS NUMBER ($PASS)
                        ;*INDICATE END-OF-PROGRAM AFTER 1 PASSES THRU THE PROGRAM
                        ;*TYPE 'END PASS #XXXXX TOTAL NUMBER OF ERRORS SINCE LAST REPORT YYYYY''
                        ;*WHERE XXXXX AND YYYYY ARE DECIMAL NUMBERS
                        ;*IF SW12=1 INHIBIT TRACE TRAP
                        ;*IF THERES A MONITOR GO TO IT
                        ;*IF THERE ISN'T JUMP TO LOOP

021252                  $EOP:
021252  000004                          SCOPE                   ;LOOP ON LAST TEST
021254  005067  156312                  CLR     MMR0            ;TURN OFF FULL RELOCATION
021260  005067  151232                  CLR     MMR3            ;DISABLE THE UNIBUS MAP
021264  104420                          TBITR                   ;RESTORE THE T BIT IF IT WAS ON
021266  005067  157606                  CLR     $TSTNM          ;;ZERO THE TEST NUMBER
021272  005067  157710                  CLR     $TIMES          ;;ZERO THE NUMBER OF ITERATIONS
021276  005267  176520                  INC     $PASS           ;;INCREMENT THE PASS NUMBER
021302  042767  100000  176512        BIC     #100000,$PASS   ;;DON'T ALLOW A NEG. NUMBER
021310  005327                          DEC     (PC)+           ;;LOOP?
021312  000001          $EOPCT: .WORD   1
021314  003072                          BGT     $DOAGN          ;;YES
021316  012737                          MOV     (PC)+,@(PC)+    ;;RESTORE COUNTER
021320  000001          $ENDCT: .WORD   1
021322  021312                          $EOPCT
021324  104400  021332                  TYPE    ,65$            ;;TYPE ASCIZ STRING
021330  000407                          BR      64$             ;;GET OVER THE ASCIZ
                        ;;65$:  .ASCIZ  <12><15>/END PASS #/
021350                  64$:
021350  016746  176446                  MOV     $PASS,-(SP)     ;;SAVE $PASS FOR TYPEOUT
                                                                ;;TYPE PASS NUMBER
021354  104410                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
021356  104400  021364                  TYPE    ,67$            ;;TYPE ASCIZ STRING
021362  000421                          BR      66$             ;;GET OVER THE ASCIZ
                        ;;67$:  .ASCIZ  /  TOTAL ERRORS SINCE LAST REPORT /
021426                  66$:
021426  016746  157456                  MOV     $ERTTL,-(SP)    ;;SAVE $ERTTL FOR TYPEOUT
                                                                ;;TOTAL NUMBER OF ERRORS
021432  104410                          TYPDS                   ;;GO TYPE--DECIMAL ASCII WITH SIGN
021434  104400  001217                  TYPE    ,$CRLF          ;;TYPE CARRIAGE RETURN, LINE FEED
021440  005067  157444                  CLR     $ERTTL          ;;CLEAR ERROR TOTAL
021444  013700  000042      $GET42: MOV     @#42,R0         ;;GET MONITOR ADDRESS
021450  001414                          BEQ     $DOAGN          ;;BRANCH IF NO MONITOR
021452  005046                          CLR     -(SP)           ;;INSURE THE "T" BIT IS CLEAR
021454  012746  021462                  MOV     #$CLR,T,-(SP)   ;;SETUP FOR AN RTI OR RTT
```

```
021460  000427                          BR      $RTRN           ;;GO DO AN RTI OR RTT TO LOAD THE PSW
                                                                ;;WITH A CLEARED 'T' BIT
021462                          $CLR.T:
021462  013700  000042                  MOV     @#42,R0         ;;INSURE R0 CONTAINS THE MONITORS
021466  001405                          BEQ     $DOAGN          ;;RETURN ADDRESS
021470  000005                          RESET                   ;;CLEAR THE WORLD
021472  004710                  $ENDAD: JSR     PC,(R0)         ;;GO TO MONITOR
021474  000240                          NOP                     ;;SAVE ROOM
021476  000240                          NOP                     ;;FOR
021500  000240                          NOP                     ;;ACT11
021502                          $DOAGN:
021502  013746  177776                  MOV     @#PS,-(SP)      ;;PUT THE PS ON THE STACK AND
021506  042716  000020                  BIC     #20,(SP)        ;;CLEAR THE 'T' BIT
021512  032777  010000  157430          BIT     #BIT12,@SWR     ;;** RUN WITH TRACE TRAP?
021520  001005                          BNE     1$              ;;BR IF NO
021522  005167  000020                  COM     $TBIT           ;;IS IT TIME FOR TRACE TRAP
021526  100402                          BMI     1$              ;;BR IF NO
021530  052716  000020                  BIS     #20,(SP)        ;;SET TRACE TRAP
021534  012746  021542          1$:     MOV     #$LOOP,-(SP)    ;;JUMP TO START OF TEST
021540  000002                  $RTRN:  RTI                     ;;RETURN--THIS IS CHANGED TO
                                                                ;;AN 'RTT' IF 'RTT' IS A LEGAL
                                                                ;;INSTRUCTION
021542                          $LOOP:
021542  000137  010332                  JMP     @#LOOP          ;;RETURN
021546  000000                  $TBIT:  .WORD   0               ;;'T' BIT STATE INDICATOR
021550     377     377     000  $ENULL: .BYTE   -1,-1,0         ;;NULL CHARACTER STRING
                                .EVEN
```

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                                .SBTTL  ERROR MESSAGES AND DATA TABLES
021554  116  117  124  EM1:     .ASCIZ  ?NOT THE CORRECT TRAP CONDITION THRU ERRVEC (#004)?
021557  040  124  110
021562  105  040  103
021565  117  122  122
021570  105  103  124
021573  040  124  122
021576  101  120  040
021601  103  117  116
021604  104  111  124
021607  111  117  116
021612  040  124  110
021615  122  125  040
021620  105  122  122
021623  126  105  103
021626  040  050  043
021631  060  060  064
021634  051  000
021636  125  116  105  EM2:     .ASCIZ  ?UNEXPECTED CPU TRAP THRU ERRVEC (#004)?
021641  130  120  105
021644  103  124  105
021647  104  040  103
021652  120  125  040
021655  124  122  101
021660  120  040  124
021663  110  122  125
021666  040  105  122
021671  122  126  105
021674  103  040  050
021677  043  060  060
021702  064  051  000
021705  125  116  105  EM3:     .ASCIZ  ?UNEXPECTED CACHE PARITY ERROR THRU CACHVEC, WILL RETRY TEST ONCE?
021710  130  120  105
021713  103  124  105
021716  104  040  103
021721  101  103  110
021724  105  040  120
021727  101  122  111
021732  124  131  040
021735  105  122  122
021740  117  122  040
021743  124  110  122
021746  125  040  103
021751  101  103  110
021754  126  105  103
021757  054  040  127
021762  111  114  114
021765  040  122  105
021770  124  122  131
021773  040  124  105
021776  123  124  040
022001  117  116  103
022004  105  000
022006  125  116  105  EM4:     .ASCIZ  ?UNEXPECTED MAIN MEMORY PARITY ERROR THRU CACHVEC, WILL RETRY TEST ONCE?
022011  130  120  105
022014  103  124  105
022017  104  040  115
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        022022  101     111     116
        022025  040     115     105
        022030  115     117     122
        022033  131     040     120
        022036  101     122     111
        022041  124     131     040
        022044  105     122     122
        022047  117     122     040
        022052  124     110     122
        022055  125     040     103
        022060  101     103     110
        022063  126     105     103
        022066  054     040     127
        022071  111     114     114
        022074  040     122     105
        022077  124     122     131
        022102  040     124     105
        022105  123     124     040
        022110  117     116     103
        022113  105     000
 2206   022115  125     116     105  EM5:    .ASCIZ  ?UNEXPECTED MEMORY MANAGEMENT TRAP, MEMORY MANAGEMENT STATUS REGISTERS?
        022120  130     120     105
        022123  103     124     105
        022126  104     040     115
        022131  105     115     117
        022134  122     131     040
        022137  115     101     116
        022142  101     107     105
        022145  115     105     116
        022150  124     040     124
        022153  122     101     120
        022156  054     040     115
        022161  105     115     117
        022164  122     131     040
        022167  115     101     116
        022172  101     107     105
        022175  115     105     116
        022200  124     040     123
        022203  124     101     124
        022206  125     123     040
        022211  122     105     107
        022214  111     123     124
        022217  105     122     123
        022222  000
 2207   022223  123     125     115  EM6:    .ASCIZ  ?SUMMARY OF MAP REGISTERS THAT TIMED OUT ON READ?
        022226  115     101     122
        022231  131     040     117
        022234  106     040     115
        022237  101     120     040
        022242  122     105     107
        022245  111     123     124
        022250  105     122     123
        022253  040     124     110
        022256  101     124     040
        022261  124     111     115
        022264  105     104     040
        022267  117     125     124
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        022272  040  117  116
        022275  040  122  105
        022300  101  104  000
2208    022303  123  125  115  EM7:    .ASCIZ  ?SUMMARY OF CACHE REGISTERS THAT TIMED OUT ON READ?
        022306  115  101  122
        022311  131  040  117
        022314  106  040  103
        022317  101  103  110
        022322  105  040  122
        022325  105  107  111
        022330  123  124  105
        022333  122  123  040
        022336  124  110  101
        022341  124  040  124
        022344  111  115  105
        022347  104  040  117
        022352  125  124  040
        022355  117  116  040
        022360  122  105  101
        022363  104  000
2209    022365  123  125  115  EM10:   .ASCIZ  ?SUMMARY OF MAP REGISTERS NOT HOLDING ZERO IN LOW 16 BITS?
        022370  115  101  122
        022373  131  040  117
        022376  106  040  115
        022401  101  120  040
        022404  122  105  107
        022407  111  123  124
        022412  105  122  123
        022415  040  116  117
        022420  124  040  110
        022423  117  114  104
        022426  111  116  107
        022431  040  132  105
        022434  122  117  040
        022437  111  116  040
        022442  114  117  127
        022445  040  061  066
        022450  040  102  111
        022453  124  123  000
2210    022456  123  125  115  EM11:   .ASCIZ  ?SUMMARY OF MAP REGISTERS NOT HOLDING ZERO IN UPPER 6 BITS?
        022461  115  101  122
        022464  131  040  117
        022467  106  040  115
        022472  101  120  040
        022475  122  105  107
        022500  111  123  124
        022503  105  122  123
        022506  040  116  117
        022511  124  040  110
        022514  117  114  104
        022517  111  116  107
        022522  040  132  105
        022525  122  117  040
        022530  111  116  040
        022533  125  120  120
        022536  105  122  040
        022541  066  040  102
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        022544  111  124  123
        022547  000
 2211   022550  120  117  123  EM12:   .ASCIZ  ?POSSIBLE ERROR IN MAP REGISTER DATA PATH (MAP REG 00)?
        022553  123  111  102
        022556  114  105  040
        022561  105  122  122
        022564  117  122  040
        022567  111  116  040
        022572  115  101  120
        022575  040  122  105
        022600  107  111  123
        022603  124  105  122
        022606  040  104  101
        022611  124  101  040
        022614  120  101  124
        022617  110  040  050
        022622  115  101  120
        022625  040  122  105
        022630  107  040  060
        022633  060  051  000
 2212   022636  116  117  127  EM13:   .ASCIZ  ?NOW PROBABLE ERROR IN MAP REGISTER DATA PATH (MAP REG 20)?
        022641  040  120  122
        022644  117  102  101
        022647  102  114  105
        022652  040  105  122
        022655  122  117  122
        022660  040  111  116
        022663  040  115  101
        022666  120  040  122
        022671  105  107  111
        022674  123  124  105
        022677  122  040  104
        022702  101  124  101
        022705  040  120  101
        022710  124  110  040
        022713  050  115  101
        022716  120  040  122
        022721  105  107  040
        022724  062  060  051
        022727  000
 2213   022730  123  125  115  EM14:   .ASCIZ  ?SUMMARY OF DUAL ADDRESSING ERRORS ON LOADING MAP REGISTERS?
        022733  115  101  122
        022736  131  040  117
        022741  106  040  104
        022744  125  101  114
        022747  040  101  104
        022752  104  122  105
        022755  123  123  111
        022760  116  107  040
        022763  105  122  122
        022766  117  122  123
        022771  040  117  116
        022774  040  114  117
        022777  101  104  111
        023002  116  107  040
        023005  115  101  120
        023010  040  122  105
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                023013  107     111     123
                023016  124     105     122
                023021  123     000
     2214       023023  123     125     115     EM15:   .ASCIZ  ?SUMMARY OF COUNT PATTERN FAILURES IN LOWER 16 BITS OF MAP REGISTERS?
                023026  115     101     122
                023031  131     040     117
                023034  106     040     103
                023037  117     125     116
                023042  124     040     120
                023045  101     124     124
                023050  105     122     116
                023053  040     106     101
                023056  111     114     125
                023061  122     105     123
                023064  040     111     116
                023067  040     114     117
                023072  127     105     122
                023075  040     061     066
                023100  040     102     111
                023103  124     123     040
                023106  117     106     040
                023111  115     101     120
                023114  040     122     105
                023117  107     111     123
                023122  124     105     122
                023125  123     000
     2215       023127  123     125     115     EM16:   .ASCIZ  ?SUMMARY OF COUNT PATTERN FAILURES IN UPPER 6 BITS OF MAP REGISTERS?
                023132  115     101     122
                023135  131     040     117
                023140  106     040     103
                023143  117     125     116
                023146  124     040     120
                023151  101     124     124
                023154  105     122     116
                023157  040     106     101
                023162  111     114     125
                023165  122     105     123
                023170  040     111     116
                023173  040     125     120
                023176  120     105     122
                023201  040     066     040
                023204  102     111     124
                023207  123     040     117
                023212  106     040     115
                023215  101     120     040
                023220  122     105     107
                023223  111     123     124
                023226  105     122     123
                023231  000
     2216       023232  103     117     125     EM17:   .ASCII  ?COULD NOT CLEAR CACHE CONTROL REGISTER?<CRLF>
                023235  114     104     040
                023240  116     117     124
                023243  040     103     114
                023246  105     101     122
                023251  040     103     101
                023254  103     110     105
                023257  040     103     117
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        023262  116     124     122
        023265  117     114     040
        023270  122     105     103
        023273  111     123     124
        023276  105     122     200
  2217  023301  120     117     123             .ASCIZ  ?POSSIBLE ERROR IN CACHE REGISTER DATA PATH?
        023304  123     111     102
        023307  114     105     040
        023312  105     122     122
        023315  117     122     040
        023320  111     116     040
        023323  103     101     103
        023326  110     105     040
        023331  122     105     107
        023334  111     123     124
        023337  105     122     040
        023342  104     101     124
        023345  101     040     120
        023350  101     124     110
        023353  000
  2218  023354  103     117     125   EM20:     .ASCII  ?COULD NOT CLEAR CACHE MAINTENENCE REGISTER?<CRLF>
        023357  114     104     040
        023362  116     117     124
        023365  040     103     114
        023370  105     101     122
        023373  040     103     101
        023376  103     110     105
        023401  040     115     101
        023404  111     116     124
        023407  105     116     105
        023412  116     103     105
        023415  040     122     105
        023420  107     111     123
        023423  124     105     122
        023426  200
  2219  023427  120     117     123             .ASCIZ  ?POSSIBLE ERROR IN CACHE REGISTER DATA PATH?
        023432  123     111     102
        023435  114     105     040
        023440  105     122     122
        023443  117     122     040
        023446  111     116     040
        023451  103     101     103
        023454  110     105     040
        023457  122     105     107
        023462  111     123     124
        023465  105     122     040
        023470  104     101     124
        023473  101     040     120
        023476  101     124     110
        023501  000
  2220  023502  103     117     125   EM21:     .ASCII  ?COULD NOT READ 177740 FROM CACHE LO ADDRESS REG (LOADRS)?<CRLF>
        023505  114     104     040
        023510  116     117     124
        023513  040     122     105
        023516  101     104     040
        023521  061     067     067
        023524  067     064     060
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        023527  040     106     122
        023532  117     115     040
        023535  103     101     103
        023540  110     105     040
        023543  114     117     040
        023546  101     104     104
        023551  122     105     123
        023554  123     040     122
        023557  105     107     040
        023562  050     114     117
        023565  101     104     122
        023570  123     051     200
2221    023573  120     117     123         .ASCIZ  ?POSSIBLE ERROR IN CACHE REGISTER DATA PATH?
        023576  123     111     102
        023601  114     105     040
        023604  105     122     122
        023607  117     122     040
        023612  111     116     040
        023615  103     101     103
        023620  110     105     040
        023623  122     105     107
        023626  111     123     124
        023631  105     122     040
        023634  104     101     124
        023637  101     040     120
        023642  101     124     110
        023645  000
2222    023646  103     117     125 EM22:   .ASCII  ?COULD NOT READ 000003 FROM CACHE HI ADDRESS REG (HIADRS)?<CRLF>
        023651  114     104     040                                                    .
        023654  116     117     124
        023657  040     122     105
        023662  101     104     040
        023665  060     060     060
        023670  060     060     063
        023673  040     106     122
        023676  117     115     040
        023701  103     101     103
        023704  110     105     040
        023707  110     111     040
        023712  101     104     104
        023715  122     105     123
        023720  123     040     122
        023723  105     107     040
        023726  050     110     111
        023731  101     104     122
        023734  123     051     200
2223    023737  120     117     123         .ASCIZ  ?POSSIBLE ERROR IN CACHE REGISTER DATA PATH?
        023742  123     111     102
        023745  114     105     040
        023750  105     122     122
        023753  117     122     040
        023756  111     116     040
        023761  103     101     103
        023764  110     105     040
        023767  122     105     107
        023772  111     123     124
        023775  105     122     040
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                024000  104     101     124
                024003  101     040     120
                024006  101     124     110
                024011  000
2224            024012  123     125     115     EM23:   .ASCIZ  ?SUMMARY OF COUNT PATTERN FAILURES IN CACHE CONTROL REGISTER?
                024015  115     101     122
                024020  131     040     117
                024023  106     040     103
                024026  117     125     116
                024031  124     040     120
                024034  101     124     124
                024037  105     122     116
                024042  040     106     101
                024045  111     114     125
                024050  122     105     123
                024053  040     111     116
                024056  040     103     101
                024061  103     110     105
                024064  040     103     117
                024067  116     124     122
                024072  117     114     040
                024075  122     105     107
                024100  111     123     124
                024103  105     122     000
2225            024106  123     125     115     EM24:   .ASCIZ  ?SUMMARY OF COUNT PATTERN FAILURES IN CACHE MAINTENENCE REGISTER?
                024111  115     101     122
                024114  131     040     117
                024117  106     040     103
                024122  117     125     116
                024125  124     040     120
                024130  101     124     124
                024133  105     122     116
                024136  040     106     101
                024141  111     114     125
                024144  122     105     123
                024147  040     111     116
                024152  040     103     101
                024155  103     110     105
                024160  040     115     101
                024163  111     116     124
                024166  105     116     105
                024171  116     103     105
                024174  040     122     105
                024177  107     111     123
                024202  124     105     122
                024205  000
2226            024206  122     105     106     EM25:   .ASCIZ  ?REFERENCED MAP REGISTER 0 WITH ADDRESS ONE BIT DIFFERENT THAN 770200?
                024211  105     122     105
                024214  116     103     105
                024217  104     040     115
                024222  101     120     040
                024225  122     105     107
                024230  111     123     124
                024233  105     122     040
                024236  060     040     127
                024241  111     124     110
                024244  040     101     104
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                024247  104     122     105
                024252  123     123     040
                024255  117     116     105
                024260  040     102     111
                024263  124     040     104
                024266  111     106     106
                024271  105     122     105
                024274  116     124     040
                024277  124     110     101
                024302  116     040     067
                024305  067     060     062
                024310  060     060     000
2227            024313  122     105     106     EM26.   .ASCII  ?REFERENCED CACHE LOW ADDRESS REGISTER WITH ADDRESS ONE BIT?<CRLF>
                024316  105     122     105
                024321  116     103     105
                024324  104     040     103
                024327  101     103     110
                024332  105     040     114
                024335  117     127     040
                024340  101     104     104
                024343  122     105     123
                024346  123     040     122
                024351  105     107     111
                024354  123     124     105
                024357  122     040     127
                024362  111     124     110
                024365  040     101     104
                024370  104     122     105
                024373  123     123     040
                024376  117     116     105
                024401  040     102     111
                024404  124     200
2228            024406  104     111     106             .ASCIZ  ?DIFFERENT THAN 777740?
                024411  106     105     122
                024414  105     116     124
                024417  040     124     110
                024422  101     116     040
                024425  067     067     067
                024430  067     064     060
                024433  000
2229            024434  103     101     116     EM30:   .ASCII  ?CAN'T GET TO MAIN MEMORY FROM UNIBUS WITH THE MAP OFF?<CRLF>
                024437  047     124     040
                024442  107     105     124
                024445  040     124     117
                024450  040     115     101
                024453  111     116     040
                024456  115     105     115
                024461  117     122     131
                024464  040     106     122
                024467  117     115     040
                024472  125     116     111
                024475  102     125     123
                024500  040     127     111
                024503  124     110     040
                024506  124     110     105
                024511  040     115     101
                024514  120     040     117
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                024517  106     106     200
2230            024522  123     117     040             .ASCIZ  ?SO I'LL JUMP TO THE SIZE JUMPER TEST FOR VERIFICATION?
                024525  111     047     114
                024530  114     040     112
                024533  125     115     120
                024536  040     124     117
                024541  040     124     110
                024544  105     040     123
                024547  111     132     105
                024552  040     112     125
                024555  115     120     105
                024560  122     040     124
                024563  105     123     124
                024566  040     106     117
                024571  122     040     126
                024574  105     122     111
                024577  106     111     103
                024602  101     124     111
                024605  117     116     000
2231            024610  123     125     115     EM31:   .ASCIZ  ?SUMMARY OF COUNT PATTERN FAILURES ON THE UNIBUS DATA PATH?
                024613  115     101     122
                024616  131     040     117
                024621  106     040     103
                024624  117     125     116
                024627  124     040     120
                024632  101     124     124
                024635  105     122     116
                024640  040     106     101
                024643  111     114     125
                024646  122     105     123
                024651  040     117     116
                024654  040     124     110
                024657  105     040     125
                024662  116     111     102
                024665  125     123     040
                024670  104     101     124
                024673  101     040     120
                024676  101     124     110
                024701  000
2232            024702  125     116     111     EM32:   .ASCIZ  ?UNIBUS MAP IS RELOCATING WHEN NOT ENABLED?
                024705  102     125     123
                024710  040     115     101
                024713  120     040     111
                024716  123     040     122
                024721  105     114     117
                024724  103     101     124
                024727  111     116     107
                024732  040     127     110
                024735  105     116     040
                024740  116     117     124
                024743  040     105     116
                024746  101     102     114
                024751  105     104     000
2233            024754  103     101     116     EM33:   .ASCII  ?CANNOT USE ANY OF THE MAP REGISTERS.POSSIBLY DUE?<CRLF>
                024757  116     117     124
                024762  040     125     123
                024765  105     040     101
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                025770      116     131     040
                025773      117     106     040
                025776      124     110     105
                026001      040     115     101
                026004      120     040     122
                026007      105     107     111
                026012      123     124     105
                026015      122     123     056
                026020      120     117     123
                026023      123     111     102
                026026      114     131     040
                026031      104     125     105
                026034      200
2234            026035      124     117     040     .ASCII  ?TO UNIBUS MEMORY IN PLACE OR PHYSICAL ADDRESS BIT 14 STUCK LOW.?<CRLF>
                026040      125     116     111
                026043      102     125     123
                026046      040     115     105
                026051      115     117     122
                026054      131     040     111
                026057      116     040     120
                026062      114     101     103
                026065      105     040     117
                026070      122     040     120
                026073      110     131     123
                026076      111     103     101
                026101      114     040     101
                026104      104     104     122
                026107      105     123     123
                026112      040     102     111
                026115      124     040     061
                026120      064     040     123
                026123      124     125     103
                026126      113     040     114
                026131      117     127     056
                026134      200
2235            026135      124     110     105     .ASCIZ  ?THE PROGRAM WILL RESTART?
                026140      040     120     122
                026143      117     107     122
                026146      101     115     040
                026151      127     111     114
                026154      114     040     122
                026157      105     123     124
                026162      101     122     124
                026165      000
2236
2237            026166      124     110     105     EM35:   .ASCII  ?THE SIZE JUMPERS ON THE UNIBUS MAP ARE NOT SET IN?<CRLF>
                026171      040     123     111
                026174      132     105     040
                026177      112     125     115
                026202      120     105     122
                026205      123     040     117
                026210      116     040     124
                026213      110     105     040
                026216      125     116     111
                026221      102     125     123
                026224      040     115     101
                026227      120     040     101
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        025232  122  105  040
        025235  116  117  124
        025240  040  123  105
        025243  124  040  111
        025246  116  200
  2238  025250  124  110  105          .ASCII  ?THEIR DEFAULT POSITION FOR FULL TEST COVERAGE .?<CRLF>
        025253  111  122  040
        025256  104  105  106
        025261  101  125  114
        025264  124  040  120
        025267  117  123  111
        025272  124  111  117
        025275  116  040  106
        025300  117  122  040
        025303  106  125  114
        025306  114  040  124
        025311  105  123  124
        025314  040  103  117
        025317  126  105  122
        025322  101  107  105
        025325  040  056  200
  2239  025330  124  110  105          .ASCII  ?THE DEFAULT POSITION ALLOWS UNIBUS ADDRESSES?<CRLF>
        025333  040  104  105
        025336  106  101  125
        025341  114  124  040
        025344  120  117  123
        025347  111  124  111
        025352  117  116  040
        025355  101  114  114
        025360  117  127  123
        025363  040  125  116
        025366  111  102  125
        025371  123  040  101
        025374  104  104  122
        025377  105  123  123
        025402  105  123  200
  2240  025405  060  060  060          .ASCII  ?000000 TO 757776 TO REFERENCE MAIN MEMORY.?<CRLF>
        025410  060  060  060
        025413  040  124  117
        025416  040  067  065
        025421  067  067  067
        025424  066  040  124
        025427  117  040  122
        025432  105  106  105
        025435  122  105  116
        025440  103  105  040
        025443  115  101  111
        025446  116  040  115
        025451  105  115  117
        025454  122  131  056
        025457  200
  2241  025460  124  110  105          .ASCII  ?THE DIAGNOSTIC,IF CONTINUED, WILL TEST WITH REDUCED COVERAGE?<CRLF>
        025463  040  104  111
        025466  101  107  116
        025471  117  123  124
        025474  111  103  054
        025477  111  106  040
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        025502  103  117  116
        025505  124  111  116
        025510  125  105  104
        025513  054  040  127
        025516  111  114  114
        025521  040  124  105
        025524  123  124  040
        025527  127  111  124
        025532  110  040  122
        025535  105  104  125
        025540  103  105  104
        025543  040  103  117
        025546  126  105  122
        025551  101  107  105
        025554  200
2242    025555  125  123  111          .ASCII  ?USING  THE CONSTRAINT THAT MAIN MEMORY WILL RESPOND?<CRLF>
        025560  116  107  040
        025563  040  124  110
        025566  105  040  103
        025571  117  116  123
        025574  124  122  101
        025577  111  116  124
        025602  040  124  110
        025605  101  124  040
        025610  115  101  111
        025613  116  040  115
        025616  105  115  117
        025621  122  131  040
        025624  127  111  114
        025627  114  040  122
        025632  105  123  120
        025635  117  116  104
        025640  200
2243    025641  124  117  040          .ASCIZ  ?TO THE RANGE OF UNIBUS ADDRESSES SPECIFIED BY THE FOLLOWING:?
        025644  124  110  105
        025647  040  122  101
        025652  116  107  105
        025655  040  117  106
        025660  040  125  116
        025663  111  102  125
        025666  123  040  101
        025671  104  104  122
        025674  105  123  123
        025677  105  123  040
        025702  123  120  105
        025705  103  111  106
        025710  111  105  104
        025713  040  102  131
        025716  040  124  110
        025721  105  040  106
        025724  117  114  114
        025727  117  127  111
        025732  116  107  072
        025735  000
2244    025736  115  101  120  EM36:   .ASCIZ  ?MAP REGISTER UNDER TEST DID NOT RESPOND IN DUAL MAPPING TEST?
        025741  040  122  105
        025744  107  111  123
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        025747  124     105     122
        025752  040     125     116
        025755  104     105     122
        025760  040     124     105
        025763  123     124     040
        025766  104     111     104
        025771  040     116     117
        025774  124     040     122
        025777  105     123     120
        026002  117     116     104
        026005  040     111     116
        026010  040     104     125
        026013  101     114     040
        026016  115     101     120
        026021  120     111     116
        026024  107     040     124
        026027  105     123     124
        026032  000
2245    026033  123     125     115     EM37:   .ASCIZ  ?SUMMARY OF UNIBUS ADDRESS ERRORS, WITH THE MAP RELOCATION DISABLED?
        026036  115     101     122
        026041  131     040     117
        026044  106     040     125
        026047  116     111     102
        026052  125     123     040
        026055  101     104     104
        026060  122     105     123
        026063  123     040     105
        026066  122     122     117
        026071  122     123     054
        026074  040     127     111
        026077  124     110     040
        026102  124     110     105
        026105  040     115     101
        026110  120     040     122
        026113  105     114     117
        026116  103     101     124
        026121  111     117     116
        026124  040     104     111
        026127  123     101     102
        026132  114     105     104
        026135  000
2246    026136  115     101     111     EM40:   .ASCIZ  ?MAIN MEMORY TIMEOUT OVER THE UNIBUS DID NOT OCCUR PROPERLY?
        026141  116     040     115
        026144  105     115     117
        026147  122     131     040
        026152  124     111     115
        026155  105     117     125
        026160  124     040     117
        026163  126     105     122
        026166  040     124     110
        026171  105     040     125
        026174  116     111     102
        026177  125     123     040
        026202  104     111     104
        026205  040     116     117
        026210  124     040     117
        026213  103     103     125
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                026216  122  040  120
                026221  122  117  120
                026224  105  122  114
                026227  131  000
 2247           026231  122  105  114  EM41:   .ASCIZ  ?RELOCATION THRU THE MAP WAS NOT CORRECT, FULL ADD?
                026234  117  103  101
                026237  124  111  117
                026242  116  040  124
                026245  110  122  125
                026250  040  124  110
                026253  105  040  115
                026256  101  120  040
                026261  127  101  123
                026264  040  116  117
                026267  124  040  103
                026272  117  122  122
                026275  105  103  124
                026300  054  040  106
                026303  125  114  114
                026306  040  101  104
                026311  104  000
 2248           026313  122  105  114  EM42:   .ASCIZ  ?RELOCATION THRU THE MAP WAS NOT CORRECT, CARRY PROPAGATION?
                026316  117  103  101
                026321  124  111  117
                026324  116  040  124
                026327  110  122  125
                026332  040  124  110
                026335  105  040  115
                026340  101  120  040
                026343  127  101  123
                026346  040  116  117
                026351  124  040  103
                026354  117  122  122
                026357  105  103  124
                026362  054  040  103
                026365  101  122  122
                026370  131  040  120
                026373  122  117  120
                026376  101  107  101
                026401  124  111  117
                026404  116  000
 2249           026406  124  110  105  EM43:   .ASCIZ  ?THE TOP OF MEMORY IS DIFFERENT THAN THE SIZE JUMPERS?
                026411  040  124  117
                026414  120  040  117
                026417  106  040  115
                026422  105  115  117
                026425  122  131  040
                026430  111  123  040
                026433  104  111  106
                026436  106  105  122
                026441  105  116  124
                026444  040  124  110
                026447  101  116  040
                026452  124  ' 0  105
                026455  040  '23  111
                026460  132  105  040
                026463  112  125  115
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        026466  120  105  122
        026471  123  000
  2250  026473  115  101  111  EM45:   .ASCII  ?MAIN MEMORY TIMEOUT OVER THE UNIBUS DID NOT OCCUR PROPERLY?<CRLF>
        026476  116  040  115
        026501  105  115  117
        026504  122  131  040
        026507  124  111  115
        026512  105  117  125
        026515  124  040  117
        026520  126  105  122
        026523  040  124  110
        026526  105  040  125
        026531  116  111  102
        026534  125  123  040
        026537  104  111  104
        026542  040  116  117
        026545  124  040  117
        026550  103  103  125
        026553  122  040  120
        026556  122  117  120
        026561  105  122  114
        026564  131  200
  2251  026566  124  105  123          .ASCIZ  ?TEST CODE BEING RUN OVER UNIBUS?
        026571  124  040  103
        026574  117  104  105
        026577  040  102  105
        026602  111  116  107
        026605  040  122  125
        026610  116  040  117
        026613  126  105  122
        026616  040  125  116
        026621  111  102  125
        026624  123  000
  2252  026626  122  105  114  EM46:   .ASCII  ?RELOCATION THRU THE MAP WAS NOT CORRECT, FULL ADD?<CRLF>
        026631  117  103  101
        026634  124  111  117
        026637  116  040  124
        026642  110  122  125
        026645  040  124  110
        026650  105  040  115
        026653  101  120  040
        026656  127  101  123
        026661  040  116  117
        026664  124  040  103
        026667  117  122  122
        026672  105  103  124
        026675  054  040  106
        026700  125  114  114
        026703  040  101  104
        026706  104  200
  2253  026710  124  105  123          .ASCIZ  ?TEST CODE BEING RUN OVER UNIBUS?
        026713  124  040  103
        026716  117  104  105
        026721  040  102  105
        026724  111  116  107
        026727  040  122  125
        026732  116  040  117
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        026735  126  105  122
        026740  040  125  116
        026743  111  102  125
        026746  123  000
 2254   026750  122  105  114  EM47:   .ASCII  ?RELOCATION THRU THE MAP WAS NOT CORRECT, CARRY PROPAGATION?<CRLF>
        026753  117  103  101
        026756  124  111  117
        026761  116  040  124
        026764  110  122  125
        026767  040  124  110
        026772  105  040  115
        026775  101  120  040
        027000  127  101  123
        027003  040  116  117
        027006  124  040  103
        027011  117  122  122
        027014  105  103  124
        027017  054  040  103
        027022  101  122  122
        027025  131  040  120
        027030  122  117  120
        027033  101  107  101
        027036  124  111  117
        027041  116  200
 2255   027043  124  105  123          .ASCIZ  ?TEST CODE BEING RUN OVER UNIBUS?
        027046  124  040  103
        027051  117  104  105
        027054  040  102  105
        027057  111  116  107
        027062  040  122  125
        027065  116  040  117
        027070  126  105  122
        027073  040  125  116
        027076  111  102  125
        027101  123  000
 2256   027103  124  110  105  EM50:   .ASCII  ?THE TOP OF MEMORY IS DIFFERENT THAN THE SIZE JUMPERS?<CRLF>
        027106  040  124  117
        027111  120  040  117
        027114  106  040  115
        027117  105  115  117
        027122  122  131  040
        027125  111  123  040
        027130  104  111  106
        027133  106  105  122
        027136  105  116  124
        027141  040  124  110
        027144  101  116  040
        027147  124  110  105
        027152  040  123  111
        027155  132  105  040
        027160  112  125  115
        027163  120  105  122
        027166  123  200
 2257   027170  124  105  123          .ASCIZ  ?TEST CODE BEING RUN OVER UNIBUS?
        027173  124  040  103
        027176  117  104  105
        027201  040  102  105
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                027204  111     116     107
                027207  040     122     125
                027212  116     040     117
                027215  126     105     122
                027220  040     125     116
                027223  111     102     125
                027226  123     000
 2258           027230  124     105     123             .ASCIZ  ?TEST CODE BEING RUN OVER UNIBUS?
                027233  124     040     103
                027236  117     104     105
                027241  040     102     105
                027244  111     116     107
                027247  040     122     125
                027252  116     040     117
                027255  126     105     122
                027260  040     125     116
                027263  111     102     125
                027266  123     000
 2259           027270  123     125     115     EM52:   .ASCIZ  ?SUMMARY OF DUAL MAPPING ERRORS?
                027273  115     101     122
                027276  131     040     117
                027301  106     040     104
                027304  125     101     114
                027307  040     115     101
                027312  120     120     111
                027315  116     107     040
                027320  105     122     122
                027323  117     122     123
                027326  000
 2260           027327  124     110     105     EM201:  .ASCIZ  ?THE FOLLOWING REGISTERS TIMED OUT WHEN READ?
                027332  040     106     117
                027335  114     114     117
                027340  127     111     116
                027343  107     040     122
                027346  105     107     111
                027351  123     124     105
                027354  122     123     040
                027357  124     111     115
                027362  105     104     040
                027365  117     125     124
                027370  040     127     110
                027373  105     116     040
                027376  122     105     101
                027401  104     000
 2261           027403  124     110     105     EM202:  .ASCIZ  ?THE FOLLOWING MAP REGISTERS WILL NOT CLEAR?
                027406  040     106     117
                027411  114     114     117
                027414  127     111     116
                027417  107     040     115
                027422  101     120     040
                027425  122     105     107
                027430  111     123     124
                027433  105     122     123
                027436  040     127     111
                027441  114     114     040
                027444  116     117     124
                027447  040     103     114
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        027452  105     101     122
        027455  000
  2262  027456  124     110     105     EM203:  .ASCIZ  ?THE FOLLOWING ARE DUAL ADDRESSING ERRORS IN THE UNIBUS MAP?
        027461  040     106     117
        027464  114     114     117
        027467  127     111     116
        027472  107     040     101
        027475  122     105     040
        027500  104     125     101
        027503  114     040     101
        027506  104     104     122
        027511  105     123     123
        027514  111     116     107
        027517  040     105     122
        027522  122     117     122
        027525  123     040     111
        027530  116     040     124
        027533  110     105     040
        027536  125     116     111
        027541  102     125     123
        027544  040     115     101
        027547  120     000
  2263  027551  124     110     105     EM204:  .ASCIZ  ?THE COUNT PATTERN THRU THE MAP REGISTERS FAILED?
        027554  040     103     117
        027557  125     116     124
        027562  040     120     101
        027565  124     124     105
        027570  122     116     040
        027573  124     110     122
        027576  125     040     124
        027601  110     105     040
        027604  115     101     120
        027607  040     122     105
        027612  107     111     123
        027615  124     105     122
        027620  123     040     106
        027623  101     111     114
        027626  105     104     000
  2264  027631  125     116     111     EM205:  .ASCIZ  ?UNIBUS DATA PATH COUNT PATTERN FAILURE?
        027634  102     125     123
        027637  040     104     101
        027642  124     101     040
        027645  120     101     124
        027650  110     040     103
        027653  117     125     116
        027656  124     040     120
        027661  101     124     124
        027664  105     122     116
        027667  040     106     101
        027672  111     114     125
        027675  122     105     000
  2265  027700  125     116     111     EM206:  .ASCIZ  ?UNIBUS ADDRESSING ERRORS, MAP RELOCATION DISABLED?
        027703  102     125     123
        027706  040     101     104
        027711  104     122     105
        027714  123     123     111
        027717  116     107     040
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        027722  105  122  122
        027725  117  122  123
        027730  054  040  115
        027733  101  120  040
        027736  122  105  114
        027741  117  103  101
        027744  124  111  117
        027747  116  040  104
        027752  111  123  101
        027755  102  114  105
        027760  104  000
  2266  027762  103  117  125  EM207:  .ASCIZ  ?COUNT PATTERN FAILURES IN CACHE REGISTERS?
        027765  116  124  040
        027770  120  101  124
        027773  124  105  122
        027776  116  040  106
        030001  101  111  114
        030004  125  122  105
        030007  123  040  111
        030012  116  040  103
        030015  101  103  110
        030020  105  040  122
        030023  105  107  111
        030026  123  124  105
        030031  122  123  000
  2267
  2268  030034  122  105  103  DH1:    .ASCIZ  ?RECEIVD EXPECTD TESTNO  PC AT ABORT?
        030037  105  111  126
        030042  104  040  105
        030045  130  120  105
        030050  103  124  104
        030053  040  124  105
        030056  123  124  116
        030061  117  040  040
        030064  120  103  040
        030067  101  124  040
        030072  101  102  117
        030075  122  124  000
  2269  030100  122  105  103  DH2:    .ASCIZ  ?RECEIVD TESTNO  PC AT ABORT?
        030103  105  111  126
        030106  104  040  124
        030111  105  123  124
        030114  116  117  040
        030117  040  120  103
        030122  040  101  124
        030125  040  101  102
        030130  117  122  124
        030133  000
  2270  030134  103  117  116  DH3:    .ASCII  ?CONDITN ADDRESS   MAINTEN CONTROL?<CRLF>
        030137  104  111  124
        030142  116  040  101
        030145  104  104  122
        030150  105  123  123
        030153  040  040  040
        030156  115  101  111
        030161  116  124  105
        030164  116  040  103
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                030167  117     116     124
                030172  122     117     114
                030175  200
2271            030176  122     105     103             .ASCIZ  ?RECEIVD REFERENCD REGISTR REGISTR TESTNO  PC AT ABORT?
                030201  105     111     126
                030204  104     040     122
                030207  105     106     105
                030212  122     105     116
                030215  103     104     040
                030220  122     105     107
                030223  111     123     124
                030226  122     040     122
                030231  105     107     111
                030234  123     124     122
                030237  040     124     105
                030242  123     124     116
                030245  117     040     040
                030250  120     103     040
                030253  101     124     040
                030256  101     102     117
                030261  122     124     000
2272            030264  123     124     101     DH5:    .ASCII  ?STATUS  AUTOI/D VIRTUAL?<CRLF>
                030267  124     125     123
                030272  040     040     101
                030275  125     124     117
                030300  111     057     104
                030303  040     126     111
                030306  122     124     125
                030311  101     114     200
2273            030314  122     105     107             .ASCIZ  ?REGISTR REGISTR ADDRESS TESTNO  PC AT ABORT?
                030317  111     123     124
                030322  122     040     122
                030325  105     107     111
                030330  123     124     122
                030333  040     101     104
                030336  104     122     105
                030341  123     123     040
                030344  124     105     123
                030347  124     116     117
                030352  040     040     120
                030355  103     040     101
                030360  124     040     101
                030363  102     117     122
                030366  124     000
2274            030370  122     105     107     DH6:    .ASCII  ?REGADRS REGADRS?<CRLF>
                030373  101     104     122
                030376  123     040     122
                030401  105     107     101
                030404  104     122     123
                030407  200
2275            030410  040     042     117             .ASCIZ  ? 'OR''    ''AND''  #ERRORS TESTNO  ERRORPC?
                030413  122     042     040
                030416  040     040     040
                030421  042     101     116
                030424  104     042     040
                030427  040     043     105
                030432  122     122     117
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        030435  122     123     040
        030440  124     105     123
        030443  124     116     117
        030446  040     040     105
        030451  122     122     117
        030454  122     120     103
        030457  000
  2276  030460  122     105     107  DH10:   .ASCII  ?REGADRS REGADRS RECEIVD RECEIVD?<CRLF>
        030463  101     104     122
        030466  123     040     122
        030471  105     107     101
        030474  104     122     123
        030477  040     122     105
        030502  103     105     111
        030505  126     104     040
        030510  122     105     103
        030513  105     111     126
        030516  104     200
  2277  030520  040     042     117          .ASCIZ  ? ''DR''   ''AND''  ''DR''   ''AND''  #ERRORS TESTNO  ERRORPC?
        030523  122     042     040
        030526  040     040     040
        030531  042     101     116
        030534  104     042     040
        030537  040     040     042
        030542  117     122     042
        030545  040     040     040
        030550  040     042     101
        030553  116     104     042
        030556  040     040     043
        030561  105     122     122
        030564  117     122     123
        030567  040     124     105
        030572  123     124     116
        030575  117     040     040
        030600  105     122     122
        030603  117     122     120
        030606  103     000
  2278  030610  103     117     125  DH12:   .ASCII  ?COUNT   COUNT?<CRLF>
        030613  116     124     040
        030616  040     040     103
        030621  117     125     116
        030624  124     200
  2279  030626  105     130     120          .ASCIZ  ?EXPECTD RECEIVD TESTNO  ERRORPC?
        030631  105     103     124
        030634  104     040     122
        030637  105     103     105
        030642  111     126     104
        030645  040     124     105
        030650  123     124     116
        030653  117     040     040
        030656  105     122     122
        030661  117     122     120
        030664  103     000
  2280  030666  122     105     107  DH14:   .ASCII  ?REGLOAD REGLOAD REGDUAL REGDUAL?<CRLF>
        030671  114     117     101
        030674  104     040     122
        030677  105     107     114
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        030702  117     101     104
        030705  040     122     105
        030710  107     104     125
        030713  101     114     040
        030716  122     105     107
        030721  104     125     101
        030724  114     200
  2281  030726  040     042     117             .ASCIZ  ? 'OR''   ''AND''   'OR''   ''AND'' #ERRORS TESTNO?
        030731  122     042     040
        030734  040     040     040
        030737  042     101     116
        030742  104     042     040
        030745  040     040     042
        030750  117     122     042
        030753  040     040     040
        030756  040     042     101
        030761  116     104     042
        030764  040     040     043
        030767  105     122     122
        030772  117     122     123
        030775  040     124     105
        031000  123     124     116
        031003  117     000
  2282  031005  115     101     120   DH15:     .ASCII  ?MAPREG  MAPREG  EXPECTD EXPECTD RECEIVD RECEIVD?<CRLF>
        031010  122     105     107
        031013  040     040     115
        031016  101     120     122
        031021  105     107     040
        031024  040     105     130
        031027  120     105     103
        031032  124     104     040
        031035  105     130     120
        031040  105     103     124
        031043  104     040     122
        031046  105     103     105
        031051  111     126     104
        031054  040     122     105
        031057  103     105     111
        031062  126     104     200
  2283  031065  040     042     117             .ASCIZ  ? 'OR''   ''AND''   'OR''   ''AND''   'OR''   ''AND'' #ERRORS TESTNO?
        031070  122     042     040
        031073  040     040     040
        031076  042     101     116
        031101  104     042     040
        031104  040     040     042
        031107  117     122     042
        031112  040     040     040
        031115  040     042     101
        031120  116     104     042
        031123  040     040     040
        031126  042     117     122
        031131  042     040     040
        031134  040     040     042
        031137  101     116     104
        031142  042     040     040
        031145  043     105     122
        031150  122     117     122
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        031153  123  040  124
        031156  105  123  124
        031161  116  117  000
 2284   031164  122  105  103  DH17:   .ASCIZ  ?RECEIVD TESTNO  ERRORPC?
        031167  105  111  126
        031172  104  040  124
        031175  105  123  124
        031200  116  117  040
        031203  040  105  122
        031206  122  117  122
        031211  120  103  000
 2285   031214  105  130  120  DH23:   .ASCII  ?EXPECTD EXPECTD RECEIVD RECEIVD<CRLF>
        031217  105  103  124
        031222  104  040  105
        031225  130  120  105
        031230  103  124  104
        031233  040  122  105
        031236  103  105  111
        031241  126  104  040
        031244  122  105  103
        031247  105  111  126
        031252  104  200
 2286   031254  040  042  117          .ASCIZ  ? ''OR''   ''AND''  ''OR''   ''AND''  #ERRORS TESTNO?
        031257  122  042  040
        031262  040  040  040
        031265  042  101  116
        031270  104  042  040
        031273  040  040  042
        031276  117  122  042
        031301  040  040  040
        031304  040  042  101
        031307  116  104  042
        031312  040  040  043
        031315  105  122  122
        031320  117  122  123
        031323  040  124  105
        031326  123  124  116
        031331  117  000
 2287   031333  101  104  104  DH25:   .ASCIZ  ?ADDRUSED  BITDIFF  TESTNO  ERRORPC?
        031336  122  125  123
        031341  105  104  040
        031344  040  102  111
        031347  124  104  111
        031352  106  106  040
        031355  124  105  123
        031360  124  116  117
        031363  040  040  105
        031366  122  122  117
        031371  122  120  103
        031374  000
 2288   031375  101  104  104  DH27:   .ASCIZ  ?ADDRUSED  TESTNO  ERRORPC?
        031400  122  125  123
        031403  105  104  040
        031406  040  124  105
        031411  123  124  116
        031414  117  040  040
        031417  105  122  122
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                031422  117     122     120
                031425  103     000
2289            031427  124     105     123     DH30:   .ASCIZ  ?TESTNO  ERRORPC?
                031432  124     116     117
                031435  040     040     105
                031440  122     122     117
                031443  122     120     103
                031446  000
2290            031447  122     105     115     DH34:   .ASCIZ  ?REMOVED MISSING TESTNO  ERRORPC?
                031452  117     126     105
                031455  104     040     115
                031460  111     123     123
                031463  111     116     107
                031466  040     124     105
                031471  123     124     116
                031474  117     040     040
                031477  105     122     122
                031502  117     122     120
                031505  103     000
2291            031507  114     117     127     DH35:   .ASCIZ  ?LOWEST  HIGHEST TESTNO  ERRORPC?
                031512  105     123     124
                031515  040     040     110
                031520  111     107     110
                031523  105     123     124
                031526  040     124     105
                031531  123     124     116
                031534  117     040     040
                031537  105     122     122
                031542  117     122     120
                031545  103     000
2292            031547  124     105     123     DH36:   .ASCIZ  ?TESTNO  ERRORPC UNIBUS ADDRESS OF MAP REGISTER UNDER TEST?
                031552  124     116     117
                031555  040     040     105
                031560  122     122     117
                031563  122     120     103
                031566  040     125     116
                031571  111     102     125
                031574  123     040     101
                031577  104     104     122
                031602  105     123     123
                031605  040     117     106
                031610  040     115     101
                031613  120     040     122
                031616  105     107     111
                031621  123     124     105
                031624  122     040     125
                031627  116     104     105
                031632  122     040     124
                031635  105     123     124
                031640  000
2293            031641  103     117     116     DH40:   .ASCII  ?CONDITN CONDITN?<CRLF>
                031644  104     111     124
                031647  116     040     103
                031652  117     116     104
                031655  111     124     116
                031660  200
2294            031661  105     130     120             .ASCIZ  ?EXPECTD RECEIVD TESTNO  ERRORPC?
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        031664  105  103  124
        031667  104  040  122
        031672  105  103  105
        031675  111  126  104
        031700  040  124  105
        031703  123  124  116
        031706  117  040  040
        031711  105  122  122
        031714  117  122  120
        031717  103  000
 2295   031721  103  117  122  DH41:   .ASCII  ?CORRECT ADDRESS?<CRLF>
        031724  122  105  103
        031727  124  040  101
        031732  104  104  122
        031735  105  123  123
        031740  200
 2296   031741  101  104  104          .ASCIZ  ?ADDRESS FETCHED TESTNO  ERRORPC?
        031744  122  105  123
        031747  123  040  106
        031752  105  124  103
        031755  110  105  104
        031760  040  124  105
        031763  123  124  116
        031766  117  040  040
        031771  105  122  122
        031774  117  122  120
        031777  103  000
 2297   032001  103  117  122  DH42:   .ASCII  ?CORRECT EXPECTD RECEIVD?<CRLF>
        032004  122  105  103
        032007  124  040  105
        032012  130  120  105
        032015  103  124  104
        032020  040  122  105
        032023  103  105  111
        032026  126  104  200
 2298   032031  101  104  104          .ASCIZ  ?ADDRESS DATA    FROM UB TESTNO  ERRORPC?
        032034  122  105  123
        032037  123  040  104
        032042  101  124  101
        032045  040  040  040
        032050  040  106  122
        032053  117  115  040
        032056  125  102  040
        032061  124  105  123
        032064  124  116  117
        032067  040  040  105
        032072  122  122  117
        032075  122  120  103
        032100  000
 2299   032101  122  105  107  DH201:  .ASCIZ  ?REGADRS TESTNO  ERRORPC?
        032104  101  104  122
        032107  123  040  124
        032112  105  123  124
        032115  116  117  040
        032120  040  105  122
        032123  122  117  122
        032126  120  103  000
```

```
                032131  122  105  107  DH202:  .ASCIZ  ?REGADRS DATAREC TESTNO  ERRORPC?
                032134  101  104  122
                032137  123  040  104
                032142  101  124  101
                032145  122  105  103
                032150  040  124  105
                032153  123  124  116
                032156  117  040  040
                032161  105  122  122
                032164  117  122  120
                032167  103  000
2301            032171  115  101  120  DH203:  .ASCII  ?MAPREG  MAPREG?<CRLF>
                032174  122  105  107
                032177  040  040  115
                032202  101  120  122
                032205  105  107  200
2302            032210  124  105  123          .ASCIZ  ?TESTING DUALFD  TESTNO  ERRORPC?
                032213  124  111  116
                032216  107  040  104
                032221  125  101  114
                032224  105  104  040
                032227  040  124  105
                032232  123  124  116
                032235  117  040  040
                032240  105  122  122
                032243  117  122  120
                032246  103  000
2303            032250  122  105  107  DH204:  .ASCIZ  ?REGADRS PATTERN EXPECTD RECEIVD TESTNO  ERRORPC?
                032253  101  104  122
                032256  123  040  120
                032261  101  124  124
                032264  105  122  116
                032267  040  105  130
                032272  120  105  103
                032275  124  104  040
                032300  122  105  103
                032303  105  111  126
                032306  104  040  124
                032311  105  123  124
                032314  116  117  040
                032317  040  105  122
                032322  122  117  122
                032325  120  103  000
2304            032330  105  130  120  DH205:  .ASCIZ  ?EXPECTD RECEIVD ADDRSLOAD TESTNO  ERRORPC?
                032333  105  103  124
                032336  104  040  122
                032341  105  103  105
                032344  111  126  104
                032347  040  101  104
                032352  104  122  123
                032355  114  117  101
                032360  104  040  124
                032363  105  123  124
                032366  116  117  040
                032371  040  105  122
                032374  122  117  122
                032377  120  103  000
```

```
 2305 032402   101   104   104  DH206:  .ASCII  ?ADDRESS ADDRESS?<CRLF>
      032405   122   105   123
      032410   123   040   101
      032413   104   104   122
      032416   105   123   123
      032421   200
 2306 032422   105   130   120          .ASCIZ  ?EXPECTD RECEIVD TESTNO  ERRORPC?
      032425   105   103   124
      032430   104   040   122
      032433   105   103   105
      032436   111   126   104
      032441   040   124   105
      032444   123   124   116
      032447   117   040   040
      032452   105   122   122
      032455   117   122   120
      032460   103   000
 2307 032462   122   105   107  DH207:  .ASCII  ?REGISTR EXPECTD RECEIVD?<CRLF>
      032465   111   123   124
      032470   122   040   105
      032473   130   120   105
      032476   103   124   104
      032501   040   122   105
      032504   103   105   111
      032507   126   104   200
 2308 032512   101   104   104          .ASCIZ  ?ADDRESS  DATA    DATA    TESTNO  ERRORPC?
      032515   122   105   123
      032520   123   040   040
      032523   104   101   124
      032526   101   040   040
      032531   040   040   104
      032534   101   124   101
      032537   040   040   040
      032542   124   105   123
      032545   124   116   117
      032550   040   040   105
      032553   122   122   117
      032556   122   120   103
      032561   000
 2309
```

```
2311
2312                                                        .EVEN
2313 032562  001270  001266  001264  DT1:    .WORD   PCPUER,CPUEXP,TESTNO,BADPC,0
     032570  001300  000000
2314 032574  001270  001264  001300  DT2:    .WORD   PCPUER,TESTNO,BADPC,0
     032602  000000
2315 032604  001156  001172  001264  DT4:    .WORD   $REG0,$TMP0,TESTNO,$ERRPC,0
     032612  001114  000000
2316 032616  001310  001312  001314  DT5:    .WORD   PMMR0,PMMR1,PMMR2,TESTNO,BADPC,0
     032624  001264  001300  000000
2317 032632  001230  001226  001256  DT6:    .WORD   ADDROR,ADRAND,ERRCNT,TESTNO,$ERRPC,0
     032640  001264  001114  000000
2318 032646  001230  001226  001234  DT10:   .WORD   ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO,$ERRPC,0
     032654  001232  001256  001264
     032662  001114  000000
2319 032666  001162  001156  001264  DT12:   .WORD   $REG2,$REG0,TESTNO,$ERRPC,0
     032674  001114  000000
2320 032700  001164  001160  001264  DT13:   .WORD   $REG3,$REG1,TESTNO,$ERRPC,0
     032706  001114  000000
2321 032712  001230  001226  001234  DT14:   .WORD   ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO,0
     032720  001232  001256  001264
     032726  000000
2322 032730  001230  001226  001240  DT15:   .WORD   ADDROR,ADRAND,PATTOR,PATAND,DATAOR,DATAND,ERRCNT,TESTNO,0
     032736  001236  001234  001232
     032744  001256  001264  000000
2323 032752  001156  001264  001114  DT17:   .WORD   $REG0,TESTNO,$ERRPC,0
     032760  000000
2324 032762  001160  001264  001114  DT20:   .WORD   $REG1,TESTNO,$ERRPC,0
     032770  000000
2325 032772  001240  001236  001234  DT23:   .WORD   PATTOR,PATAND,DATAOR,DATAND,ERRCNT,TESTNO,0
     033000  001232  001256  001264
     033006  000000
2326 033010  001166  001156  001264  DT25:   .WORD   $REG4,$REG0,TESTNO,$ERRPC,0
     033016  001114  000000
2327 033022  001160  001264  001114  DT27:   .WORD   $REG1,TESTNO,$ERRPC,0
     033030  000000
2328 033032  001264  001114  000000  DT30:   .WORD   TESTNO,$ERRPC,0
2329 033040  001256  001260  001264  DT34:   .WORD   ERRCNT,CNTR,TESTNO,$ERRPC,0
     033046  001114  000000
2330 033052  001242  001244  001264  DT35:   .WORD   LOWEST,HIGEST,TESTNO,$ERRPC,0
     033060  001114  000000
2331 033064  001264  001114  001156  DT36:   .WORD   TESTNO,$ERRPC,$REG0,0
     033072  000000
2332 033074  001230  001226  001234  DT37:   .WORD   ADDROR,ADRAND,DATAOR,DATAND,ERRCNT,TESTNO,0
     033102  001232  001256  001264
     033110  000000
2333 033112  001266  001270  001264  DT40:   .WORD   CPUEXP,PCPUFR,TESTNO,$ERRPC,0
     033120  001114  000000
2334 033124  001162  001160  001264  DT41:   .WORD   $REG2,$REG1,TESTNO,$ERRPC,0
     033132  001114  000000
2335 033136  001160  001164  001162  DT42:   .WORD   $REG1,$REG3,$REG2,TESTNO,$ERRPC,0
     033144  001264  001114  000000
2336 033152  001156  001264  001114  DT201:  .WORD   $REG0,TESTNO,$ERRPC,0
     033160  000000
2337 033162  001156  001172  001264  DT202:  .WORD   $REG0,$TMP0,TESTNO,$ERRPC,0
     033170  001114  000000
2338 033174  001156  001160  001264  DT203:  .WORD   $REG0,$REG1,TESTNO,$ERRPC,0
```

```
                033202  001114  000000
2339            033206  001156  001162  001166  DT204:  .WORD   $REG0,$REG2,$REG4,$REG3,TESTNO,$ERRPC,0
                033214  001164  001264  001114
                033222  000000
2340            033224  001160  001156  001162  DT205:  .WORD   $REG1,$REG0,$REG2,TESTNO,$ERRPC,0
                033232  001264  001114  000000
2341            033240  001156  001164  001264  DT206:  .WORD   $REG0,$REG3,TESTNO,$ERRPC,0
                033246  001114  000000
2342            033252  001156  001162  001164  DT207:  .WORD   $REG0,$REG2,$REG3,TESTNO,$ERRPC,0
                033260  001264  001114  000000
2343
2344
2345            033266      000     000     000  DF1:    .BYTE   0,0,0,0
                033271      000
2346            033272      000     000     000  DF2:    .BYTE   0,0,0
2347            033275      000     002     000  DF3:    .BYTE   0,2,0,0,0,0
                033300      000     000     000
2348            033303      000     000     000  DF5:    .BYTE   0,0,0,0,0
                033306      000     000
2349            033310      000     000     001  DF6:    .BYTE   0,0,1,0,0
                033313      000     000
2350            033315      000     000     000  DF10:   .BYTE   0,0,0,0,1,0,0
                033320      000     001     000
                033323      000
2351            033324      000     000     000  DF12:   .BYTE   0,0,0,0
                033327      000
2352            033330      000     000     000  DF14:   .BYTE   0,0,0,0,1,0
                033333      000     001     000
2353            033336      000     000     000  DF15:   .BYTE   0,0,0,0,0,0,1,0
                033341      000     000     000
                033344      001     000
2354            033346      000     000     000  DF17:   .BYTE   0,0,0
2355            033351      000     000     000  DF23:   .BYTE   0,0,0,0,1,0
                033354      000     001     000
2356            033357      003     004     000  DF25:   .BYTE   3,4,0,0
                033362      000
2357            033363      003     000     000  DF27:   .BYTE   3,0,0
2358            033366      000     000          DF30:   .BYTE   0,0
2359            033370      000     000     000  DF34:   .BYTE   0,0,0,0
                033373      000
2360            033374      004     004     000  DF35:   .BYTE   4,4,0,0
                033377      000
2361            033400      000     000     003  DF36:   .BYTE   0,0,3
2362            033403      000     000     000  DF37:   .BYTE   0,0,0,0,1,0
                033406      000     001     000
2363            033411      000     000     000  DF40:   .BYTE   0,0,0,0
                033414      000
2364            033415      000     000     000  DF41:   .BYTE   0,0,0,0
                033420      000
2365            033421      003     000     000  DF42:   .BYTE   3,0,0,0,0
                033424      000     000
2366            033426      000     000     000  DF201:  .BYTE   0,0,0
2367            033431      000     000     000  DF202:  .BYTE   0,0,0,0
                033434      000
2368            033435      000     000     000  DF203:  .BYTE   0,0,0,0
                033440      000
2369            033441      000     000     000  DF204:  .BYTE   0,0,0,0,0,0
```

```
                033444      000     000     000
2370            033447      000     000     003     DF205:  .BYTE   0,0,3,0,0
                033452      000     000
2371            033454      000     000     000     DF206:  .BYTE   0,0,0,0
                033457      000
2372            033460      000     000     000     DF207:  .BYTE   0,0,0,0,0
                033463      000     000
2373
2374                                                        .EVEN
2375                000001                                  .END
```

```
ABASE = 000000        BIT01 = 000002        DF30  033366        DT30  033032        EM7     022303
ACDW1 = 000000        BIT02 = 000004        DF34  033370        DT34  033040        EREXIT  021002
ACDW2 = 000000        BIT03 = 000010        DF35  033374        DT35  033052        ERRCNT  001256
ACPUOP= 000000        BIT04 = 000020        DF36  033400        DT36  033064        ERROR = 104000
ADDROR  001230        BIT05 = 000040        DF37  033403        DT37  033074        ERRVEC= 000004
ADDW0 = 000000        BIT06 = 000100        DF40  033411        DT4   032604        ERTYPE  001736
ADDW1 = 000000        BIT07 = 000200        DF41  033415        DT40  033112        ER200   001656
ADDW10= 000000        BIT08 = 000400        DF42  033421        DT41  033124        FLAG    001262
ADDW11= 000000        BIT09 = 001000        DF5   033303        DT42  033136        HIADRS= 177742
ADDW12= 000000        BIT1  = 000002        DF6   033310        DT5   032616        HIGEST  001244
ADDW13= 000000        BIT10 = 002000        DH    030034        DT6   032632        HITMIS= 177752
ADDW14= 000000        BIT11 = 004000        DH10  030460        DUALAD  004342      HREGL   001252
ADDW15= 000000        BIT12 = 010000        DH12  030610        EMTVEC= 000030      HREGU   001254
ADDW2   000000        BIT13 = 020000        DH14  030666        EM1     021554      HT    = 000011
ADDW3   000000        BIT14 = 040000        DH15  031005        EM10    022365      IOTVEC= 000020
ADDW4   000000        BIT15 = 100000        DH17  031164        EM11    022456      KDPAR0= 172360
ADDW5 = 000000        BIT2  = 000004        DH2   030100        EM12    022550      KDPAR1= 172362
ADDW6 = 000000        BIT3    000010        DH201 032101        EM13    022636      KDPAR2= 172364
ADDW7 = 000000        BIT4    000020        DH202 032131        EM14    022730      KDPAR3= 172366
ADDW8 = 000000        BIT5    000040        DH203 032171        EM15    023023      KDPAR4= 172370
ADDW9 = 000000        BIT6    000100        DH204 032250        EM16    023127      KDPAR5= 172372
ADEVCT= 000000        BIT7    000200        DH205 032330        EM17    023232      KDPAR6= 172374
ADEVM = 000000        BIT8  = 000400        DH206 032402        EM2     021636      KDPAR7= 172376
ADRAND  001226        BIT9  = 001000        DH207 032462        EM20    023354      KDPDR0= 172320
AENV    000000        BPTVEC= 000014        DH23  031214        EM201   027327      KDPDR1= 172322
AENVM = 000000        CACHVE= 000114        DH25  031333        EM202   027403      KDPDR2= 172324
AFATAL= 000000        CLRMAP  004120        DH27  031375        EM203   027456      KDPDR3= 172326
AMADR1= 000000        CNTR    001260        DH3   030134        EM204   027551      KDPDR4= 172330
AMADR2= 000000        CONTRL= 177746        DH30  031427        EM205   027631      KDPDR5= 172332
AMADR3= 000000        COUNT   004416        DH34  031447        EM206   027700      KDPDR6= 172334
AMADR4= 000000        CPFLAG  004564        DH35  031507        EM207   027762      KDPDR7= 172336
AMAMS1= 000000        CPUER   004562        DH36  031547        EM21    023502      KERSTK= 001100
AMAMS2= 000000        CPUERR= 177766        DH40  031641        EM22    023646      KIPAR0= 172340
AMAMS3= 000000        CPUEXP  001266        DH41  031721        EM23    024012      KIPAR1= 172342
AMAMS4= 000000        CR    = 000015        DH42  032001        EM24    024106      KIPAR2= 172344
AMSGAD= 000000        CRLF  = 000200        DH5   030264        EM25    024206      KIPAR3= 172346
AMSGLG= 000000        DATA    001324        DH6   030370        EM26    024313      KIPAR4= 172350
AMSGTY= 000000        DATAND  001232        DISPLA  001152      EM3     021705      KIPAR5= 172352
AMTYP1= 000000        DATAOR  001234        DT1   032562        EM30    024434      KIPAR6= 172354
AMTYP2= 000000        DF1     033266        DT10  032646        EM31    024610      KIPAR7= 172356
AMTYP3= 000000        DF10    033315        DT12  032666        EM32    024702      KIPDR0= 172300
AMTYP4= 000000        DF12    033324        DT13  032700        EM33    024754      KIPDR1= 172302
APASS = 000000        DF14    033330        DT14  032712        EM35    025166      KIPDR2= 172304
APRIOR  000000        DF15    033336        DT15  032730        EM36    025736      KIPDR3= 172306
APTCSU= 000040        DF17    033346        DT17  032752        EM37    026033      KIPDR4= 172310
APTENV= 000001        DF2     033272        DT2   032574        EM4     022006      KIPDR5= 172312
APTSIZ= 000200        DF201   033426        DT20  032762        EM40    026136      KIPDR6= 172314
APTSPO= 000100        DF202   033431        DT201 033152        EM41    026231      KIPDR7= 172316
ASWREG= 000000        DF203   033435        DT202 033162        EM42    026313      KSP   =%000006
ATESTN= 000000        DF204   033441        DT203 033174        EM43    026406      LF    = 000012
AUNIT = 000000        DF205   033447        DT204 033206        EM45    026473      LOADRS= 177740
AUSWR   000000        DF206   033454        DT205 033224        EM46    026626      LOOP    010332
AVECT1= 000000        DF207   033460        DT206 033240        EM47    026750      LOWEST  001242
AVECT2= 000000        DF23    033351        DT207 033252        EM5     022115      LREGL   001246
BADPC   001300        DF25    033357        DT23  032772        EM50    027103      LREGU   001250
BIT0    000001        DF27    033363        DT25  033010        EM52    027270      MAINT = 177750
BIT00   000001        DF3     033275        DT27  033022        EM6     022223      MAPH0   170202
```

CKKUAA0 *1/44 UBI MAP MACRO M1111 20-SEP-79 *1:20 PAGE 64-4
SYMBOL TABLE

SEQ 0118

```
MAPH00= 170202   MAPL2  = 170210   PSW    = 177776   SSP    =%000006   TST20   013046
MAPH01  170206   MAPL20= 170300   PWRMSG  003670   STACK  = 001100   TST21   013420
MAPH02- 170212   MAPL21= 170304   PWRVEC= 000024   START    010000   TST22   013614
MAPH03= 170216   MAPL22= 170310   RELC22  012166   STKLMT= 177774   TST23   014074
MAPH04= 170222   MAPL23= 170314   RESREG= 104414   SUPSTK= 000700   TST24   014206
MAPH05= 170226   MAPL24= 170320   RESVEC= 000010   SWR      001150   TST25   015114
MAPH06= 170232   MAPL25= 170324   RETRY   001320   SW0    = 000001   TST26   015450
MAPH07- 170236   MAPL26= 170330   RSIZE   001316   SW00   = 000001   TST27   015602
MAPH1  = 170206  MAPL27= 170334   R10    =%000000  SW01   = 000002   TST3    010604
MAPH10= 170242   MAPL3  = 170214   R11    =%000001  SW02   = 000004   TST30   016516
MAPH11= 170246   MAPL30= 170340   R12    =%000002  SW03   = 000010   TST31   016774
MAPH12= 170252   MAPL31- 170344   R13    =%000003  SW04   = 000020   TST32   017324
MAPH13- 170256   MAPL32= 170350   R14    =%000004  SW05   = 000040   TST4    010674
MAPH14= 170262   MAPL33  170354   R15    =%000005  SW06   = 000100   TST5    010764
MAPH15= 170266   MAPL34- 170360   R6     =%000006  SW07   = 000200   TST6    011054
MAPH16- 170272   MAPL35- 170364   R7     =%000007  SW08   = 000400   TST7    011200
MAPH17  170276   MAPL36- 170370   SAVREG= 104412   SW09   = 001000   TYPDS  = 104410
MAPH2  = 170212  MAPL37= 170374   SCOPE  = 000004   SW1    = 000002   TYPE   = 104400
MAPH20- 170302   MAPL4  = 170220   SDPAR0= 172260   SW10   = 002000   TYPOC  = 104402
MAPH21= 170306   MAPL5  = 170224   SDPAR1= 172262   SW11   = 004000   TYPON  = 104406
MAPH22- 170312   MAPL6  = 170230   SDPAR2= 172264   SW12   = 010000   TYPOS  = 104404
MAPH23= 170316   MAPL7  = 170234   SDPAR3= 172266   SW13   = 020000   TYPVAD  002244
MAPH24= 170320   MEMERR- 177744   SDPAR4= 172270   SW14   = 040000   UBADDR  002352
MAPH25  170326   MMFLAG  004676   SDPAR5= 172272   SW15   = 100000   UBCOUN  004506
MAPH26= 170332   MMR0   = 177572   SDPAR6= 172274   SW2    = 000004   UBMAP   015372
MAPH27- 170336   MMR1   = 177574   SDPAR7= 172276   SW3    = 000010   UDPAR0= 177660
MAPH3  - 170216  MMR2   - 177576   SDPDR0= 172220   SW4    = 000020   UDPAR1= 177662
MAPH30= 170342   MMR3   = 172516   SDPDR1= 172222   SW5    = 000040   UDPAR2= 177664
MAPH31- 170346   MMTRAP  004674   SDPDR2= 172224   SW6    = 000100   UDPAR3= 177666
MAPH32= 170352   MMVEC  - 000250   SDPDR3= 172226   SW7    = 000200   UDPAR4= 177670
MAPH33- 170356   NEXMEM= 000040   SDPDR4= 172230   SW8    = 000400   UDPAR5= 177672
MAPH34= 170362   NXTTST  001322   SDPDR5= 172232   SW9    = 001000   UDPAR6= 177674
MAPH35= 170366   OLDPC   001302   SDPDR6= 172234   SYSTID= 177764   UDPAR7= 177676
MAPH36= 170372   OLDPS   001304   SDPDR7- 172236   TBIT   = 000020   UDPDR0= 177620
MAPH37= 170376   OLDPSW  001306   SIPAR0- 172240   TBITO  = 104416   UDPDR1= 177622
MAPH4  = 170222  PADRSH  001224   SIPAR1= 172242   TBITOF  004054   UDPDR2= 177624
MAPH5  - 170226  PADRSL  001222   SIPAR2= 172244   TBITR  = 104420   UDPDR3= 177626
MAPH6    170232  PATAND  001236   SIPAR3= 172246   TBITRE  004102   UDPDR4= 177630
MAPH7    170236  PATTOR  001240   SIPAR4= 172250   TBITVE= 000014   UDPDR5= 177632
MAPL0    170200  PCONTR  001274   SIPAR5= 172252   TESTNO  001264   UDPDR6= 177634
MAPL00   170200  PCPUER  001270   SIPAR6= 172254   TIMEOU  004136   UDPDR7= 177636
MAPL01- 170204   PIRQ   = 177772   SIPAR7= 172256   TIMOUT= 000020   UIPAR0= 177640
MAPL02= 170210   PIRQVE= 000240   SIPDR0- 172200   TKVEC  = 000060   UIPAR1= 177642
MAPL03- 170214   PMAINT  001276   SIPDR1- 172202   TOFLAG  004140   UIPAR2= 177644
MAPL04= 170220   PMMR0    001310   SIPDR2= 172204   TPVEC  = 000064   UIPAR3= 177646
MAPL05- 170224   PMMR1    001312   SIPDR3= 172206   TRAPVE= 000034   UIPAR4= 177650
MAPL06= 170230   PMMR2    001314   SIPDR4= 172210   TRTVEC= 000014   UIPAR5= 177652
MAPL07= 170234   PPARER   001272   SIPDR5= 172212   TST1     010422   UIPAR6= 177654
MAPL1  = 170204  PR0    = 000000   SIPDR6= 172214   TST10    011322   UIPAR7= 177656
MAPL10= 170240   PR1    = 000040   SIPDR7= 172216   TST11    011446   UIPDR0= 177600
MAPL11= 170244   PR2    - 000100   SIZEHI= 177762   TST12    011572   UIPDR1= 177602
MAPL12= 170250   PR3    = 000140   SIZEJ    013064   TST13    011716   UIPDR2= 177604
MAPL13= 170254   PR4    = 000200   SIZELO= 177760   TST14    012042   UIPDR3= 177606
MAPL14- 170260   PR5    = 000240   SR0    = 177572   TST15    012330   UIPDR4= 177610
MAPL15- 170264   PR6      000300   SR1    - 177574   TST16    012502   UIPDR5= 177612
MAPL16- 170270   PR7    = 000340   SR2    = 177576   TST17    012734   UIPDR6= 177614
MAPL17  170274   PS     = 177776   SR3    = 172516   TST2     010506   UIPDR7= 177616
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```
CKKUAA0 11/44 UBI MAP   MACRO M1111  20-SEP-79 11:20  PAGE 64-5                    SEQ 0119
SYMBOL TABLE

USESTK= 000600          $DDW3   020106          $GET42  021444          $OCTVL  004036          $TKS    001134
USP   =%000006          $DDW4   020110          $HD   = 000000          $OMODE  003244          $TMP0   001172
WRITEE  004256          $DDW5   020112          $HIBTS  020000          $OVER   020452          $TMP1   001174
$APTHD  020000          $DDW6   020114          $ICNT   001102          $PASS   020022          $TMP2   001176
$ATYC   021030          $DDW7   020116          $ILLUP  003662          $PASTM  020006          $TMP3   001200
$ATY1   021004          $DDW8   020120          $ITEMB  001112          $PWRAD  003656          $TMP4   001202
$ATY3   021012          $DDW9   020122          $LF     001220          $PWRDN  003534          $TMP5   001204
$ATY4   021022          $DEVCT  020024          $LFLG   021247          $PWRMG  003652          $TN   = 000033
$BASE   020070          $DEVM   020072          $LOOP   021542          $PWRUP  003602          $TPB    001142
$BDADR  001120          $DOAGN  021502          $LPADR  001104          $QUES   001216          $TPFLG  001147
$BDDAT  001124          $DTBL   003452          $LPERR  001106          $REGAD  001154          $TPS    001140
$BELL   001212          $ENDAD  021472          $MADR1  020046          $REG0   001156          $TRAP   003472
$CDW1   020074          $ENDCT  021320          $MADR2  020052          $REG1   001160          $TRP  = 000022
$CDW2   020076          $ENULL  021550          $MADR3  020056          $REG2   001162          $TRPAD  003512
$CHARC  003014          $ENV    020034          $MADR4  020062          $REG3   001164          $TSTM   020004
$CLR.T  021462          $ENVM   020035          $MAIL   020014          $REG4   001166          $TSTNM  001100
$CMTAG  001100          $EOP    021252          $MAMS1  020044          $REG5   001170          $TYPDS  003246
$CM1  = 000006          $EOPCT  021312          $MAMS2  020050          $RESRE  002466          $TYPE   002524
$CM2  = 000014          $ERFLG  001101          $MAMS3  020054          $RTRN   021540          $TYPEC  002700
$CM3  = 000006          $ERMAX  001113          $MAMS4  020060          $SAVRE  002430          $TYPEX  003016
$CM4  = 000006          $ERROR  020470          $MBADR  020002          $SAVR6  003666          $TYPOC  003044
$CPUOP  020042          $ERRPC  001114          $MFLG   021246          $SCOPE  020140          $TYPON  003060
$CRLF   001217          $ERRTB  001326          $MSGAD  020030          $SETUP= 000037          $TYPOS  003020
$DBLK   003462          $ERTTL  001110          $MSGLG  020032          $STUP = 177777          $UNIT   020026
$DB20   003734          $ESCAP  001210          $MSGTY  020014          $SVLAD  020416          $UNITM  020010
$DDW0   020100          $ETABL  020034          $MTYP1  020045          $SVPC = 000204          $USWR   020040
$DDW1   020102          $ETEND  020140          $MTYP2  020051          $SWR  = 177400          $VECT1  020064
$DDW10  020124          $FATAL  020016          $MTYP3  020055          $SWREG  020036          $VECT2  020066
$DDW11  020126          $FFLG   021250          $MTYP4  020061          $SWRMK= 000300          $XTSTR  020214
$DDW12  020130          $FILLC  001146          $MXCNT  020466          $TBIT   021546          $$GET4= 000001
$DDW13  020132          $FILLS  001145          $NULL   001144          $TESTN  020020          $$TRP = 000002
$DDW14  020134          $GDADR  001116          $NWTST  000001          $TIMES  001206          $OFILL  003243
$DDW15  020136          $GDDAT  001122          $OCNT   003242          $TKB    001136          .$X     020000
$DDW2   020104

. ABS.  033466      000
        000000      001
ERRORS DETECTED:  0

VIRTUAL MEMORY USED:  64784 WORDS  ( 254 PAGES)
DYNAMIC MEMORY:  20434 WORDS  ( 78 PAGES)
ELAPSED TIME:  00:08:47
CKKUAA0,CKKUAA0/NL:TOC/CRF/-SP-CKKUAA0.SML,CKKUAA0.P11
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SYMBOL	VALUE	REFERENCES							
ABASE	= 000000	62-2195	62-2195						
ACDW1	= 000000	62-2195	62-2195						
ACDW2	= 000000	62-2195	62-2195						
ACPUOP	= 000000	62-2195	62-2195						
ADDROR	001230	#52-226	*57-742	*57-766	*57-789	*57-811	*59-1591	*62-2196	64-2317	64-2318
		64-2321	64-2322	64-2332						
ADDW0	= 000000	62-2195	62-2195						
ADDW1	= 000000	62-2195	62-2195						
ADDW10	= 000000	62-2195	62-2195						
ADDW11	= 000000	62-2195	62-2195						
ADDW12	= 000000	62-2195	62-2195						
ADDW13	= 000000	62-2195	62-2195						
ADDW14	- 000000	62-2195	62-2195						
ADDW15	- 000000	62-2195	62-2195						
ADDW2	- 000000	62-2195	62-2195						
ADDW3	- 000000	62-2195	62-2195						
ADDW4	000000	62-2195	62-2195						
ADDW5	- 000000	62-2195	62-2195						
ADDW6	000000	62-2195	62-2195						
ADDW7	- 000000	62-2195	62-2195						
ADDW8	= 000000	62-2195	62-2195						
ADDW9	- 000000	62-2195	62-2195						
ADEVCT	- 000000	62-2195	62-2195						
ADEVM	000000	62-2195	62-2195						
ADRAND	001226	#52-226	*57-743	*57-767	*57-790	*57-812	*59-1589	*62-2196	64-2317	64-2318
		64-2321	64-2322	64-2332						
AENV	- 000000	62-2195	62-2195						
AENVM	- 000000	62-2195	62-2195						
AFATAL	= 000000	62-2195	62-2195						
AMADR1	= 000000	62-2195	62-2195						
AMADR2	= 000000	62-2195	62-2195						
AMADR3	= 000000	62-2195	62-2195						
AMADR4	- 000000	62-2195	62-2195						
AMAMS1	= 000000	62-2195	62-2195						
AMAMS2	= 000000	62-2195	62-2195						
AMAMS3	- 000000	62-2195	62-2195						
AMAMS4	= 000000	62-2195	62-2195						
AMSGAD	- 000000	62-2195	62-2195						
AMSGLG	- 000000	62-2195	62-2195						
AMSGTY	= 000000	62-2195	62-2195						
AMTYP1	- 000000	62-2195	62-2195						
AMTYP2	000000	62-2195	62-2195						
AMTYP3	- 000000	62-2195	62-2195						
AMTYP4	000000	62-2195	62-2195						
APASS	000000	62-2195	62-2195						
APRIOR	000000	62-2195							
APTCSU	= 000040	#62-2198							
APTENV	= 000001	62-2198	#62-2198						
APTSIZ	- 000200	#62-2198							
APTSPO	000100	62-2198	#62-2198						
ASWREG	000000	62-2195	62-2195						
ATESTN	- 000000	62-2195	62-2195						

SYMBOL	VALUE	REFERENCES								
AUNIT	= 000000	62-2195	62-2195							
AUSWR	= 000000	62-2195	62-2195							
AVECT1	= 000000	62-2195	62-2195							
AVECT2	= 000000	62-2195	62-2195							
BADPC	001300	#52-226	*57-877	*57-910	64-2313	64-2314	64-2316			
BIT0	- 000001	#51-222	58-1293							
BIT00	= 000001	#51-222	51-222							
BIT01	= 000002	#51-222	51-222							
BIT02	= 000004	#51-222	51-222							
BIT03	- 000010	#51-222	51-222							
BIT04	= 000020	#51-222	51-222							
BIT05	= 000040	#51-222	51-222							
BIT06	- 000100	#51-222	51-222							
BIT07	- 000200	#51-222	51-222							
BIT08	= 000400	#51-222	51-222	62-2196						
BIT09	- 001000	#51-222	51-222	62-2196	62-2197					
BIT1	- 000002	#51-222								
BIT10	002000	#51-222	62-2197							
BIT11	= 004000	#51-222	58-1313	62-2196						
BIT12	- 010000	#51-222	62-2199							
BIT13	- 020000	#51-222	62-2197							
BIT14	040000	#51-222								
BIT15	= 100000	#51-222								
BIT2	000004	#51-222								
BIT3	= 000010	#51-222								
BIT4	000020	#51-222	56-672	58-1294	58-1307					
BIT5	- 000040	#51-222	58-1440	58-1552	59-1614	59-1714				
BIT6	- 000100	#51-222								
BIT7	= 000200	#51-222								
BIT8	- 000400	#51-222								
BIT9	- 001000	#51-222	53-498							
BPTVEC	000014	#51-222								
CACHVE	000114	#51-222								
CLRMAP	004120	#57-710	58-1188	58-1346	58-1505					
CNTR	001260	#52-226	64-2329							
CONTRL	- 177746	#51-222								
COUNT	004416	#57-810	58-1224	58-1237	58-1251	58-1264				
CPFLAG	004564	#57-865	*57-886	*57-947	*62-2197					
CPUER	004562	#57-864	57-941	57-989						
CPUERP	- 177766	#51-222	57-736	*57-737	57-876	*57-885	57-950	62-2197		
CPUEXP	001266	#52-226	57-738	57-878	57-880	*57-943	*58-1308	*58-1331	*58-1347	*58-1385
		*58-1402	*58-1420	*58-1434	*58-1463	*59-1615	*59-1633	*59-1724	*59-1735	*59-1761
		*59-1811	*59-1829	*59-1925	*59-1936	*59-1962	64-2313	64-2333		
CR	= 000015	#51-222	53-642	53-642						
CRLF	- 000200	#51-222	53-642	53-642	57-936	57-936	63-2216	63-2218	63-2220	63-2222
		63-2227	63-2229	63-2233	63-2234	63-2237	63-2238	63-2239	63-2240	63-2241
		63-2242	63-2250	63-2252	63-2254	63-2256	63-2270	63-2272	63-2274	63-2276
		63-2278	63-2280	63-2282	63-2285	63-2293	63-2295	63-2297	63-2301	63-2305
		63-2307								
DATA	001324	#52-226	59-1726	*59-1750	*59-1757	*59-1758	*59-1759	59-1927	*59-1951	*59-1958
		*59-1959	*59-1960							
DATAND	001232	#52-226	*57-769	*57-792	*57-814	*57-839	*59-1590	*62-2196	64-2318	64-2321

SYMBOL	VALUE	REFERENCES								
		64-2322	64-2325	64-2332						
DATAOR	001234	#52-226	*57-768	*57-791	*57-813	*57-838	*59-1592	*62-2196	64-2318	64-2321
		64-2322	64-2325	64-2332						
DF1	033266	53-231	#64-2345							
DF10	033315	53-258	53-265	#64-2350						
DF12	033324	53-272	53-279	#64-2351						
DF14	033330	53-286	#64-2352							
DF15	033336	53-293	53-300	#64-2353						
DF17	033346	#64-2354								
DF2	033272	53-237	#64-2346							
DF201	033426	53-425	#64-2366							
DF202	033431	53-431	#64-2367							
DF203	033435	53-438	#64-2368							
DF204	033441	53-444	#64-2369							
DF205	033447	53-450	#64-2370							
DF206	033454	53-457	#64-2371							
DF207	033460	#64-2372								
DF23	033351	53-321	#64-2355							
DF25	033357	53-307	#64-2356							
DF27	033363	#64-2357								
DF3	033275	#64-2347								
DF30	033366	53-314	53-327	53-335	#64-2358					
DF34	033370	#64-2359								
DF35	033374	53-349	#64-2360							
DF36	033400	53-355	#64-2361							
DF37	033403	53-362	53-415	#64-2362						
DF40	033411	53-369	53-391	#64-2363						
DF41	033415	53-376	53-399	#64-2364						
DF42	033421	53-383	53-407	#64-2365						
DF5	033303	53-244	#64-2348							
DF6	033310	53-251	#64-2349							
DH1	030034	53-229	#63-2268							
DH10	030460	53-255	53-262	#63-2276						
DH12	030610	53-269	53-276	#63-2278						
DH14	030666	53-283	#63-2280							
DH15	031005	53-290	53-297	#63-2282						
DH17	031164	#63-2284								
DH2	030100	53-235	#63-2269							
DH201	032101	53-423	#63-2299							
DH202	032131	53-429	#63-2300							
DH203	032171	53-435	#63-2301							
DH204	032250	53-442	#63-2303							
DH205	032330	53-448	#63-2304							
DH206	032402	53-454	#63-2305							
DH207	032462	#63-2307								
DH23	031214	53-318	53-359	53-412	#63-2285					
DH25	031333	53-305	#63-2287							
DH27	031375	#63-2288								
DH3	030134	#63-2270								
DH30	031427	53-312	53-325	53-333	#63-2289					
DH34	031447	#63-2290								
DH35	031507	53-347	#63-2291							

SYMBOL	VALUE	REFERENCES					
DH36	031547	53-353	#63-2292				
DH40	031641	53-366	53-388	#63-2293			
DH41	031721	53-373	53-396	#63-2295			
DH42	032001	53-380	53-404	#63-2297			
DH5	030264	53-241	#63-2272				
DH6	030370	53-248	#63-2274				
DISPLA	001152	#52-226	58-1306	58-1433	59-1809	62-2196	62-2197
DT1	032562	53-230	#64-2313				
DT10	032646	53-257	53-264	#64-2318			
DT12	032666	53-271	#64-2319				
DT13	032700	53-278	#64-2320				
DT14	032712	53-285	#64-2321				
DT15	032730	53-292	53-299	#64-2322			
DT17	032752	#64-2323					
DT2	032574	53-236	#64-2314				
DT20	032762	#64-2324					
DT201	033152	53-424	#64-2336				
DT202	033162	53-430	#64-2337				
DT203	033174	53-437	#64-2338				
DT204	033206	53-443	#64-2339				
DT205	033224	53-449	#64-2340				
DT206	033240	53-456	#64-2341				
DT207	033252	#64-2342					
DT23	032772	53-320	#64-2325				
DT25	033010	53-306	#64-2326				
DT27	033022	#64-2327					
DT30	033032	53-313	53-326	53-334	#64-2328		
DT34	033040	#64-2329					
DT35	033052	53-348	#64-2330				
DT36	033064	53-354	#64-2331				
DT37	033074	53-361	53-414	#64-2332			
DT4	032604	#64-2315					
DT40	033112	53-368	53-390	#64-2333			
DT41	033124	53-375	53-398	#64-2334			
DT42	033136	53-382	53-406	#64-2335			
DT5	032616	53-243	#64-2316				
DT6	032632	53-250	#64-2317				
DUALAD	004342	#57-787	58-1196	58-1521			
EMTVEC -	000030	#51-222	57-935	57-935			
EM1	021554	53-228	#63-2202				
EM10	022365	53-254	#63-2209				
EM11	022456	53-261	#63-2210				
EM12	022550	53-268	#63-2211				
EM13	022636	53-275	#63-2212				
EM14	022730	53-282	#63-2213				
EM15	023023	53-289	#63-2214				
EM16	023127	53-296	#63-2215				
EM17	023232	#63-2216					
EM2	021636	53-234	#63-2203				
EM20	023354	#63-2218					
EM201	027327	53-422	#63-2260				
EM202	027403	53-428	#63-2261				

SYMBOL	VALUE	REFERENCES							
EM203	027456	53-434	#63-2262						
EM204	027551	53-441	#63-2263						
EM205	027631	53-447	#63-2264						
EM206	027700	53-453	#63-2265						
EM207	027762	#63-2266							
EM21	023502	#63-2220							
EM22	023646	#63-2222							
EM23	024012	#63-2224							
EM24	024106	#63-2225							
EM25	024206	53-303	#63-2226						
EM26	024313	#63-2227							
EM3	021705	#63-2204							
EM30	024434	53-310	#63-2229						
EM31	024610	53-317	#63-2231						
EM32	024702	53-324	#63-2232						
EM33	024754	53-330	#63-2233						
EM35	025166	53-343	#63-2237						
EM36	025736	53-352	#63-2244						
EM37	026033	53-358	#63-2245						
EM4	022006	#63-2205							
EM40	026136	53-365	#63-2246						
EM41	026231	53-372	#63-2247						
EM42	026313	53-379	#63-2248						
EM43	026406	#63-2249							
EM45	026473	53-386	#63-2250						
EM46	026626	53-394	#63-2252						
EM47	026750	53-402	#63-2254						
EM5	022115	53-240	#63-2206						
EM50	027103	#63-2256							
EM52	027270	53-411	#63-2259						
EM6	022223	53-247	#63-2207						
EM7	022303	#63-2208							
EREXIT	021002	62-2197	#62-2197						
ERRCNT	001256	#52-226	57-744	57-770	57-793	57-817	57-840	57-973	57-1002	58-1033
		58-1063	58-1093	58-1205	58-1224	58-1237	58-1251	58-1264	58-1380	58-1536
		59-1593	59-1599	*62-2196	*62-2197	64-2317	64-2318	64-2321	64-2322	64-2325
		64-2329	64-2332							
ERROR	= 104000	#51-222							
ERRVEC	= 000004	#51-222	*57-941	*57-942	*57-963	*57-989	62-2196	62-2196	62-2196	62-2196
ERTYPE	001736	#53-488	62-2197						
ER200	001656	#53-417	53-508	53-511					
FLAG	001262	#52-226							
GNS	= ******	51-224	51-224	53-645	53-645	53-645	53-645	53-645	53-645	53-645
		53-645	53-645	53-645	53-645	53-645	53-645	53-645	53-646	53-646
		53-647	53-647	57-936	62-2199	62-2199				
HIADRS	177742	#51-222							
HIGEST	001244	#52-226	*58-1455	58-1468	58-1475	58-1525	58-1534	64-2330		
HITMIS	= 177752	#51-222							
HREGL	001252	#52-226	*58-1486						
HREGU	001254	#52-226	*58-1488						
HT	= 000011	#51-222	53-642	53-642					
IOTVEC	= 000020	#51-222	57-935	57-935					

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SYMBOL  VALUE    REFERENCES
KDPAR0  = 172360 #51-222
KDPAR1  = 172362 #51-222
KDPAR2  = 172364 #51-222
KDPAR3  = 172366 #51-222
KDPAR4  = 172370 #51-222
KDPAR5  = 172372 #51-222
KDPAR6  = 172374 #51-222
KDPAR7  = 172376 #51-222
KDPDR0  = 172320 #51-222
KDPDR1  = 172322 #51-222
KDPDR2  = 172324 #51-222
KDPDR3  = 172326 #51-222
KDPDR4  = 172330 #51-222
KDPDR5  = 172332 #51-222
KDPDR6  = 172334 #51-222
KDPDR7  = 172336 #51-222
KERSTK  = 001100 #51-222  57-874
KIPAR0  = 172340 #51-222  53-600  *58-1285  *59-1795
KIPAR1  = 172342 #51-222  *58-1286  *59-1793
KIPAR2  = 172344 #51-222  *58-1287
KIPAR3  = 172346 #51-222  *58-1288
KIPAR4  = 172350 #51-222  *58-1289  *58-1442  *58-1449  58-1450  58-1454  58-1455  *58-1456  58-1457
                 *58-1515  *58-1553  *58-1560  58-1561  *59-1616  *59-1721  59-1749  *59-1751  *59-1812
                 *59-1922  59-1950  *59-1952
KIPAR5  = 172352 #51-222  *58-1290  *58-1360  *58-1361
KIPAR6  = 172354 #51-222  *58-1291  *58-1310  *58-1315  *58-1326  *58-1349  *58-1355  58-1356  58-1360
                 58-1404  58-1568  58-1571  *59-1584  59-1585  59-1651  59-1656  59-1661  59-1666
                 59-1671  59-1676  59-1681  59-1686  59-1691  59-1696  59-1701  *59-1722  59-1852
                 59-1857  59-1862  59-1867  59-1872  59-1877  59-1882  59-1887  59-1892  59-1897
                 59-1902  *59-1923
KIPAR7  = 172356 #51-222  *58-1292
KIPDR0  = 172300 #51-222  *58-1277
KIPDR1  = 172302 #51-222  *58-1278
KIPDR2  = 172304 #51-222  *58-1279
KIPDR3  = 172306 #51-222  *58-1280
KIPDR4  = 172310 #51-222  *58-1281
KIPDR5  = 172312 #51-222  *58-1282
KIPDR6  = 172314 #51-222  *58-1283
KIPDR7  = 172316 #51-222  *58-1284
KSP     =%000006 #51-222  *53-488  *53-492  53-504  *53-532  *53-539  *53-545  *53-551  53-553
                 *53-554  *53-562  *53-567  *53-575  *53-576  53-593  *53-608  53-610  *53-611
                 *53-616  53-616  53-625  *53-630  53-632  *53-633  *53-637  53-637  56-674
                 56-676  56-677  56-693  *57-734  *57-735  *57-750  *57-751  *57-765  *57-788
                 *57-810  *57-835  *57-872  *57-873  *57-874  *57-887  *57-888  57-910  *57-911
                 *57-912  *57-919  *57-920
LF      = 000012 #51-222  53-642  53-642
LOADRS  = 177740 #51-222
LOOP      010332 #57-937  62-2199
LOWEST    001242 #52-226  *58-1454  58-1466  58-1476  58-1510  58-1511  59-1616  59-1651  59-1656
                 59-1661  59-1666  59-1671  59-1676  59-1681  59-1686  59-1691  59-1696  59-1701
                 59-1722  59-1791  59-1812  59-1852  59-1857  59-1862  59-1867  59-1872  59-1877
                 59-1882  59-1887  59-1892  59-1897  59-1902  59-1923  64-2330
```

SYMBOL	VALUE	REFERENCES
LREGL	001246	#52-226 •58-1483 58-1509 59-1618 59-1651 59-1656 59-1661 59-1666 59-1671 59-1676 59-1681 59-1686 59-1691 59-1696 59-1701 59-1718 59-1752 59-1814 59-1852 59-1857 59-1862 59-1867 59-1872 59-1877 59-1882 59-1887 59-1892 59-1897 59-1902 59-1919 59-1953
LREGL	001250	#52-226 •58-1485 59-1617 59-1651 59-1656 59-1661 59-1666 59-1671 59-1676 59-1681 59-1686 59-1691 59-1696 59-1701 59-1717 59-1754 59-1755 59-1785 59-1813 59-1852 59-1857 59-1862 59-1867 59-1872 59-1877 59-1882 59-1887 59-1892 59-1897 59-1902 59-1918 59-1955 59-1956
MAINT	= 177750	#51-222
MAPH0	= 170202	#51-222 58-1021 58-1150
MAPH00	= 170202	#51-222 51-222 58-1151 58-1237
MAPH01	= 170206	#51-222 51-222
MAPH02	= 170212	#51-222 51-222
MAPH03	= 170216	#51-222 51-222
MAPH04	= 170222	#51-222 51-222
MAPH05	= 170226	#51-222 51-222
MAPH06	= 170232	#51-222 51-222
MAPH07	= 170236	#51-222 51-222
MAPH1	= 170206	#51-222
MAPH10	= 170242	#51-222
MAPH11	= 170246	#51-222
MAPH12	= 170252	#51-222
MAPH13	= 170256	#51-222
MAPH14	= 170262	#51-222
MAPH15	= 170266	#51-222
MAPH16	= 170272	#51-222
MAPH17	= 170276	#51-222 58-1029 58-1237
MAPH2	= 170212	#51-222
MAPH20	= 170302	#51-222 58-1081 58-1162 58-1163 58-1264
MAPH21	= 170306	#51-222
MAPH22	= 170312	#51-222
MAPH23	= 170316	#51-222
MAPH24	= 170320	#51-222
MAPH25	= 170326	#51-222
MAPH26	= 170332	#51-222
MAPH27	= 170336	#51-222
MAPH3	= 170216	#51-222
MAPH30	= 170342	#51-222
MAPH31	= 170346	#51-222
MAPH32	= 170352	#51-222
MAPH33	= 170356	#51-222
MAPH34	= 170362	#51-222
MAPH35	= 170366	#51-222
MAPH36	= 170372	#51-222
MAPH37	= 170376	#51-222 57-712 57-969 58-1089 58-1187 58-1201 58-1264
MAPH4	= 170222	#51-222
MAPH5	= 170226	#51-222
MAPH6	= 170232	#51-222
MAPH7	= 170236	#51-222
MAPL0	= 170200	#51-222 57-710 57-964 57-990 58-1185 58-1198 58-1312 58-1321 58-1435
MAPL00	= 170200	#51-222 51-222 •58-1113 58-1114 58-1224
MAPL01	= 170204	#51-222 51-222

SYMBOL	VALUE	REFERENCES								
MAPL02	= 170210	#51-222	51-222							
MAPL03	= 170214	#51-222	51-222							
MAPL04	= 170220	#51-222	51-222							
MAPL05	= 170224	#51-222	51-222							
MAPL06	= 170230	#51-222	51-222							
MAPL07	= 170234	#51-222	51-222							
MAPL1	= 170204	#51-222								
MAPL10	= 170240	#51-222								
MAPL11	= 170244	#51-222								
MAPL12	= 170250	#51-222								
MAPL13	= 170254	#51-222								
MAPL14	= 170260	#51-222								
MAPL15	= 170264	#51-222								
MAPL16	= 170270	#51-222								
MAPL17	= 170274	#51-222	57-998	58-1224						
MAPL2	170210	#51-222								
MAPL20	170300	#51-222	58-1051	*58-1125	58-1126	58-1251				
MAPL21	= 170304	#51-222								
MAPL22	170310	#51-222								
MAPL23	170314	#51-222								
MAPL24	= 170320	#51-222								
MAPL25	170324	#51-222								
MAPL26	= 170330	#51-222								
MAPL27	170334	#51-222								
MAPL3	170214	#51-222								
MAPL30	170340	#51-222								
MAPL31	= 170344	#51-222								
MAPL32	= 170350	#51-222								
MAPL33	170354	#51-222								
MAPL34	170360	#51-222								
MAPL35	= 170364	#51-222								
MAPL36	= 170370	#51-222								
MAPL37	170374	#51-222	58-1059	58-1251	58-1438					
MAPL4	170220	#51-222								
MAPL5	= 170224	#51-222								
MAPL6	= 170230	#51-222								
MAPL7	= 170234	#51-222								
MEMERR	= 177744	#51-222								
MMFLAG	004676	#57-903	*57-918	*57-949	*62-2197					
MMR0	177572	#51-222	51-222	57-913	57-917	57-944	*58-1293	62-2197	*62-2199	
MMR1	177574	#51-222	51-222	57-914						
MMR2	177576	#51-222	51-222	57-915						
MMR3	= 172516	#51-222	51-222	57-945	*58-1294	58-1440	*58-1552	*59-1614	*62-2199	
MMTRAP	004674	#57-902	57-938							
MMVEC	= 000250	#51-222	*57-938	*57-940						
NEXMEM	000040	#59-1714	59-1735	59-1737	59-1936	59-1938				
NXTTST	001322	#52-226	*57-962	*57-988	*58-1020	*58-1050	*58-1080	*58-1108	*58-1145	*58-1184
		*58-1223	*58-1236	*58-1250	*58-1263	*58-1345	*58-1401	*58-1432	*58-1504	*58-1551
		*59-1613	*59-1646	*59-1713	*59-1810	*59-1845	*59-1916	*59-1990	*60-2097	
OLDPC	001302	#52-226	*57-734	57-751	*57-765	57-775	*57-788	57-798	*57-810	57-822
		*57-835	57-845	*57-872	57-877	57-888	*57-911	57-920		
OLDPS	001304	#52-226	*57-735	57-750	*57-873	57-887	*57-912	57-919		

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SYMBOL   VALUE          REFERENCES
OLDPSW     001306       #52-226   *56-676   56-693   *57-695
PADRSH     001224       #52-226   *53-606   *53-629
PADRSL     001222       #52-226   *53-607   53-608   *53-628   53-630
PATAND     001236       #52-226   *57-816   *57-837   *62-2196   64-2322   64-2325
PATTOR     001240       #52-226   *57-815   *57-836   *62-2196   64-2322   64-2325
PCONTR     001274       #52-226
PCPUER     001270       #52-226   *57-736   57-737   57-738   *57-876   57-880   57-885   *58-1350   58-1353
                        *59-1620   59-1629   *59-1725   59-1733   59-1737   *59-1816   59-1825   *59-1926   59-1934
                         59-1938   64-2313   64-2314   64-2333
PIRQ     = 177772       #51-222
PIRQVE   = 000240       #51-222
PMAINT     001276       #52-226
PMMR0      001310       #52-226   *57-913   64-2316
PMMR1      001312       #52-226   *57-914   64-2316
PMMR2      001314       #52-226   *57-915   64-2316
PPARER     001272       #52-226
PR0      = 000000       #51-222
PR1      = 000040       #51-222
PR2      = 000100       #51-222
PR3      = 000140       #51-222
PR4      = 000200       #51-222
PR5      = 000240       #51-222
PR6      = 000300       #51-222
PR7        000340       #51-222
PS       = 177776       #51-222   51-222   57-935   62-2199
PSW      = 177776       #51-222
PWRMSG     003670        53-649   #53-650
PWRVEC   = 000024       #51-222    53-649   53-649   53-649   53-649   53-649   57-935   57-935
RELC22     012166        58-1264  #58-1273
RESREG   = 104414        53-615    53-636  #53-645   53-653
RESVEC   = 000010       #51-222    57-935    57-935   57-935
RETRY      001320       #52-226   *62-2196
RSIZE      001316       #52-226   *59-1749  *59-1950
R10      =%000000       #51-222
R11      =%000001       #51-222
R12      =%000002       #51-222
R13      =%000003       #51-222
R14      =%000004       #51-222
R15      =%000005       #51-222
R6       =%000006       #51-222   51-222   *57-935   *57-935   57-935   *60-2042   *60-2042   *60-2156   *60-2156
R7       =%000007       #51-222   51-222
SAVREG   = 104412        53-592    53-624  #53-645   53-653
SCOPE    = 000004       #51-222    57-962    57-988   58-1020   58-1050   58-1080   58-1108   58-1145   58-1184
                         58-1223   58-1236   58-1250   58-1263   58-1345   58-1401   58-1432   58-1504   58-1551
                         59-1613   59-1646   59-1713   59-1772   59-1845   59-1916   59-1990   60-2096   62-2199
SDPAR0   = 172260       #51-222
SDPAR1   = 172262       #51-222
SDPAR2   = 172264       #51-222
SDPAR3   = 172266       #51-222
SDPAR4   = 172270       #51-222
SDPAR5   = 172272       #51-222
SDPAR6     172274       #51-222
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SYMBOL  VALUE            REFERENCES
SDPAR7  = 172276         #51-222
SDPDR0  = 172220         #51-222
SDPDR1  = 172222         #51-222
SDPDR2  = 172224         #51-222
SDPDR3  = 172226         #51-222
SDPDR4  = 172230         #51-222
SDPDR5  = 172232         #51-222
SDPDR6  = 172234         #51-222
SDPDR7  = 172236         #51-222
SIPAR0  = 172240         #51-222
SIPAR1  = 172242         #51-222
SIPAR2  = 172244         #51-222
SIPAR3  = 172246         #51-222
SIPAR4  = 172250         #51-222
SIPAR5  = 172252         #51-222
SIPAR6  = 172254         #51-222
SIPAR7  = 172256         #51-222
SIPDR0  = 172200         #51-222
SIPDR1  = 172202         #51-222
SIPDR2  = 172204         #51-222
SIPDR3  = 172206         #51-222
SIPDR4  = 172210         #51-222
SIPDR5  = 172212         #51-222
SIPDR6  = 172214         #51-222
SIPDR7  = 172216         #51-222
SIZEHI  = 177762         #51-222
SIZEJ     013064          58-1359   #58-1433
SIZELO  = 177760         #51-222
SR0     = 177572         #51-222
SR1     = 177574         #51-222
SR2     = 177576         #51-222
SR3       172516         #51-222
SSP     =%000006         #51-222
STACK   = 001100         #51-222   51-222   51-222   51-222   57-935
START     010000          51-224   53-649  #57-930   58-1453
STKLMT  = 177774         #51-222
SUPSTK  = 000700         #51-222
SWR       001150         #52-226   53-501  *57-932   62-2196   62-2196   62-2196   62-2196   62-2196   62-2197
                          62-2197   62-2197   62-2197   62-2197   62-2197   62-2199
SW0     = 000001         #51-222
SW00    = 000001         #51-222   51-222
SW01    = 000002         #51-222   51-222
SW02    = 000004         #51-222   51-222
SW03    = 000010         #51-222   51-222
SW04    = 000020         #51-222   51-222
SW05    = 000040         #51-222   51-222
SW06    = 000100         #51-222   51-222
SW07      000200         #51-222   51-222
SW08    = 000400         #51-222   51-222
SW09    = 001000         #51-222   51-222
SW1     = 000002         #51-222
SW10      002000         #51-222
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SYMBOL	VALUE	REFERENCES								
SW11	= 004000	#51-222								
SW12	= 010000	#51-222								
SW13	= 020000	#51-222								
SW14	= 040000	#51-222								
SW15	= 100000	#51-222								
SW2	= 000004	#51-222								
SW3	= 000010	#51-222								
SW4	= 000020	#51-222								
SW5	= 000040	#51-222								
SW6	= 000100	#51-222								
SW7	000200	#51-222	53-501							
SW8	= 000400	#51-222								
SW9	= 001000	#51-222	62-2197							
SYSTID	= 177764	#51-222								
TBIT	= 000020	#56-672	56-674	56-677	57-695					
TBITO	= 104416	#53-646								
TBITOF	004054	53-646	#56-673							
TBITR	= 104420	#53-647	58-1273	59-1773	62-2199					
TBITRE	004102	53-647	#56-692							
TBITVE	= 000014	#51-222	57-935	57-935						
TESTNO	001264	#52-226	*62-2197	64-2313	64-2314	64-2315	64-2316	64-2317	64-2318	64-2319
		64-2320	64-2321	64-2322	64-2323	64-2324	64-2325	64-2326	64-2327	64-2328
		64-2329	64-2330	64-2331	64-2332	64-2333	64-2334	64-2335	64-2336	64-2337
		64-2338	64-2339	64-2340	64-2341	64-2342				
TIMEOU	004136	#57-725	57-963							
TIMOUT	= 000020	#58-1307	58-1308	58-1347	58-1402	58-1434	59-1615	59-1629	59-1925	
TKVEC	= 000060	#51-222								
TOFLAG	004140	#57-727	*57-749	*57-948	*62-2197					
TPVEC	= 000064	#51-222								
TRAPVE	= 000034	#51-222	57-935	57-935						
TRTVEC	= 000014	#51-222								
TST1	010422	#57-962								
TST10	011322	58-1145	#58-1184							
TST11	011446	58-1184	58-1206	#58-1223						
TST12	011572	58-1223	58-1224	#58-1236						
TST13	011716	58-1236	58-1237	#58-1250						
TST14	012042	58-1250	58-1251	#58-1263						
TST15	012330	58-1263	#58-1306							
TST16	012502	#58-1345								
TST17	012734	58-1345	#58-1401							
TST2	010506	57-962	57-974	#57-988						
TST20	013046	58-1401	#58-1432							
TST21	013420	58-1432	58-1465	#58-1504						
TST22	013614	58-1504	58-1537	#58-1551						
TST23	014074	58-1551	58-1570	#59-1613						
TST24	014206	59-1613	#59-1646							
TST25	015114	59-1646	#59-1713							
TST26	015450	59-1713	#59-1809							
TST27	015602	59-1810	#59-1845							
TST3	010604	57-988	57-1003	#58-1020						
TST30	016516	59-1845	#59-1916							
TST31	016774	59-1916	#59-1990							

SYMBOL	VALUE	REFERENCES
TST32	017324	59-1990 #60-2096
TST4	010674	58-1020 58-1034 #58-1050
TST5	010764	58-1050 58-1064 #58-1080
TST6	011054	58-1080 58-1094 #58-1108
TST7	011200	58-1108 #58-1145
TYPDS	= 104410	53-546 #53-645 62-2199 62-2199
TYPE	= 104400	53-518 53-520 53-525 53-527 53-555 53-571 53-612 53-634 53-642
		53-643 53-644 #53-645 53-649 57-936 62-2197 62-2197 62-2199 62-2199
		62-2199
TYPOC	= 104402	53-493 53-540 #53-645
TYPON	= 104406	#53-645
TYPOS	= 104404	#53-645
TYPVAD	002244	53-563 #53-592
UBADDR	002352	53-568 #53-624
UBCOUN	004506	#57-835 58-1377
UBMAP	015372	#59-1772
UDPAR0	= 177660	#51-222
UDPAR1	= 177662	#51-222
UDPAR2	= 177664	#51-222
UDPAR3	= 177666	#51-222
UDPAR4	= 177670	#51-222
UDPAR5	= 177672	#51-222
UDPAR6	= 177674	#51-222
UDPAR7	= 177676	#51-222
UDPDR0	= 177620	#51-222
UDPDR1	= 177622	#51-222
UDPDR2	= 177624	#51-222
UDPDR3	= 177626	#51-222
UDPDR4	= 177630	#51-222
UDPDR5	= 177632	#51-222
UDPDR6	= 177634	#51-222
UDPDR7	= 177636	#51-222
UIPAR0	= 177640	#51-222
UIPAR1	= 177642	#51-222
UIPAR2	= 177644	#51-222
UIPAR3	= 177646	#51-222
UIPAR4	= 177650	#51-222
UIPAR5	= 177652	#51-222
UIPAR6	= 177654	#51-222
UIPAR7	= 177656	#51-222
UIPDR0	= 177600	#51-222
UIPDR1	= 177602	#51-222
UIPDR2	= 177604	#51-222
UIPDR3	= 177606	#51-222
UIPDR4	= 177610	#51-222
UIPDR5	= 177612	#51-222
UIPDR6	= 177614	#51-222
UIPDR7	= 177616	#51-222
USESTK	= 000600	#51-222
USP	=%000006	#51-222
WRITEE	004256	#57-764 57-996 58-1027 58-1057 58-1087
$APTHD	020000	62-2194 #62-2194

SYMBOL	VALUE	REFERENCES								
$ASTAT	= ******	62-2198	62-2198							
$ATYC	021030	62-2198	#62-2198							
$ATY1	021004	#62-2198								
$ATY3	021012	#62-2198								
$ATY4	021022	62-2197	#62-2198							
$BASE	020070	#62-2195								
$BDADR	001120	#52-226								
$BDDAT	001124	#52-226								
$BELL	001212	#52-226	62-2197	62-2197	62-2197					
$CDW1	020074	#62-2195								
$CDW2	020076	#62-2195								
$CHARC	003014	*53-642	53-642	*53-642	#53-642					
$CLR.T	021462	62-2199	#62-2199							
$CMTAG	001100	#52-226	57-935	57-935	57-935	57-935	57-935	57-935	57-935	
$CM1	000006	#52-226	52-226	52-226	#52-226	52-226	52-226	#52-226	52-226	52-226
		#52-226	52-226	52-226	#52-226	52-226	52-226	#52-226	52-226	52-226
		#52-226								
$CM2	- 000014	#52-226	52-226	52-226	#52-226	52-226	52-226	#52-226	52-226	52-226
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$GDDAT	001122	#52-226								
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		*59-1872	*59-1877	*59-1882	*59-1887	*59-1892	*59-1897	*59-1902	*59-1903	*59-1924
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$REG5    001170         #52-226   *62-2197
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SYMBOL	VALUE	REFERENCES
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$TYPON	003060	53-643 #53-643 53-645
$TYPOS	003020	#53-643 53-645
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DONE	#51-13	#62-2199								
ENDCOM	#13-1369	#51-222								
ENTRY	#51-46	#58-1306	#58-1433	#59-1809						
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	#57-842	#57-844	#57-882	#57-884	#57-916	#57-975	#57-1004	#58-1035	#58-1065	#58-1095
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H20H37	#51-153	58-1264								
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MSG37	#59-1832	59-1845								
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MSG42	#60-2063	60-2096								
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MSG7	#58-1098	58-1108								
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	#59-1613	#59-1646	#59-1713	#59-1809	#59-1845	#59-1916	#59-1990	#60-2096		
POP	#20-1876	#51-222	#53-641	#53-644	#53-649	#62-2198	#62-2198			
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REPUAT	#48-4775									

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              58-1251    58-1264    58-1465    58-1537    58-1570
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SPACE        #51-9      #51-222
SSCOPE       #51-32     #62-2196
STARS        #11-1278   #51-222    #51-225    #52-226    #53-226    #53-641    #53-642    #53-643    #53-644    #53-645
             #53-649    #53-653    #57-962    #57-962    #57-988    #57-988    #58-1020   #58-1020   #58-1050   #58-1050
             #58-1080   #58-1080   #58-1108   #58-1108   #58-1145   #58-1145   #58-1184   #58-1184   #58-1223   #58-1223
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             #59-1646   #59-1646   #59-1713   #59-1713   #59-1809   #59-1809   #59-1845   #59-1845   #59-1916   #59-1916
             #59-1990   #59-1990   #60-2096   #60-2096   #62-2194   #62-2194   #62-2194   #62-2195   #62-2196   #62-2197
             #62-2198   #62-2199
TRACK        #51-27      57-962     57-988     58-1020    58-1050    58-1080    58-1108    58-1145    58-1184    58-1223
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              59-1713    59-1845    59-1916    59-1990
TRACKS       #51-20      57-962     57-988     58-1020    58-1050    58-1080    58-1108    58-1145    58-1184    58-1223
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              59-1713    59-1845    59-1916    59-1990
TRMTRP       #53-645
TYPBIN       #19-1812   #51-222
TYPDEC       #19-1782   #51-222     62-2199    62-2199
TYPNAM       #17-1558   #51-222     57-936
TYPNUM       #19-1749   #51-222
TYPOCS       #19-1702   #51-222
TYPOCT       #19-1665   #51-222
TYPTXT       #18-1619   #51-222     62-2199    62-2199
USER         #51-78      52-226
ZEROER       #51-66      62-2197
$$CMRE       #51-226    #52-226    #52-226    #52-226    #52-226    #52-226    #52-226
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.KT11        #5-326
.SETUP       #9-1134    #51-210     51-223
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MACRO NAME	REFERENCES		
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.$APTB	#45-4428	#51-213	62-2195
.$APTH	#46-4684	#51-213	#62-2194
.$APTY	#49-4859	#51-213	62-2198
.$ASTA	#47-4730		
.$CATC	#7-929	#51-210	51-224
.$CMTA	#8-986	#51-210	51-226
.$DB2D	#40-4111		
.$DB2O	#42-4236	#51-212	53-653
.$DIV	#39-4013		
.$EOP	#21-1935	#51-211	#62-2199
.$ERRO	#23-2352	#51-211	62-2197
.$ERRT	#24-2534		
.$MULT	#38-3949		
.$POWE	#34-3657	#51-212	53-649
.$RAND	#35-3717		
.$RDDE	#31-3353		
.$RDOC	#30-3261		
.$READ	#29-3025		
.$SAVE	#32-3429	#51-211	#53-641
.$SB2D	#41-4196		
.$SB2O	#43-4299		
.$SCOP	#22-2153	#51-211	62-2196
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.$SUPR	#44-4338		
.$TRAP	#33-3530	#51-212	#53-645
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.$TYPD	#27-2850	#51-211	53-644
.$TYPE	#25-2622	#51-211	53-642
.$TYPO	#26-2753	#51-211	53-643
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