PDP11

MOS/CORE 0-124K EXER.

CZKMAF0

AH-8851F-MC



FICHE 1 OF 1

SEP 1979

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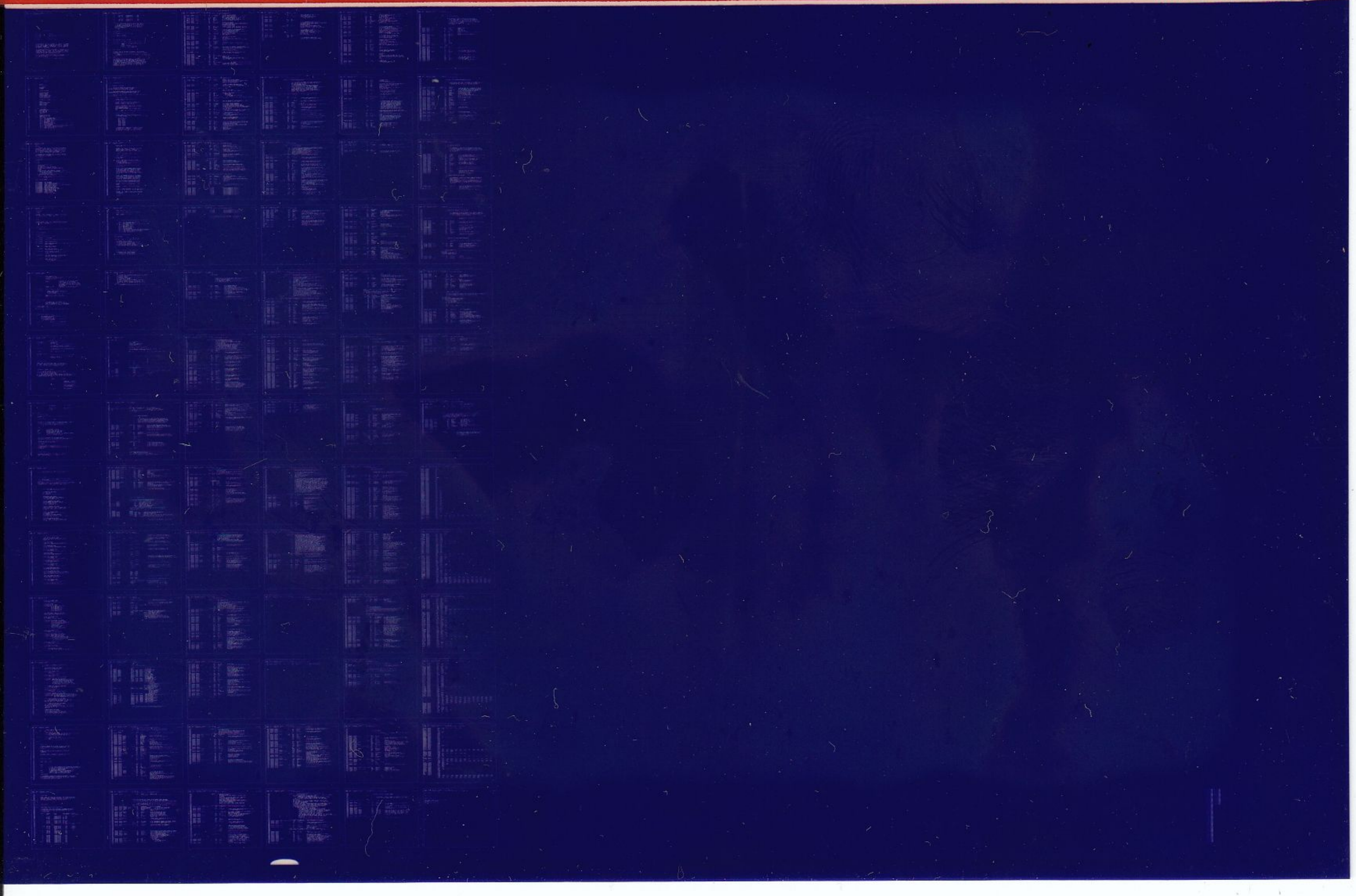
MADE IN USA



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17                      IDENTIFICATION
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21          PRODUCT CODE:           AC-8850F-MC
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23          PRODUCT NAME:           CZKMAF0 MOS/CORE 0-124K EXER
24
25          DATE CREATED:           MAR., 1979
26
27          MAINTAINER:             DIAGNOSTIC GROUP
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31
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CONTENTS

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104  [1.0]   ABSTRACT
105
106          THIS DIAGNOSTIC WILL TEST 0 - 124K OF MOS OR CORE MEMORY
107          ON ANY PDP-11 FAMILY COMPUTER.  SOME TESTS ARE WORST CASE
108          FOR MOS AND SOME FOR CORE, BUT ALL TESTS ARE ALWAYS RUN.
109          THE TESTS OCCUPIES LESS THAN 2K OF MEMORY SO IT CAN BE
110          USED TO TEST A SYSTEM WITH ONLY 4K OF MEMORY.  IF ONLY 4K
111          EXISTS, HOWEVER, THE ABSOLUTE LOADER IS NOT SAVED.
112
113          THIS PROGRAM CAN BE RUN UNDER XXDP, APT AND ACT MONITORS.
114          ON PROCESSORS WITH NO HARDWARE SWITCH REGISTER, SOFTWARE
115          SWITCH REGISTER = LOCATION 176.
116
117  [1.1]   GETTING STARTED
118
119          IF NO HARDWARE SWITCH REGISTER SET LOCATION 176 TO OBTAIN SWITCH
120          OPTIONS.
121
122          TO START:
123          ---------
124
125          A.  SET SWITCH REGISTER = 00000
126          B.  START AT 200.
127          C.  THE MEMORY LIMITS WILL BE PRINTED.
128          D.  SEE SECTION 4.4 FOR REST OF PRINTOUTS EXPECTED.
129          E.  'PASS#01'' WILL BE TYPED LAST, AND THE TEST WILL
130              RESTART.
131          F.  TO HALT THE TEST, TYPE CONTROL-C, THIS WILL INSURE THE
132              PROGRAM IS RELOCATED BACK TO LOWER MEMORY.
133                  BE PATIENT, THE CONTROL-C IS ONLY RECOGNIZED AT THE END
134                  OF THE CURRENT SUBTEST.
135          G.  IF AN UNEXPECTED HALT OCCURS SEE SECTION 6.0.  IF AN
136              ERROR # IS TYPED SEE SECTION 6.2.
137
138                  !CAUTION!  BEFORE 'DIGGING'' INTO THE LISTING READ
139                             SECTION 9.
140
141          SWITCH SETTING SUMMARY (SEE SECTION 4.1 FOR DETAILS)
142          ----------------------
143
144          BIT15(100000)    HALT ON ERROR
145          BIT14(040000)    LOOP IN SUBTEST DEFINED BY BITS <3:0>
146          BIT13(020000)    INHIBIT ERROR PRINTOUTS
147          BIT12(010000)    ENABLE TESTING ABOVE 28K (WITH MEMORY MANAGEMENT)
148          BIT11(004000)    ENABLE PARITY TESTING
149          BIT10(002000)    HALT AFTER EACH SUBTEST
150          BIT09(001000)    INHIBIT PROGRAM RELOCATION
151          BIT08(000400)    TYPE FIRST FAILING BIT ERROR PER 4K.
152          BIT07(000200)    ENABLE LONG GALLOPING TEST
153          BIT06(000100)    INHIBIT MEMORY SIZING
154          BIT05(000040)    INHIBIT 'PASS#XX'' PRINTOUTS
155          BIT04(000020)    INHIBIT PRINTOUTS
156          BIT03-BIT00      BEGINNING TEST NUMBER.
157
158
159
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160  [2.0]   REQUIREMENTS
161
162  [2.1]   EQUIPMENT
163
164          STANDARD 11 FAMILY COMPUTER WITH A CONSOLE OUTPUT DEVICE
165          AND FROM 4K TO 124K OF MEMORY.  PROGRAM WILL ALSO RUN ON THE
166          PDT-11 AND ON 30K LSI SYSTEMS.
167
168
169
170  [2.2]   STORAGE
171
172          PROGRAM STORAGE - 0000 - 7744.  PROGRAM EXPANDS FOR ERROR
173          HISTORY AND TO SAVE ABSOLUTE LOADER OR XXDP CHAIN MONITOR.
174          (SEE SECTION 9. FOR DETAILS)
175
176
177
178  [3.0]   LOADING PROCEDURE
179
180          USE STANDARD PROCEDURE FOR PDP-11 ABSOLUTE BINARY FORMATTED TAPES.
181
182
183
184  [4.0]   STARTING PROCEDURE
185
186  [4.1]   SWITCH SETTINGS
187
188          SOFTWARE SWITCH REGISTER - LOCATION 176
189
190          BIT15(100000)   HALT ON ERROR
191
192          BIT14(040000)   LOOP ON TEST DEFINED BY SWITCH REGISTER BITS <3:0>
193
194          BIT13(020000)   INHIBIT ERROR PRINTOUTS
195
196          BIT12(010000)   ENABLE MEMORY MANAGEMENT (TESTING ABOVE 28K, 30K SYSTEM DOES NOT
197                          NEED KT SUPPORT)
198
199          BIT11(004000)   ENABLE PARITY MODULES.
200                          !"PAR" WILL BE TYPED
201
202          BIT10(002000)   HALT AFTER EACH SUBTEST
203                          !PRESS CONTINUE TO DO NEXT SUBTEST
204
205          BIT09(001000)   INHIBIT PROGRAM RELOCATION
206                          !IF SET LOCATIONS 430-7776 WILL NOT BE
207                          !TESTED.
208
209          BIT08(000400)   TYPE FIRST FAILING BIT IN EACH 4K BANK ONLY.
210                          !THE TOTAL ERROR COUNT (UP TO 377) WILL
211                          !BE SAVED IN THE ERROR HISTORY.
212
213          BIT07(000200)   ENABLE LONG GALLOPING TEST.
214                          !"GLP" WILL BE TYPED.
215                          !CAUTION! INCREASES TEST TIME BY FACTOR OF 25.
```

```
216
217          BIT06(000100)   INHIBIT MEMORY SIZING.
218                          !THE MEMORY LIMITS MUST BE SETUP IN THE FOLLOWING LOCATIONS:
219                          (VALUES TO TEST 0-8K ARE SHOWN)
220                          (LOWTWO=LOCATION 324)
221
222                          LOWTWO: 0               ;STORE BITS 17:16 OF LOW TEST ADDRESS
223                          LOWADD: 0               ;STORE REST OF LOW TEST ADDRESS
224                                                  ;DO NOT ATTEMPT TO SET THE LOWER LIMIT
225                                                  ;AT OR ABOVE 160000 ON A 30K LSI SYSTEM.
226                                                  ;THE PROGRAM WILL ASSUME MEMORY MANAGEMENT
227                                                  ;MUST BE USED.
228                          HIGHTWO: 0              ;STORE BITS 17:16 OF HIGH TEST ADDRESS
229                          HIGHADD: 37776          ;STORE REST OF HIGH TEST ADDRESS
230
231          BIT05(000040)   INHIBIT 'PASS#XX'' PRINTOUTS
232
233          BIT04(000020)   A.  INHIBIT ERROR HISTORY PRINTOUTS.  THE
234                              ERROR HISTORY CAN STILL BE OBTAINED
235                              BY TYPING CONTROL-C.
236                          B.  INHIBIT PRINTOUTS 'PAR','GLP','TST13 BNK XX'.
237
238          BIT03-BIT00     NUMBER OF TEST (0-13) TO RUN FIRST.
239                          .NORMALLY USED WITH BIT14 (LOOP ON TEST)
240
241
242
243  [4.2]   CONTROL-C OPTION
244
245          CONTROL C [^C]  AFTER COMPLETION OF THE CURRENT TEST.
246                          THE ERROR HISTORY (SEE SEC. 6.3) WILL BE
247                          TYPED. THE PROGRAM WILL HALT IN LOWER MEMORY.
248                          PRESSING CONTINUE WILL RESTART THE DIAGNOSTIC.
249
250  [4.3]   STARTING ADDRESS= 200
251          RESTART ADDRESS - 250 OR 200
252
253          RESTART AT 200 CLEARS PASS COUNT ($PASS) AND PRINTS ''CZKMAF'' TITLE.
254
255
256
257
258
259  [4.4]   PROGRAM AND/OR OPERATOR ACTION
260
261          1)      LOAD PROGRAM INTO MEMORY USING ABSOLUTE LOADER.
262          2)      SET OPTIONS (SEE SEC. 4.1)
263          3)      START THE PROGRAM AT 200
264          4)      THE FOLLOWING IS AN EXAMPLE WITH EXPLANATIONS
265                  OF THE PRINTOUTS EXPECTED.
266
267          ''XXXXX-YYYYY''             ;ADDRESSES OF TEST BOUNDARIES.
268
269          ''PAR''                     ;IF PARITY OPTION SELECTED
270
271          ''GLP''                     ;IF LONG GALLOPING OPTION SELECTED.
```

```
                                    ;PRINTED AS TST11 IS ENTERED.

        'TST13 BNK 00''             ;ENTERING BANK 00 IN TEST 13.
        'TST13 BNK 01''             ;AND BANK 1...
        ETC...                      ;UNTIL ALL BANKS (UP TO 7) HAVE BEEN TESTED.

        'REL''                      ;THE DIAGNOSTIC RELOCATES TO HIGHEST
                                    ;LOCATIONS UNDER TEST AND RUNS TST0-TST13 AGAIN.

        ''TST13 BNK 00''            ;TESTING BANK 00 IN TEST 13 (RELOCATED STATE.)
                                    ;NOTE-ONLY BANK 00 IS TESTED IN THE RELOCATED STATE.

        'PASS#XX''                  ;WHERE 'XX'' IS THE PASS NO.


        ADDITIONAL PRINTOUTS
        'NO PAR''                   ;PRINTED IF PARITY SELECTED BUT NOT AVAILABLE.

        'NO KT''                    ;PRINTED IF SWR BIT 12 IS SET AND NO MEMORY
                                    ;MANAGEMENT AVAILABLE.



4.5     LONG GALLOP OPTION

        NORMAL WORST CASE SR SETTING = 0000.  FOR LONG GALLOP
        SR = 200.  LONG GALLOP OPTION SHOULD ONLY BE USED IF AN
        MOS MEMORY PROBLEM IS SUSPECTED AND NO OTHER SUBTESTS
        WILL FAIL.  THE TEST TIME IS INCREASED 25 TIMES.



[5.0]   PROGRAM HALTS (NORMAL+ ERROR)

        THIS IS A LIST OF EXPECTED HALTS.  IF THE TEST HALTS
        IN A LOCATION NOT IN THIS LIST AND IT IS LESS THAN 776, IT
        MAY BE DUE TO A DEVICE INTERRUPTING.
                NOTE THE HALT AT END OF SUBTEST AND HALT ON ERROR HALT LOCATIONS
        MAY BE RELOCATED. THE ACTUAL LOCATIONS THEY ARE IN CAN BE FOUND
        BY SUBTRACTING 500 FROM THE HALT PC AND ADDING THIS DIFFERENCE TO THE
        CONTENTS OF SAVR6 [LOC. 350].

                PC              REASON              RECOVERY
                --              --------            ---------

                112             TRAP TO LOC. 4          EXAMINE R6, IT CONTAINS
                                                        THE POINTER TO THE PC
                                                        WHERE THE TRAP OCCURRED.

                ---              POWER FAIL             POWER UP WILL RECOVER
                                                        IF IN CORE MEMORY. IF
                                                        NOT CORE OPERATION IS UNDEFINED.

                1714        HALT AT END OF              PRESS CONTINUE TO GO TO
                            TEST SWITCH SET.            NEXT SUBTEST.
```

| | | | |
|---|---|---|---|
| | 6156 | HALT ON ERROR SWITCH SET. | PRESS CONTINUE. |
| | 6240 | CONTROL-C TYPED OR FATAL ERROR OCCURRED | PRESS CONTINUE TO RE-START TEST. |

[6.0] ERRORS

[6.1] ERROR MESSAGE FORMAT

THE ERROR PRINTOUT CONSISTS OF 6 OCTAL WORDS IN THE FOLLOWING FORMAT:

'LOCATION  GOOD  BAD  PC  ERROR  PASFLG''

''ADR ERR'' WILL BE PRINTED PRIOR IF AN ADDRESSING ERROR IS SUSPECTED.
'PAR ERR'' WILL BE PRINTED PRIOR IF A PARITY ERROR TRAP OCCURRED
!CAUTION. IF PARITY ERROR THE GOOD DATA PRINTOUT IS THE
PARITY MODULE UNIBUS ADDRESS THAT FAILED.

WHERE:

| | | |
|---|---|---|
| LOCATION= | | FAILING MEMORY LOCATION |
| GOOD | = | GOOD DATA [DATA THAT WAS EXPECTED] |
| BAD | = | BAD DATA [DATA THAT WAS FOUND] |
| PC | - | PROGRAM COUNTER AT ERROR CALL. |
| ERROR | | FAILING ERROR NO. (SEE SEC 6.2 - ERROR DICTIONARY) |
| PASFLG | | CONTENTS OF LOCATION PASFLG.THIS MAY NOT BE RELEVANT. (SEE SEC. 6.2-ERROR DICTIONARY) |

!THE TEST WILL CONTINUE AFTER THE ERROR PRINTOUT.
!''NO KT'' WILL BE TYPED IF TESTING ABOVE 28K SELECTED AND NO MEMORY
!MANAGEMENT IS FOUND.(30K SYSTEM DOES NOT NEED KT SUPPORT)

.''NO PAR'' WILL BE TYPED IF PARITY OPTION SELECTED
.AND NO PARITY MODULES WERE FOUND.

(FATAL ERRORS)

''ERR #XXXXXX'' WILL BE TYPED WHERE ''XXXXXX'' IS
THE ERROR NUMBER. THE DIAGNOSTIC WILL USUALLY HALT ON THIS TYPE
OF ERROR. SEE SEC. 6.2 -ERROR DICTIONARY - FOR DESCRIPTIONS
OF THE ERROR.

(APT MODE ERRORS)

ALL ERRORS ARE TREATED AS FATAL UNDER APT. WHEN AN
ERROR OCCURS UNDER APT A ''1'' IS STORED IN LOCATION
$MSGTY AND THE PROGRAM HALTS AT FATHLT.

```
384
385                 $FATAL CONTAINS THE ERROR NO. IN THE LOW BYTE AND
386           THE FAILING BANK NO. UNDER TEST IN THE HIGH BYTE.
387
388
389
390
391   [6.2]   ERROR DICTIONARY
392
393                 THIS IS A LIST OF ERROR NUMBERS PRINTED AND POSSIBLE
394           CAUSES FOR THE ERROR.
395                 THE ROUTINE NAME WHERE THE ERROR CALL ORIGINATED IS GIVEN IN
396           BRACKETS.
397           NOTE- 'BAKPAT'' REFERS TO THE BACKGROUND PATTERN WRITTEN INTO MEMORY
398           FOR VARIOUS TESTS. IF PARITY SELECTED IT HAS A VALUE = 376 ,ELSE=377
399           ''SWAPPED BAKPAT'' = 77000 IF PARITY SELECTED, ELSE-77400
400
401   .ENDR
402
403
404   ;ERR # 0          ;[BUSER] BUS ERROR TRAP TO LOC. 4 OCCURRED
405                     ;       THIS ERROR IS NOT PRINTED AND IS FOR ''APT'' USE.
406
407   ;ERR # 1          ;[TSTTRP]FATAL DATA ERROR
408                     ;LOCATIONS 0000-430 FAILED 1'S + 0'S TEST.
409                     ;R0 = GOOD DATA
410                     ;R1 = ADDRESS OF FAILING LOCATION.
411
412   ;ERR # 2          ;[APTSIZ] APT FATAL ERROR
413                     ;APT MEMORY TABLES NOT SETUP CORRECTLY.
414                     ;CHECK LOCATIONS $MAMS1 [430] TO $MADR4[446]
415                     ;, FOR CORRECT MEMORY SIZE DATA.
416
417   ;ERR # 3          ;[TSTSIZ]  OPERATOR FATAL ERROR
418                     ;SELECTED MEMORY SIZE GREATER THAN 28K
419                     ;(30K SYSTEM DOES NOT NEED KT SUPPORT), BUT
420                     ;SR BIT12 (10000) NOT SET.
421                     ;SET BIT12 AND RESTART AT 200.
422
423   ;ERR # 4          ;[TSTSIZ]  OPERATOR FATAL ERROR
424                     ;LOWEST SELECTED TEST LIMIT IS HIGHER THAN
425                     ;HIGHEST TEST LIMIT.  SET LOCATIONS ''LOWTWO''[322]
426                     ;TO ''HIGHADD'' [330] CORRECTLY AND RESTART
427                     ;AT 200.
428
429   ;ERR # 5          ;[TSTO]  TEST SEQUENCE ERROR
430                     ;TSTO HAS BEEN ENTERED OUT OF SEQUENCE
431                     ;TESTN SHOULD = 00
432                     ;THE DIAGNOSTIC HAS BEEN CORRUPTED.
433                     ;IF POSSIBLE SELECT ANOTHER 4K BANK
434                     ;BANK 0 AND RERUN THE TEST ON THE FAILING MEMORY.
435
436   ;ERR # 6          ;[TSTO] DUAL ADDRESSING ERROR
437                     ;FOR THIS ERROR THE GOOD DATA PRINTED IS AN
438                     ;ADDRESS.  THIS IS THE ADDRESS SELECTED WHEN
439                     ;THE SAME DATA WAS WRITTEN INTO THE FAILING
```

```
440                     ;LOCATION.  CHECK BANK SELECT CIRCUITRY
441
442   ;ERR # 7          ;[TST0] ADDRESS AND DATA ERROR
443                     ;IDENTICAL TO PREVIOUS ERROR EXCEPT THE DATA
444                     ;WRITTEN INTO THE FAILING LOCATION WAS IN
445                     ;ERROR ALSO.
446
447   ;ERR # 10         ;[TST0] DATA ERROR
448                     ;IF BAD DATA = 0000 COULD BE AN ADDRESSING
449                     ;ERROR , ELSE COMPARE GOOD AND BAD DATA FOR FAILING BITS.
450
451   ;ERR # 11         ;[TST0] ADDRESSING ERROR
452                     ;THE FAILING ADDRESS RESPONDED BUT IS NON-
453                     ;EXISTENT.  MAY BE A DUAL ADDRESSING PROBLEM.
454
455   ;ERR # 12         ;[TST1] TEST SEQUENCE ERROR
456                     ;$TESTN [404] SHOULD = 01
457                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
458
459   ;ERR # 13         ;[TST1] DATA ERROR
460                     ;COMPARE GOOD AND BAD PRINTED DATA, FAILING
461                     ;DATA BITS MAY SHORTED OR SWAPPED.
462
463   ;ERR # 14         ;[TST2] TEST SEQUENCE ERROR
464                     ;$TESTN [404] SHOULD - 02
465                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
466
467   ;ERR # 15         ;[TST2] ADDRESS OR DATA ERROR
468                     ;IF "ADR ERR" NOT PRINTED THEN THE BYTE SELECT
469                     ;CIRCUITRY PROBABLY FAILED.
470
471   ;ERR # 16         ;[TST3] TEST SEQUENCE ERROR
472                     ;$TESTN [404] SHOULD = 03
473                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
474
475   ;ERR # 17         ;[TST3] DUAL ADDRESSING ERROR
476                     ;DUAL ADDRESSING PROBLEM FOR BITS THAT DIFFER
477                     ;IN GOOD AND BAD DATA PRINTOUT.
478
479   ;ERR # 20         ;[TST3] DUAL ADDRESSING ERROR
480                     ;FOR THIS ERROR THE DATA PRINTED IS AN ADDRESS.
481                     ;THIS IS THE ADDRESS THAT WAS SELECTED WHEN THE
482                     ;SAME DATA WAS WRITTEN INTO THE FAILING LOCATION.
483
484   ;ERR # 21         ;[TST3] DUAL ADDRESSING ERROR
485                     ;SAME AS ERROR #20 EXCEPT DIFFERENT DATA
486                     ;(SWAPPED BAKPAT) WAS WRITTEN.
487
488   ;ERR # 22         ;[TST4] TEST SEQUENCE ERROR
489                     ;$TESTN [404] SHOULD = 04.
490                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
491
492   ;ERR # 23         ;[TST4] DUAL ADDRESSING ERROR
493                     ;IF PASFLG = 0 THEN THE FAILING LOCATION
494                     ;AND FAILING DATA ARE DUAL ADDRESSES.
495
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;ERR # 24        ;[TST5] TEST SEQUENCE ERROR
                 ;$TESTN [404] SHOULD = 05
                 ; THE DIAGNOSTIC HAS BEEN CORRUPTED.

;ERR # 25        ;[TST5] DATA ERROR
                 ;DATA WRITE OR READ ERROR.
;ERR # 26        ;[TST5] MARCHING 1'S AND 0'S DATA ERROR
                 ;IF PASFLG=0  FAILED MARCHING 1'S + 0'S IN
                 ;             MAX TO MIN DIRECTION.
                 ;IF PASFLG=1  FAILED MARCHING 1'S + 0'S IN
                 ;             MIN TO MAX DIRECTION
                 ;IF PASFLG=3  FAILED MARCHING 0'S + 1'S IN
                 ;             MAX TO MIN DIRECTION.

;ERR # 27        ;[TST5] MARCHING 1'S AND 0'S DATA ERROR
                 ;IDENTICAL TO PREVIOUS ERROR EXCEPT THE DATA IS
                 ;CHECKED IMMEDIATELY AFTER BEING WRITTEN.

;ERR # 30        ;[TST6] TEST SEQUENCE ERROR
                 ;$TESTN SHOULD = 06
                 ;THE DIAGNOSTIC HAS BEEN CORRUPTED.

;ERR # 31        ;[TST6] VOLATILITY/REFRESH TEST ERROR
                 ;IF PASFLG=0  BAKPAT WRITE OR READ ERROR.
                 ;IF PASFLG=1  THE FAILING LOCATION CHANGED WHILE
                 ;             ANOTHER LOCATIONS WAS WRITTEN FOR
                 ;             2 MS.  THE OTHER LOCATION IS SAVED
                 ;             IN SAVLOC [352]
                 ;IF PASFLG=2  SWAPPED BAKPAT (77400 OR 77000)
                 ;             WRITE OR READ ERROR.
                 ;IF PASFLG=3  SAME AS IF PASFLG 2 EXCEPT
                 ;             THE DATA IS SWAPPED BAKPAT.

;ERR # 32        ;[TST7] TEST SEQUENCE ERROR
                 ;$TESTN SHOULD - 07
                 ;THE DIAGNOSTIC HAS BEEN CORRUPTED.

;ERR # 33        ;[TST7] SHIFTING DIAGONAL DATA ERROR
                 ;IF PASFLG 0  BAKPAT WRITE OR READ ERROR.
                 ;IF PASFLG=1  BAKPAT READ CHECK ERROR
                 ;IF PASFLG GREATER THAN 1 BUT EVEN VALUE THEN:
                 ;             THE FAILING LOCATION COULD NOT BE WRITTEN INTO.
                 ;IF PASFLG GREATER THAN 1 BUT ODD VALUE THEN:
                 ;             THE FAILING LOCATION WAS WRITTEN CORRECTLY
                 ;             BUT LOST THE DATA.

;ERR # 34        ;[TST10] TEST SEQUENCE ERROR
                 ;$TESTN SHOULD   10
                 ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.

;ERR # 35        ;[TST10] BAKPAT DATA ERROR
                 ;BAKPAT WRITE OR READ ERROR INTO THE FAILING LOCATION.

;ERR # 36        ;[TST10] PEAD RECOVERY DATA ERROR
                 ;       THIS ERROR CAN BE REPORTED BY TST10 AND TST11.
                 ;(THEY SHARE CODE). SEE $TESTN [404] FOR WHICH TEST FAILED.
```

```
552                     ;FOR BOTH TESTS COMPARE THE GOOD AND BAD DATA AT THE FAILING
553                     ;LOCATION TO SEE WHICH BITS FAILED.
554
555   ;ERR # 37         ;[TST10] READ RECOVERY DATA ERROR
556                     ;IDENTICAL TO THE PREVIOUS ERROR EXCEPT SWAPPED BAKPAT IS
557                     ;USED AS WRITE AND READ DATA.
558
559   ;ERR # 40         ;[TST11] TEST SEQUENCE ERROR
560                     ;$TESTN SHOULD - 11
561                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
562
563   ;ERR # 41         ;[TST12] TEST SEQUENCE ERROR
564                     ;$TESTN SHOULD = 12
565                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
566
567   ;ERR # 42         ;[TST12] WORST CASE CORE TEST DATA ERROR
568                     ;IF PASFLG=1  COMPARE GOOD AND BAD DATA FOR FAILING BITS.
569                     ;IF PASFLG=2  THE FAILING LOCATION WAS WRITTEN AND READ
570                     ;               WITH GOOD DATA,BUT FAILED READ CHECK
571                     ;               READING IN THE MIN. TO MAX DIRECTION.
572                     ;IF PASFLG=3  SAME CONDITIONS AS PASFLG=2 EXCEPT FAILED
573                     ;               DOING THE READ CHECK FROM MAX TO MIN DIRECTION.
574
575   ;ERR # 43         ;[TST12] WORST CASE CORE TEST DATA ERROR
576                     ;       IDENTICAL TO PREVIOUS ERROR EXCEPT THE DATA WRITTEN
577                     ;AND READ IS COMPLEMENTED.
578
579   ;ERR # 44         ;[TST13] TEST SEQUENCE ERROR
580                     ;$TESTN SHOULD = 13
581                     ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
582
583   ;ERR # 45         ;[TST13] WRITE RECOVERY TEST DATA ERROR
584                     ;IF PASFLG=0  COMPARE GOOD AND BAD DATA FOR FAILING BITS.
585                     ;IF PASFLG=77400  DATA ERROR FOUND WHILE DOING A SECOND READ CHECK.
586                     ;IF PASFLG=77402  DATA ERROR FOUND IN FAILING LOCATION AFTER
587                     ;               SMALL TEST PROGRAM RUN IN FAILING BANK.
588
589   ;ERR # 46         ;[TST13] WRITE RECOVERY TEST DATA ERROR
590                     ;       DATA ERROR FOUND JUST BEFORE THE SMALL TEST
591                     ;WAS TO BE RUN IN THE FAILING BANK. TO AVOID 'BLOWING' UP
592                     ;WHEN THE SMALL TEST IS RUN TST13 IS ABORTED.
593
594   ;ERR # 47         ;[TST13] WRITE RECOVERY TEST DATA ERROR
595                     ;       IDENTICAL TO ERROR #XXX EXCEPT THE DATA WRITTEN
596                     ;AND READ IS DIFFERENT.(177667).
597                     ;177667 IS THE COMPLEMENT OF ''JMP (R0)'' (110) WHICH IS
598                     ;THE ESCAPE FROM THE SMALL TEST PROGRAM RUN IN THE BANK
599                     ;UNDER TEST.
600
601   ;ERR # 50         ;[PARERR] PARITY TRAP ERROR
602                     ; PARITY TRAP TO 114 OCCURRED.
603                     ;FOR THIS ERROR PRINTOUT THE ''GOOD DATA'' IS ACTUALLY
604                     ;THE FAILING PARITY MODULE UNIBUS ADDRESS.
605                     ; SAVLOC [352] CONTAIN  THE PC WHERE THE TRAP OCCURRED.
606
607   ;ERR # 51         ;[PARITY] PARITY TRAP FATAL ERROR
```

```
                        ; A PARITY TRAP TO 114 OCCURRED, BUT NO PARITY MODULES COULD BE FOUND
                        ;WITH AN ERROR BIT (BIT15) SET.

;ERR # 52                ;[NOMM] OPERATOR FATAL ERROR
                        ;       TESTING ABOVE 28K WAS SELECTED, BUT NO MEMORY MANAGEMENT
                        ;OPTION WAS FOUND.(30K SYSTEM DOES NOT NEED KT)
                        ;       RESET SWITCH OPTIONS AND RESTART AT 200.

;ERR # 53                ;[PARITY] OPERATOR FATAL ERROR
                        ;       PARITY TESTING WAS SELECTED BUT NO PARITY MODULES
                        ;WERE FOUND.
                        ;       RESET SWITCH OPTIONS AND START AT 200.

.REPT   0


[6.3]   ERROR HISTORY

        LOCATIONS IN MEMORY ARE SET ASIDE TO COLLECT A HISTORY
        OF THE FAILING BITS IN A PARTICULAR MEMORY BANK.  THIS
        DATA IS COLLECTED FOR EVERY ERROR REGARDLESS OF SWITCH
        SETTINGS.

        NORMALLY THE DATA IS OUTPUT AT THE END OF TESTING, BUT
        IF CONTROL-C IS TYPED IT IS OUTPUT AT THE END OF THE
        CURRENT TEST.

        THE ERROR HISTORY IS INTENDED TO HIGHLIGHT IF THE ERRORS
        ARE DUE TO 1 BIT FAILING OR ONLY ADDRESS ERRORS.



        ERROR HISTORY FORMAT:


        ERROR   BANK    COUNT
        -----   ----    -----


        WHERE:

        ERROR   -       BIT THAT FAILED [NUMBER OF THE FAILING BIT IN DECIMAL I.E.
                        0-15 WILL BE TYPED OUT OR THE WORDS 'ADR ERR' OR 'PAR ERR' WILL
                        BE TYPED OUT IF ADDRESS ERROR OR PARITY ERROR WAS SEEN
                        IN THE SPECIFIC BANK OF MEMORY
        BANK    -       4K MEMORY BANK IN WHICH THIS FAILURE WAS SEEN
                        A 0 FOR 0 TO 4K, A 1 FOR 4 TO 8K AND SO ON
        COUNT   =       NUMBER OF TIMES THIS MEMORY BANK FAILED.
                        (377 IS MAXIMUM FAILURE COUNT RECORDED.)
[6.4]   ERROR RECOVERY

        IF THE PROGRAM IS HALTED AFTER REPORTING AN ERROR IT CAN EITHER
        BE CONTINUED OR RESTARTED AT 200 OR 250 (SEE SEC 4.2). HOWEVER FOR
        CPU'S THAT DESTROY CONTENTS OF REGISTERS AFTER COMING TO A HALT
        THE PROGRAM SHOULD ONLY BE RESTARTED.
```

## [7.0] RESTRICTIONS

MEMORY UNDER TEST SHOULD BE CONTIGUOUS. FOR SYSTEMS HAVING NON-CONTIGUOUS MEMORY THE MEMORY BOUNDARIES SHOULD BE DEFINED BY THE OPERATOR. (CONTIGUOUS MEMORY IS DEFINED AS A MEMORY THAT CAN BE BOTH READ AND WRITTEN IN CONSECUTIVE LOCATIONS.)

## [8.0] MISCELLANEOUS

### [8.1] ADDRESS/BANK RANGES IN OCTAL AND DECIMAL

THIS REFERENCE TABLE CROSS REFERENCES THE MEMORY BANK NO.S, THE RANGE AND THE PAR USED WHEN MEMORY MANAGEMENT IS ENABLED. IT IS ALSO USEFUL TO SHOW STARTING ADDRESSES IN A PARTICULAR 4K BANK.

| BANK NO. | DECIMAL RANGE | OCTAL RANGE | [PAGE ADDRESS REGISTER] USED/CONTENT | UNIBUS ADDRESS |
|---|---|---|---|---|
| 0 | 0 - 4K | 000000-017776 | 0 0000 | 772340 |
| 1 | 4K - 8K | 020000-037776 | NOT USED | |
| 2 | 8K-12K | 040000-057776 | NOT USED | |
| 3 | 12K-16K | 060000-077776 | NOT USED | |
| 4 | 16K-20K | 100000-117776 | NOT USED | |
| 5 | 20K-24K | 120000-137776 | NOT USED | |
| 6 | 24K-28K | 140000-157776 | NOT USED | |
| 7 | 28K-32K | 160000-177776 | NOT USED ON 30K (LSI-11) SYSTEMS | |
| | | | 1 1600 | 772342 |
| 8 | 32K-36K | 200000-217776 | 2 2000 | 772344 |
| 9 | 36K-40K | 220000-237776 | 3 2200 | 772346 |
| 10 | 40K-44K | 240000-257776 | 4 2400 | 772350 |
| 11 | 44K-48K | 260000-277776 | 5 2600 | 772352 |
| 12 | 48K-52K | 300000-317776 | 6 3000 | 772354 |
| 13 | 52K-56K | 320000-337776 | 1 3200 | |
| 14 | 56K-60K | 340000-357776 | 2 3400 | |
| 15 | 60K-64K | 360000-377776 | 3 3600 | |
| 16 | 64K-68K | 400000-417776 | 4 4000 | |
| 17 | 68K-72K | 420000-437776 | 5 4200 | |
| 18 | 72K-76K | 440000-457776 | 6 4400 | |
| 19 | 76K-80K | 460000-477776 | 1 4600 | |
| 20 | 80K-84K | 500000-517776 | 2 5000 | |
| 21 | 84K-88K | 520000-537776 | 3 5200 | |
| 22 | 88K-92K | 540000-557776 | 4 5400 | |
| 23 | 92K-96K | 560000-577776 | 5 5600 | |
| 24 | 96K-100K | 600000-617776 | 6 6000 | |
| 25 | 100K-104K | 620000-637776 | 1 6200 | |

```
                26      104K-108K     640000-657776   2   6400
                27      108K-112K     660000-677776   3   6600
                28      112K-116K     700000-717776   4   7000

                29      116K-120K     720000-737776   5   7200
                30      120K-124K     740000-757776   6   7400
                31      124K-128K     760000-777776   7   7600        772354

            NOTES:
            1.  THE PAR (PAGE ADDRESS REGISTER) CONTENTS ARE SHOWN IN A TEST THAT SELF SIZES.
                IF THE LIMITS OF TESTING ARE SET BY THE OPERATOR AND
                IF THE BANK IS ABOVE 28K PAR NO. 1 WILL BE SET TO THE
                BEGINNING PAGE.  FOR EXAMPLE IF THE TESTING WAS TO
                BEGIN WITH BANK 8 PAR NO. 1 WOULD EQUAL 2000, PAR 2
                WOULD EQUAL 2200 ETC.


[8.2]   EXECUTION TIME

            HERE ARE SOME TYPICAL EXECUTION TIMES.

            LSI-11 AND 4K:= 100 SECS.
            LSI-11 AND 8K:= 5 MINUTES.


[8.2]   PASS COUNT AND TEST NO. LOCATIONS

            $PASS [406] = PASS COUNT - CLEARED BY START AT 200.

            $TESTN [404] = CURRENT TEST NO. AND RELOCATION, PARITY FLAGS.
                             WHERE:
                           LOW BYTE = TEST NO.
                           IF BIT15 = 1 TEST IS RELOCATED
                           IF BIT13 - 1 PARITY UNDER TEST.


[8.4]   STACK POINTER

            THE STACK STARTS AT 500 WHEN THE PROGRAM IS NOT RELOCATED.
            SAVR6[350] CONTAINS THE STACK STARTING VALUE WHEN THE DIAGNOSTIC
            IS RELOCATED.
                    SAVR6 ALSO CONTAINS THE STARTING ADDRESS OF THE PROGRAM WHEN
            IT IS RELOCATED.

[8.5]   POWER FAIL

            THE DIAGNOSTIC CAN BE POWER FAILED WITH NO ERRORS.  TO USE,
            START THE TEST AS USUAL AND POWER DOWN THEN UP AT ANY TIME.
            THE PROGRAM SHOULD TYPE 'P' AND CONTINUE TO RUN FROM TEST 0
            IN THE SAME STATE [I.E. STATE OF RELOCATION] AS IT WAS BEFORE
            THE POWER WAS INTERRUPTED, HOWEVER IF THE DIAGNOSTIC WAS IN
            A MEMORY THAT CAN NOT HOLD DATA WITH THE POWER DOWN THEN THE
            PROGRAM WILL NOT RECOVER FROM POWER FAIL AND ON POWER-UP
            OPERATION IS UNDEFINED.
```

```
776
777
778
779  [9.0]   PROGRAM DESCRIPTION
780
781
782  [9.1]   NARRATIVE FLOW CHART
783
784          THE TEST IS LOADED INTO LOCATIONS 0000 - 7744 BUT
785  EXPANDS DEPENDING ON HOW MUCH MEMORY IS UNDER TEST.
786  SEE STEP 6. BELOW FOR A DETAILED EXPLANATION.
787
788          THE FOLLOWING NARRATIVE FLOW CHART DESCRIBES MAJOR
789  PROGRAM OPERATION.  FOR THE PERSON WHO NEEDS DETAIL THE
790  TAG ASSOCIATED WITH THE OPERATION IS GIVEN IN BRACKETS.
791
792          FOR THIS DISCUSSION SWITCH SETTINGS ARE IGNORED AND EVERYTHING IS
793  ASSUMED ENABLED.
794
795          1.  [START]  PRINT ''CZKMAF'' TIT_E
796
797          2.  [TSTRP]  SAVE DATA FROM LOCATIONS 0-376
798              INTO 7744-10314.
799
800          3.  [TSTRP]  TEST LOCATIONS 0-376 BY WRITING AND
801              READING 1'S AND 0'S.  NOTE THIS IS THE ONLY
802              EXPLICIT TESTING OF THESE LOCATIONS.
803
804          4.  [SLFSIZ]  SIZE MEMORY BY WRITING INTO SUCCEEDING
805              MEMORY LOCATIONS UNTIL TIMEOUT TRAP TO 4 OCCURS,
806              OR 30K BOUNDARY REACHED.
807              ENABLE MEMORY MANAGEMENT AND SIZE MEMORY ABOVE
808              28K.
809              NOTE:  IF UNDER XXDP CHAIN MODE IN 30K SYSTEM, SYSTEM IS SIZED
810                     TO 28K.
811
812          5.  [TYPSIZ]  TYPE MEMORY TEST LIMITS.
813
814          6.  [SETSTK]  SPACE IS SAVED AT THE END OF THE TEST
815              FOR AN ERROR HISTORY.  FOR EACH 4K BANK 18 BYTES ARE SAVED
816              IN THE FOLLOWING FORMAT:
817
818                   !ADR ERR!PAR ERR!
819                   !BIT14  !BIT15  !
820                   !BIT12  !BIT13  !
821                   !BIT10  !BIT11  !
822                   !BIT08  !BIT09  !
823                   !BIT06  !BIT07  !
824                   !BIT04  !BIT05  !
825                   !BIT02  !BIT03  !
826                   !BIT00  !BIT01  !
827
828              IF GREATER THAN 4K UNDER TEST THE ABSOLUTE LOADER
829              (300 ADDRESSES) IS APPENDED.  IF GREATER THAN 4K
830              AND UNDER XXDP CHAIN MODE 5376 (OCTAL) ADDRESSES
831              ARE APPENDED TO THE TEST.  THIS SAVES THE XXDP
```

```
832             MONITOR, AND ALLOWS THE LOCATIONS OCCUPIED BY XXDP
833             TO BE TESTED.
834
835         7.  [CLRMEM]  CALL 'PARITY' ROUTINE AND IF SELECTED,
836             ENABLE ALL PARITY MODULES.  'PARMAP' [LOC. 352]
837             CONTAINS A MAP OF PARITY MODULES FOUND.  IF
838             MODULE 172336 BIT 15 IS SET, IF #172334 FOUND BIT 14
839             IS SET ETC..
840
841         8.  [CLRMEM]  CLEAR MEMORY CURRENTLY UNDER TEST
842
843         9.  [CONT]  DISPATCH TO TST0
844
845         10. [TST0]  EXECUTE TEST 0.  SEE SECTION 10 FOR TEST
846             DESCRIPTIONS.
847
848         11. [TSTSCP]  COMES HERE AFTER EACH TEST AND IF
849             CNTRL-C TYPED THEN GO TO ERROR HISTORY PRINTOUT.
850             IF SR=2000 THEN HALT
851             IF SR=40000 THEN LOOP ON TEST DEFINED BY <3:0>
852             ELSE CONTINUE TO NEXT TEST.
853
854         12. [TST1-TST12]  EXECUTE TST1-TST12 EACH TIME
855             GOING TO STEP 9.
856
857         13. [TST13]  TEST 13 IS DIFFERENT FROM TESTS 0-12,
858             BECAUSE IT IS A SMALL PROGRAM ACTUALLY RUNNING
859             IN THE MEMORY UNDER TEST.  BEFORE THIS SMALL
860             PROGRAM IS STARTED 'TST13 BNK XX' IS TYPED.
861             THIS IS DONE IN CASE THE PROGRAM FAILS . THE
862             USER CAN THEN AT LEAST TELL WHICH BANK OF MEMORY
863             FAILED.
864
865         14. [RELOC]  THE PROGRAM RELOCATES TO HIGH MEMORY
866             TO TEST THE LOCATIONS IT OCCUPIES. (430-ENDPRG).
867             WHERE 'ENDPRG' IS THE CONTENTS OF ENDSTK[306].
868             I.E THE LAST PROGRAM ADDRESS.  NOTE 'REL' IS
869             PRINTED JUST PRIOR TO THE ACTUAL RELOCATION.
870
871         15. TESTS 0-13 ARE RUN AS DESCRIBED ABOVE EXCEPT
872             ONLY BANK 0 LOCATIONS 430-ENDPRG ARE TESTED.
873
874         16. [RELOER]  RELOCATE THE PROGRAM BACK TO LOWER
875             MEMORY.
876
877         17. [LOWER]  IF CONTROL-C TYPED GO PRIN  ERROR
878             HISTORY.
879
880         18.[TSTMM]  IF MEMORY MANAGEMENT SELECTED AND AVAILABLE,
881             RUN TESTS 0-13 ON THE FIRST 24K SLICE ABOVE 28K.
882
883         19. [CONTMM]  CALL 'UPMM' TO UPDATE MEMORY MANAGEMENT
884             PAR REGISTERS TO POINT TO THE NEXT 24K SLICE OF
885             UPPER MEMORY.
886
887         20. [MAXADR]  REPEAT STEPS 18 + 19 UNTIL ALL
```

```
888              MEMORY ABOVE 28K IS TESTED.
889
890          21. [ENDPAS]  PRINT ERROR HISTORY OF FAILING BITS
891
892          22. [$EOP]  DISABLE PARITY MODULES.
893              PRINT "PASS#XX"
894
895
896
897  [9.2]   TEST TITLES
898
899          SEE THE TEST HEADINGS IN THE LISTING FOR DETAILS ON EACH TEST.
900
901                  TEST 0: TEST FOR PROPER BANK SELECTION
902                  TEST 1: CHECK DATI/DATO LINES
903                  TEST 2: TEST MEMORY FOR HOLDING DATA AND BYTE SELECTION
904                  TEST 3: DUAL ADDRESS TEST A
905                  TEST 4: DUAL ADDRESS TEST B
906                  TEST 5: MARCHING 1'S AND 0'S
907                  TEST 6: CELLS' VOLATILITY TEST
908                  TEST 7: SHIFTING DIAGONAL
909                  TEST 10: READ RECOVERY GALLOPING TEST THROUGH EVERY 64TH CELL
910                  TEST 11: READ RECOVERY LONG GALLOPING/FAST GALLOPING TEST
911                  TEST 12: WORST CASE TESTING FOR CORE MEMORY
912                  TEST 13: WRITE RECOVERY TEST
913
914
915  [10.0]  RXDP & ACT11 & APT OPERATION
916
917          RXDP CHAIN MODE
918          --------------
919
920          OPERATION IS IDENTICAL TO STAND ALONE EXCEPT:
921
922          1.  NO "CZKMAF" TITLE IS PRINTED.
923          2.  NO TEST 13 PRINTOUTS SUCH AS "TST13 BNK 00".
924          3.  THE PROGRAM ALWAYS HALTS ON ERROR.
925          4.  AT THE END OF TEST ($ENDAD) CONTROL IS RETURNED TO
926              THE RXDP CHAIN MONITOR VIA LOCATION 42.
927          5.  IF 30K SYSTEM ONLY 28K WILL BE TESTED IN XXDP CHAIN MODE
928
929          ACT11
930          -----
931
932          OPERATION IS IDENTICAL TO STAND ALONE EXCEPT:
933
934          1.  NO PRINTOUTS EXCEPT ERROR PRINTOUTS.
935          2.  THE PROGRAM ALWAYS HALTS ON ERROR.
936          3.  AT THE END OF TEST ($ENDAD) CONTROL IS RETURNED TO
937              THE ACT11 MONITOR VIA LOCATION 42.
938
939          APT
940          ---
941
942          OPERATION IS SIMILAR TO STAND ALONE EXCEPT:
943
```

```
                1.  THE SOFTWARE SWITCH REGISTER BECOMES LOCATION 422 ($SWREG).
                2.  AUTO SIZING CAN BE INHIBITED BY SETTING BIT 7 OF BYTE
                    LOCATION 421 ($ENVM).
                3.  ALL PRINTOUTS CAN BE INHIBITED BY SETTING BIT 5 OF
                    BYTE LOCATION 421 ($ENVM).
                4.  ALL ERRORS CAUSE LOCATION 400 ($MSGTY) TO BE SET =
                    000' AND THE PROGRAM HALTS AT LOCATION 6240 (FATHLT).
                    LOCATION 402 ($FATAL) CONTAINS THE ERROR NO. IN THE
                    LOW BYTE AND THE FAILING MEMORY BANK NO. IN THE HIGH
                    BYTE.
                NOTE: THE ENVIRONMENTAL MODE BYTE SHOULD BE SET TO 240 WHILE THE SOFTWARE
                      ENVIRONMENTAL BYTE SHOULD BE SET TO 001.


        .ENDR
```

```
                                .ENABL  ABS
                                .NLIST  MD,MC,CND
                                .LIST   ME,BIN,SEQ,LOC
                                .TITLE  CZKMA
                                ;*COPYRIGHT (C) MARCH 1979
                                ;*DIGITAL EQUIPMENT CORP.
                                ;*MAYNARD, MASS. 01754
                                ;*
                                ;*PROGRAM BY DIAGNOSTIC ENGINEERING
                                ;*
                                ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                                ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
                                ;*
                        160000  $SWR=160000     ;;HALT ON ERROR, LOOP ON TEST, INHIBIT ERROR TYPOU
                                ;;TRAP CATCHER OF .+2 AND HALT FOR 0-776 LOCATIONS
                        000240  SCOPE   -NOP
                        000042          .=42
000042  000000                  .WORD   0       ;FOR ACT/XXDP
                                .SBTTL  ACT11 HOOKS
                                ;;**************************************************************
                                ;HOOKS REQUIRED BY ACT11
                        000044          $SVPC=.                 ;SAVE PC
                        000046          .=46
000046  000156                  $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .$EOP
                        000052          .=52
000052  040000                  .WORD   40000           ;;2)SET LOC.52 TO 40000
                        000044          .=$SVPC                 ;; RESTORE PC
                        000070          .-70
000070  012737  000136  000024  PWRDN:  MOV     #PWRUP,@#24
000076  000000                  HALT
```

```
                        000104                  .=104
                                                ; GET HERE IF AN ILLEGAL TRAP TO LOC. 4 OCCURRED.
000104  013727  000001  000400  BUSER:  MOV     @#1,#$MSGTY     ;TELL APT FATAL ERROR#000
000112  000000                  HALT            ;*ERROR* TRAP TO LOC. 4 OCCURRED.
                                                ;114 AND 116 ARE RESERVED FOR PARITY TRAP VECTORS.  SETUP IN
                                                ;ROUTINE 'BEGIN'.
                        000120                  .=120


                                                ;* WRITE MEMORY BACKGROUND
                                                ;* ----------------------
                                                ;*
                                                ;*      THIS ROUTINE IS USED TO WRITE THE MEMORY BACKGROUND TO
                                                ;*      THE VALUE STORED AT LOCATION BAKPAT. THE ROUTINE ASSUMES
                                                ;*      THAT R4 IS POINTING TO THE LOWEST LOCATION AND R5 TO THE
                                                ;*      HIGHEST LOCATION TO BE WRITTEN. THE PROGRAM LEAVES THE
                                                ;*      SUBROUTINE WITH R0 CONTAINING THE CONTENTS OF BAKPAT.
                                                ;*

000120  010401          WRTMEM: MOV     R4,R1           ;SET R1 TO LOWEST LOCATION UNDER TEST
000122  013700  000316          MOV     @#BAKPAT,R0     ;LOAD R0 WITH THE CONTENTS OF LOCATION BAKPAT
000126  010021          2$:     MOV     R0,(R1)+        ;STARTING FROM THE LOWEST LOCATION WRITE THE
000130  020105                  CMP     R1,R5           ;MEMORY TO BACK GROUND PATTERN
000132  103775                  BLO     2$
000134  000207                  RTS     PC              ;RETURN FROM THE SUBROUTINE


000136  013706  000350  PWRUP:  MOV     @#SAVR6,SP      ;RESTORE STACK POINTER
000142  012700  006112          MOV     #PUTMES-BEGIN,R0
000146  060600                  ADD     SP,R0           ;GET THE INDIRECT ADDRESS OF LOCATION TPCRLF
                                                        ;RELATIVE TO LOCATION OF DIAGNOSTIC IN THE CORE
000150  004710                  JSR     PC,(R0)         ;GO TO THE TYPE ROUTINE AND TYPE CR, LF AND A 'P'
000152  000120                  .ASCIZ  /P/
                                .EVEN

000154  000411                  BR      START


                        ;* SERVICE XXDP/ACT11
000156  004710          $ENDAD: JSR     PC,(R0)         ;RETURN TO ACT11/XXDP MONITOR
000160  000240                  NOP                     ;IF QUICK VERIFY=RESET ELSE NOP
000162  000240                  NOP                     ;IF QUICK VERIFY=CLR #-1 ELSE INC #0
000164  000240                  NOP                     ;IF QUICK VERIFY=BR .-4 ELSE NOP
000166  000430                  BR      RESTRT          ;REPEAT TEST UNDER ACT11/XXDP

                        000176  .=176
000176  000000          SWREG:  .WORD   0


                        ;;*******************************************************************
                        .SBTTL  START AND RESTART ROUTINES
                        ;*      RESTART AT 200 TO CLEAR APT TABLES
                        ;;*******************************************************************
000200  013706  000350  START:  MOV     @#SAVR6,SP      ;SETUP STACK POINTER.
```

```
1059  000204  012703  000412          MOV     #$UNIT,R3       ;CLEAR THE APT MAILBOX FROM $MAIL TO $DEVCT
1060  000210  005043                1$:   CLR     -(R3)           ;CLEAR A MAILBOX LOCATION
1061  000212  022703  000400          CMP     #$MAIL,R3       ;DONE?
1062  000216  001374                  BNE     1$              ;BRANCH IF NO
1063  000220  105737  000042          TSTB    @#42            ;ACT11 MODE?
1064  000224  001011                  BNE     RESTRT          ;BRANCH IF YES
1065  000226  105737  000405          TSTB    @#$TESTN+1              ;ARE WE RELOCATED?
1066  000232  100406                  BMI     RESTRT          ;BR IF YES- SINCE TPCRLF IS RELOCATED ALSO-
1067  000234  004767  006344          JSR     PC,TPCRLF       ;PRINT TITLE
1068  000240  055103  046513  043101        .ASCIZ  /CZKMAF0/
1069  000246  000060
1070                                  .EVEN
1071
1072  000250  012704  007744    RESTRT: MOV     #ENDPRG,R4      ;LOAD R4 WITH THE ADDRESS OF THE END OF THE PROGRAM
1073  000254  012703  000346            MOV     #SAVR5,R3       ;CAUSE R3 TO POINT TO THE LOCATION SAVR5
1074  000260  012305                    MOV     (R3)+,R5        ;RESTORE R5
1075  000262  012306                    MOV     (R3)+,SP        ;AND RESTORE R6 JUST IN CASE IT IS A RESTART
1076  000264  010600                    MOV     SP,R0           ;PLACE THE STARTING ADDRESS OF THE TEST IN R0
1077  000266  012746  000340            MOV     #340,-(SP)      ;SET HIGH PRIORITY FOR RTI
1078  000272  010046                    MOV     R0,-(SP)
1079  000274  000002                    RTI                     ;GO TO ''START''-MAY BE RELOCATED.
1080                                                            ;IF RELOCATED SEE LOCATION SAVR6 FOR START.
1081
1082
1083
1084
1085
1086
1087
1088
1089                                  .SBTTL  APT PARAMETER BLOCK
1090
1091                                  ;;**********************************************************************
1092                                  ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
1093                                  ;;**********************************************************************
1094          000276                          .$X=.   ;;SAVE CURRENT LOCATION
1095          000024                          .=24    ;;SET POWER FAIL TO POINT TO START OF PROGRAM
1096  000024  000200                          200     ;;FOR APT START UP
1097          000044                          .=44    ;;POINT TO APT INDIRECT ADDRESS PNTR.
1098  000044  000276                          $APTHDR ;;POINT TO APT HEADER BLOCK
1099          000276                          .=.$X   ;;RESET LOCATION COUNTER
1100                                  ;;**********************************************************************
1101                                  ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
1102                                  ;INTERFACE SPEC.
1103
1104  000276                          $APTHD:
1105  000276  000000                 $HIBTS: .WORD   0        ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
1106  000300  000400                 $MBADR: .WORD   $MAIL    ;;ADDRESS OF APT MAILBOX (BITS 0-15)
1107  000302  001440                 $TSTM:  .WORD   800.     ;;RUN TIM OF LONGEST TEST
1108  000304  002260                 $PASTM: .WORD   1200.    ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
1109  000306  000000                 $UNITM: .WORD            ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
1110  000310  000024                         .WORD   $ETEND-$MAIL/2 ;;LENGTH MAILBOX-ETABLE(WORDS)
1111
1112
1113          000405                  REL=$TESTN+1                    ;IT WILL BE 0 IF THE PROGRAM IS IN THE LOWER
1114                                                                  ;CORE. BIT 7 OF THE BYTE WILL BE SET IF THE
```

```
                        000276                  . $APTHD
000276                  MMAVA:                  ;THIS BYTE IS USED TO DETERMINE IF MEMORY
                                                ;MANAGEMENT IS AVAILABLE OR NOT

                        000277                  .=MMAVA+1
000277                  TYPENB.                 ;THIS BYTE IS USED TO DETERMINE IF THE
                                                ;TYPE OUT OF ERROR HAS BEEN ENABLED OR NOT

                        000300                  .=TYPENB+1
000300                  $PRERR:                 ;THIS BYTE DETERMINES IF THE PROGRAM HAS FOUND
                                                ;A PARITY ERROR

                        000301                  . $PRERR+1
000301                  $ADERR:                 ;THIS BYTE IS USED TO DETERMINE IF THE
                                                ;PROGRAM HAS ENCOUNTERED ADDRESS ERROR

                        000302                  . $ADERR+1
000302                  STRTDI:
                        000304                  .=STRTDI+2
000304                  LOWBNK:
                        000306                  .=LOWBNK+2
000306                  PASFLG:                 ;LOWER BYTE OF THIS WORD GIVES THE PASS NUMBER FOR
                                                ;THE SPECIFIC TEST WHEREAS THE UPPER BYTE
                                                ;HAS BEEN USED BY DIFFERENT TEST FOR DIFFERENT PURPOSES

                        000310                  .=PASFLG+2
000310                  ENDSTK:
                        000312                  .=ENDSTK+2
000312                  PBNK:                   ;HOLDS BANK UNDER TEST FOR 'TST BNK XX' PRINTOUT.
000312                  DECWRD:
                        000314                  .=DECWRD+2
000314    000           TYPCNT: .BYTE   0       ;THIS BYTE DETERMINES THE NUMBER OF WORDS
                                                ;TO BE TYPED
000315    000           SAVKBB: .BYTE   0       ;THIS LOCATION IS USED TO SAVE THE CHARACTER
                                                ;HIT BY THE OPERATOR
                        .EVEN

                        177560          TKS=    177560
                        177562          $KBB=   177562
                        177564          $TPS=   177564
                        177566          $TPB=   177566
                        177572          SR0=    177572
000316  000377          BAKPAT: .WORD   377     ;BACKGROUND PATTERN WRITTEN TO MEMORY.

000320  000000          SWAPAT: .WORD
000322  000430          RELBOT: BEGIN-50        ;HOLDS LOWEST TEST ADDRESS WHEN RELOCATED.

                        ;;*****************************************************************
                        ;LOCATIONS TO BE MODIFIED IF LIMITS SET BY OPERATOR
000324  000000          LOWTWO: 0               ;HOLDS BITS 17:16 OF LOW TEST ADDRESS
000326  000000          LOWADD: 0               ;HOLDS BITS 15:0 OF LOW TEST ADDRESS

000330  000000          HIGHTWO:        0       ;HOLDS BITS 17:16 OF HIGH TEST ADDRESS
```

```
1171  000332  037776          HIGHADD:        37776                   ;HOLDS BITS 15:0 OF HIGH TEST ADDRESS
1172                          ;;*************************************************************
1173
1174  000334  000000          $HIMAX: 0                               ;HOLDS BITS 17:16 OF MAXIMUM AVAILABLE MEMORY
1175  000336  017776          $MAXM:  17776                           ;HOLDS BITS 15:0 OF MAXIMUM AVAILABLE MEMORY
1176
1177  000340  000000          MAXMEM: .WORD   ;MAXIMUM CURRENT VIRTUAL MEMORY UNDER TEST
1178
1179  000342  000000          SAVMAX: .WORD
1180  000344  000000          SAVR4:  .WORD
1181  000346  000000          SAVR5:  .WORD
1182
1183                          ;* SAVR6 POINTS TO WHERE THE PROGRAM STARTS EVEN WHEN RELOCATED.
1184  000350  000500          SAVR6:  .WORD   BEGIN                   ;CONTAINS START ADDRESS WHEN RELOCATED ALSO.
1185  000352  000000          PARMAP: 0               ;MAP OF PARITY MODULES UNDER TEST.
1186  000354  000000          SAVLOC: 0               ;TEST 6 STORES ERROR INFO HERE
1187  000356  000000          PARSP:  0       ;SAVE SP DURING PARITY ERROR TRAP.
1188  000360  000000          PARPS:  0               ;SAVE PSW DURING PARITY ERROR TRAP.
1189                                                  ;NOTE-PARSP +PARPS ARE NEEDED SINCE THERE IS
1190                                                  ;IS NOT ENOUGH ROOM ON THE STACK (500-452) AND
1191                                                  ;SO THE STACK MUST BE RESET IN THE PARERR ROUTINE.
1192                                                  ;IN THIS CRUDE FASHION.
1193
1194
1195                          ;*364-400 IS USED AS A STACK AREA BY ERRCHK ROUTINE FOR ERROR HISTORY PRINTOUT
```

```
                        000400                          .=400
                                                .SBTTL  APT MAILBOX-ETABLE
                                                ;;*****************************************************************
                                                .EVEN
000400                                          $MAIL:                          ;;APT MAILBOX
000400  000000                                  $MSGTY: .WORD   AMSGTY  ;;MESSAGE TYPE CODE
000402  000000                                  $FATAL: .WORD   AFATAL  ;;FATAL ERROR NUMBER
000404  000000                                  $TESTN: .WORD   ATESTN  ;;TEST NUMBER
000406  000000                                  $PASS:  .WORD   APASS   ;;PASS COUNT
000410  000000                                  $DEVCT: .WORD   ADEVCT  ;;DEVICE COUNT
000412  000000                                  $UNIT:  .WORD   AUNIT   ;;I/O UNIT NUMBER
000414  000000                                  $MSGAD: .WORD   AMSGAD  ;;MESSAGE ADDRESS
000416  000000                                  $MSGLG: .WORD   AMSGLG  ;;MESSAGE LENGTH
000420                                          $ETABLE:                        ;;APT ENVIRONMENT TABLE
000420      000                                 $ENV:   .BYTE   AENV    ;;ENVIRONMENT BYTE
000421      000                                 $ENVM:  .BYTE   AENVM   ;;ENVIRONMENT MODE BITS
000422  000000                                  $SWREG: .WORD   ASWREG  ;;APT SWITCH REGISTER
000424  000000                                  $USWR:  .WORD   AUSWR   ;;USER SWITCHES
000426  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
000430      000                                 $MAMS1: .BYTE   AMAMS1  ;;HIGH ADDRESS,M.S. BYTE
000431      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
000432  000000                                  $MADR1: .WORD   AMADR1  ;;HIGH ADDRESS,BLK#1
                                                ;*                        MEM.LAST ADDR.=3 BYTES,THIS WORD AND LOW OF ''TYPE'' ABOVE
000434      000                                 $MAMS2: .BYTE   AMAMS2  ;;HIGH ADDRESS,M.S. BYTE
000435      000                                 $MTYP2: .BYTE   AMTYP2  ;;MEM.TYPE,BLK#2
000436  000000                                  $MADR2: .WORD   AMADR2  ;;MEM.LAST ADDRESS,BLK#2
000440      000                                 $MAMS3: .BYTE   AMAMS3  ;;HIGH ADDRESS,M.S.BYTE
000441      000                                 $MTYP3: .BYTE   AMTYP3  ;;MEM.TYPE,BLK#3
000442  000000                                  $MADR3: .WORD   AMADR3  ;;MEM.LAST ADDRESS,BLK#3
000444      000                                 $MAMS4: .BYTE   AMAMS4  ;;HIGH ADDRESS,M.S.BYTE
000445      000                                 $MTYP4: .BYTE   AMTYP4  ;;MEM.TYPE,BLK#4
000446  000000                                  $MADR4: .WORD   AMADR4  ;;MEM.LAST ADDRESS,BLK#4
000450                                          $ETEND:
                                                .MEXIT

                                                ;;*****************************************************************
                                                .SBTTL  BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.
```

```
                                ;;*****************************************************************
000450  177570                  SWR:    177570  ;CHANGES TO SWREG IF NO HARDWARE SWITCH REGISTER

        000500                          .=500
000500  010706                  BEGIN:  MOV     PC,SP           ;SET UP STACK POINTER TO EQUAL BEGIN ADDRESS

000502  005746                          TST     -(SP)
000504  010637  000350                  MOV     SP,@#SAVR6      ;SAVE SP FOR FUTURE USE
000510  012737  000070  000024          MOV     #PWRDN,@#24     ;PREPARE FOR ANY FUTURE POWER DOWN
000516  005037  000300                  CLR     @#$PRERR
000522  005037  000314                  CLR     @#TYPCNT
000526  012700  000114                  MOV     #114,R0         ;PREPARE TO SETUP PARITY TRAP VECTOR
000532  012710  005504                  MOV     #PARERR-.-6,(R0)
000536  060720                          ADD     PC,(R0)+        ;TO PARERR
000540  012710  000340                  MOV     #340,(R0)       ;AND PSW OF 340
000544  105737  000405                  TSTB    @#REL           ;IS THIS CODE RELOCATED?
000550  100002                          BPL     ONEPAS          ;BRANCH IF NO
000552  000167  000614                  JMP     TSTREL          ;THIS CODE IS RELOCATED SO GET TEST SIZE.

000556  005737  000406          ONEPAS: TST     @#$PASS         ;IS THIS THE FIRST PASS?
000562  001402                          BEQ     TSTRP           ;BRANCH IF YES (TEST TRAP CATCHER ADDRESSES)
000564  000167  000430                  JMP     SETSTK          ; GET THE TEST SIZE
000570  012704  007744          TSTRP:  MOV     #ENDPRG ,R4     ;LOAD R4 WITH THE ADDRESS OF THE END OF THE PROGRAM
000574  012700  000377                  MOV     #377,R0
000600  010037  000316                  MOV     R0,@#BAKPAT
000604  005001                          CLR     R1
000606  012124                  2$:     MOV     (R1)+,(R4)+     ;SAVE FROM 0000 TO BEGIN-30 AT END OF PROGRAM FOR NOW
000610  020127  000400                  CMP     R1,#$MAIL
000614  103774                          BLO     2$
000616  005741                  3$:     TST     -(R1)           ;PREPARE TO TEST THE TRAP VECTORS
000620  010011                  4$:     MOV     R0,(R1)         ;CHECK THE TRAP VECTORS FOR THE CAPABILITY
                                                                ;OF HOLDING 0'S & 1'S
000622  020011                          CMP     R0,(R1)         ;IS THE DATA OK?
000624  001403                          BEQ     6$              ;BRANCH IF YES

000626  004767  005334                  JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
000632  000001                          1                       ;******ERROR NUMBER 1******

000634  000300                  6$:     SWAB    R0
000636  001370                          BNE     4$
000640  005701                          TST     R1              ;IF WE HAVE NOT REACHED THE LOWEST MEMORY LOCATION
000642  001365                          BNE     3$              ;THEN REPEAT FROM 3$
000644  012701  000400                  MOV     #$MAIL,R1
000650  014441                  8$:     MOV     -(R4),-(R1)     ;RESTORE TRAP CATCHER ETC.
000652  005701                          TST     R1
000654  001375                          BNE     8$

000656  012700  000006          SETSWR: MOV     #6,R0
000662  012710  000340                  MOV     #340,(R0)       ;SET UP TIME OUT TRAP PSW
000666  012740  000700                  MOV     #4$,-(R0)       ;AND THE RETURN ADDRESS
000672  005777  177552          2$:     TST     @SWR            ;DOES THE SWITCH REGISTER POINTED BY SWR EXIST ?
000676  000404                          BR      5$              ;BRANCH IF YES
000700  022626                  4$:     CMP     (SP)+,(SP)+     ;RESTORE THE STACK POINTER
000702  012737  000176  000450          MOV     #SWREG,@#SWR    ;AND PLACE THE ADDRESS OF THE SWITCH REGISTER
                                                                ;DESIGNED FOR THE COMPUTERS NOT HAVING HARDWARE
                                                                ;SWITCH REGISTER AND RUNNING STAND ALONE
000710  105737  000420          5$:     TSTB    @#$ENV          ;RUNNING UNDER APT?
```

```
1300  000714  001403                          BEQ     APTSIZ          ;BRANCH IF NO
1301  000716  012737  000422  000450          MOV     #$SWREG,@#SWR   ;SET SWR EQUAL TO APT SWITCH REGISTER.
1302
1303
1304
1305
1306                                  ;APTSIZ- THIS ROUTINE WILL SEARCH THE APT MEMORY ETABLE AND WHEN
1307                                  ;A NON ZERO TYPE IS FOUND WILL SETUP TO TEST TO GIVEN HIGH ADDRESS.
1308                                  ;       IF APT DEFINES SIZE THE LOW TEST ADDRESS MUST=00000.(DUE TO ETABLE FORMAT)
1309                                  ;FLOW;
1310                                  ;       IF BLOCK 4 (OR 3,2,1) TYPE NON ZERO THEN GET APT HIGH ADDRESS AND EXIT.
1311                                  ;       ELSE    SEND ERROR #3
1312                                  ;NOTE; THE MEMORY TYPE IS IGNORED SINCE ALL TESTS ARE RUN REGARDLESS OF MEMORY TYPE.
1313
1314  000724  012703  000340          APTSIZ: MOV     #MAXMEM,R3      ;POINT R3 TO MAXMEM.
1315  000730  013737  000330  000334          MOV     @#HIGHTWO,@#$HIMAX      ;IN CASE NO SELF SIZING DONE.
1316  000736  013737  000332  000336          MOV     @#HIGHADD,@#$MAXM       ;IN CASE NO SELF SIZING DONE.
1317  000744  105737  000421                  TSTB    @#$ENVM         ;DOES APT ALLOW SELF SIZING?
1318  000750  100021                          BPL     TRYSR           ;BRANCH IF YES
1319
1320  000752  012701  000451                  MOV     #$MTYP4+4,R1    ;POINT R1 TO BLOCK TYPE 4(+4)
1321  000756  162701  000004          1$:     SUB     #4,R1           ;POINT R1 TO NEXT BLOCK TYPE.
1322  000762  105711                          TSTB    (R1)            ;IS THE BLOCK TYPE NON ZERO?
1323  000764  001006                          BNE     2$              ;BRANCH IF YES (MEMORY EXISTS)
1324  000766  020127  000431                  CMP     R1,#$MTYP1      ;ALL APT BLOCK TYPES BEEN CHECKED?
1325  000772  101371                          BHI     1$              ;BRANCH IF NO
1326
1327  000774  004767  005166                  JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
1328  001000  000002                          2                       ;******ERROR NUMBER 2******
1329
1330  001002  004767  006324          2$:     JSR     PC,GETADR       ;GO SET MAXIMUM APT ADDRESS INTO $MAXM + $HIMAX
1331  001006  004767  006320                  JSR     PC,GETADR       ;GO SET MAXIMUM APT ADDRESS INTO HIGHADD+HIGHTWO
1332  001012  000464          BRTPSZ: BR      TYPSIZ          ; TYPE THE SIZE OF MEMORY UNDER TEST
1333
1334  001014  032777  000100  177426  TRYSR:  BIT     #100,@SWR       ;USER DEFINED MEMORY TEST BOUNDARIES??
1335  001022  001060                          BNE     TYPSIZ           BRANCH IF YES (DON'T SIZE MEMORY)
1336
1337
1338
1339
1340
1341  001024  010401          SLFSIZ: MOV     R4,R1           ;SETUP R1 AND R4 TO THE LOWEST ADDRESS OF MEMORY
1342  001026  012710  001072                  MOV     #4$,(R0)        ;SET UP RETURN ADDRESS FROM TIME OUT TRAP TO 4$
1343  001032  011111          2$:     MOV     (R1),(R1)       ;WRITE A MEMORY LOCATION INTO ITSELF AND TRAP IF NXM
1344  001034  062701  000002                  ADD     #2,R1           ;ADD 2 TO THE ADDRESS POINTER
1345  001040  022701  170000                  CMP     #170000,R1      ;CHECK IF BEYOND 30K MEMORY BOUNDARY
1346  001044  101372                          BHI     2$              ;KEEP ON SIZING UP THE MEMORY UNTIL NXM TRAP
1347                                                                   ;(TIME OUT TRAP) IS ENCOUNTERED
1348                                                                   ;OR 30K BOUNDARY REACHED
1349  001046  005737  000042                  TST     @#42            ;IF NOT XXDP
1350  001052  001410                          BEQ     5$              ;    THEN CONTINUE
1351  001054  023737  000042  000046          CMP     @#42,@#46       ;    ELSE IF NOT XXDP CHAINING
1352  001062  001404                          BEQ     5$              ;        THEN CONTINUE
1353  001064  162701  010000                  SUB     #10000,R1       ;        ELSE SET MAX. MEM. AT 28K
1354  001070  000401                          BR      5$
1355
```

BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.  SEQ 0027

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1356  001072  022626           4$:     CMP     (SP)+,(SP)+     ;RESTORE THE STACK POINTER
1357  001074  004767  005764   5$:     JSR     PC,MEMMNG       ; SERVICE MEMORY MANAGEMENT IF IT IS AVAILABLE
1358                                                            ;AND IF IT HAS TO BE TESTED
1359  001100  105737  000276           TSTB    @#MMAVA         ;SEE IF MEMORY MANAGEMENT HAS TO BE TESTED
1360  001104  001416                   BEQ     12$             ;IF NO MEM. MANG. THEN GO TO 12$
1361  001106  012710  001120   6$:     MOV     #8$,(R0)        ;SET UP THE RETURN ADDRESS FROM TRAP TO 8$
1362  001112  012701  020000           MOV     #20000,R1       ;BEGIN CHECKING MEMORY ABOVE 28K
1363  001116  000745                   BR      2$
1364  001120  022626           8$:     CMP     (SP)+,(SP)+     ;RESTORE STACK POINTER
1365  001122  022701  160000           CMP     #160000,R1      ;IF R1 DID NOT READ ALL THE LOCATIONS POINTED BY
1366                                                            ;PAGE ADDRESS REGISTER 6 THEN IT HAS REACHED THE
1367                                                            ;MAXIMUM AVAILABLE MEMORY
1368  001126  001005                   BNE     12$             ;IN WHICH CASE GO TO 12$
1369  001130  013702  172352           MOV     @#172352,R2     ;PREPARE TO UPDATE MEMORY MANAGEMENT REGISTERS
1370  001134  004767  005730           JSR     PC,MMREG                ;OTHERWISE GO TO UPDATE MEM. MANG. REGISTERS
1371  001140  000762                   BR      6$
1372  001142  024341           12$:    CMP     -(R3),-(R1)     ;CAUSE R3 TO POINT TO LOCATION $MAXM AND R1
1373                                                            ;TO THE MAXIMUM AVAILABLE MEMORY
1374  001144  004767  006072           JSR     PC,PUTADR       ;GO TO THE SUBROUTINE TO PLACE THE ADDRESS IN R1
1375                                                            ;AT LOCATIONS $MAXM AND $HIMAX
1376  001150  024343                   CMP     -(R3),-(R3)     ;MAKE R3 POINT TO HIGHADD
1377  001152  004767  006064           JSR     PC,PUTADR       ;PLACE THE ADDRESS IN R1 AT LOCATIONS HIGHADD
1378                                                            ;AND HIGHTWO
1379  001156  005743                   TST     -(R3)
1380  001160  005043                   CLR     -(R3)           ;CLEAR THE LOCATION LOWADD
1381  001162  005043                   CLR     -(R3)           ;AND LOWTWO
1382  001164  012720  000104   TYPSIZ: MOV     #BUSER,(R0)+    ;SET UP VECTOR FOR ANY FUTURE TRAP
1383  001170  010403                   MOV     R4,R3           ;SET R3 TO POINT TO THE LOWEST AVAILABLE MEMORY
1384                                                            ;LOCATION
1385  001172  012701  000324           MOV     #LOWTWO,R1
1386  001176  004767  005370           JSR     PC,PCRLF        ;TYPE CR/LF
1387  001202  004767  005536           JSR     PC,OCTTYP       ;TYPE LOW TEST ADDRESSE (LOWTWO+LOWADD)
1388  001206  004767  005272   TYPMEM: JSR     PC,$TYPE        ; TYPE "-"
1389  001212  000055                   .ASCIZ  /-/
1390                                    .EVEN
1391  001214  004767  005524           JSR     PC,OCTTYP       ;TYPE HIGHEST TEST ADDRESS (HIGHTWO+HIGHADD)
1392  001220  012703  000330   SETSTK: MOV     #HIGHTWO,R3     ;MAKE R3 POINT TO THE HIGH ORDER BITS OF TOP ADDRESS
1393  001224  004767  006116           JSR     PC,$GTSIZ       ; GET THE BITS 13-17 OF THE TOP ADDRESS
1394                                                            ;PLACED IN BITS 0-4 OF R2
1395  001230  010401                   MOV     R4,R1           ;SET R1 TO LOWEST TEST ADDRESS
1396
1397  001232  062704  000022   4$:     ADD     #18.,R4         ;APPEND THE ERROR STACK FOR THE MEMORY UNDER
1398                                                            ;TEST TO THE END OF THE PROGRAM
1399  001236  005302                   DEC     R2
1400  001240  002374                   BGE     4$
1401  001242  022737  167776  000336   CMP     #167776,@#$MAXM ;CHECK IF THIS IS A 30K SYSTEM
1402  001250  001002                   BNE     5$              ;BRANCH IF NOT
1403  001252  062704  000022           ADD     #18.,R4         ;SAVE ANOTHER BANKS WORTH OF ERROR STACK
1404  001256  010437  000310   5$:     MOV     R4,@#ENDSTK     ;SAVE THE ADDRESS OF THE END OF THE ERROR STACK
1405  001262  005021           6$:     CLR     (R1)+           ;CLEAR THE ERROR STACK
1406  001264  020104                   CMP     R1,R4
1407  001266  101775                   BLOS    6$
1408  001270  012737  157776  000340   MOV     #157776,@#MAXMEM                ;SET MAXMEM TO MAXIMUM VIRTUAL ADDRESS
1409  001276  005723                   TST     (R3)+           ;TESTING MEMORY MANAGEMENT?
1410  001300  001005                   BNE     SAVLDR          ;BRANCH IF YES (GO SAVE LOADERS AT TOP OF VIRTUAL MEMORY
1411  001302  021327  170000           CMP     (R3),#170000    ;IS THE VIRTUAL ADDRESS ABOVE 167776?
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1412  001306  103002                          BHIS    SAVLDR          ;BRANCH IF YES (GO SAVE LOADERS)
1413  001310  011363  000002                  MOV     (R3),2(R3)      ;OTHERWISE MAKE THE CONTENTS OF LOCATION MAXMEM
1414                                                                    ;EQUAL TO THE MAXIMUM AVAILABLE MEMORY
1415                                                                    ;AND FALL INTO SAVE LOADERS.
1416
1417  001314  004767  006100          SAVLDR: JSR     PC,CLRMM        ; DISABLE THE MEMORY MANAGEMENT UNIT
1418  001320  005723                          TST     (R3)+           ;MAKE R3 TO POINT TO THE LOCATION MAXMEM
1419  001322  011305                          MOV     (R3),R5         ;R5 CONTAINS THE ADDRESS OF MAXIMUM AVAILABLE MEM.
1420
1421                                  ;IF ONLY 4K BEING TESTED DON'T SAVE LOADERS
1422
1423  001324  020527  017776                  CMP     R5,#17776       ;ONLY TESTING 4K MAX?
1424  001330  103416                          BLO     4$              ;BRANCH IF YES (DON'T SAVE LOADERS)
1425
1426  001332  162705  000276          3$:     SUB     #276,R5         ;PREPARE TO SAVE 300 BYTES OF THE LOADERS
1427  001336  005737  000042                  TST     @#42            ;IF RUNNING UNDER XXDP
1428  001342  001406                          BEQ     2$              ;    THEN CONTINUE
1429  001344  023737  000042  000046          CMP     @#42,@#46       ;    ELSE IF NOT UNDER XXDP CHAIN MODE
1430  001352  001402                          BEQ     2$              ;       THEN CONTINUE
1431  001354  162705  005376                  SUB     #<1502.*2>-276,R5       ;       ELSE SAVE 1500. WORDS FOR XXDP CHAIN MODE
1432  001360  012524          2$:     MOV     (R5)+,(R4)+     ;SAVE LOADER
1433  001362  020513                  CMP     R5,(R3)
1434  001364  101775                  BLOS    2$
1435  001366  012323          4$:     MOV     (R3)+,(R3)+     ;SAVE THE CONTENTS OF LOCATION MAXMEM IN SAVMAX
1436  001370  010423                  MOV     R4,(R3)+        ;AND THE CONTENTS OF R4 AT SAVR4
1437
1438  001372  010537  000346  TSTREL: MOV     R5,@#SAVR5      ;SAVE HIGHEST VIRTUAL ADDRESS+2
1439  001376  004767  006016  TSTSIZ: JSR     PC,CLRMM        ;GO TO DISABLE MEMORY MANAGEMENT UNIT
1440  001402  005745                  TST     -(R5)           ;SET R5 BACK TO HIGHEST VIRTUAL ADDRESS
1441  001404  012703  000324          1$:     MOV     #LOWTWO,R3      ;PREPARE TO LOAD R4 AND R5 WITH THE MEMORY BOUNDRIES
1442  00141C  005723                  TST     (R3)+           ;IF THE BITS 16,17 OF THE LOWEST LOCATION UNDER
1443                                                           ;TEST ARE NON ZERO
1444  001412  001003                  BNE     2$              ;THEN GO TO 2$
1445  001414  021327  157776          CMP     (R3),#157776    ;IF THE LOWEST LOCATION UNDER TEST IS HIGHER THAN
1446                                                           ;157776 THEN GO TO TEST MEMORY MANAGEMENT
1447  001420  103411                  BLO     4$
1448  001422  032777  010000  177020  2$:     BIT     #10000,@SWR     ;IS MEMORY MANAGEMENT SELECTED?
1449  001430  001003                  BNE     3$              ;YES ALL IS WELL
1450  001432  004767  004530          JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
1451  001436  000003                  3                       ;******ERROR NUMBER 3******
1452
1453  001440  000167  003512          3$:     JMP     TSTMM           ;GO TO TEST MEMORY MANAGEMENT
1454  001444  020423                  4$:     CMP     R4,(R3)+        ;COMPARE TOP OF PROGRAM (WITH SAVED LOADERS) TO
1455                                                                  ;LOWEST LOCATION UNDER TEST
1456
1457  001446  103002                  BHIS    6$
1458  001450  016304  177776                  MOV     -2(R3),R4       ;ADJUST R4 TO POINT TO THE LOWEST LOCATION UNDER TEST
1459  001454  005723                  6$:     TST     (R3)+           ;IF BITS 16-17 OF HIGHEST LOCATION TO BE TESTED
1460  001456  001003                  BNE     8$              ;ARE NON ZERO THEN GO TO 8$
1461  001460  021305                  CMP     (R3),R5         ;OTHERWISE SEE IF THE HIGHEST LOCATION TO BE
1462                                                           ;TESTED IS HIGHER THAN HIGHEST VIRTUAL ADDRESS
1463  001462  101001                  BHI     8$              ;IF SO THEN GO TO 8$
1464  001464  011305                  MOV     (R3),R5         ;MODIFY R5
1465  001466  105737  000405          8$:     TSTB    @#REL           ;ARE WE RELOCATED.?
1466  001472  100014                  BPL     10$             ;BRANCH IF NO
1467  001474  013704  000322                  MOV     @#RELBOT,R4     ;SET BOTTOM TEST ADDRESS WHEN RELOCATED.
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1468  001500  020527  017776          CMP     R5,#17776       ;ARE WE RELOCATED IN BANK 0?
1469  001504  103402                  BLO     9$              ;BRANCH IF YES
1470  001506  012705  017776          MOV     #17776,R5       ;ELSE SET HIGH MEMORY UNDER TEST=4K
1471
1472  001512  020405          9$:     CMP     R4,R5           ;IS LOW LIMIT LOWER THAN HIGH LIMIT?
1473  001514  103403                  BLO     10$             ;BRANCH IF YES
1474  001516  004767  004444          JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
1475  001522  000004                  4                       ;******ERROR NUMBER 4******
1476
1477  001524  012703  000542  10$:     MOV     #SAVMAX,R3
1478  001530  011343                  MOV     (R3),-(R3)      ;RESTORE THE CONTENTS OF MAXMEM
1479  001532  062713  000002  MEMTST: ADD     #2,(R3)         ;MAKE THE CONTENTS OF MAXMEM - MAXIMUM AVAILABLE
1480                                                          ;MEMORY +2
1481  001536  005725                  TST     (R5)+           ;AND SET R5=MAX MEMORY+2
1482
1483                          ;CLEAR MEMORY UNDER TEST
1484
1485  001540  010500          CLRMEM: MOV     R5,R0           ;MOVE HIGH ADDRESS TO R0
1486  001542  005040          2$:     CLR     -(R0)           ;BEGIN CLEARING THE MEMORY FROM THE TOP
1487  001544  020004                  CMP     R0,R4           ;UNTIL THE BOTTOM IS REACHED
1488  001546  101375                  BHI     2$
1489  001550  012702  000001          MOV     #1,R2           ;SET R2 TO ENABLE PARITY MODULE CODE.
1490  001554  004767  005740          JSR     PC,PARITY       ;ENABLE PARITY IF WANTED AND AVAILABLE.
1491  001560  012702  000316          MOV     #BAKPAT,R2
1492  001564  012212                  MOV     (R2)+,(R2)      ;WRITE SWAPPED BAKPAT IN LOCATION SWAPAT
1493  001566  000312                  SWAB    (R2)
1494  001570  017702  176654          MOV     @SWR,R2         ;LOAD R2 WITH THE OPTIONS STORED AT $SWREG
1495  001574  042702  177760          BIC     #177760,R2      ;ONLY LEAVE THE LOWER 4 BITS OF $SWREG IN R2 TO GO TO
1496                                                          ;THE TEST # SPECIFIED [DEFAULT IS TEST#0]
1497
1498
1499
1500                          ;ENTER HERE FROM TSTSCP ROUTINE AT END OF SUBTEST
1501
1502  001600  005037  000306  CONT:   CLR     @#PASFLG        ;INIT SUBTEST PASS FLAG.
1503  001604  110237  000404          MOVB    R2,@#$TESTN     ;SET UP $TESTN WITH THE TEST NUMBER GOING
1504                                                          ;TO BE EXECUTED
1505  001610  010401          LOOP:   MOV     R4,R1           ;LOAD R1 WITH THE LOWEST LOCATION UNDER TEST
1506  001612  010400                  MOV     R4,R0           ;PLACE THE ADDRESS OF THE LOWEST LOCATION UNDER
1507                                                          ;TEST IN R0
1508  001614  010403                  MOV     R4,R3           ;AND IN R3
1509  001616  006302                  ASL     R2
1510  001620  060702                  ADD     PC,R2
1511  001622  066207  000004          ADD     TBL-.(R2),PC            ;GO TO THE TEST #
1512                                                          ;STORED IN BITS 0-3 OF SWITCH REGISTER
1513
1514
1515  001626  000102          TBL:    TST0-TBL                ;RELATIVE ADDRESS OF TEST # 0
1516  001630  000340                  TST1-TBL                ;RELATIVE ADDRESS OF TEST # 1
1517  001632  000440                  TST2-TBL                ;RELATIVE ADDRESS OF TEST # 2
1518  001634  000550                  TST3-TBL                ;RELATIVE ADDRESS OF TEST # 3
1519  001636  001016                  TST4-TBL                ;RELATIVE ADDRESS OF TEST # 4
1520  001640  001126                  TST5-TBL                ;RELATIVE ADDRESS OF TEST # 5
1521  001642  001274                  TST6-TBL                ;RELATIVE ADDRESS OF TEST # 6
1522  001644  001430                  TST7-TBL                ;RELATIVE ADDRESS OF TEST # 7
1523  001646  001654                  TST10-TBL               ;RELATIVE ADDRESS OF TEST # 10
```

```
1524  001650  002204                    TST11-TBL               ;RELATIVE ADDRESS OF TEST # 11
1525  001652  002256                    TST12-TBL               ;RELATIVE ADDRESS OF TEST # 12
1526  001654  002530                    TST13-TBL               ;RELATIVE ADDRESS OF TEST # 13
1527  001656  003156                    RELOC-TBL               ;RELATIVE ADDRESS OF ROUTINE 'RELOC'
1528
1529
1530
1531                                    ;R5 IS POINTING TO THE TOP OF THE MEMORY TO BE TESTED+2
1532                                    ;R4 & R0 ARE POINTING TO THE LOWEST ADDRESS OF MEMORY TO BE TESTED
```

```
1533                                    ;*      SCOPE ROUTINE
1534                                    ;*      -------------
1535                                    ;*
1536                                    ;*
1537                                    ;*              PROGRAM COMES TO THIS ROUTINE AFTER COMPLETION OF EACH TEST AND
1538                                    ;*              IF CNTRL-C TYPED GOTO ERROR HISTORY TYPE ROUTINE.
1539                                    ;*              IF SR= 2000 (BIT10) THEN HALT
1540                                    ;*              IF SR= 40000 (BIT14) THEN LOOP ON TEST DEFINED BY SR BITS<3:0>
1541                                    ;*              ELSE CONTINUE TO NEXT TEST.
1542                                    ;*
1543
1544
1545  001660  105737  000420            TSTSCP: TSTB    @#$ENV          ;ARE WE RUNNING UNDER APT?
1546  001664  001002                            BNE     CNTSCP          ;IF SO THEN GO TO CNTSCP
1547  001666  004767  006002                    JSR     PC,CHECKC       ;TEST FOR CONTROL-C AND IF TYPED GO
1548                                                                    ;PRINT ERROR HISTORY AND HALT AT FATHLT.
1549  001672  113702  000404            CNTSCP: MOVB    @#$TESTN,R2     ;PLACE THE TEST NUMBER IN THE LOWER BYTE OF R2
1550                                                                    ;SINCE THERE ARE LESS THAN 377 TESTS UPPER BYTE
1551                                                                    ;OF R2 WILL BE 0
1552  001676  005237  000410                    INC     @#$DEVCT        ;TELL APT WE ARE STILL RUNNING OKAY
1553  001702  032777  002000  176540            BIT     #2000,@SWR      ;IS THE PROGRAM GOING TO HALT AFTER EACH TEST?
1554  001710  001401                            BEQ     TSTGO           ;IF NOT THEN GO TO 2$
1555  001712  000000            SWHALT: HALT                            ;HALT AT END OF TEST SWITCH SET.
1556
1557  001714  032777  040000  176526  TSTGO:    BIT     #40000,@SWR     ;IS THE PROGRAM GOING TO LOOP ON TEST
1558  001722  001332                            BNE     LOOP            ;IF SO THEN GO TO THE STARTING OF THE SAME TEST
1559  001724  105202                            INCB    R2
1560  001726  000724                            BR      CONT            ;GO TO CONT AND CONTINUE EXECUTING THE NEXT TEST
```

```
                                ;;*********************************************************************
                                ;*TEST 0         TEST FOR PROPER BANK SELECTION
                                ;*(1)    THIS TEST ASSUMES THAT THE MEMORY IS IN A STATE
                                ;*       OF ALL 0'S AND R0 HAS THE ADDRESS OF THE LOWEST
                                ;*       LOCATION UNDER TEST
                                ;*(2)    IT CHECKS FOR PROPER BANK SELECTION BY WRITING
                                ;*       1'S IN A LOCATION AND CHECKING FOR 0'S IN THE SAME
                                ;*       LOCATIONS OF OTHER 4K BANKS OF THE MEMORY
                                ;*       [I.E. LOCATIONS LIKE 7766 AND 27766 ETC.]
                                ;*(3)    THIS TEST ALSO CHECKS TO SEE THAT NONE OF THE NON EXIST-
                                ;*       ING BANK RESPOND WHEN THEY ARE ADDRESSED
                                ;;*********************************************************************
001730  105737  000404          TST0:   TSTB    @#$TESTN        ;CHECK FOR PROPER TEST SEQUENCE
001734  001403                          BEQ     .+10
001736  004767  004224                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HA'T AT FATHLT
001742  000005                          5                       ;******ERROR NUMBER 5******
001744  012703  177777                  MOV     #177777,R3
001750  010401                  1$:     MOV     R4,R1           ;R1 = ADDRESS OF LOWEST LOCATION OF MEMORY UNDER TEST
001752  010310                          MOV     R3,(R0)         ;SET ALL THE BITS AT (R0)
001754  020001                  2$:     CMP     R0,R1           ;IS R0 POINTING TO THE SAME MEMORY LOCATION AS R1
001756  001417                          BEQ     4$              ;IN WHICH CASE CHECK FOR ALL 1'S AT (R1)
001760  005711                          TST     (R1)            ;OTHERWISE CHECK (R1) FOR ALL 0'S
001762  001430                          BEQ     5$
001764  020311                          CMP     R3,(R1)         ;IF R1 IS NOT EQUAL TO R0 AND (R1)
                                                                ;DOES NOT CONTAIN ALL 0'S THEN
                                                                ;CHECK TO SEE IF (R0) = (R1)
001766  001004                          BNE     3$
001770  012767  000006  000042          MOV     #6,12$          ;*ERROR* SETUP ERROR NO. IN 12$
                                                                ;******ERROR NUMBER #6******
001776  000403                          BR      10$
002000                          3$:
002000  012767  000007  000032          MOV     #7,12$          ;*ERROR* SETUP ERROR NO. IN 12$
                                                                ;******ERROR NUMBER #7******
002006  010046                  10$:    MOV     R0,-(SP)        ;SAVE R0 ON STACK
002010  105237  000301                  INCB    @#$ADERR        ;AN ADDRESSING ERROR IS SUSPECTED
002014  000407                          BR      11$
002016  020311                  4$:     CMP     R3,(R1)         ;CHECK (R1) FOR ALL 1'S
002020  001411                          BEQ     5$
002022  012767  000010  000010          MOV     #10,12$         ;*ERROR* SETUP ERROR NO. IN 12$
                                                                ;******ERROR NUMBER #10******
002030  010046                          MOV     R0,-(SP)        ;SAVE R0 ON STACK
002032  010300                          MOV     R3,R0
002034  004767  003570          11$:    JSR     PC,ERROR        ;GO TO THE ERROR SUBROUTINE
002040  000000                  12$:    .WORD                   ;ERROR NUMBER TO BE REPORTED WILL BE PLACED HERE
002042  012600                          MOV     (SP)+,R0        ;RESTORE R0
002044  013706  000350          5$:     MOV     @#SAVR6,SP      ;RESTORE THE STACK POINTER
002050  062701  020000                  ADD     #20000,R1       ;CAUSE R1 TO POINT TO THE SAME CHIP
                                                                ;LOCATION IN THE NEXT 4K BANK OF MEMORY
                                                                ;BY ADDING 1 TO THE 14TH BIT OF ADDRESS IN R1
002054  020105                          CMP     R1,R5           ;COMPARE R1 WITH THE HIGHEST MEMORY
                                                                ;LOCATION WHICH IS STORED IN R5
002056  103736                          BLO     2$              ;IF R1 LESS THAN R5 THEN REPEAT THE TEST FROM 2$
002060  105737  000421                  TSTB    @#$ENVM         ;HAS APT INHIBITED SIZING?
```

```
1617  002064  100432                        BMI     8$              ;BRANCH IF YES (DON'T TEST NON-EXISTENT MEMORY)
1618  002066  032777  000100  176354        BIT     #100,@SWR       ;HAS USER INHIBITED SIZING?
1619  002074  001026                        BNE     8$              ;BRANCH IF YES (DON'T TEST NON-EXISTENT MEMORY)
1620
1621  002076  020127  157776                CMP     R1,#157776      ;SEE IF R1 HAS CROSSED 28K BOUNDRY OF VIRTUAL ADDRESS
1622  002102  101016                        BHI     6$              ;IN WHICH CASE GO TO 6$
1623                                                                ;SHOULD BE LEFT AS IS FOR 30K SYSTEMS (WHICH USE 16K CHI
1624  002104  020137  000340                CMP     R1,@#MAXMEM     ;IS R1 LOWER THAN THE MAXIMUM AVAILABLE
1625                                                                ;MEMORY ?
1626  002110  103755                        BLO     5$              ;IF SO THEN GO TO 5$
1627  002112  012702  000006                MOV     #6,R2           ;MAKE R2 POINT TO TRAP VECTOR+2 FOR NXM
1628  002116  012712  000340                MOV     #340,(R2)       ;SET PSW TO 340
1629  002122  012742  177714                MOV     #5$-.-6,-(R2)   ;SET UP RETURN ADDRESS FROM TRAP TO 5$
1630  002126  060712                        ADD     PC,(R2)
1631  002130  011111                        MOV     (R1),(R1)       ;TRY TO WRITE TO NON-EXISTENT MEMORY (SHOULD TRAP)
1632  002132  004767  004030                JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
1633  002136  000011                        11                      ;******ERROR NUMBER 11******
1634
1635
1636  002140  012702  000004        6$:     MOV     #4,R2
1637  002144  012722  000006                MOV     #6,(R2)+        ;RESTORE TRAP VECTOR
1638  002150  005012                        CLR     (R2)
1639  002152  005010                8$:     CLR     (R0)
1640
1641  002154  062700  020000                ADD     #20000,R0       ;CAUSE R0 TO POINT TO THE SAME CHIP
1642                                                                ;LOCATION IN THE NEXT 4K MEMORY BANK
1643                                                                ;BY ADDING 1 TO THE 14TH BIT OF ADDRESS IN R0
1644  002160  020005                        CMP     R0,R5           ;COMPARE R0 WITH THE HIGHEST MEMORY
1645                                                                ;LOCATION WHICH IS STORED IN R5.
1646  002162  103672                        BLO     1$              ;IF R0 LESS THEN REPEAT THE TEST
1647  002164  000635                ENDO:   BR      TSTSCP
1648
1649
```

```
1650                                    ;;*****************************************************************
1651                                    ;*TEST 1         CHECK DI/DO LINES
1652                                    ;*(1)    THIS TEST CHECKS THE DATI/DATO LINES BY SHIFTING
1653                                    ;*       A 1 IN THE WORD DIRECTION
1654                                    ;;*****************************************************************
1655  002166  122737  000001  000404  TST1:   CMPB    #1,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
1656
1657
1658  002174  001403                          BEQ     .+10
1659  002176  004767  003764                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
1660  002202  000012                          12                      ;******ERROR NUMBER 12******
1661
1662  002204  012700  000001          1$:     MOV     #1,R0
1663  002210  010002                          MOV     R0,R2           ;SET R2-1
1664  002212  010011          2$:     MOV     R0,(R1)         ;MOV 1 AT LOCATION (R1)
1665  002214  020011          3$:     CMP     R0,(R1)         ;COMPARE R1 WITH THE CONTENTS OF LOCATION (R1)
1666  002216  001403                          BEQ     4$
1667  002220  004767  003404                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
1668  002224  000013                          13                      ;******ERROR NUMBER 13******
1669
1670
1671  002226  005702          4$:     TST     R2              ;ARE WE SHIFTING A 0 IN DATA DIRECTION?
1672  002230  001406                          BEQ     5$              ;IF SO THEN GO TO 5$
1673  002232  006300                          ASL     R0              ;SHIFT THE 1 BROUGHT IN AT 1$ IN
1674                                                                  ;DATA DIRECTION
1675  002234  103366                          BCC     2$              ;IF THE 1 HAS NOT BEEN SHIFTED THRU
1676                                                                  ;THE 16 DATA BITS THEN REPEAT FROM 2$
1677  002236  005002                          CLR     R2              ;INITIATE SHIFTING OF 0 IN DATA DIRECTION
1678  002240  012700  177776                  MOV     #177776,R0
1679  002244  000762                          BR      2$
1680
1681  002246  000261          5$:     SEC                             ;SET C BIT
1682  002250  006100                          ROL     R0              ;SHIFT A 0 16 TIMES IN DATA DIRECTION
1683  002252  103757                          BCS     2$              ;IF THE 0 HAS NOT BEEN SHIFTED THRU
1684                                                                  ;THE 16 DATA BITS THEN REPEAT FROM 2$
1685  002254  062701  020000                  ADD     #20000,R1       ;OTHERWISE GO TO THE NEXT BANK OF
1686                                                                  ;4K MEMORY AND REPEAT THE TEST
1687  002260  020105                          CMP     R1,R5
1688  002262  103750                          BLO     1$
1689  002264  000737          END1:   BR      END0
1690
```

```
1691                                    ;;*****************************************************************
1692                                    ;*TEST 2         TEST MEMORY FOR HOLDING DATA AND BYTE SELECTION
1693                                    ;*(1)    THIS TEST CHECKS THE MEMORY FOR THE CAPABILITY
1694                                    ;*       OF HOLDING 1'S AND 0'S BY WRITING A BACKGROUND
1695                                    ;*       OF BAKPAT AND READING IT
1696                                    ;*(2)    MEMORY IS WRITTEN USING A BYTE AT A TIME
1697                                    ;*(3)    STEPS 1 & 2 ARE REPEATED WITH A SWAPPED BACKGROUND PATTERN
1698                                    ;;*****************************************************************
1699  002266  122737  000002  000404  TST2:   CMPB    #2,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
1700
1701  002274  001403                  BEQ     .+10
1702  002276  004767  003664          JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
1703  002302  000014                  14                      ;******ERROR NUMBER 14******
1704
1705  002304  013700  000316  1$:     MOV     @#BAKPAT,R0
1706  002310  110021                  MOVB    R0,(R1)+
1707  002312  113721  000317          MOVB    @#BAKPAT+1,(R1)+;WRITE THE MEMORY WITH THE WORD STORED IN BAKPAT
1708  002316  020105                  CMP     R1,R5
1709  002320  103771                  BLO     1$
1710
1711  002322  020041          2$:     CMP     R0,-(R1)        ;TEST THE MEMORY TO SEE IF IT CONTAINS
1712                                                          ;THE WORD STORED IN BAKPAT
1713  002324  001416                  BEQ     8$
1714  002326  062701  000002          ADD     #2,R1
1715  002332  123741  000317          CMPB    @#BAKPAT+1,-(R1),CHECK FOR BYTE SELECTION PROBLEM
1716  002336  001402                  BEQ     4$
1717  002340  120041                  CMPB    R0,-(R1)        ;AGAIN CHECK FOR BYTE SELECTION PROBLEM
1718  002342  001002                  BNE     6$
1719  002344  105237  000301  4$:     INCB    @#$ADERR        ;PREPARE TO INFORM THAT IT IS ADDRESSING ERROR
1720  002350  042701  000001  6$:     BIC     #1,R1           ;MAKE THE ADDRESS IN R1 EVEN
1721  002354  004767  003250          JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
1722  002360  000015                  15                      ;******ERROR NUMBER 15******
1723
1724  002362  020104          8$:     CMP     R1,R4           ;KEEP ON TESTING THE MEMORY UNTIL
1725  002364  101356                  BHI     2$              ;R1 EQUALS THE LOWEST ADDRESS
1726  002366  000337  000316          SWAB    @#BAKPAT        ;CHANGE THE DATA PATTERN
1727  002372  001744                  BEQ     1$              ;IF THE DATA PATTERN DOES NOT HAVE LOW
1728                                                          ; BYTE =0 THEN FALL THRU
1729  002374  000733          END2:   BR      END1
1730
1731                                    ;THE TEST LEAVES BAKPAT LOCATION THE SAME AS IT WAS IN THE BEGINNING
1732
```

```
                                        ;;*****************************************************************
                                        ;*TEST 3         DUAL ADDRESS TEST A
                                        ;
                                                ;*(1)   THIS TEST CHECKS FOR DUAL ADDRESSING PROBLEMS BY WRITING A
                                                ;*      BACK GROUND OF BAKPAT.
                                                ;*(2)   STARTING FROM THE LOWEST LOCATION IN THE BANK THE TEST WRITES A
                                                ;*      LOCATION WITH SWAPPED BAKPAT
                                                ;*(3)   READS THE MEMORY FOR PROPER CONTENTS
                                                ;*(4)   SHIFTS A 1 ALONG THE ADDRESS DIRECTION AND REPEATS STEPS 1-3
                                                ;*(5)   REPEATS STEP 1-4 FOR EACH 4K BANK
                                        ;;*****************************************************************
002376  122737  000003  000404  TST3:   CMPB    #3,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
002404  001403                        BEQ     .+10
002406  004767  003554                JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
002412  000016                        16                      ;******ERROR NUMBER 16*****
002414  005003                        CLR     R3
002416  004737  000120          2$:   JSR     PC,@#WRTMEM     ; WRITE MEMORY WITH THE BACKGROUND STORED
                                                              ;AT LOCATION BAKPAT
002422  005002                  4$:   CLR     R2
002424  050302                  6$:   BIS     R3,R2           ;MAKE R2 POINT TO THE MEMORY BANK POINTED BY R3
002426  020204                        CMP     R2,R4           ;IF R2 IS LESS THAN R4
002430  103465                        BLO     16$             ;THEN DO NOTHING
002432  020205                        CMP     R2,R5           ;IF R2 IS HIGHER THAN THE HIGHEST LOCATION TO BE
002434  103077                        BHIS    20$             ;TESTED THEN EXIT THE TEST
002436  000312                        SWAB    (R2)            ;OTHERWISE WRITE THE COMPLEMENT OF BAKPAT IN
                                                              ;THE LOCATION POINTED BY R2
002440  005001                        CLR     R1
002442  050301                  7$:   BIS     R3,R1
002444  020104                        CMP     R1,R4           ;IF R1 IS POINTING TO A LOCATION LOWER THAN R4
002446  103445                        BLO     12$             ;THEN GO TO 12$
002450  020105                        CMP     R1,R5
002452  103053                        BHIS    15$
002454  020102                        CMP     R1,R2           ;CHECK THE MEMORY FOR CORRECT DATA
002456  001431                        BEQ     10$
002460  020011                        CMP     R0,(R1)         ;IF R1 IS NOT = TO R2 THEN (R1) SHOULD HAVE
                                                              ;THE SAME WORD AS BAKPAT
002462  001437                        BEQ     12$             ;IN WHICH CASE GO BACK TO 12$
002464  012767  000017  000032        MOV     #17,22$         ;*ERROR* SETUP ERROR NO. IN 22$
                                                              ;******ERROR NUMBER #17******
002472  010046                  8$:   MOV     R0,-(SP)        ;PLACE R0 ON THE STACK
002474  000316                        SWAB    (SP)
002476  022611                        CMP     (SP)+,(R1)      ;IF (R1) IS NOT = R0 THEN SEE IF IT IS SAME
                                                              ;AS A SWAPPED R0
002500  001003                        BNE     9$              ;IF NOT THEN A SUSPECTED DUAL ADDRESSING PROBLEM
                                                              ;FOR THE BITS THAT ARE DIFFERENT IN R0 AND (R1)
                                                              ;OTHERWISE THERE IS DUAL ADDRESSING FOR THE
                                                              ;ENTIRE WORD
002502  012767  000020  000014        MOV     #20,22$         ;*ERROR* SETUP ERROR NO. IN 22$
                                                              ;******ERROR NUMBER #20******
002510  105237  000301          9$:   INCB    @#$ADERR        ;ADDRESSING PROBLEM IS DETECTED
002514  010046                        MOV     R0,-(SP)        ;SAVE R0
002516  010200                        MOV     R2,R0           ;SET R0=GOOD ADDRESS FOR ERROR REPORT
002520  004767  003104                JSR     PC,ERROR        ;GO TO THE ERROR SUBROUTINE
002524  000000                  22$:  .WORD                   ;ERROR NUMBER TO BE REPORTED WILL BE PLACED HERE
002526  012600                        MOV     (SP)+,R0        ;RESTORE R0
```

```
1789  002530  010011                        MOV     R0,(R1)         ;RESTORE (R1)
1790  002532  020037  000316                CMP     R0,@#BAKPAT     ;IF THE CONTROL CAME HERE FROM 15$-2 THEN
1791  002536  001411                        BEQ     12$
1792  002540  000407                        BR      11$             ;RETURN TO 11$
1793  002542  000300              10$:      SWAB    R0              ;MAKE R0 SAME AS SWAPPED BAKPAT
1794  002544  020011                        CMP     R0,(R1)         ;IF R1 = R2 THEN (R1) SHOULD CONTAIN A WORD
1795                                                                ;EQUAL TO SWAPPED R0
1796  002546  001404                        BEQ     11$             ;IN WHICH CASE GO BACK TO 11$
1797  002550  012767  000021  177746        MOV     #21,22$         ;*ERROR* SETUP ERROR NO. IN 22$
1798                                                                ;******ERROR NUMBER #21******
1799  002556  000745                        BR      8$              ;AND GO TO 8$
1800  002560  000300              11$:      SWAB    R0              ;RESTORE R0 TO BAKPAT
1801  002562  040301              12$:      BIC     R3,R1           ;TAKE OUT THE BANK ADDRESS FROM THE ADDRESS IN R1
1802  002564  005701                        TST     R1              ;IF R1 IS 0 THEN PLACE A 1 IN R1
1803  002566  001001                        BNE     13$             ;OTHERWISE GO TO 13$
1804  002570  005201                        INC     R1
1805  002572  006101              13$:      ROL     R1
1806  002574  020127  020000                CMP     R1,#20000       ;IF R1 IS LESS THAN A 4K BOUNDRY
1807  002600  103720                        BLO     7$              ;THEN REPEAT FROM 7$
1808  002602  000312              15$:      SWAB    (R2)            ;RESTORE (R2) TO BAKPAT
1809  002604  040302              16$:      BIC     R3,R2           ;TAKE OUT THE BANK ADDRESS FROM THE ADDRESS
1810                                                                ;STORED IN R2
1811  002606  005702                        TST     R2              ;IF R2 = 0 THEN MOVE A 1 TO R2
1812  002610  001001                        BNE     18$             ;OTHERWISE GO TO 18$
1813  002612  005202                        INC     R2
1814  002614  006102              18$:      ROL     R2              ;SHIFT A ONE IN THE ADDRESS WORD
1815  002616  020227  020000                CMP     R2,#20000       ;IS THE ADDRESS IN R2 MORE THAN THE BOUNDRY
1816                                                                ;OF 4K
1817  002622  103700                        BLO     6$              ;IF NOT THEN GO TO 6$
1818  002624  060203                        ADD     R2,R3           ;OTHERWISE MAKE R3 POINT TO THE NEXT 4K BANK
1819  002626  020337  000340                CMP     R3,@#MAXMEM     ;IF R3 IS POINTING TO A BANK THAT IS LOWER
1820                                                                ;THAN MAXMEM
1821  002632  103673                        BLO     4$              ;THEN REPEAT FROM 4$
1822  002634  000337  000316      20$:      SWAB    @#BAKPAT
1823  002640  001656                        BEQ     TST3            ;REPEAT THE TEST WITH SWAPPED BAKPAT ONLY IF
1824                                                                ;THE LOWER BYTE OF BAKPAT IS 0
1825  002642  000654              END3:     BR      END2
```

```
                                ;;*****************************************************************
                                ;*TEST 4         DUAL ADDRESS TEST B
                                ;*(1)    THIS TEST CHECKS FOR DUAL ADDRESSING BY WRITING
                                ;*       AND READING THE ADDRESS IN THE LOCATION AND THEN
                                ;*       WRITING AND READING ADDRESS COMPLEMENT
                                ;;*****************************************************************
002644  122737  000004  000404 T4:    CMPB    #4,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
002652  001403                        BEQ     .+10
002654  004767  003306              JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
002660  000022                        22                      ;******ERROR NUMBER 22******

002662  005003                        CLR     R3
002664  010100                1$:     MOV     R1,R0
002666  005703                        TST     R3              ;IF R3 IS NOT 0 THEN STORE THE ADDRESS
002670  001401                        BEQ     2$              ;IN THE LOCATION
002672  005100                        COM     R0              ;OTHERWISE STORE COMPLEMENT
002674  010021                2$:     MOV     R0,(R1)+        ;OF THE ADDRESS
002676  020105                        CMP     R1,R5           ;UNTIL THE HIGHEST MEMORY LOCATION IS REACHED
002700  103771                        BLO     1$

002702  020041                3$:     CMP     R0,-(R1)        ;CHECK THE LOCATION FOR THE CORRECT CONTENTS
002704  001405                        BEQ     4$
002706  105237  000301              INCB    @#$ADERR        ;THIS IS PROBABLY ADDRESS PROBLEM RATHER THAN
                                                              ;BIT PROBLEM
002712  004767  002712              JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
002716  000023                        23                      ;******ERROR NUMBER 23******

002720  010100                4$:     MOV     R1,R0
002722  162700  000002              SUB     #2,R0           ;CHECK THAT THE ADDRESS IS STORED AT
002726  005703                        TST     R3              ;LOCATION IF R3 IS NOT 0
002730  001401                        BEQ     5$              ;OTHERWISE CHECK FOR
002732  005100                        COM     R0              ;ADDRESS COMPLEMENT
002734  020104                5$:     CMP     R1,R4
002736  101361                        BHI     3$
002740  112737  000001  000306      MOVB    #1,@#PASFLG     ;SET PASFLG FOR ERROR REPORT.
002746  005103                        COM     R3              ;COMPLEMENT THE CONTENTS OF R3
002750  001345                        BNE     1$              ;REPEAT TST3 IF R3, IS NON 0, ENABLING ADDRESS
                                                              ;COMPLEMENT TO BE WRITTEN AND READ, OTHERWISE FALL THRU
002752  000733                END4:   BR      END3
```

```
1866                                    ;;*****************************************************************
1867                                    ;*TEST 5         MARCHING 1'S AND 0'S
1868                                            ;*(1)   THIS TEST WRITES A BACK GROUND OF THE WORD STORED
1869                                            ;*      AT BAKPAT.
1870                                            ;*(2)   READS EVERY LOCATION FOR CORRECT DATA, SWAPS BYTES
1871                                            ;*      AT THE LOCATION AND PROCEEDS IN MAX. TO MIN
1872                                            ;*      DIRECTION OF MEMORY LOCATIONS.
1873                                            ;*(3)   READS EVERY LOCATION FOR SWAPPED BAKPAT PATTERN
1874                                            ;*      WRITES BAKPAT BACKGROUND IN THE LOCATION AND PROCEEDS
1875                                            ;*      IN  MIN. TO MAX. DIRECTION
1876                                            ;*(4)   REPEATS STEP 2 GOING IN MIN. TO MAX. DIRECTION
1877                                            ;*(5)   REPEATS STEP 3 GOING IN MAX. TO MIN. DIRECTION
1878
1879                                    ;;*****************************************************************
1880  002754  122737  000005  000404  TST5:   CMPB    #5,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
1881
1882  002762  001403                          BEQ     .+10
1883  002764  004767  003176                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
1884  002770  000024                          24                      ;******ERROR NUMBER 24******
1885
1886  002772  004737  000120          1$:     JSR     PC,@#WRTMEM     ;GO TO WRITE THE MEMORY WITH A BACKGROUND OF THE
1887                                                                  ;WORD STORED IN BAKPAT
1888  002776  020041                  2$:     CMP     R0,-(R1)        ;READ THE CONTENTS OF LOCATION POINTED BY R1
1889  003000  001403                          BEQ     3$              ;TO SEE IF IT HAS THE SAME VALUE AS R0
1890  003002  004767  002622                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
1891  003006  000025                          25                      ;******ERROR NUMBER 25******
1892
1893  003010  000300                  3$:     SWAB    R0
1894  003012  010011                          MOV     R0,(R1)         ;SWAP THE BYTES AT (R1)
1895  003014  021100                          CMP     (R1),R0         ;READ (R1) FOR CORRECT VALUE
1896  003016  001403                          BEQ     4$
1897  003020  004767  002604                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
1898  003024  000026                          26                      ;******ERROR NUMBER 26******
1899
1900
1901  003026  000300                  4$:     SWAB    R0              ;SWAP THE BYTES OF THE REGISTER
1902                                                                  ;CONTAINING BACKGROUND PATTERN
1903  003030  001023                          BNE     9$              ;IF THE LOWER BYTE OF THE REGISTER
1904                                                                  ;IS NOT 0 THEN THE PROGRAM IS READING
1905                                                                  ;THE MEMORY TO CONTAIN A BACK GROUND OF
1906
1907                                                                  ;BAKPAT AND WRITING THE SWAPPED WORD
1908
1909                                                                  ;IN WHICH CASE GO TO 9$
1910
1911  003032  005703                  5$:     TST     R3              ;R3 WAS 0 WHEN THE PROGRAM ENTERED
1912                                                                  ;THIS TEST, AND IT IS NOT ALTERED UNTIL PASFLG=3
1913                                                                  ;IF R3 EQUAL 0 THEN THE PROGRAM IS
1914                                                                  ;READING/WRITING MIN. TO MAX. OTHERWISE
1915                                                                  ;IT IS GOING IN MAX. TO MIN. DIRECTION
1916  003034  001023                          BNE     10$             ;IF R3 IS NOT CLEAR THEN GO TO 10$
1917  003036  062701  000002          6$:     ADD     #2,R1           ;OTHERWISE ADD 2 TO THE CONTENTS OF R1
1918  003042  020105                          CMP     R1,R5           ;COMPARE R1 WITH THE MAX. MEMORY LOCATION TO
1919                                                                  ;BE TESTED
1920  003044  103006                          BHIS    8$              ;IF R1>R5 THEN GO TO 8$ OTHERWISE
1921  003046  020011                  7$:     CMP     R0,(R1)         ;READ (R1) FOR THE CORRECT DATA
```

```
1922  003050  001757                      BEQ     3$              ; WRITE COMPLEMENT OF THE DATA FOUND AT (R1)
1923                                                              ;AND REPEAT UNTIL R1 > R5
1924  003052  004767  002552              JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
1925  003056  000027                      27                      ;******ERROR NUMBER 27******
1926
1927  003060  000753                      BR      3$
1928  003062  105237  000306'    8$:     INCB    @#PASFLG
1929  003066  000300                      SWAB    R0
1930  003070  001742                      BEQ     2$              ;IF THE LOWER BYTE OF R0 IS ALL 0'S
1931                                                              ;THEN BEGIN READING BAKPAT SWAPPED WRITING BAKPAT
1932                                                              ;AND READING BAKPAT GOING FROM MAX. TO MIN.[PASFLG=4]
1933  003072  005103                      COM     R3              ;OTHERWISE CLEAR R0
1934  003074  010401                      MOV     R4,R1           ;PUT THE LOWEST TESTING ADDRESS IN R1
1935  003076  000763                      BR      7$              ;AND BEGIN READING 0'S, WRITING 1'S AND
1936                                                              ;READING 1'S IN MIN. TO MAX. DIRECTION [PASFLG=3]
1937
1938  003100  005703            9$:     TST     R3              ;IF R3 IS NON 0, I.E. PASFLG=3
1939  003102  001353                      BNE     5$              ;THEN READ BAKPAT, WRITE
1940                                                              ;SWAPPED BAKPAT AND READ SWAPPED BAKPAT
1941                                                              ;IN MIN. TO MAX. DIRECTION
1942  003104  020104            10$:    CMP     R1,R4           ;OTHERWISE TEST IS PROCEEDING IN MAX. TO
1943                                                              ;MIN. DIRECTION.
1944  003106  101333                      BHI     2$              ;KEEP ON LOOPING UNTIL R1=R4
1945  003110  105237  000306              INCB    @#PASFLG
1946  003114  000300                      SWAB    R0
1947  003116  001753                      BEQ     7$              ;IF R0 SWAPPED HAS LOWER BYTE-0
1948                                                              ;THEN READ BAKPAT SWAPPED, WRITE BAKPAT,
1949                                                              ;AND READ BAKPAT GOING FROM MIN. TO MAX.
1950  003120  000714            END5:   BR      END4
1951
```

```
                                ;;*****************************************************************
                                ;*TEST 6         CELLS' VOLATILITY TEST

                                        ;*(1)   THIS TEST WRITES THE MEMORY WITH A BACK GROUND OF BAKPAT
                                        ;*(2)   WITH PASFLG=0 THE TEST READS THE MEMORY FOR BAKPAT
                                        ;*      AND THEN INCREMENTS PASFLG
                                        ;*(3)   IT THEN READS/SWAPS BYTES/WRITES A LOCATION X FOR
                                        ;*      OVER 2 MSEC AND THEN READS THE MEMORY FOR BAKPAT
                                        ;*(4)   REPEATS STEP 3 WITH X=X+4K UNTIL END OF MEMORY IS ENCOUNTERED
                                        ;*(5)   IT THEN INCREMENTS PASFLG AND WRITES THE MEMORY TO
                                        ;*      BAKPAT AND WITH PASFLG=2 IT READS MEMORY FOR ALL
                                        ;*      SWAPPED BAKPAT AFTER WHICH PASFLG IS INCREMENTED TO 3
                                        ;*(6)   REPEATS STEPS 3 AND 4 READING THE MEMORY FOR SWAPPED
                                        ;*      BAKPAT INSTEAD OF BAKPAT.

                                ;;*****************************************************************
003122  122737  000006  000404  TST6:  CMPB    #6,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE

003130  001403                        BEQ     .+10
003132  004767  003030                JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
003136  000030                        30                      ;******ERROR NUMBER 30******

003140  004737  000120          RPT6: JSR     PC,@#WRTMEM     ;GO TO WRITE THE MEMORY WITH A BACKGROUND OF THE
                                                              ;WORD STORED AT LOCATION BAKPAT
003144  005037  000306                CLR     @#PASFLG
003150  010403                  1$:   MOV     R4,R3           ;SET R3
003152  010401                  2$:   MOV     R4,R1           ;AND R1 TO THE STARTING ADDRESS OF MEMORY UNDER TEST
003154  020011                  3$:   CMP     R0,(R1)         ;CHECK (R1) FOR CORRECT DATA
003156  001403                        BEQ     4$
003160  004767  002444                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
003164  000031                        31                      ;******ERROR NUMBER 31******

003166  062701  000002          4$:   ADD     #2,R1           ;INCREMENT R1 BY 2
003172  020105                        CMP     R1,R5           ;SEE IF R1 HAS REACHED THE MAX. OF MEMORY
003174  103767                        BLO     3$
003176  132737  000001  000306        BITB    #1,@#PASFLG     ;CHECK TO SEE IF PASFLG=0 OR 2
003204  001002                        BNE     5$
003206  105237  000306                INCB    @#PASFLG        ;IN WHICH CASE INCREMENT PASFLG COUNTER BY 1

003212  020305                  5$:   CMP     R3,R5           ;SEE IF R3 HAS REACHED THE MAX. OF THE MEMORY
003214  103012                        BHIS    7$
003216  012702  037776                MOV     #37776,R2       ;WRITE INTO 1 LOC FOR >2MS (ABOUT 100MS)
003222  000313                  6$:   SWAB    (R3)
003224  005302                        DEC     R2
003226  001375                        BNE     6$
003230  010337  000354                MOV     R3,@#SAVLOC     ;SAVE LOCATION WRITTEN FOR 2MS FOR ERROR REPORT.
003234  062703  020000                ADD     #20000,R3       ;BY ADDING 1 TO THE 14TH ADDRESS BIT CAUSE
                                                              ;R3 TO POINT TO A LOCATION IN THE NEXT
                                                              ;4K BANK OF MEMORY
003240  000744                        BR      2$
003242  105237  000306          7$:   INCB    @#PASFLG        ;MAKE PASFLG=2
003246  000337  000316                SWAB    @#BAKPAT        ;IF BAKPAT IS NOT BEING SWAPPED FOR THE 2ND
003252  001732                        BEQ     RPT6            ;THEN GO BACK TO THE LOCATION RPT6
003254  000721                  END6: BR      END5
```

```
2007                                    ;;*****************************************************************
2008                                    ;*TEST 7         SHIFTING DIAGONAL
2009
2010                                            ;*(1)   THIS TEST WRITES THE MEMORY WITH A BACKGROUND OF BAKPAT
2011                                            ;*(2)   IT WRITES A DIAGONAL OF SWAPPED BAKPAT THROUGH EACH MEMORY BANK
2012                                            ;*(3)   READS THE MEMORY FOR CORRECT DATA
2013                                            ;*(4)   SHIFTS THE DIAGONAL AND REPEATS STEP 3 UNTIL THE
2014                                            ;*      DIAGONAL HAS BEEN SHIFTED 64 TIMES
2015                                            ;*(5)   WRITES A BACKGROUND OF SWAPPED BAKPAT, A DIAGONAL OF
2016                                            ;*      BAKPAT AND REPEATS FROM STEP 3
2017                                    ;;*****************************************************************
2018  003256  122737  000007  000404    TST7:   CMPB    #7,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
2019
2020  003264  001403                            BEQ     .+10
2021  003266  004767  002674                    JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
2022  003272  000032                            32                      ;******ERROR NUMBER 32******
2023
2024  003274  005037  000306            2$:     CLR     @#PASFLG
2025  003300  010337  000304                    MOV     R3,@#LOWBNK     ;LOWBNK CONTAINS ADDRESS OF THE LOWEST LOCATION
2026                                                                    ;IN THE 4K BANK THAT CAN BE TESTED
2027  003304  010302                            MOV     R3,R2
2028  003306  052702  017777                    BIS     #17777,R2       ;R2 CONTAINS THE ADDRESS OF THE TOP OF THE BANK
2029  003312  005202                            INC     R2              ;ADD 1 TO POINT IT TO NEXT BANK
2030  003314  001402                            BEQ     3$              ;BRANCH IF ZERO (IT MUST BE A 30K SYSTEM)
2031  003316  020502                            CMP     R5,R2
2032  003320  103001                            BHIS    4$              ;IF R2 IS GREATER THAN R5 THEN GO TO 4$
2033  003322  010502                    3$:     MOV     R5,R2           ;NOW R2 CONTAINS THE ADDRESS OF THE HIGHEST LOCATION
2034                                                                    ;THAT CAN BE TESTED
2035  003324  010337  000302            4$:     MOV     R3,@#STRTDI     ;LOAD STRTDI WITH THE STARTING ADDRESS OF THE
2036                                                                    ;DIAGONAL
2037  003330  013701  000304                    MOV     @#LOWBNK,R1     ;R1 IS NOW POINTING TO THE LOWEST LOCATION IN THE 4K
2038                                                                    ;BANK
2039  003334  013700  000316            6$:     MOV     @#BAKPAT,R0     ;STORE THE CONTENTS OF BAKPAT IN R0
2040  003340  020103                            CMP     R1,R3           ;IS R1 POINTING TO A LOCATION IN THE DIAGONAL ?
2041  003342  001010                            BNE     10$             ;IF NOT THEN GO TO 10$
2042  003344  062703  000002                    ADD     #2,R3           ;THE FOLLOWING CODE IS USED TO PLACE THE
2043  003350  032703  000176                    BIT     #176,R3         ;ADDRESS OF THE NEXT LOCATION IN THE DIAGONAL
2044  003354  001402                            BEQ     8$              ;IN R3
2045  003356  062703  000200                    ADD     #200,R3         ;
2046  003362  000300                    8$:     SWAB    R0              ;DIAGONAL WILL CONTAIN SWAPPED BACKGROUND PATTERN
2047  003364  132737  000001  000306  10$:     BITB    #1,@#PASFLG     ;CONTENTS OF LOCATION PASFLG WILL BE EVEN IF THE
2048                                                                    ;MEMORY IS BEING WRITTEN AND IT WILL BE ODD
2049                                                                    ;IF IT IS ONLY BEING READ
2050  003372  001001                            BNE     12$             ;IF IT IS BEING READ ONLY THEN GO TO 12$
2051  003374  010011                            MOV     R0,(R1)         ;OTHERWISE WRITE THE MEMORY WITH THE CONTENTS
2052                                                                    ;OF R0
2053  003376  020011                    12$:    CMP     R0,(R1)         ;CHECK THE LOCATION POINTED BY R1 TO CONTAIN
2054                                                                    ;PROPER DATA
2055  003400  001403                            BEQ     14$             ;IF IT IS OK THEN GO TO 14$
2056  003402  004767  002222                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2057  003406  000033                            33                      ;******ERROR NUMBER 33******
2058
2059  003410  062701  000002            14$:    ADD     #2,R1           ;CAUSE R1 TO POINT TO THE NEXT MEMORY LOCATION
2060  003414  020102                            CMP     R1,R2           ;IS IT THE END OF THE BANK ?
2061  003416  103746                            BLO     6$              ;IF NOT THEN GO TO 6$
2062  003420  005237  000410            16$:    INC     @#$DEVCT                ;TELL APT WE ARE STIL RUNNING OKAY
```

```
2063  003424  105237  000306                  INCB    @#PASFLG
2064  003430  013703  000302                  MOV     @#STRTDI,R3     ;LOAD R3 WITH THE STARTING ADDRESS OF THE DIAGONAL
2065  003434  132737  000001  000306          BITB    #1,@#PASFLG     ;HAS THE READ OF THE MEMORY BEEN DONE ?
2066  003442  001330                          BNE     4$              ;IF NOT THEN GO TO 4$
2067  003444  005723                          TST     (R3)+           ;ADD 2 TO THE STARTING ADDRESS OF THE DIAGONAL
2068  003446  020302                          CMP     R3,R2           ;AND UNLESS THE END OF THE BANK IS REACHED
2069  003450  103003                          BHIS    18$             ;
2070  003452  105737  000306                  TSTB    @#PASFLG        ;OR THE DIAGONAL HAS BEEN ROTATED 64 TIMES
2071  003456  100322                          BPL     4$              ;REPEAT FROM 4$
2072  003460  013703  000304          18$:    MOV     @#LOWBNK,R3     ;MAKE R3 POINT TO THE LOWEST LOCATION IN THE
2073                                                                  ;IN THE BANK UNDER TEST
2074  003464  000337  000316                  SWAB    @#BAKPAT
2075  003470  001715                          BEQ     4$              ;AND IF THE TEST HAS NOT BEEN PERFORMED WITH THE
2076                                                                  ;SWAPPED BACK GROUND PATTERN THEN GO TO 4$
2077  003472  010203                          MOV     R2,R3           ;MAKE THE PRESENT HIGH BOUNDRY AS THE NEXT
2078                                                                  ;LOW BOUNDRY
2079  003474  020205                          CMP     R2,R5           ;UNLESS THE PRESENT HIGH BOUNDRY IS ALSO THE
2080                                                                  ;HIGH BOUNDRY FOR THE MEMORY UNDER TEST
2081  003476  103676                          BLO     2$
2082  003500  000665                  END7:   BR      END6
```

```
                        ;;*****************************************************************
                        ;*TEST 10        READ RECOVERY GALLOPING TEST/EVERY 64TH CELL
                        ;
                        ;*(1)    THIS TEST WRITES THE MEMORY WITH A BACK GROUND PATTERN
                        ;*       STORED AT LOCATION BAKPAT
                        ;*(2)    TEST BEGINS AT LOWEST LOCATION BEING TESTED
                        ;*       (LETS NAME IT 'A')
                        ;*(3)    LETS NAME THE 1ST LOCATION IN THE ROW/COLUMN UNDER TEST AS 'B'.
                        ;*(4)    SWAPS BYTES FOR LOCATION 'A'.
                        ;*(5)    READS 'A', READS 'B'
                        ;*(6)    'B' = 'B'+200 (MAKES 'B'=64TH CELL I.E. 200TH OCTAL
                        ;*       LOCATION FROM THE PRESENT LOCATION OF 'B')
                        ;*(7)    REPEATS STEPS 5 AND 6 UNTIL 'B' IS GREATER THAN THE
                        ;*       END OF THE 4K BANK OF THE MEMORY IN WHICH 'A' IS RESIDING
                        ;*(8)    A = A+2
                        ;*(9)    REPEATS  STEPS 3-8 UNTILL 'A' REACHES THE END OF THE BANK
                        ;*(10)   GOES TO THE NEXT 4K BANK OF MEMORY AND REPEATS STEPS
                        ;*       3-9 UNTIL THE END OF THE MEMORY
                        ;*(11)   AFTER EXECUTING THE TEST BYTES ARE SWAPPED AT
                        ;*       LOCATION BAKPAT AND STEPS 1-10 ARE REPEATED
                        ;*(12)   IN THIS TEST R0 IS POINTING TO LOCATION 'A', R1 TO
                        ;*       LOCATION 'B', R2 TO THE END OF THE 4K BANK IN WHICH THE
                        ;*       TEST IS TAKING PLACE AND R3 TO THE LOWEST LOCATION IN THE
                        ;*       COLUMN/ROW CONTAINING 'A' AND 'B'
                        ;*(13)   MOST OF THE CODE USED BY THIS TEST IS ALSO USED BY TEST 11
                        ;
                        ;;*****************************************************************
003502  122737  000010  000404  TST10:  CMPB    #10,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
                        ;
003510  001403                        BEQ     .+10
003512  004767  002450                JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
003516  000034                        34                      ;******ERROR NUMBER 34******
                        ;
003520  010402                        MOV     R4,R2           ;SET R2 TO THE LOWEST MEMORY UNDER TEST
003522  052702  017776        RPT10:  BIS     #17776,R2       ;MAKE R2 POINT TO THE HIGHEST LOCATION IN THE 4K
                        ;                                       ;BANK FOR WHICH GALLOPING WILL BE PERFOMED
003526  062702  000002        GALLOP: ADD     #2,R2           ;INCREMENT R2 BY 2
003532  001402                        BEQ     1$              ;BR IF IT WENT TO 0 (IT MUST BE A 30K SYSTEM)
003534  020205                        CMP     R2,R5           ;IF THE HIGH BOUNDRY OF THE TEST IS HIGHER THAN
003536  101401                        BLOS    2$
003540  010502                1$:     MOV     R5,R2           ;THE MAXIMUM ALLOWED ADDRESS THEN ADJUST R2
003542  005046                2$:     CLR     -(SP)
003544  010200                        MOV     R2,R0
003546  013740  000316        4$:     MOV     @#BAKPAT,-(R0)  ;WRITE THE MEMORY UNDER TEST WITH A BACKGROUND OF
                        ;                                       ;BAKPAT
003552  020003                        CMP     R0,R3
003554  101374                        BHI     4$
003556  010301                6$:     MOV     R3,R1           ;R3 AND R1 ARE POINTING TO THE LOWEST LOCATION THAT
                        ;                                       ;CAN BE TESTED IN THIS BLOCK
003560  023710  000316                CMP     @#BAKPAT,(R0)   ;BEFORE STARTING THE GALLOPING TEST FOR LOCATION
                        ;                                       ;(R0) CHECK IT
003564  001410                        BEQ     8$              ;CONTINUE IF OK
003566  010001                        MOV     R0,R1           ;OTHERWISE PREPARE TO REPORT THE ERROR
003570  013700  000316                MOV     @#BAKPAT,R0
003574  004767  002030                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
003600  000035                        35                      ;******ERROR NUMBER 35******
```

```
2139
2140  003602  010011                          MOV     R0,(R1)         ;RESTORE THE CONTENTS OF (R1)
2141  003604  010100                          MOV     R1,R0           ;RESTORE R0
2142
2143  003606  000310                  8$:     SWAB    (R0)
2144  003610  031011                  10$:    BIT     (R0),(R1)       ;CHECK TO SEE THAT NONE OF THE BITS SET
2145                                                                  ;IN (R0) ARE SET IN (R1) AND VICE VERSA
2146  003612  020001                          CMP     R0,R1           ;THE ONLY EXCEPTION TO THIS WILL BE WHEN R0 R1
2147
2148  003614  001412                          BEQ     12$
2149  003616  021137  000316                  CMP     (R1),@#BAKPAT   ;CHECK THAT (R1) HAS BAKPAT IN IT
2150  003622  001407                          BEQ     12$
2151  003624  010046                          MOV     R0,-(SP)        ;SAVE R0 ON STACK
2152  003626  013700  000316                  MOV     @#BAKPAT,R0     ;PLACE THE PATTERN WORD IN R0
2153  003632  004767  001772                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2154  003636  000036                          36                      ;******ERROR NUMBER 36******
2155
2156  003640  012600                          MOV     (SP)+,R0        ;RESTORE R0
2157  003642  021037  000320          12$:    CMP     (R0),@#SWAPAT   ;CHECK THAT (R0) HAS SWAPPED BAKPAT IN IT
2158  003646  001412                          BEQ     14$
2159  003650  010146                          MOV     R1,-(SP)        ;SAVE R1 ON THE STACK
2160  003652  010001                          MOV     R0,R1           ;MAKE R1 POINT TO THE FAILING LOCATION
2161  003654  013700  000320                  MOV     @#SWAPAT,R0     ;LOAD R0 WITH THE EXPECTED RESULT IN (R1)
2162  003660  004767  001744                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2163  003664  000037                          37                      ;******ERROR NUMBER 37******
2164
2165  003666  010011                          MOV     R0,(R1)         ;RECOVER (R1) FROM THE ERROR
2166  003670  010100                          MOV     R1,R0           ;RESTORE R0
2167  003672  012601                          MOV     (SP)+,R1        ;AND RESTORE R1
2168  003674  122737  000011  000404  14$:    CMPB    #11,@#$TESTN    ;IS THE PROGRAM EXECUTING TEST # 11 ?
2169  003702  001402                          BEQ     16$             ;IF SO THEN GO TO 16$
2170  003704  062701  000176                  ADD     #176,R1
2171  003710  062701  000002          16$:    ADD     #2,R1           ;MAKE R1 POINT TO THE NEXT ADJACENT CELL
2172  003714  020102                          CMP     R1,R2           ;AND IF R1 HAS NOT REACHED THE END OF THE BOUNDRY
2173  003716  103734                          BLO     10$             ;THEN REPEAT FROM 10$
2174  003720  000320                          SWAB    (R0)+           ;RESTORE THE LOCATION FOR WHICH THE GALLOPING TEST
2175                                                                  ;WAS BEING PERFORMED
2176  003722  122737  000011  000404          CMPB    #11,@#$TESTN    ;IS IT TEST 11 ?
2177  003730  001407                          BEQ     17$             ;IF SO THEN GO TO 17$
2178  003732  005723                          TST     (R3)+           ;OTHERWISE INCREMENT R3 BY 2
2179  003734  062716  000002                  ADD     #2,(SP)         ;FOR EVERY ROW/COLUMN TESTED ADD 2
2180  003740  105716                          TSTB    (SP)
2181  003742  100002                          BPL     17$             ;UNTIL (SP) IS 200
2182  003744  161603                          SUB     (SP),R3         ;SUBTRACT 200 FROM R3
2183  003746  005016                          CLR     (SP)
2184  003750  032700  000177          17$:    BIT     #177,R0         ;AT A 64TH CALL BOUNDRY?
2185  003754  001002                          BNE     18$             ;BRANCH IF NO
2186  003756  005237  000410                  INC     @#$DEVCT        ;TELL APT WE ARE STILL RUNNING
2187  003762  020002                  18$:    CMP     R0,R2           ;IF R0 HAS NOT REACHED THE END OF THE BOUNDRY
2188  003764  103674                          BLO     6$              ;THEN REPEAT FROM 6$
2189  003766  162603                          SUB     (SP)+,R3        ;RESTORE SP AND R3
2190  003770  000337  000320                  SWAB    @#SWAPAT
2191  003774  000337  000316                  SWAB    @#BAKPAT
2192  004000  001660                          BEQ     2$              ;IF THE LOWER BYTE OF BAKPAT IS 0 THEN REPEAT FROM 2$
2193  004002  010203                          MOV     R2,R3           ;OTHERWISE MAKE THE PRESENT HIGH BOUNDRY AS THE
2194                                                                  ;NEXT LOW BOUNDRY
```

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2195  004004  020205                          CMP     R2,R5
2196  004006  001410                          BEQ     END10           ;IF PREVIOUS HIGH BOUNDRY WAS THE END OF THE
2197                                                                  ;TEST BOUNDRY THEN EXIT THE TEST
2198  004010  032702  017776                  BIT     #17776,R2       ;WAS IT A 4K BOUNDRY ?
2199  004014  001025                          BNE     RPT11           ;IF NOT THEN WE WERE PERFORMING TEST 11 WITH LONG
2200                                                                  ;GALLOPING TEST DISABLED
2201  004016  122737  000011  000404          CMPB    #11,@#$TESTN    ;IF IT IS TEST # 11 THEN GO TO REPEAT TEST 11
2202  004024  001421                          BEQ     RPT11
2203  004026  000635                          BR      RPT10           ;OTHERWISE REPEAT TEST 10
2204  004030  000623                  END10:  BR      END7
2205
2206
2207
```

```
2208                                    ;;*****************************************************************
2209                                    ;*TEST 11        READ RECOVFRY LONG GALLOPING/FAST GALLOPING TEST
2210
2211                                            ;*(1)   THIS TEST WRITES MEMORY WITH BAKPA~
2212                                            ;*(2)   THE TEST BEGINS AT THE LOWEST LOCATION BEING TESTED
2213                                            ;*      (LETS NAME IT 'B')
2214                                            ;*(3)   'A' 'B' [MOVE THE ADDRESS OF 'B' TO THE POINTER FOR LOCATION 'A']
2215                                            ;*(4)   SWAPS BYTES FOR LOCATION 'A'
2216                                            ;*(5)   READS 'A', READS 'B'
2217                                            ;*(6)   'B'='B'+2
2218                                            ;*(7)    IF GALLOPING OPTION BIT AT $SWREG IS HIGH THEN STEPS 4 AND 5
2219                                            ;*      ARE REPEATED UNTIL 'B' REACHES THE HIGHEST MEMORY LOCATION
2220                                            ;*      OF THE 4K BANK IN WHICH 'A' IS RESIDING, THEN 'A' IS
2221                                            ;*      DECREMENTED BY 2 AND AFTER MAKING 'B' TO POINT TO THE LOWEST
2222                                            ;*      LOCATION OF THE 4K MEMORY BANK CONTAINING 'A' STEPS 3,4,5 AND
2223                                            ;*      6 ARE REPEATED UNTIL 'A' EQUALS THE END OF THE ENTIRE MEMORY
2224                                            ;*(8)   IF GALLOPING OPTION BIT IS NCT HIGH THEN STEPS 4 AND 5 ARE
2225                                            ;*      REPEATED UNTIL 'B' IS POINTING TO A CELL IN THE NEXT COLUMN
2226                                            ;*      IF SEQUENTIAL CELLS LIE ALONG THE ROW, OR THE NEXT ROW
2227                                            ;*      IF SEQUENTIAL CELLS LIE ALONG THE COLUMN, AT WHICH TIME
2228                                            ;*      STEPS 2,3,4,5 AND 7 ARE REPEATED UNTIL THE END OF THE MEMORY
2229                                            ;*(9)   TEST IS REPEATED FOR THE OPPOSITE BACKGROUND DATA
2230                                            ;*(10)  IN THIS TEST R0 POINTS TO LOCATION 'A', R1 TO LOCATION
2231                                            ;*      'B', R2 TO THE HIGHEST LOCATION AND R3 TO THE LOWEST
2232                                            ;*      LOCATION IN A 64/4K CELL BOUNDRY
2233                                            ;*(11)  MOST OF THE CODE USED BY TEST 10 IS ALSO USED BY THIS TEST
2234
2235                                    ;;*****************************************************************
2236  004032  122737  000011  000404  TST11:  CMPB    #11,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
2237
2238  004040  001403                          BEQ     .+10
2239  004042  004767  002120                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
2240  004046  000040                          40                      ;******ERROR NUMBER 40******
2241
2242  004050  010402                          MOV     R4,R2           ;MAKE R2 TO POINT TO THE LOWEST LOCATION
2243                                                                  ;UNDER TEST
2244  004052  105777  174372                  TSTB    @SWR            ;LONG GALLOP ENABLED?
2245  004056  100004                          BPL     RPT11           ;BRANCH IF NO
2246  004060  004767  002526                  JSR     PC,PNTMES       ;TYPE ''GLP''
2247  004064  046107  000120                  .ASCIZ  /GLP/
2248  004070  105777  174354          RPT11:  TSTB    @SWR            ;LONG GALLOPING ENABLED?
2249  004074  100612                          BMI     RPT10           ;BRANCH IF YES
2250                                                                  ;TO RPT10
2251  004076  052702  000176                  BIS     #176,R2         ;OTHERWISE SET THE LOW ORDER BITS OF THE ADDRESS
2252                                                                  ;TO GET THE HIGH BOUNDRY
2253
2254  004102  000611                          BR      GALLOP          ; PERFORM GALLOPING TEST
```

```
                                ;;*****************************************************************
                                ;*TEST 12        WORST CASE TESTING FOR CORE MEMORY
                                        ;*(1)   STARTING FROM THE LOWEST LOCATION UNDER TEST THE MEMORY
                                        ;*      IS WRITTEN WITH A BACKGROUND OF BAKPAT, HOWEVER LOCATIONS
                                        ;*      HAVING ADDRESS SUCH THAT EXCLUSIVE OR OF ADDRESS BITS 1 &
                                        ;*      8 = 1 ARE WRITTEN TO A VALUE OF SWAPPED BAKPAT
                                        ;*(2)   STARTING FROM THE LOWEST LOCATION THE MEMORY IS CHECKED
                                        ;*      TO CONTAIN THE CORRECT DATA AS EXPLAINED IN STEPS 3 & 4,
                                        ;*      UNTILL THE HIGHEST LOCATION UNDER TEST IS REACHED
                                        ;*(3)   READ EACH LOCATION FOR THE CORRECT CONTENT
                                        ;*(4)   COMPLEMENT THE LOCATION AND READ IT; COMPLEMENT THE LOCATION
                                        ;*      BACK TO ITS ORIGINAL VALUF AND READ IT AGAIN
                                        ;*(5)   STARTING FROM THE HIGHEST LOCATION UNDER TEST REPEAT STEPS
                                        ;*      3 & 4 UNTIL THE LOWEST LOCATION UNDER TEST IS REACHED
                                        ;*(6)   REPEAT STEPS 1-5, HOWEVER THIS TIME LOCATIONS WITH XOR
                                        ;*      OF ADDRESS BITS 8 & 13 =1 ARE WRITTEN TO SWAPPED BAKPAT
                                        ;*(7)   REPEAT STEPS 1-5, HOWEVER THIS TIME LOCATIONS WITH XOR
                                        ;*      OF ADDRESS BITS 3 & 9 =1 ARE WRITTEN TO SWAPPED BAKPAT
                                        ;*(8)   REPEAT STEPS 1-7 WITH A BACKGROUND OF SWAPPED BAKPAT AND
                                        ;*      THE LOCATIONS TO BE WRITTEN TO SWAPPED BAKPAT WRITTEN TO
                                        ;*      BAKPAT.
                                ;;*****************************************************************
004104  122737  000012  000404  TST12:  CMPB    #12,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
004112  001403                         BEQ     .+10
004114  004767  002046                 JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HA T AT FATHLT
004120  000041                         41                      ;******ERROR NUMBER 41******

004122  012702  000002                 MOV     #2,R2           ;PREPARE TO TAKE THE EXCLUSIVE OR OF ADDRESS BITS 1
004126  012703  000400                 MOV     #400,R3         ;AND 8
004132  112737  000001  000306  1$:     MOVB    #1,@#PASFLG     ;INITIALIZE THE COUNTER FOR THE SUBTEST
004140  010401                 2$:     MOV     R4,R1           ;PLACE THE STARTING ADDRESS OF MEMORY UNDER
                                                                ;TEST IN R1
004142  013700  000316         4$:     MOV     @#BAKPAT,R0
004146  030201                         BIT     R2,R1           ;CHECK TO SEE IF ADDRESS BIT STORED IN R2 IS SET
004150  001004                         BNE     8$              ;IF IT IS SET THEN GO TO 8$
004152  030301                         BIT     R3,R1           ;CHECK TO SEE IF ADDRESS BIT POINTED BY R3 IS SET
004154  001404                         BEQ     12$             ;IF IT IS NOT SET THEN GO TO 12$
004156  005100                 6$:     COM     R0              ;COME HERE ONLY IF EXCLUSIVE OR OF ADDRESS BITS
                                                                ;POINTED BY R2 & POINTED BY R3 = 1 IN WHICH
                                                                ;CASE PREPARE TO WRITE THE LOCATION
                                                                ;WITH A COMPLEMENT OF LOCATIONS NOT MEETING
                                                                ;THIS CONDITION
004160  000402                         BR      12$
004162  030301                 8$:     BIT     R3,R1           ;COME HERE IF ADDRESS BIT POINTED BY R2 IS 1 AND
```

```
 2300
 2301  004164  001774                    BEQ     6$              ;CHECK ADDRESS BIT POINTED BY R3
                                                                 ;IF ADDRESS BIT POINTED BY R3 IS 0 THEN GO TO 6$
```

```
 2302  004166  132737  000002  000306  12$:    BITB    #2,@#PASFLG     ;IS IT 2ND OR 3RD PASS OF THE SUBTEST ?
 2303  004174  001001                          BNE     14$             ;IF SO THEN READ THE MEMORY
```

```
2304  004176  010011                      MOV     R0,(R1)         ;OTHERWISE WRITE THE MEMORY BFORE READING IT
2305  004200  020011              14$:    CMP     R0,(R1)         ;READ THE MEMORY FOR CORRECT CONTENTS
2306  004202  001403                      BEQ     16$
2307  004204  004767  001420              JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2308  004210  000042                      42                      ;******ERROR NUMBER 42******
2309
2310  004212  012746  000002      16$:    MOV     #2,-(SP)
2311  004216  005100              18$:    COM     R0
2312  004220  005111                      COM     (R1)
2313  004222  020011                      CMP     R0,(R1)         ;READ THE MEMORY AGAIN
2314  004224  001404                      BEQ     19$
2315  004226  004767  001376              JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2316  004232  000043                      43                      ;******ERROR NUMBER 43******
2317
2318  004234  010011                      MOV     R0,(R1)         ;RESTORE THE LOCATION (R1)
2319  004236  005316              19$:    DEC     (SP)
2320  004240  001366                      BNE     18$             ;EXECUTE THE CODE FROM 18$ TWICE
2321  004242  005726                      TST     (SP)+           ;RESTORE THE STACK POINTER
2322  004244  122737  000003  000306      CMPB    #3,@#PASFLG     ;IS IT THE 3RD PASS OF THE SUBTEST ?
2323  004252  001412                      BEQ     20$             ;IF SO THEN GO TO 20$
2324  004254  062701  000002              ADD     #2,R1           ;IN FIRST 2 PASSES THE PROGRAM PROCEEDS IN
2325                                                              ;MIN. TO MAX. DIRECTION
2326  004260  020105                      CMP     R1,R5           ;HAVE WE REACHED THE MAX. ADDRESS UNDER TEST ?
2327  004262  103727                      BLO     4$              ;IF NOT THEN REPEAT FROM 4$
2328  004264  105237  000306              INCB    @#PASFLG
2329  004270  122737  000002  000306      CMPB    #2,@#PASFLG     ;IF IT IS THE 2ND PASS OF THE SUBTEST
2330  004276  001720                      BEQ     2$              ;THEN REPEAT FROM 2$
2331  004300  162701  000002      20$:    SUB     #2,R1           ;OTHERWISE EXECUTE THE TEST IN MAX. TO MIN.
2332                                                              ;DIRECTION
2333  004304  020104                      CMP     R1,R4           ;HAVE WE REACHED THE MIN. ADDRESS UNDER TEST ?
2334  004306  103315                      BHIS    4$              ;IF NOT THEN REPEAT FROM 4$
2335  004310  012702  020000              MOV     #20000,R2       ;PREPARE TO CHECK THE MEMORY WITH THE XOR OF
2336                                                              ;ADDRESS BITS 8 AND 13
2337  004314  105237  000307              INCB    @#PASFLG+1      ;THE SUB TEST HAS CHECKED THE XOR ONE KIND
2338  004320  123727  000307  000002      CMPB    @#PASFLG+1,#2   ;HAS TWO XOR COMBINATIONS BEEN CHECKED ?
2339  004326  103701                      BLO     1$              ;IF NOT THEN GO TO 1$
2340  004330  101004                      BHI     22$             ;IF ALL THREE HAVE BEEN CHECKED THEN GO TO 22$
2341  004332  012702  000010              MOV     #10,R2          ;IF IT IS THE 2ND XOR COMBINATION THEN CHECK
2342  004336  006303                      ASL     R3              ;FOR ADDRESS BITS 3 & 8
2343  004340  000674                      BR      1$
2344  004342  005137  000316      22$:    COM     @#BAKPAT        ;IF THE TEST WAS NOT PERFORMED WITH THE SWAPPED
2345  004346  105737  000316              TSTB    @#BAKPAT
2346  004352  001654                      BEQ     TST12           ;BAKPAT THEN RE-EXECUTE THE TEST
2347  004354  000625              END12:  BR      END10
```

```
2348                            ;;*****************************************************************
2349                            ;*TEST 13       WRITE RECOVERY TEST
2350                            ;*      THIS TEST DIFFERS FROM 0-12 IN THAT IT CONSISTS OF A SMALL TEST PROGRAM
2351                            ;*      ACTUALLY RUNNING IN THE 4K BANK UNDER TEST.
2352                            ;*              THE PROGRAM IS SELF MODIFYING AND MAY BE DIFFICULT TO DEBUG.
2353                            ;*      TO AID IN THE DEBUG, BEFORE A BANK IS ENTERED 'TST13 BNK XX''
2354                            ;*      IS TYPED. THIS WILL ALLOW THE USER TO AT LEAST SEE WHICH MEMORY
2355                            ;*      BANK FAILED.
2356                            ;*      THE TEST CONSISTS OF 1/2 OF THE BANK STORED WITH 'MOV R2,-(PC)''
2357                            ;*      AND THE OTHER 1/2 CONTAINING ''177667''. ''177667'' IS THE COMPLEMENT
2358                            ;*      OF ''JMP (R0)'' INSTRUCTION.
2359                            ;*      R2 CONTAINS ''COM -(R1)'' INSTRUCTION ON ENTRY TO THE BANK AND R1 CONTAINS
2360                            ;*      THE HIGHEST TEST ADDRESS IN THAT BANK. THE HIGHEST TEST ADDRESS IS
2361                            ;*      USUALLY ON 4K BOUNDARIES. WHEN TESTING BANK 0 RELOCATED,HOWEVER
2362                            ;*      R1 CONTAINS THE FIRST FREE TEST ADDRESS BELOW THE DIAGNOSTIC.
2363                            ;*      IF YOU UNDERSTAND THIS SO FAR THE REST IS EASY.
2364                            ;*              THE TEST EXECUTION IS AS FOLLOWS:
2365                            ;*              1. THE 'MOV R2,-(PC)'' INSTRUCTION EXECUTES STORING
2366                            ;*                 THE CONTENTS OF R2 IN THE ADDRESS IT VACATED (DUE TO -(PC).
2367                            ;*              2. SINCE R2 CONTAINS A ''COM -(R1)'' INSTRUCTION IT COMPLEMENTS
2368                            ;*                 THE HIGHEST ADDRESS UNDER TEST. THIS ADDRESS CONTAINED
2369                            ;*                 ''177667'' SO AFTER THE COM -(R1) IT EQUALS 110
2370                            ;*                 CLEVERLY THIS IS THE ''JMP (R0)'' INSTRUCTION.
2371                            ;*              3. THIS SEQUENCE CONTINUES UNTIL THE 'MOV R2,-(PC) INSTRUCTIONS
2372                            ;*                 REACH THE MIDDLE OF THE TEST BANK. THEN THE ''JMP (R0) ' INSTRUCTION IS
2373                            ;*                 AND EXECUTED. R0 CONTAINED THE RETURN ADDRESS BACK
2374                            ;*                 TO TEST 13.
2375                            ;*              4. THESE STEPS ARE REPEATED FOR EACH BANK UNDER TEST.
2376                            ;*
2377                            ;;*****************************************************************
2378  004356  122737  000013  000404  TST13:  CMPB    #13,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
2379  004364  001403                          BEQ     .+10
2380  004366  004767  001574                 JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
2381  004372  000044                          44                      ;******ERROR NUMBER 44******
2382
2383  004374  012702  010247          1$:     MOV     #10247,R2       ;PLACE THE OP CODE OF INSTRUCTION MOV R2,-(PC)
2384                                                                   ;IN R2.
2385  004400  012700  177667                  MOV     #177667,R0      ;PLACE THE COMPLEMENT OF THE INSTRUCTION
2386                                                                   ;JMP (R0) IN R0
2387                            ;INSURE LOWEST TEST ADDRESS TO END OF 4K SEGMENT IS MULTIPLE OF 2
2388                            ;SINCE THE TEST STORES 'MOV R2,-(PC) IN 1/2 AND 177667 IN THE OTHER 1/2
2389
2390  004404  010546                  2$:     MOV     R5,-(SP)        ;SAVE R5
2391  004406  010446                          MOV     R4,-(SP)        ;STORE LOWEST ADDRESS ON STACK
2392  004410  000241                  29$:    CLC
2393  004412  006005                          ROR     R5              ;MAKE POSITIVE BYTE COUNT OF HIGH ADDRESS
2394  004414  006004                          ROR     R4              ;DO SAME FOR LOWEST ADDRESS
2395  004416  160405                          SUB     R4,R5           ;GET DIFFERENCE OF LOWEST ADDRESS AND HIGHEST
2396  004420  006005                          ROR     R5              ;IF DIFFERENCE IS ODD THEN R4 IS AT LOWEST ADDRESS
2397  004422  103002                          BCC     30$             ;BRANCH IF R4 IS AT LOWEST TEST ADDRESS.
2398  004424  062716  000002                 ADD     #2,(SP)         ;INCREASE LOWEST TEST ADDRESS BY 2
2399  004430  012604                  30$:    MOV     (SP)+,R4        ;RESTORE R4 (POSSIBLY INCREASED BY 2 FROM ENTRY)
2400  004432  012605                          MOV     (SP)+,R5        ;RESTORE HIGHEST TEST ADDRESS
2401  004434  010403                          MOV     R4,R3           ;PLACE THE LOWEST LOCATION UNDER TEST
2402                                                                   ;IN R3
2403  004436  000406                          BR      26$             ;LEAVE LOW BITS OF R3 ALONE FIRST TIME IN CASE BANK 0
```

```
2404  004440  042703  017776          3$:     BIC     #17776,R3       ;CAUSE R3 TO POINT TO THE LOWEST LOCATION
2405                                                                    ;IN THE 4K BANK UNDER TEST
2406  004444  001507                          BEQ     14$             ;IF ADDRESS WENT TO 0, IT MUST BE A 30K SYSTEM
2407  004446  105737  000405                  TSTB    @#REL           ;ARE WE RELOCATED?
2408  004452  100504                          BMI     14$             ;BRANCH IF YES-TEST BANK0 ONLY-
2409  004454  020305                  28$:    CMP     R3,R5           ;IF R3 IS HIGHER THAN THE HIGHEST LOCATION
2410  004456  103102                          BHIS    14$             ;UNDER TEST THEN EXIT
2411                                  ;IF R5 LESS THAN 20000 THEN WE ARE TESTING BANK0 RELOCATED IN BANK0
2412  004460  020527  020000                  CMP     R5,#20000       ;IS HIGHEST TEST ADDRESS BELOW 4K?
2413  004464  103002                          BHIS    31$             ;BRANCH IF NO
2414  004466  010501                          MOV     R5,R1           ;SET R1 TO HIGHEST TEST ADDRESS IN BANK0
2415  004470  000407                          BR      32$
2416
2417  004472  010301                  31$:    MOV     R3,R1           ;SET R1 TO LOWEST CURRENT TEST ADDRESS
2418  004474  052701  017777                  BIS     #17777,R1       ;SET LOW ORDER ADDRESS BITS
2419  004500  005201                          INC     R1              ;CAUSE R1 TO POINT TO THE HIGHEST LOCATION+2
2420                                                                    ;OF THE 4K BANK BEING POINTED BY R3
2421  004502  001402                          BEQ     32$             ;BRANCH IF R1 WENT TO 0 (WHICH MIGHT
2422                                                                    ;HAVE HAPPENED IF TESTING A 30K LSI SYSTEM)
2423  004504  020105                          CMP     R1,R5           ;COMPARE R1 TO HIGHEST ADDRESS UNDER TEST
2424  004506  101401                          BLOS    33$             ;BRANCH IF WITHIN RANGE
2425  004510  010501                  32$:    MOV     R5,R1           ;SET R1 TO THE MAXIMUM AVAILABLE MEMORY
2426
2427  004512  132737  000001  000306  33$:    BITB    #1,@#PASFLG     ;IS THE LOWEST BIT OF LOCATION PASFLG
2428  004520  001101                          BNE     16$             ;SET? IN WHICH CASE BACK GROUND HAS
2429                                                                    ;ALREADY BEEN WRITTEN AND WRITE RECOVERY
2430                                                                    ;TEST IS BEING PERFORMED
2431
2432  004522  020304                  4$:     CMP     R3,R4           ;OTHERWISE WRITE THE BACKGROUND
2433  004524  103430                          BLO     8$              ;DEFINED AT STEP 3.
2434  004526  105737  000307                  TSTB    @#PASFLG+1      ;IS THE TEST JUST DOING READ, I.E.
2435  004532  001002                          BNE     6$              ;IS THE PASFLG+1 LOCATION NON ZERO? IF SO
2436                                                                    ;THEN GO TO 6$
2437  004534  012713  010247                  MOV     #10247,(R3)     ;WRITE THE LOCATION WITH THE OP CODE FOR MOV R2,-(PC)
2438  004540  020213                  6$:     CMP     R2,(R3)         ;READ (R3) TO CONTAIN CORRECT DATA
2439  004542  001421                          BEQ     8$
2440  004544  010046                          MOV     R0,-(SP)        ;SAVE R0
2441  004546  010146                          MOV     R1,-(SP)        ;AND R1 ON THE STACK
2442  004550  010301                          MOV     R3,R1
2443  004552  010200                          MOV     R2,R0           ;SET R0= GOOD DATA FOR ERROR PRINTOUT
2444  004554  004767  001050                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2445  004560  000045                          45                      ;******ERROR NUMBER 45******
2446
2447  004562  012601                          MOV     (SP)+,R1        ;RESTORE R1
2448  004564  012600                          MOV     (SP)+,R0        ;AND R0
2449  004566  105737  000306                  TSTB    @#PASFLG        ;IF PASFLG IS 0 AND THE MEMORY DOES NOT HAVE
2450                                                                    ;THE PROPER DATA THEN WE DON'T WANT TO GO AND
2451                                                                    ;EXECUTE THE INSTRUCTIONS STORED IN MEMORY UNDER
2452                                                                    ;TEST
2453  004572  001005                          BNE     8$              ;BRANCH IF PASFLG NOT -0
2454
2455  004574  010200                          MOV     R2,R0   ;SAVE FOR ERROR REPORT
2456  004576  004767  001026                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2457  004602  000046                          46                      ;******ERROR NUMBER 46******
2458
2459  004604  000663                          BR      END12           ;ABORT TST 13.
```

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2460
2461  004606  062703  000002          8$:   ADD   #2,R3          ;INCREMENT R3 BY 2
2462  004612  162701  000002                SUB   #2,R1          ;DECREMENT R1 BY 2
2463  004616  020105                        CMP   R1,R5          ;WRITE THE BACKGROUND DEFINED AT STEP 4.
2464  004620  103014                        BHIS  12$
2465  004622  020103                        CMP   R1,R3          ;HAS STORING THE 177667 REACHED WHERE 'MOV R2,-(PC) IS?
2466  004624  103405                        BLO   10$            ;BRANCH IF YES DON'T DESTROY THE MOV R2,-(PC) IS.
2467  004626  105737  000307                TSTB  @#PASFLG+1     ;IS THE THE READ ONLY CHECK PASS?
2468  004632  001002                        BNE   10$            ;BRANCH IF YES
2469  004634  012711  177667                MOV   #177667,(R1)   ;WRITE THE LOCATION WITH THE COMPLEMENT OF THE
2470                                                             ;OP CODE JMP (R0)
2471  004640  020011                10$:    CMP   R0,(R1)        ;READ R1 TO CONTAIN CORRECT DATA
2472  004642  001403                        BEQ   12$
2473  004644  004767  000760                JSR   PC,ERROR       ;*ERROR* REPORT ERROR MESSAGE
2474  004650  000047                        47                   ;******ERROR NUMBER 47******
2475
2476  004652  020301                12$:    CMP   R3,R1          ;IF WE HAVE NOT REACHED THE MIDDLE OF 4K BANK
2477  004654  103722                        BLO   4$             ;THEN REPEAT FROM 4$
2478
2479                                ;RETURN HERE AFTER PROGRAM RUN IN BANK UNDER TE.
2480
2481  004656  062703  020000          13$:  ADD   #20000,R3      ;OTHERWISE GO TO THE NEXT 4K BANK
2482  004662  000666                        BR    3$
2483
2484  004664  122737  000001  000306  14$:  CMPB  #1,@#PASFLG    ;THE PROGRAM CONTROL COMES HERE AS FOLLOWS
2485                                                             ;1-PASFLG=0, PROGRAM HAS JUST COMPLETED A
2486                                                             ;  WRITE/READ CYCLE FOR THE BACK GROUND
2487                                                             ;  AND WANTS TO BEGIN THE WRITE RECOVERY TEST
2488  004672  001437                        BEQ   24$            ;2-PASFLG=1, PROGRAM HAS JUST COMPLETED
2489                                                             ;  THE WRITE RECOVERY TEST AND WANTS TO
2490                                                             ;  READ MEMORY FOR CORRECT DATA
2491  004674  103627                        BLO   END12          ;3-PASFLG=2, PROGRAM HAS CORRECTLY READ THE
2492                                                             ;  MEMORY AND WANTS TO GO THE NEXT TEST.
2493
2494  004676  105137  000307                COMB  @#PASFLG+1     ;ENTER HERE WITH PASFLG=0, ON THE FIRST ENTRY
2495                                                             ;ENABLE READ ONLY FOR THE MEMORY AND ON THE SECOND
2496                                                             ;ENTRY DISABLE READ ONLY
2497  004702  001240                        BNE   2$
2498  004704  012702  005141                MOV   #5141,R2       ;PLACE THE OP CODE FOR INSTRUCTION COM -(R1)
2499                                                             ;IN R2
2500  004710  012700  177740                MOV   #13$-.-6,R0    ;PLACE THE RETURN ADDRESS IN R0 AS 13$
2501  004714  060700                        ADD   PC,R0          ;THUS WHEN THE READ RECOVERY TEST REACHES
2502                                                             ;THE MIDDLE OF THE 4K MEMORY THEN THE
2503                                                             ;INSTRUCTION EXECUTED WILL BE JMP (R0)
2504                                                             ;BRANCHINGING THE PROGRAM TO 13$
2505  004716  105237  000306          15$:  INCB  @#PASFLG       ;INCREMENT PASFLG BY 1.
2506  004722  000630                        BR    2$
2507
2508  004724  032777  000020  173516  16$:  BIT   #20,@SWR      ;HAS THE PRINTOUTS BEEN SUPRESSED ?
2509  004732  001016                        BNE   18$            ;IF SO THEN GO TO 18$
2510  004734  105737  000042                TSTB  @#42           ;IS THE PROGRAM RUNNING UNDER ACT?
2511  004740  001013                        BNE   18$            ;BRANCH IF YES
2512  004742  004767  001644                JSR   PC,PNTIMES     ; TYPE THE BANK UNDER TEST
2513  004746  051524  030524  020063        .ASCIZ  /TST13 BNK/
2514  004754  047102  000113
2515                                        .EVEN
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2516  004760  004767  002454          JSR     PC,GETBNK       ;GET BANK NO. UNDER TEST INTO DECWRD FOR PRINT.
2517  004764  004767  001650          JSR     PC,$TPDEC       ;TYPE BANK NO. UNDER TEST
2518
2519  004770  000113          18$:    JMP     (R3)            ;BEGIN EXECUTING MOV R2,-(PC) ,COM -(R1) SEQUENCE IN TES
2520
2521
2522  004772  105137  000307  24$:    COMB    @#PASFLG+1
2523  004776  012700  000110          MOV     #110,R0         ;PLACE THE OP CODE FOR JMP (R0) IN R0
2524  005002  000745                  BR      15$             ; READ THE MEMORY FOR CORRECT DATA AFTER
2525                                                          ;INCREMEMTING PASFLG TO 2
2526
2527                          ;TST13 EXITS VIA END12.
2528
```

```
2529  005004  012737  000377  000316  RELOC:  MOV     #377,@#BAKPAT
2530  005012  105737  000276          TSTB    @#MMAVA         ;IS THE MEMORY MANAGEMENT BEING TESTED ?
2531  005016  001065                  BNE     CONTMM          ;IF SO THEN GO TO CONTMM AND CONTINUE TESTING
2532                                                          ;MEMORY MANAGEMENT
2533  005020  032777  001000  173422          BIT     #1000,@SWR      ;RELOCATION WANTED?
2534  005026  001046                  BNE     CKDONE          ;BRANCH IF NO
2535  005030  105737  000405          TSTB    @#REL           ;IF THE PROGRAM HAS ALREADY BEEN RELOCATED THEN ALSO
2536  005034  100420                  BMI     RELOER          ; PLACE THE PROGRAM BACK IN LOWER CORE
2537  005036  112737  000200  000405          MOVB    #200,@#REL      ;OTHERWISE PREPARE TO RELOCATE
2538
2539                                  ;RELOCATE THE DIAGNOSTIC TO HIGHEST AVAILABLE MEMORY
2540
2541
2542  005044  004767  001542          JSR     PC,PNTMES       ;TYPE 'REL''
2543  005050  042522  047514  000103          .ASCIZ /RELOC/
2544                                          .EVEN
2545  005056  013705  000340          MOV     @#MAXMEM,R5     ;PREPARE TO LOAD THE PROGRAM IN THE HIGHEST
2546                                                          ;AVAILABLE MEMORY
2547  005062  014445          2$:     MOV     -(R4),-(R5)     ;RELOCATE THE PROGRAM
2548  005064  020427  000430          CMP     R4,#BEGIN-50    ;NEITHER RELOCATE NOR TEST LOCATIONS LOWER THAN BEGIN-50
2549  005070  101374                  BHI     2$
2550  005072  000165  000050          JMP     50(R5)
2551
2552                                  ;*RELOCATE THE DIAGNOSTIC BACK TO LOWER MEMORY
2553
2554
2555  005076  013705  000346  RELOER: MOV     @#SAVR5,R5      ;RESTORE R5
2556  005102  105737  000405          TSTB    @#REL           ;IS DIAGNOSTIC IN RELOCATED STATE?
2557  005106  100016                  BPL     CKDONE          ;BRANCH IF NO
2558
2559  005110  012704  000430          MOV     #BEGIN-50,R4    ;PREPARE TO RELOCATE THE PROGRAM TO LOWER CORE
2560  005114  012524          2$:     MOV     (R5)+,(R4)+
2561  005116  020537  000340          CMP     R5,@#MAXMEM
2562  005122  103774                  BLO     2$
2563  005124  105037  000405          CLRB    @#REL
2564  005130  010537  000346          MOV     R5,@#SAVR5      ;SAVE R5
2565  005134  012706  000500          MOV     #BEGIN,SP       ;RESET STACK TO LOWER MEMORY
2566  005140  010637  000350          MOV     SP,@#SAVR6      ;'BEGIN'' USES THIS TO RESET THE STACK.
2567  005144  000137  005150  CKDONE: JMP     @#LOWER         ;TRANSFER THE PROGRAM CONTROL TO THE LOWER CORE
2568
2569
2570
2571  005150  105737  000315  LOWER:  TSTB    @#SAVKBB        ;HERE DUE TO ^C TYPED?
2572  005154  001073                  BNE     $TPSTK          ;BRANCH IF YES (TYPE ERROR STACK)
2573  005156  004767  001702  TSTMM:  JSR     PC,MEMMNG       ; SET THE REGISTERS IF THE MEMORY MANAGEMENT
2574                                                          ;IS AVAILABLE
2575  005162  105737  000276          TSTB    @#MMAVA         ;IS MEM. MANAG. AVAILABLE ?
2576  005166  001462                  BEQ     ENDPAS          ;BRANCH IF NO
2577  005170  000402                  BR      $CNTMM          ;BEGIN TESTING ABOVE 28K
2578  005172  004767  002036  CONTMM: JSR     PC,UPMM         ;GO TO UPDATE MEM. MANAG. REGISTERS
2579  005176  012703  000324  $CNTMM: MOV     #LOWTWO,R3      ;MAKE R3 POINT TO THE LOCATION LOWTWO
2580  005202  004767  002142          JSR     PC,GETSIZ       ; LOAD BITS 6-10 OF R2 WITH THE BITS 13-17
2581                                                          ;OF THE LOWEST ADDRESS UNDER TEST
2582  005206  012704  020000          MOV     #20000,R4       ;MAKE R4 POINT TO THE LOWEST LOCATION IN THE BANK
2583                                                          ;POINTED BY PAGE ADDRESS REGISTER 1 (PAR1)
2584  005212  020237  172342          CMP     R2,@#172342     ;IS THE CONTENT OF R2 LOWER THAN THE CONTENT OF
```

```
2585
2586  005216  103405                  BLO     2$              ;PAR1 ?
2587  005220  050104                  BIS     R1,R4           ;IF SO THEN GO 2$
2588                                                          ;SUBROUTINE GETSIZ LOADED R1 WITH BITS 0-12
2589  005222  162702  000200          SUB     #200,R2         ;OF LOWADD WHICH HAVE NOW BEEN LOADED IN R4
2590  005226  004767  001636          JSR     PC,MMREG        ; SET MEM. MANAG. REGISTERS
2591  005232  004767  002112  2$:     JSR     PC,GETSIZ       ;PLACE BITS 13-17 OF HIGHEST LOCATION TO BE TESTED
2592                                                          ;IN BITS 6-10 OF R2, #160000 IN R0 AND BITS 0-12
2593                                                          ;OF LOCATION HIGHADD IN R1
2594  005236  004767  000020          JSR     PC,MAXADR       ; GET THE ADDRESS OF MAX. MEM. UNDER TEST
2595  005242  010005                  MOV     R0,R5
2596  005244  004767  002100          JSR     PC,GETSIZ       ; PREPARE TO SET UP LOCATION MAXMEM
2597  005250  004767  000006          JSR     PC,MAXADR       ; GET THE MAXIMUM ADDRESS OF AVAILABLE MEMORY
2598  005254  010013                  MOV     R0,(R3)         ;AND STORE INTO 'MAXMEM'
2599  005256  000167  174256          JMP     CLRMEM          ;GO TEST A 24K SLICE ABOVE 28K.
2600
2601
2602                                  ;MAXADR - SUBROUTINE TO GET CURRENT 24K SLICE OF MEMORY ADDRESSES ABOVE 28K.
2603                                  ;REGISTERS:
2604                                  ;R0= ON ENTRY= #160000 AND ON EXIT=HIGHEST VIRTUAL ADDR. UNDER TEST
2605                                  ;R1= LOW ORDER 12 BITS OF VIRTUAL TEST ADDRESS
2606                                  ;R2= PAR BLOCK NO. CURRENTLY UNDER TEST.
2607
2608  005262  010046          MAXADR: MOV     R0,-(SP)        ;PUT MAXIMUM AVAILABLE ADDRESS ON STACK
2609  005264  012700  172356          MOV     #172356,R0      ;R0=PAR7 UNIBUS ADDRESS
2610                                  ;**BEGIN LOOP TO FIND PAR ADDRESS UNDER TEST
2611  005270  162716  020000  2$:     SUB     #20000,(SP)     ;DECREMENT VIRTUAL ADDRESS BY 4K
2612  005274  050116                  BIS     R1,(SP)         ;SET BITS 11:0 TO MAXIMUM VIRTUAL TEST ADDRESS
2613  005276  020240                  CMP     R2,-(R0)        ;DOES CURRENT PAR= TEST BLOCK NO.?
2614  005300  001410                  BEQ     3$              ;BRANCH IF YES
2615  005302  020027  172340          CMP     R0,#172340      ;ARE WE AT PAR0?
2616  005306  101370                  BHI     2$              ;NO KEEP TRYING
2617                                  ;**END LOOP TO FIND PAR ADDRESS UNDER TEST
2618  005310  005720                  TST     (R0)+           ;SET TO PAR CURRENT
2619  005312  021002                  CMP     (R0),R2 ;IS THE PAR BLOCK UNDER TEST GTR THAN ALLOWED?
2620  005314  003006                  BGT     4$              ;BRANCH IF YES (FALL INTO ENDPAS)
2621  005316  012716  157776          MOV     #157776,(SP)    ;EXIT WITH MAXADR= 28K SEGMENT TEST SIZE
2622  005322  012600          3$:     MOV     (SP)+,R0        ;SET R0 TO MAXIMUM VIRTUAL TEST ADDRESS
2623  005324  062700  000002          ADD     #2,R0           ;MAKE MAXIMUM MEMORY+2
2624  005330  000207                  RTS     PC              ;AND EXIT MAXADR ROUTINE
2625
2626  005332  022626          4$:     CMP     (SP)+,(SP)+     ;FIXUP STACK
2627                                                          ;AND FALL THRU TO ENDPAS.
```

```
                                        ;* TYPE ROUTINE FOR ERROR STACK
                                        ;* --------------------------
                                        ;*
                                        ;*      THIS ROUTINE IS USED TO DETERMINE IF TYPE OUT OF THE ERROR STACK
                                        ;*      FOR ONLY THE FAILING BITS IS REQUIRED OR NOT


005334  032777  000020  173106  ENDPAS: BIT     #20,@SWR        ;ARE WE GOING TO TYPE THE ERROR STACK AND END OF PASS?
005342  001055                  BNE     $EOP            ;IF NOT THEN GO TO $EOP
005344  012746  177777          $TPSTK: MOV     #-1,-(SP)       ;THE PROGRAM HAS REACHED THE END AND ERROR
                                                        ;STACK AND END OF PASS WILL BE TYPED OUT
005350  012701  007744                  MOV     #ENDPRG,R1      ;PLACE THE STARTING ADDRESS OF THE ERROR STACK
                                                        ;FOR 0 TO 4K MEMORY IN R1
005354  012703  000376          TYPSTK: MOV     #376,R3
005360  005216                  INC     (SP)            ;IF WE HAVE GONE THRU THE ENTIRE
005362  020137  000310                  CMP     R1,@#ENDSTK     ;HAS THE END OF THE ERROR STACK BEEN REACHED ?
005366  103043                  BHIS    $EOP            ;THEN GO TO TYPE END OF PASS
005370  112702  000022                  MOVB    #18.,R2
005374  105302          RETSTK: DECB    R2      ;IF ALL 16 BITS OF THIS BANK HAVE BEEN CHECKED.
005376  002766                  BLT     TYPSTK          ;BEEN CHECKED FOR ERROR THEN SEE IF THERE
                                                        ;IS ANY MORE 4K MEMORY BANK
005400  105721                  TSTB    (R1)+           ;OTHERWISE CHECK THE BYTE STORED AT (R1)
005402  001774                  BEQ     RETSTK          ;IF IT IS 0 WE WILL NOT TYPE IT
005404  020227  000020                  CMP     R2,#16.         ;IS THE POINTER POINTING TO ERROR STACK BYTE
                                                        ;MEANT FOR COLLECTING ADDRESS FAILURES FOR
                                                        ;THE SPECIFIC MEMORY BANK
005410  103404                  BLO     2$              ;IF NOT THEN GO TO TYPE BIT NUMBER
005412  101026                  BHI     PARFL           ;IF IT IS POINTING TO THE STACK LOCATION INTENDED
                                                        ;TO COLLECT PARITY FAILURES THEN GO TO PARFL
005414  004767  001000                  JSR     PC,TPADER       ;OTHERWISE TYPE ''ADDRESS ERROR''
005420  000404                  BR      FAILNM
005422  010237  000312          2$:     MOV     R2,@#DECWRD     ;PREPARE TO TYPE THE NUMBER OF THE FAILING BIT
                                                        ;IN DECIMAL
005426  004767  001202                  JSR     PC,TYPDEC       ;GO TO TYPE THE BIT NUMBER IN DECIMAL
005432  011637  000312          FAILNM: MOV     (SP),@#DECWRD   ;PREPARE TO TYPE THE PAGE NUMBER
005436  004767  001176                  JSR     PC,$TPDEC       ;IN DECIMAL
005442  005043                  CLR     -(R3)
005444  114113                  MOVB    -(R1),(R3)      ;PREPARE TO PRINTOUT THE NUMBER OF TIMES THIS
                                                        ;FAILURE OCCURED
005446  105021                  CLRB    (R1)+           ;CLEAR THE ERROR STACK
005450  005043                  CLR     -(R3)
005452  105237  000314                  INCB    @#TYPCNT        ;ENABLE THE TYPE OUT OF 1 WORDS
005456  004767  001316                  JSR     PC,RPTOCT       ; TYPE THE 4K BANK AND THE NUMBER OF TIMES
                                                        ;THIS FAILURE WAS SEEN
005462  012703  000376                  MOV     #376,R3         ;RESET SCRATCH STACK FOR EACH BIT PRINTED.
005466  000742                  BR      RETSTK
005470  004767  000750          PARFL:  JSR     PC,TPPRER       ; TYPE 'PAR ERR''
005474  000756                  BR      FAILNM
```

```
2677
2678
2679                                    ;* END OF PASS
2680                                    ;* ----------
2681                                    ;*
2682                                    ;*      TYPE 'PASS#'' AND DISABLE PARITY.
2683                                    ;*      ALSO SERVICE ACT11.
2684                                    ;*      AND EVERY CONSECUTIVE PASSES UNLESS BIT 4 OF $SWREG IS HIGH
2685                                    ;*
2686
2687
2688  005476  005002                    $EOP:   CLR     R2              ;SET R2= PARITY MODULE DISABLE CODE
2689  005500  004767  002014                    JSR     PC,PARITY       ;GO DISABLE PARITY MODULES IF SELECTED.
2690  005504  105737  000315                    TSTB    @#SAVKBB        ;CONTROL-C TYPED?
2691  005510  001043                            BNE     CTLC            ;BRANCH IF YES-RESTORE LOADERS AND HALT-
2692  005512  005237  000406                    INC     @#$PASS         ;INCREMENT PASS COUNT
2693  005516  032777  000040  172724            BIT     #40,@SWR        ;'PASS#XX'' PRINTOUT WANTED?
2694  005524  001012                            BNE     ACT11           ;BRANCH IF NO
2695  005526  004767  001052                TYPEOP: JSR     PC,TPCRLF       ; TYPE CR, LF, AND 'PASS#''
2696  005532  040520  051523  000043            .ASCIZ  /PASS#/
2697                                            .EVEN
2698  005540  013737  000406  000312            MOV     @#$PASS,@#DECWRD        ;GET PASS COUNT
2699  005546  004767  001066                    JSR     PC,$TPDEC               ;TYPE IT
2700  005552  013700  000042              ACT11: MOV     @#42,R0         ;GET THE MONITOR ADDRESS
2701  005556  001405                            BEQ     $DOAGN          ;IF NONE
2702  005560  004767  000012                    JSR     PC,RLODER       ;RESTORE XXDP MONITOR
2703  005564  000005                            RESET                   ;RETURN TO ACT11 MONITOR.
2704
2705
2706                                    ;* SERVICE XXDP/ACT11
2707  005566  000137  000156                    JMP     @#$ENDAD        ;JUMP TO ACT SERVICE
2708
2709  005572  000137  000250            $DOAGN: JMP     @#RESTRT        ;REPEAT TEST IF NOT UNDER ACT11/XXDP
2710
2711  005576  004767  001616            RLODER: JSR     PC,CLRMM        ;STOP MEMORY MANAGEMENT SO CAN RESTORE LOADERS
2712  005602  013704  000344                    MOV     @#SAVR4,R4      ;RESTORE R4 WITH SAVR4
2713  005606  014445                    4$:     MOV     -(R4),-(R5)     ;RESTORE LOADERS
2714  005610  020437  000310                    CMP     R4,@#ENDSTK
2715  005614  101374                            BHI     4$
2716  005616  000207                            RTS     PC              ;RETURN FROM RLODER CALL
2717
2718                                    ;CONTROL C HANDLER
2719
2720  005620  004767  177752            CTLC:   JSR     PC,RLODER       ;RESTORE ABS LOADER
2721  005624  000167  000400                    JMP     APTHLT          ;IF NOT APT HALT AT FATHLT
2722
2723
```

```
2724                                        ;* ERROR HANDLING ROUTINE
2725                                        ;* ---------------------
2726                                        ;*
2727                                        ;*      PROGRAM COMES HERE EACH TIME AN ERROR IS ENCOUNTERED THIS
2728                                        ;*      ROUTINE TYPES OUT THE ERROR MESSAGE IN THE FORMAT GIVEN EARLIER
2729
2730
2731  005630  017637  000000  000402  ERROR:  MOV     @(SP),@#$FATAL  ;LOAD THE LOCATION $FATAL WITH THE ERROR NUMBER
2732  005636  010346                  1$:     MOV     R3,-(SP)        ;SAVE R3
2733  005640  010046                          MOV     R0,-(SP)        ;AND R0 ON THE STACK
2734
2735                                  ;SETUP BANK NO. IN FATAL FOR APT
2736
2737  005642  010103                          MOV     ..1,R3          ;GET VIRTUAL ADDRESS UNDER TEST FOR GETBNK
2738  005644  004767  001570                  JSR     PC,GETBNK       ;GET BANK NO. UNDER TEST INTO PBNK
2739  005650  013703  000312                  MOV     @#PBNK,R3       ;GET BANK UNDER TEST
2740  005654  110337  000403                  MOVB    R3,@#$FATAL+1   ;STORE FAILING BANK NO. FOR APT
2741
2742                                  ;
2743
2744  005660  010346                          MOV     R3,-(SP)        ;TEMPORARILY STORE R3
2745  005662  012703  000376                  MOV     #376,R3         ;MAKE R3 AS THE STACK POINTER
2746  005666  013743  000306                  MOV     @#PASFLG,-(R3)  ;OUTPUT THE WORD STORED AT
2747  005672  005043                  2$:     CLR     -(R3)
2748  005674  113713  000402                  MOVB    @#$FATAL,(R3)   ;PUT ERROR NO. ON ERROR STACK
2749  005700  016643  000006                  MOV     6(SP),-(R3)     ;PLACE THE RETURN PC AT (R3)
2750  005704  011143                          MOV     (R1),-(R3)      ;PLACE BAD DATA,
2751  005706  010043                          MOV     R0,-(R3)        ;AND GOOD DATA ON THE STACK
2752  005710  005043                          CLR     -(R3)
2753  005712  016313  000004                  MOV     4(R3),(R3)      ;TAKE THE
2754  005716  040013                          BIC     R0,(R3)         ;EXCLUSIVE OR OF GOOD AND BAD DATA
2755  005720  046300  000004                  BIC     4(R3),R0        ;TO FIND THE BITS THAT FAILED
2756  005724  050013                          BIS     R0,(R3)         ;AND PLACE IT ON THE STACK
2757  005726  012700  001766                  MOV     #ENDPRG-.-24.,R0;THIS CODE BRINGS THE RELATIVE ADDRESS
2758  005732  060700                          ADD     PC,R0           ;OF THE STARTING OF THE ERROR STACK
2759  005734  062700  000022          6$:     ADD     #18.,R0         ;FOR THE SPECIFIC 4K BANK
2760  005740  005316                          DEC     (SP)
2761  005742  002374                          BGE     6$
2762  005744  005726                          TST     (SP)+           ;RESTORE THE STACK POINTER
2763
2764  005746  105037  000277          ERRTYP: CLRB    @#TYPENB        ;DISABLE ANY TYPE OUT
2765  005752  105737  000300          1$:     TSTB    @#$PRERR        ;IF THIS IS PARITY PROBLEM
2766  005756  001007                          BNE     3$              ;THEN GO TO 3$
2767  005760  105720                          TSTB    (R0)+           ;OTHERWISE INCREMENT THE ERROR STACK POINTER BY 1
2768  005762  105737  000301                  TSTB    @#$ADERR        ;IF THIS IS ADDRESSING PROBLEM
2769  005766  001003                          BNE     3$              ;THEN GO TO 3$
2770  005770  105720                          TSTB    (R0)+           ;INCREMENT THE POINTER R0 BY 1
2771  005772  005713                  2$:     TST     (R3)            ;IS BIT 15 OF (R3) SET?
2772  005774  100015                          BPL     4$              ;IF NOT THEN GO TO 4$
2773  005776  122710  000377          3$:     CMPB    #377,(R0)       ;OTHERWISE SEE IF THIS ERROR HAS OCCURED 377 TIMES
2774  006002  001401                          BEQ     5$              ;IF SO DON'T BUMP ERROR COUNT
2775  006004  105210                          INCB    (R0)            ;INCREMENT THE ERROR COUNTER BY 1
2776  006006  122710  000001          5$:     CMPB    #1,(R0)         ;MORE THAN 1 ERROR OCCURRED ON THIS BIT?
2777  006012  001404                          BEQ     7$              ;BRANCH IF NO
2778  006014  032777  000400  172426          BIT     #400,@SWR       ;STOP ERROR PRINTOUT AFTER 1 WANTED?
2779  006022  001002                          BNE     4$              ;BRANCH IF YES (DON'T TYPE ERROR)
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2780  006024  105237  000277          7$:     INCB    @#TYPENB        ;ENABLE THE TYPE OUT ROUTINE
2781  006030  105737  000300          /$:     TSTB    @#$PRERR        ;PARITY ERROR?
2782  006034  001403                          BEQ     9$              ;BRANCH IF NO
2783  006036  004767  000402                  JSR     PC,TPPRER       ;ELSE TYPE 'PAR ERR'
2784  006042  000411                          BR      8$              ;AND DON'T TEST INDIVIDUAL BIT FAILURES.
2785  006044  105737  000301          9$:     TSTB    @#$ADERR        ;ADDRESS ERROR?
2786  006050  001403                          BEQ     6$              ;BRANCH IF NO
2787  006052  004767  000342                  JSR     PC,TPADERR      ;PRINT 'ADR ERR'
2788  006056  000403                          BR      8$
2789  006060  105720                  6$:     TSTB    (R0)+           ;POINT TO NEXT ENTRY IN ERROR STACK
2790  006062  006313                          ASL     (R3)            ;IS THERE STILL AN ERROR BIT SET IN ERROR.
2791  006064  001342                          BNE     2$              ;BR IF YES - KEEP FILLING ERROR STACK
2792  006066  112737  000006  000314  8$:     MOVB    #6,@#TYPCNT     ;TELL TYPOCT TO TYPE 6 WORDS OF ERROR STACK.
2793                                                                  ;THE STACK POINTED BY R3
2794  006074  004767  001142                  JSR     PC,PUTADR       ;GO TO THE SUBROUTINE TO PLACE THE ADDRESS IN R1
2795                                                                  ;AT LOCATIONS (R3) AND (R3-2)
2796  006100  004767  000616                  JSR     PC,TYPERR       ;TYPE ERROR STACK (7 WORDS)
2797
2798  006104  005037  000300          10$:    CLR     @#$PRERR        ;CLEAR ADDRESS/PARITY ERROR FLAGS
2799  006110  012600                          MOV     (SP)+,R0        ;RESTORE R0
2800  006112  012603                          MOV     (SP)+,R3        ;AND R3
2801  006114  105737  000420          FNDERR: TSTB    @#$ENV          ;ARE WE RUNNING UNDER APT?
2802  006120  001404                          BEQ     2$              ;IF NOT THEN TEST FOR HALT
2803  006122  012737  000001  000400          MOV     #1,@#$MSGTY     ;OTHERWISE INFORM THE APT
2804  006130  000442                          BR      FATHLT          ;GOTO FATHLT AND WAIT FOR APT.
2805
2806  006132  010246                  2$:     MOV     R2,-(SP)        ;SAVE R2 TEMP
2807  006134  005777  172310                  TST     @SWR            ;DOES THE OPERATOR REQUIRE THE PROGRAM TO HALT
2808                                                                  ;ON ERROR
2809  006140  100405                          BMI     4$              ;IF SO THEN HALT ON ERROR
2810                                  ;CHECK FOR CONTROL-C KEY
2811
2812  006142  004767  001526                  JSR     PC,CHECKC       ;IF CONTROL-C TYPED THEN PRINT ERROR HISTORY
2813                                                                  ;AND HALT AT FATHLT.
2814  006146  105737  000042          7$:     TSTB    @#42            ;ARE WE RUNNING UNDER ACT?
2815  006152  001401                          BEQ     6$              ;BRANCH IF NO
2816
2817  006154  000000                  4$:     HALT                    ;PROGRAM HAS HALTED ON ERROR. R1 IS POINTING
2818                                                                  ;TO A LOCATION WHICH SHOULD HAVE CONTAINED
2819                                                                  ;THE WORD STORED IN R0
2820  006156  012602                  6$:     MOV     (SP)+,R2        ;RESTORE R2
2821  006160  062716  000002                  ADD     #2,(SP)         ;RESTORE THE RETURN ADDRESS
2822  006164  000207                          RTS     PC              ;RETURN FROM THE SUBROUTINE
2823
2824
2825
2826  006166                          FATERR:
2827  006166  004767  000412          SFQERR: JSR     PC,TPCRLF       ;TYPE 'ERR #'
2828  006172  051105  020122  000043          .ASCIZ  /ERR #/
2829                                          .EVEN
2830
2831  006200  017637  000000  000402          MOV     @(SP),@#$FATAL  ;LOAD THE LOCATION $FATAL WITH THE ERROR NUMBER
2832  006206  105237  000314                  INCB    @#TYPCNT        ;TELL $TPNUM TO TYPE 1 WORD
2833  006212  012703  000376                  MOV     #376,R3         ;$TPNUM USES R3 AS STACK
2834  006216  013743  000402                  MOV     @#$FATAL,-(R3)  ;PUT ERROR NO. ON STACK
2835  006222  005743                          TST     -(R3)           ;$TPNUM REQUIRES THIS
```

```
2836  006224  004767  000560                  JSR     PC,FATYP        ;TYPE ERROR NO.
2837  006230  105737  000420          APTHLT: TSTB    @#$ENV  ;RUNNING UNDER APT?
2838  006234  001327                          BNE     FNDERR          ;BRANCH IF YES
2839  006236  000000                  FATHLT: HALT                    ;FATAL ERROR OR ^C HALT.
2840  006240  000137  000250                  JMP     @#RESTRT                ;RESTART TST BUT DON'T CLEAR PASS COUNT
2841                                                                  ;IN CASE ^C RESTART.
2842
2843
2844                                  ;PARERR
2845                                  ;       PARITY TRAP HANDLER
2846                                  ;COME HERE FROM A TRAP TO 114.
2847                                  ;       THIS ROUTINE SEARCHES THE AVAILABLE PARITY MODULES AND IF ONE
2848                                  ;HAS A PARITY ERROR BIT SET THE GET THE PARITY ERROR ADDRESS
2849                                  ;AND CALL THE 'ERROR' ROUTINE TO PRINT ERROR MESSAGE.
2850                                  ;IF NO PARITY ERROR BITS CAN BE FOUND A FATAL ERROR IS DONE.
2851                                  ;
2852                                  ;REGISTER US AGE.
2853                                  ;R0= HOLDS PARITY MODULE ADDRESSES
2854                                  ;R1= GETS ERROR ADDRESS FOR 'ERROR' CALL.
2855
2856  006244  012637  000356          PARERR: MOV     (SP)+,@#PARSP   ;SET PARSP TO RETURN ADDRESS
2857  006250  011637  000360                  MOV     (SP),@#PARPS    ;SAVE PSW FOR RETURN
2858  006254  013706  000350                  MOV     @#SAVR6,SP      ;AND RESET THE SP SINCE NOT ENOUGH STACK ROOM
2859                                                                  ;TO COMPLETE THE ERROR SERVICE ROUTINE.
2860  006260  010067  000130                  MOV     R0,SAVR0        ;SAVE R0 DURING PARITY SERVICE
2861  006264  010167  000126                  MOV     R1,SAVR1        ;SAVE R1 DURING PARITY SERVICE
2862  006270  013701  000352                  MOV     @#PARMAP,R1     ;GET PARITY AVAILABLE MAP
2863  006274  012700  172100                  MOV     #172100,R0      ;R0= FIRST PARITY ADDRESS.
2864
2865  006300  005701                          TST     R1              ;ANY PARITY MODULES AVAILABLE?
2866  006302  001441                          BEQ     4$              ;BR IF NO -FATAL ERROR-
2867  006304  006001          1$:             ROR     R1              ;SHIFT PARITY MAP BIT INTO C BIT.
2868  006306  103005                          BCC     2$              ;BRANCH IF THIS PARITY MODULE NOT AVAILABLE.
2869  006310  005710                          TST     (R0)            ;PARITY MODULE ERROR BIT SET?
2870  006312  100406                          BMI     3$              ;BRANCH IF YES -CALL 'ERROR' ROUTINE
2871  006314  020027  172136                  CMP     R0,#172136      ;DONE ALL PARITY MODULES?
2872  006320  002032                          BGE     4$              ;BR IF YES- GO TO FATAL ERROR CALL-
2873  006322  062700  000002          2$:     ADD     #2,R0   ;POINT TO NEXT PARITY ADDRESS
2874  006326  000766                          BR      1$              ;AND KEEP TRYING
2875  006330  042710  100000          3$:     BIC     #100000,(R0)    ;CLEAR PARITY ERROR BIT.
2876  006334  011001                          MOV     (R0),R1         ;GET PARITY MODULE CSR
2877  006336  006101                          ROL     R1              ;SHIFT ERROR ADDRESS BITS 11-5 INTO 15-9
2878  006340  006101                          ROL     R1
2879  006342  006101                          ROL     R1
2880  006344  006101                          ROL     R1
2881  006346  042701  000777                  BIC     #777,R1 ;SAVE ERROR ADDRESS ONLY
2882  006352  105237  000300                  INCB    @#$PRERR        ;TELL 'ERROR' PARITY ERROR CALL.
2883  006356  004767  177246                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
2884  006362  000050                          50                      ;******ERROR NUMBER 50******
2885
2886  006364  016700  000024                  MOV     SAVR0,R0        ;RESTORE R0
2887  006370  016701  000022                  MOV     SAVR1,R1        ;RESTORE R1
2888  006374  013746  000360                  MOV     @#PARPS,-(SP)   ;SET RETURN PSW ON STACK
2889  006400  013746  000356                  MOV     @#PARSP,-(SP)   ;AND SET RETURN ADDRESS ON STACK
2890  006404  000002                          RTI                     ;RETURN TO TEST WHERE PARITY TRAP OCCURRED.
2891
```

```
                                        ;COME HERE IF NO PARITY ERROR FLAG FOUND SET
006406                                  4$:
006406  004767  177554                        JSR     PC,FATER?       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
006412  000051                                51                      ;******ERROR NUMBER 51******


                                        ;R0+R1 ARE SAVED HERE FOR PARITY TRAP DUE TO INSUFFICIENT
                                        ;STACK SPACE BETWEEN 500-450.
006414  000000                          SAVR0:  0               ;SAVE R0 DURING PARITY TRAP SERVICE
006416  000000                          SAVR1:  0       ;SAVE R1 DURING PARITY TRAP SERVICE


006420  105737  000277                  TPADER: TSTB    @#TYPENB        ;TYPE ERROR?
006424  001406                                  BEQ     1$              ;BRANCH IF NO
006426  004767  000160                        JSR     PC,PNTMES       ; TYPE CR, LF AND ''ADR ER''
006432  042101  020122  051105                .ASCIZ  /ADR ERR/
006440  000122
                                                .EVEN
006442  000207                          1$:     RTS     PC

006444  105737  000277                  TPPRER: TSTB    @#TYPENB        ;ERROR PRINTOUTS ALLOWED?
006450  001406                                  BEQ     1$              ;BRANCH IF NO
006452  004767  000134                        JSR     PC,PNTMES       ;GO TO TYPE CR, LF AND 'PAR ERR''
006456  040520  020122  051105                .ASCIZ  /PAR ERR/
006464  000122
                                                .EVEN
006466  000207                          1$:     RTS     PC
```

```
2919
2920
2921                                    ;* TYPE OUT ROUTINE
2922                                    ;* ---------------
2923                                    ;*
2924                                    ;*      THIS ROUTINE IS USED BY THE PROGRAM TO TYPE OUT ANY CHARACTER
2925                                    ;*
2926
2927  006470  010146                NOTYP:  MOV     R1,-(SP)
2928  006472  016601  000002               MOV     2(SP),R1
2929  006476  105721                4$:     TSTB    (R1)+           ;IF THIS TYPE OUT HAS BEEN SUPRESSED THEN
2930  006500  001376                        BNE     4$              ;PREPARE TO RETURN
2931  006502  000412                        BR      RETTYP
2932  006504  010146                $TYPE:  MOV     R1,-(SP)        ;SAVE R1
2933  006506  010046                        MOV     R0,-(SP)        ;AND R0 ON THE STACK
2934  006510  016601  000004               MOV     4(SP),R1        ;PLACE THE ADDRESS OF MESSAGE TO BE TYPED IN R1
2935  006514  112100                2$:     MOVB    (R1)+,R0        ;PLACE THE BYTE TO BE TYPED IN R0
2936  006516  001403                        BEQ     4$              ;IF IT IS END OF MESSAGE THEN GO TO 4$
2937  006520  004767  000022               JSR     PC,$TPCHR       ;OTHERWISE GO TO TYPE THE CONTENTS OF R0
2938  006524  000773                        BR      2$
2939  006526  012600                4$:     MOV     (SP)+,R0        ;RESTORE R0
2940  006530  005201                RETTYP: INC     R1              ;CAUSE R1 TO
2941  006532  042701  000001               BIC     #1,R1           ;POINT TO EVEN ADDRESS
2942  006536  010166  000002               MOV     R1,2(SP)        ;MODIFY THE RETURN ADDRESS
2943  006542  012601                        MOV     (SP)+,R1        ;RESTORE R1
2944  006544  000416                        BR      EXTYP           ;AND RETURN VIA RTS PC
2945
2946  006546  132737  000040  000421  $TPCHR: BITB   #40,@#$ENVM     ;HAVE TYPE OUTS BEEN DISABLED?
2947  006554  001005                        BNE     4$              ;IF SO THEN RETURN FROM THE SUBROUTINE
2948  006556  105737  177564         2$:     TSTB    @#$TPS          ;WAIT HERE
2949  006562  100375                        BPL     2$              ;UNTIL THE PRINTER IS READY
2950  006564  110037  177566               MOVB    R0,@#$TPB       ;LOAD DATA TO BE TYPED INTO DATA REG.
2951  006570  000404                4$:     BR      EXTYP           ;RETURN
2952
2953  006572  004767  177706        PCRLF:  JSR     PC,$TYPE
2954  006576  005015     000               .ASCIZ  <15><12>        ;CR/LF
2955           006602                       .EVEN
2956  006602  000207                EXTYP:  RTS     PC      ;RETURN
2957
2958  006604  004767  177762        TPCRLF: JSR     PC,PCRLF        ;TYPE CR/LF
2959  006610  000735                        BR      $TYPE           ;NOW GO TO TYPE THE REST OF THE MESSAGE
2960
2961
2962  006612  032777  000020  171630  PNTMES: BIT     #20,@SWR        ;PRINTOUTS ALLOWED?
2963  006620  001323                        BNE     NOTYP           ;BRANCH IF NO
2964  006622  123737  000042  000046        CMPB    @#42,@#46       ;RUNNING UNDER ACT 11?
2965  006630  001717                        BEQ     NOTYP           ;BRANCH IF YES -NOT PRINTOUT-
2966  006632  000764                        BR      TPCRLF          ;SEND CR/LF AND TYPE MESSAGE.
```

```
2967
2968                                    ;* ROUTINE TO TYPE OUT A DECIMAL NUMBER
2969                                    ;* ----------------------------------
2970                                    ;*
2971                                    ;*      THIS ROUTINE IS USED TO CONVERT THE CONTENTS OF LOCATION
2972                                    ;*      DECWRD TO DECIMAL NUMBERS AND TYPE THEN FOLLOWING 3 SPACES
2973                                    ;*
2974
2975  006634  004767  177732       TYPDEC: JSR     PC,PCRLF        ;TYPE CR/LF
2976
2977  006640  005046                $TPDEC: CLR     -(SP)
2978  006642  013746  000312               MOV     @#DECWRD,-(SP)  ;GET THE WORD THAT HAS TO BE CONVERTED TO A
2979                                                                ;DECIMAL NUMBER
2980  006646  162716  000012       2$:     SUB     #10.,(SP)
2981  006652  002403                       BLT     4$              ;IF THE NUMBER IN (SP) WAS LESS THAN 10. THEN
2982                                                                ;GO TO 4$
2983  006654  005266  000002               INC     2(SP)           ;OTHERWISE ADD 1 TO THE LOCATION STORING 10'S DIGIT
2984  006660  000772                       BR      2$              ;AND RETURN TO 2$
2985  006662  062716  000012       4$:     ADD     #10.,(SP)
2986  006666  052716  000060               BIS     #60,(SP)        ;MAKE THE CONTENTS OF (SP) A DECIMAL NUMBER
2987  006672  112667  000020               MOVB    (SP)+,6$-2      ;PLACE THE 1'S DIGIT TO BE TYPED
2988  006676  052716  000060               BIS     #60,(SP)        ;MAKE THE CONTENTS OF (SP) A DECIMAL NUMBER
2989  006702  112667  000007               MOVB    (SP)+,6$-3      ;PLACE THE 10'S DIGIT TO BE TYPED
2990  006706  004767  177572               JSR     PC,$TYPE        ;GO TO TYPE THE NUMBER IN DECIMAL FOLLOWED BY
2991                                                                ;3 SPACES
2992  006712  020040  030040  000060       .ASCIZ  /   00/
2993                                        .EVEN
2994  006720  000207                6$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
```

```
2995
2996
2997                                    ;* OCTAL TYPE OUT ROUTINE
2998                                    ;* ---------------------
2999                                    ;*
3000                                    ;*      THIS ROUTINE IS USED TO TYPE OUT THE OCTAL VALUES
3001                                    ;*      CONTROL SHOULD COME TO THIS ROUTINE WITH R3 POINTING TO
3002                                    ;*      THE LOW ORDER BITS (I.E. BITS 0-15) OF THE ADDRESS TO
3003                                    ;*      BE TYPED WHERE AS R3-2 SHOULD CONTAIN THE HIGH ORDER BITS
3004                                    ;*      (I.E. BITS 16 & 17). CONTENTS OF LOCATION R3-1 AND R0 ARE
3005                                    ;*      DESTROYED BY THIS SUBROUTINE
3006                                    ;*      BYTE TYPCNT SHOULD BE SET TO THE NUMBER OF WORDS THAT HAVE
3007                                    ;*      TO BE TYPED.
3008                                    ;*
3009
3010  006722  032777  020000  171520  TYPERR: BIT     #20000,@SWR     ;ERROR PRINTOUT WANTED?
3011  006730  001054                          BNE     OCTXT           ;BRANCH IF NO
3012  006732  004767  177634                  JSR     PC,PCRLF        ;TYPE CR/LF
3013  006736  004767  000012                  JSR     PC,TYPOCT       ;TYPE OCTAL NO.
3014  006742  000447                          BR      OCTXT           ;RETURN VIA RTS PC
3015  006744  012123                  OCTTYP: MOV     (R1)+,(R3)+     ;PLACE THE HIGH ORDER BITS AT LOCATION POINTED
3016                                                                  ;BY R3
3017  006746  012113                          MOV     (R1)+,(R3)      ;AND NOW PLACE THE LOW ORDER BITS
3018  006750  105237  000314                  INCB    @#TYPCNT        ;ENABLE THE TYPE OUT OF ONE OCTAL WORD
3019  006754  052743  000004          TYPOCT: BIS     #4,-(R3)
3020  006760  106113                  2$:     ROLB    (R3)
3021  006762  103376                          BCC     2$
3022  006764  005000                          CLR     R0
3023  006766  106113                          ROLB    (R3)            ;GET BITS 17 & 16 INTO R0
3024  006770  006100                          ROL     R0
3025  006772  106113                          ROLB    (R3)
3026  006774  006100                          ROL     R0
3027  006776  000405                          BR      $TPNUM
3028  007000  004767  177500          RPTOCT: JSR     PC,$TYPE        ; TYPE 3 SPACES
3029  007004  020040  000040                  .ASCIZ  /   /
3030                                          .EVEN
3031  007010  005000                  FATYP:  CLR     R0
3032  007012  012723  000006          $TPNUM: MOV     #6,(R3)+        ;ENABLE THE TYPE OUT OF 6 OCTAL DIGITS
3033  007016  000241                  4$:     CLC
3034  007020  006113                          ROL     (R3)
3035  007022  006100                          ROL     R0              ;PLACE THE CARRY FROM (R3) IN R0
3036  007024  052700  000060                  BIS     #60,R0          ;OR THE CONTENTS OF R0 WITH AN ASCII 0
3037  007030  004767  177512                  JSR     PC,$TPCHR       ; TYPE THE OCTAL NUMBER STORED IN R0
3038  007034  005000                          CLR     R0
3039  007036  006113                          ROL     (R3)
3040  007040  006100                          ROL     R0              ;PLACE THE CARRY FROM (R3) IN R0
3041  007042  006113                          ROL     (R3)
3042  007044  006100                          ROL     R0              ;PLACE THE CARRY FROM (R3) IN R0
3043  007046  105363  177776                  DECB    -2(R3)          ;IF WE HAVEN'T TYPED THE 6 OCTAL DIGITS
3044  007052  001361                          BNE     4$              ;THEN REPEAT FROM 4$
3045  007054  105337  000314                  DECB    @#TYPCNT        ;IF ALL THE WORDS REQUIRED HAVE NOT BEEN
3046  007060  001347                          BNE     RPTOCT          ;TYPED THEN REPEAT FROM RPTOCT
3047  007062  000207                  OCTXT:  RTS     PC
```

```
3048
3049                                    ;* ROUTINE TO SET UP MEMORY MANAGEMENT REGISTERS
3050                                    ;* ----------------------------------------------
3051                                    ;*
3052                                    ;*      PROGRAM CONTROL COMES HERE TO DETERMINE IF THE MEMORY MANAGEMENT
3053                                    ;*      IS AVAILABLE OR NOT, AND IF IT IS AVAILABLE THEN WHETHER
3054                                    ;*      THE MEMORY ABOVE 28K IS REQUIRED TO BE TESTED OR NOT.
3055                                    ;*
3056
3057  007064  012702  001400        MEMMNG: MOV     #1400,R2
3058  007070  105037  000276        MMREG:  CLRB    @#MMAVA         ;CLEAR THE BYTE THAT IS SUPPOSED TO INDICATE
3059                                                                  ;THAT MEM. MANAG. IS AVAILABLE FOR TESTING
3060  007074  032777  010000  171346        BIT     #10000,@SWR     ;HAS THE OPERATOR ASKED TO CHECK MEMORY MANAG. ?
3061  007102  001441                        BEQ     RETMM           ;IF NOT THEN RETURN FROM THE SUBROUTINE
3062  007104  012700  000004                MOV     #4,R0           ;PREPARE TO SETUP TIME OUT VECTOR
3063  007110  012720  007210                MOV     #NOMM,(R0)+     ;RETURN ADDRESS TO NOMM
3064  007114  012710  000340                MOV     #340,(R0)       ;AND WITH A PSW OF 340
3065  007120  005037  177572                CLR     @#SR0           ;TRY TO REACH MEM. MANAG. SR0
3066  007124  105237  000276                INCB    @#MMAVA         ;IF IT IS AVAILABLE THEN SET MEM. MANAG. AVAILABLE
3067                                                                  ;BYTE
3068  007130  012701  172340                MOV     #172340,R1      ;R1 IS POINTING TO PAR0
3069  007134  005021                        CLR     (R1)+           ;PAR0 WILL POINT TO BANK 0
3070  007136  062702  000200        2$:     ADD     #200,R2
3071  007142  010221                        MOV     R2,(R1)+        ;SETUP PAR1-PAR6
3072  007144  020127  172356                CMP     R1,#172356
3073  007150  103772                        BLO     2$
3074  007152  012711  007600                MOV     #7600,(R1)      ;PAR7 IS POINTING TO THE I/O PAGE
3075  007156  012701  172300                MOV     #172300,R1
3076  007162  012721  077406        4$:     MOV     #77406,(R1)+    ;SETUP PDR0-PDR7
3077  007166  020127  172316                CMP     R1,#172316
3078  007172  101773                        BLOS    4$
3079  007174  005237  177572                INC     @#SR0           ;ENABLE MEM. MANAG.
3080  007200  005010                $RETMM: CLR     (R0)            ;RESTORE TIME OUT TRAP VECTOR FOR ANY FUTURE TRAP
3081  007202  012740  000104                MOV     #BUSER,-(R0)
3082  007206  000207                RETMM:  RTS     PC
3083
3084  007210  022626                NOMM:   CMP     (SP)+,(SP)+     ;RESTORE STACK POINTER
3085  007212  004767  177366                JSR     PC,TPCRLF       ;TYPE 'NO MEMORY MANAGEMENT MESSAGE
3086  007216  047516  045440  000124        .ASCIZ  /NO KT/
3087                                        .EVEN
3088  007224  004767  176736                JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
3089  007230  000052                        52                      ;******ERROR NUMBER 52******
3090
3091  007232  000762                        BR      $RETMM          ; RESTORE TIME OUT TRAP VECTOR
3092
3093  007234  013702  172354        UPMM:   MOV     @#172354,R2     ;PREPARE TO UPDATE MEMORY MANAG. REGISTERS
3094  007240  000713                        BR      MMREG
```

```
3095
3096                                    ;* 18 BIT ADDRESS GENERATOR
3097                                    ;* ------------------------
3098                                    ;*
3099                                    ;*      THIS SUBROUTINE IS USED TO PLACE THE ADDRESS STORED IN R1
3100                                    ;*      IN THE LOCATION POINTED BY R3. THE ADDRESS IN R1 IS CONVERTED
3101                                    ;*      TO AN 18 BIT ADDRESS ONLY IF MEM. MANAG. IS AVILABLE IN WHICH
3102                                    ;*      CASE THE HIGH ORDER BITS OF THE ADDRESS ARE PLACED IN LOCATION
3103                                    ;*      POINTED BY R3-2
3104                                    ;*
3105
3106  007242  005063  177776    PUTADR: CLR     -2(R3)
3107  007246  010113                    MOV     R1,(R3)         ;PLACE THE ADDRESS STORED IN R1 IN LOCATION (R3)
3108  007250  105737  000276            TSTB    @#MMAVA         ;IS THE MEM. MANAG. AVAILABLE ?
3109  007254  001425                    BEQ     6$              ;IF NOT THEN RETURN FROM THE SUBROUTINE
3110  007256  010146                    MOV     R1,-(SP)        ;SAVE R1
3111  007260  042701  017777            BIC     #17777,R1       ;CLEAR BITS 0-12 OF THE ADDRESS IN R1
3112  007264  040113                    BIC     R1,(R3)         ;LEAVE BITS 0-12 OF THE ADDRESS IN (R3)
3113  007266  052701  004000            BIS     #4000,R1        ;PREPARE TO SHIFT R1 BY 12 PLACES
3114  007272  006001            2$:     ROR     R1
3115  007274  103376                    BCC     2$              ;GET THE NUMBER OF PAR IN R1
3116  007276  062701  172340            ADD     #172340,R1      ;GET THE ADDRESS OF PAR IN R1
3117  007302  011101                    MOV     (R1),R1         ;LOAD R1 WITH THE CONTENTS OF PAR
3118  007304  052701  010000            BIS     #10000,R1
3119  007310  006101            4$:     ROL     R1
3120  007312  103376                    BCC     4$              ;PLACE THE ADDRESS BITS 13-17 IN BITS 11-15 OF R1
3121  007314  006101                    ROL     R1
3122  007316  006143                    ROL     -(R3)           ;PLACE BIT 17 IN LOCATION POINTED BY R3-2
3123  007320  006101                    ROL     R1
3124  007322  006123                    ROL     (R3)+           ;PLACE BIT 16 OF THE ADDRESS
3125  007324  050113                    BIS     R1,(R3)         ;PLACE BITS 13-15 OF THE ADDRESS IN LOCATION (R3)
3126  007326  012601                    MOV     (SP)+,R1        ;RESTORE R1
3127  007330  000207            6$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
3128
3129                                    ;* GET ADDRESS FROM THE APT MAILBOX
3130                                    ;* --------------------------------
3131                                    ;*
3132                                    ;*      THIS SUBROUTINE IS USED TO GET ADDRESS FROM APT MAILBOX AND
3133                                    ;*      PLACE IT IN THE LOCATION USED BY THE PROGRAM TO  DEFINE THE
3134                                    ;*      MEMORY BOUNDRIES.
3135                                    ;*      PROGRAM CONTROL SHOULD COME TO THIS SUBROUTINE WITH R1 POINT-
3136                                    ;*      ING TO THE MEMORY TYPE IN THE APT MAILBOX AND R3 POINTING TO
3137                                    ;*      THE LOCATION+2 WHERE THE LOW ORDER BITS OF THE ADDRESS HAVE
3138                                    ;*      TO BE PLACED
3139                                    ;*
3140
3141  007332  016143  000001    GETADR: MOV     1(R1),-(R3)     ;PLACE THE LOW ORDER BITS OF THE ADDRESS
3142  007336  005043                    CLR     -(R3)           ;CLEAR THE LOCATION WHERE THE HIGH ORDER BITS
3143                                                            ;HAVE TO BE PLACED
3144  007340  116113  177777                    MOVB    -1(R1),(R3)     ;PLACE BITS 16 & 17
3145  007344  000207            2$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
```

```
3146
3147                                    ;* CONVERT 18 BIT ADDRESS TO THE PAR FORM
3148                                    ;* ---------------------------------------
3149                                    ;*
3150                                    ;*      THIS SUBROUTINE IS USED TO CONVERT 18 BIT ADDRESS STORED IN
3151                                    ;*      LOCATIONS POINTED BY R3 AND R3+2 TO THE FORM IT WILL BE STORED
3152                                    ;*      IN A PAR. THE RESULT IS LEFT IN R2. R1 IS LOADED WITH BITS
3153                                    ;*      0-12 OF THE ADDRESS AND R0 WITH 160000
3154                                    ;*
3155
3156  007346  005046          $GTSIZ: CLR     -(SP)           ;PREPARE TO PLACE ADDRESS BITS 13-17 IN BITS
3157                                                          ;0-4 OF R2
3158
3159  007350  012301          GETSIZ: MOV     (R3)+,R1
3160  007352  011302                  MOV     (R3),R2         ;LOAD R2 WITH THE LOW ORDER BITS OF THE ADDRESS
3161  007354  042702  017777          BIC     #17777,R2       ;CLEAR ADDRESS BITS 0-12
3162  007360  052702  000040  2$:     BIS     #40,R2
3163  007364  006001          4$:     ROR     R1
3164  007366  006002                  ROR     R2              ;ROTATE R1 AND R2 7 TIMES
3165  007370  103375                  BCC     4$
3166  007372  005716                  TST     (SP)            ;IF RETURN PC IS ZERO THEN IT MUST BE THE
3167  007374  001004                  BNE     6$              ;FLAG THAT WAS SET AT $GTSIZ
3168  007376  005726                  TST     (SP)+           ;POP THE FLAG OFF STACK
3169  007400  052702  000100          BIS     #100,R2         ;KEEP ROTATING
3170  007404  000767                  BR      4$
3171  007406  012301          6$:     MOV     (R3)+,R1        ;PLACE THE LOW ORDER ADDRESS BITS IN R1
3172  007410  012700  160000          MOV     #160000,R0
3173  007414  040001                  BIC     R0,R1           ;LEAVE BITS 0-12 OF THE ADDRESS IN R1
3174  007416  000207                  RTS     PC              ;RETURN FROM THE SUBRORNE
3175
3176
3177
3178                                    ;* SUBROUTINE TO DISABLE MEMORY MANAGEMENT
3179                                    ;* ---------------------------------------
3180                                    ;*
3181                                    ;*      THIS SUBROUTINE IS CALLED TO DISABLE THE MEMORY MANAGEMENT
3182                                    ;*      UNIT
3183
3184  007420  105737  000276  CLRMM:  TSTB    @#MMAVA         ;WAS THE MEMORY MANAGEMENT ENABLED ?
3185  007424  001404                  BEQ     1$              ;IF NOT THEN GO TO 1$
3186  007426  005037  177572          CLR     @#SR0           ;DISABLE THE MEMORY MANAGEMENT
3187  007432  105037  000276          CLRB    @#MMAVA         ;AND DO NOT ATTEMPT TO TEST MEM. MANAG.
3188  007436  000207          1$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
3189
3190
3191                                    ;* GET BANK NO. UNDER TEST
3192                                    ;       CALLED BY ERRTYP AND TST13 TO GET BANK NO. UNDER TEST INTO PBNK.
3193                                    ;REGISTERS
3194                                    ;R0=POINTER TO PAR UNDER TEST
3195                                    ;R3=VIRTUAL ADDRESS ON ENTRY
3196                                    ;R0+R3 ARE RESTORED ON EXIT.
3197
3198  007440  010046          GETBNK: MOV     R0,-(SP)        ;SAVE R0
3199  007442  010346                  MOV     R3,-(SP)        ;SAVE R3
3200  007444  042703  017777          BIC     #17777,R3       ;SAVE ONLY VIRTUAL BANK BITS
3201  007450  052703  010000          BIS     #10000,R3               ;SETUP R3 SHIFT BIT
```

```
                                        CLC
                                1$:     ROR     R3              ;SHIFT A BANK BIT
                                        BCC     1$              ;UNTIL IN BITS <2:0> OF R3
                                        TSTB    @#MMAVA         ;MEMORY MANAGEMENT UNDER TEST?
                                        BEQ     2$              ;NO EXIT

                                ;GET PAR ADDRESS AND PHYSICAL BANK NO.
                                        ASL     R3              ;MAKE R3 PAR ADDRESS OFFSET.
                                        ADD     #172340,R3      ;MAKE FULL PAR ADDRESS.
                                        MOV     (R3),R0         ;GET PAR CONTENTS
                                        ASL     R0
                                        SWAB    R0              ;SHIFT BANK BITS TO BITS <7:0>
                                        MOVB    R0,R3           ;SET R3 TO PHYSICAL BANK NO.
                                2$:     MOV     R3,@#PBNK       ;STORE PHYSICAL BANK NO.
                                        MOV     (SP)+,R3        ;RESTORE R3
                                        MOV     (SP)+,R0        ;RESTORE R0
                                        RTS     PC              ;RETURN TO CALLER


                                ; PARITY ENABLE/DISABLE ROUTINE
                                ;
                                ;       THIS ROUTINE ENABLES OR DISABLES PARITY MODULES AND PRINTS ASSOCIATED MEASSAGES.
                                ;       IF PARITY AVAILABLE THEN BIT13 OF "REL" IS SET AND "PAR"ITY IS PRINTED.
                                ;       ALSO THE BACKGROUND TEST PATTERN (LOC. BAKPAT) IS SET-376
                                ;
                                ;REGISTER USAGE.
                                ;R0- POINTS TO BUS TIMEOUT TRAP VECTOR (LOC. 4)
                                ;R1= HOLDS PARITY MODULE UNIBUS ADDRESS.
                                ;R2= ON ENTRY HOLDS ENABLE/DISABLE CODE .
                                ;       IF R2=0 THEN DISABLE
                                ;       IF R2=1 THEN ENABLE
                                ;R3- SCRATCH TO SETUP LOC. PARMAP WITH A MAP OF PARITY MODULES PRESENT.

                                ;CALL IS
                                ;       MOV     #1,R2   ;ENABLE CODE
                                ;       JSR     PC,PARITY

 007520  032777  004000  170722  PARITY: BIT     #4000,@SWR      ;PARITY TEST WANTED?
 007526  001456                  6$              ;BRANCH IF NO

 007530  012700  000004          MOV     #4,R0           ;POINT R0 TO BUS TIMEOUT ADDRESS.
 007534  012710  000116          MOV     #5$-.-6,(R0)    ;SET RETURN FROM TIMEOUT TRAP TO 5$
 007540  060710                  ADD     PC,(R0)         ;IN THE CURRENT BANK.
 007542  005037  000352  1$:     CLR     @#PARMAP        ;CLEAR PARITY MAP HOLDER.
 007546  012701  172140          MOV     #172140,R1      ;SET R1 TO LAST PARITY MODULE ADDRESS+2
 007552  012703  100000          MOV     #100000,R3      ;SET R3 TO PARMAP AVAILABLE CODE BEGIN.
 007556  010241          2$:     MOV     R2,-(R1)        ;ENABLE A PARITY MODULE+TRAP IF NOT AVAILABLE.
 007560  050337  000352          BIS     R3,@#PARMAP     ;NO TRAP TO 5$, SO SET PARITY AVAILABLE.
 007564  000241                  CLC
 007566  006003          3$:     ROR     R3              ;SETUP NEXT PARMAP BIT
 007570  103372                  BCC     2$              ;BRANCH IF NOT DONE ALL PARITY ADDRESSES.
 007572  012710  000104          MOV     #BUSER,(R0)     ;RESET BUS TIMEOUT TRAP VECTOR
 007576  005702                  TST     R2              ;IS THIS A DISABLE CALL?
 007600  001431                  BEQ     6$              ;BRANCH IF YES (EXIT)
```

```
3258  007602  005737  000352          TST     @#PARMAP        ;WERE ANY PARITY MODULES FOUND?
3259  007606  001011                  BNE     4$              ;BRANCH IF YES
3260  007610  004767  176770          JSR     PC,TPCRLF       ;PRINT 'NO PAR''
3261  007614  047516  050040  051101  .ASCIZ  /NO PAR/
3262  007622     000
3263          007624                  .EVEN
3264  007624  004767  176336          JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
3265  007630  000053                  53                      ;******ERROR NUMBER 53******
3266
3267
3268  007632  152737  000040  000405  4$:     BISB    #40,@#REL       ;SET PARITY UNDER TEST FLAG
3269  007640  012737  000376  000316          MOV     #376,@#BAKPAT   ;SET BACKGROUND PATTERN TO
3270                                          ;WORST CASE PARITY CODE.
3271  007646  004767  176732          JSR     PC,TPCRLF       ;PRINT 'TST PARITY''
3272  007652  040520  000122          .ASCIZ  /PAR/
3273                                  .EVEN
3274  007656  000405                  BR      EXITC           ;AND EXIT VIA RTS PC
3275
3276                          ;GET HERE IF PARITY ADDRESS TIMED OUT TO LOC. 4
3277
```

```
3278  007660  022626                  5$:     CMP     (SP)+,(SP,+     ;RESET STACK FROM TRAP
3279  007662  000741                          BR      3$              ;KEEP TRYING PARITY ADDRESES.
3280
3281  007664  142737  000040  000405  6$:     BICB    #40,@#RFL       ;CLEAR PARITY TESTING FLAG
3282  007672                          EXITC:
3283  007672  000207                  7$:     RTS     PC              ;RETURN TO CALLER
3284
3285
3286
3287
3288                                  ;CHECKC
3289                                  ;       THIS ROUTINE CHECKS IF CONTROL-C WAS TYPED AT THE END OF EACH
3290                                  ;TEST OR IN THE ERROR TYPE ROUTINE.
3291                                  ;IF CONTROL-C TYPED THE PROGRAM IS RETURNED TO LOWER MEMORY IF IT WAS
3292                                  ;RELOCATED AND THE ERROR HISTORY IS PRINTED OUT.
3293                                  ;FINALLY IT HALTS AT FATHLT.
3294
3295  007674  105037  000315          CHECKC: CLRB    @#SAVKBB        ;INIT CONTROL-C FLAG.
3296  007700  105737  177560                  TSTB    @#TKS           ;ANY CHAR. TYPED?
3297  007704  100372                          BPL     EXITC           ;BR IF NO-EXIT VIA RTS PC-
3298  007706  113702  177562                  MOVB    @#$KBB,R2       ;GET THE CHAR TYPED.
3299  007712  042702  000200                  BIC     #200,R2 ;CLEAR THE PARITY BIT.
3300  007716  122702  000003                  CMPB    #3,R2           ;IS IT CONTROL-C?
3301  007722  001363                          BNE     EXITC           ;BRANCH IF NO -EXIT VIA RTS PC-
3302  007724  110237  000315                  MOVB    R2,@#SAVKBB     ;ELSE STORE THE CHAR. FOR USE AS A FLAG.
3303  007730  004767  176650                  JSR     PC,TPCRLF       ;PRINT "^C"
3304  007734  041536    000                   .ASCIZ  /^C/
3305          007740                          .EVEN
3306  007740  000167  175132                  JMP     RELOER          ;GO RETURN PROGRAM TO LOWER CORE IF RELOCATED.
3307
3308          007744                  .-7744
3309  007744  000000                  ENDPRG: 0               ;THIS BEGINS THE STORAGE FOR THE ERROR HISTORY
3310                                                          ;STACK.FOR EACH 4K BANK 18. BYTES ARE SAVED.
3311                                                          ;ALSO THE ABSOLUTE LOADER AND XXDP CODE IS SAVED
3312                                                          ;AFTER THE ERROR STACK.
3313                                                          ;FOR 4K MEMORY SIZE THEN PROGRAM=7744+22=7776
3314          000001                          .END
```

```
ABASE = 000000           1200
ACDW1 = 000000           1200
ACDW2 = 000000           1200
ACPUOP= 000000           1200    1215
ACT11   005552           2694    2700#
ADDW0 = 000000           1200
ADDW1 = 000000           1200
ADDW10= 000000           1200
ADDW11= 000000           1200
ADDW12= 000000           1200
ADDW13= 000000           1200
ADDW14= 000000           1200
ADDW15= 000000           1200
ADDW2 = 000000           1200
ADDW3 = 000000           1200
ADDW4 = 000000           1200
ADDW5 = 000000           1200
ADDW6 = 000000           1200
ADDW7 = 000000           1200
ADDW8 = 000000           1200
ADDW9 = 000000           1200
ADEVCT= 000000           1200    1206
ADEVM = 000000           1200
AENV  = 000000           1200    1211
AENVM = 000000           1200    1212
AFATAL= 000000           1200    1203
AMADR1= 000000           1200    1228
AMADR2= 000000           1200    1232
AMADR3= 000000           1200    1235
AMADR4= 000000           1200    1238
AMAMS1= 000000           1200    1222
AMAMS2= 000000           1200    1230
AMAMS3= 000000           1200    1233
AMAMS4= 000000           1200    1236
AMSGAD= 000000           1200    1208
AMSGLG= 000000           1200    1209
AMSGTY= 000000           1200    1202
AMTYP1= 000000           1200    1223
AMTYP2= 000000           1200    1231
AMTYP3= 000000           1200    1234
AMTYP4= 000000           1200    1237
APASS = 000000           1200    1205
APRIOR= 000000           1200
APTHLT  006230           2721    2837#
APTSIZ  000724           1300    1314#
ASWREG= 000000           1200    1213
ATESTN= 000000           1200    1204
AUNIT = 000000           1200    1207
AUSWR = 000000           1200    1214
AVECT1= 000000           1200
AVECT2= 000000           1200
BAKPAT  000316           1026    1160#   1268*   1491    1705    1707    1715    1726*   1790    1822*   2004*   2039    2074*
                         2126    2132    2136    2149    2152    2191*   2288    2344*   2345    2529*   3269*
BEGIN   000500           1034    1163    1184    1248#   2548    2559    2565
BRTFSZ  001012           1332#
BUSER   000104           1007#   1382    3081    3255
```

```
CHECKC  007674          1547    2812    3295#
CKDONE  005144          2534    2557    2567#
CLRMEM  001540          1485#   2599
CLRMM   007420          1417    1439    2711    3184#
CNTSCP  001672          1546    1549#
CONT    001600          1502#   1560
CONTMM  005172          2531    2578#
CTLC    005620          2691    2720#
DECWRD  000312          1146#   1147    2660*   2663*   2698*   2978
ENDPAS  005334          2576    2636#
ENDPRG  007744          1072    1266    2640    2757    3309#
ENDSTK  000310          1143#   1144    1404*   2644    2714
END0    002164          1647#   1689
END1    002264          1689#   1729
END10   004030          2196    2204#   2347
END12   004354          2347#   2459    2491
END2    002374          1729#   1825
END3    002642          1825#   1864
END4    002752          1864#   1950
END5    003120          1950#   2006
END6    003254          2006#   2082
END7    003500          2082#   2204
ERROR   005630          1604    1667    1721    1786    1850    1890    1897    1924    1982    2056    2137    2153    2162
                        2307    2315    2444    2456    2473    2731#   2883
ERRTYP  005746          2764#
EXITC   007672          3274    3282#   3297    3301
EXTYP   006602          2944    2951    2956#
FAILNM  005432          2659    2663#   2676
FATERR  006166          1279    1327    1450    1474    1632    2826#   2894    3088    3264
FATHLT  006236          2804    2839#
FATYP   007010          2836    3031#
FNDERR  006114          2801#   2838
GALLOP  003526          2119#   2254
GETADR  007332          1330    1331    3141#
GETBNK  007440          2516    2738    3198#
GETSIZ  007350          2580    2591    2596    3159#
HIGHAD  000332          1171#   1316
HIGHTW  000330          1170#   1315    1392
LOOP    001610          1505#   1558
LOWADD  000326          1168#
LOWBNK  000304          1136#   1137    2025*   2037    2072
LOWER   005150          2567    2571#
LOWTWO  000324          1167#   1385    1441    2579
M       =  000200        982#   2473
MAXADR  005262          2594    2597    2608#
MAXMEM  000340          1177#   1314    1408*   1624    1819    2545    2561
MEMMNG  007064          1357    2573    3057#
MEMTST  001532          1479#
MMAVA   000276          1118#   1121    1359    2530    2575    3058*   3066*   3108    3184    3187*   3205
MMREG   007070          1370    2590    3058#   3094
N       000054           982#   1279    1282#   1327    1330#   1450    1453#   1474    1477#   1575    1578#   1589    1591#
                        1592    1595#   1600    1602#   1632    1635#   1659    1662#   1667    1670#   1702    1705#   1721
                        1724#   1746    1749#   1771    1773#   1781    1783#   1797    1799#   1834    1837#   1850    1853#
                        1883    1886#   1890    1893#   1897    1900#   1924    1927#   1972    1975#   1982    1985#   2021
                        2024#   2056    2059#   2113    2116#   2137    2140#   2153    2156#   2162    2165#   2239    2242#
                        2279    2282#   2307    2310#   2315    2318#   2380    2383#   2444    2447#   2456    2459#   2473
```

```
                    2476#  2883   2886#  2893   2897#  3088   3091#  3264   3267#
NOMM     007210     3063   3084#
NOTYP    006470     2927#  2963   2965
OCTTYP   006744     1387   1391   3015#
OCTXT    007062     3011   3014   3047#
ONEPAS   000556     1260   1263#
PARERR   006244     1256   2856#
PARFL    005470     2656   2675#
PARITY   007520     1490   2689   3241#
PARMAP   000352     1185#  2862   3247*  3251*  3258
PARPS    000360     1188#  2857*  2888
PARSP    000356     1187#  2856*  2889
PASFLG   000306     1138#  1142   1502*  1860*  1928*  1945*  1977*  1988   1990*  2003*  2024*  2047   2063*
                    2065   2070   2285*  2302   2322   2328*  2329   2337*  2338   2427   2434   2449   2467
                    2484   2494*  2505*  2522*  2746
PBNK     000312     1145#  2739   3215*
PCRLF    006572     1386   2953#  2958   2975   3012
PNTMES   006612     1034   2246   2512   2542   2906   2914   2962#
PUTADR   007242     1374   1377   2794   3106#
PWRDN    000070     1000#  1252
PWRUP    000136     1000   1033#
REL    = 000405     1113#  1259   1465   2407   2535   2537*  2556   2563*  3268*  3281*
RELBOT   000322     1163#  1467
RELOC    005004     1527   2529#
RELOER   005076     2536   2555#  3306
RESTRT   000250     1048   1064   1066   1072#  2709   2840
RETMM    007206     3061   3082#
RETSTK   005374     2647#  2651   2674
RETTYP   006530     2931   2940#
RLODER   005576     2702   2711#  2720
RPTOCT   007000     2671   3028#  3046
RPT10    003522     2117#  2203   2249
RPT11    004070     2199   2202   2245   2248#
RPT6     003140     1975#  2005
SAVKBB   000315     1150#  2571   2690   3295*  3302*
SAVLDR   001314     1410   1412   1417#
SAVLOC   000354     1186#  1998*
SAVMAX   000342     1179#  1477
SAVR0    006414     2860*  2886   2900#
SAVR1    006416     2861*  2887   2901#
SAVR4    000344     1180#  2712
SAVR5    000346     1073   1181#  1438*  2555   2564*
SAVR6    000350     1033   1058   1184#  1251*  1608   2566*  2858
SCOPE  = 000240      983#
SEQERR   006166     1575   1659   1702   1746   1834   1883   1972   2021   2113   2239   2279   2380   2827#
SETSTK   001220     1265   1392#
SETSWR   000656     1290#
SLFSIZ   001024     1341#
SR0    = 177572     1159#  3065*  3079*  3186*
START    000200     1041   1056#
STRTDI   000302     1134#  1135   2035*  2064
SWAPAT   000320     1162#  2157   2161   2190*
SWHALT   001712     1555#
SWR      000450     1245#  1293   1296*  1301*  1334   1448   1494   1553   1557   1618   2244   2248   2508
                    2533   2636   2693   2778   2807   2962   3010   3060   3241
SWREG    000176     1051#  1296
```

```
SW11   = 004000   982#
TBL      001626  1511  1515#  1516  1517  1518  1519  1520  1521  1522  1523  1524  1525  1526
                 1527
TKS    = 177560  1155#  3296
TPADER   006420  2658  2787  2904#
TPCRLF   006604  1067  2695  2827  2958#  2966  3085  3260  3271  3303
TPPRER   006644  2675  2783  2912#
TRYSR    001014  1318  1334#
TSTGO    001714  1554  1557#
TSTMM    005156  1453  2573#
TSTREL   001372  1261  1438#
TSTRP    000570  1264  1266#
TSTSCP   0C1660  1545#  1647
TSTSIZ   001376  1439#
TST0     001730  1515  1573#
TST1     002166  1516  1655#
TST10    003502  1523  2110#
TST11    004032  1524  2236#
TST12    004104  1525  2277#  2346
TST13    004356  1526  2378#
TST2     002266  1517  1699#
TST3     002376  1518  1744#  1823
TST4     002644  1519  1832#
TST5     002754  1520  1880#
TST6     003122  1521  1968#
TST7     003256  1522  2018#
TYPCNT   000314  1148#  1254*  2670*  2792*  2832*  3018*  3045*
TYPDEC   006634  2662  2975#
TYPENB   000277  1122#  1125  2764*  2780*  2904  2912
TYPEOP   005526  2695#
TYPERR   006722  2796  3010#
TYPMEM   001206  1388#
TYPOCT   006754  3013  3019#
TYPSIZ   001164  1332  1335  1382#
TYPSTK   005354  2642#  2648
UPMM     007234  2578  3093#
WRTMEM   000120  1025#  1750  1886  1975
$A     = 000001   402#  404  405#  407  408#  412  413#  417  418#  423  424#  429  430#
                  436  437#  442  443#  447  448#  451  452#  455  456#  459  460#  463
                  464#  467  468#  471  472#  475  476#  479  480#  484  485#  488  489#
                  492  493#  496  497#  500  501#  502  503#  510  511#  514  515#  518
                  519#  529  530#  533  534#  542  543#  546  547#  549  550#  555  556#
                  559  560#  563  564#  567  568#  575  576#  579  580#  583  584#  589
                  590#  594  595#  601  602#  607  608#  611  612#  616  617#  620#
$ADERR   000301  1130#  1133  1596*  1719*  1783*  1848*  2768  2785
$APTHD   000276  1098  1104#  1117
$CNTMM   005176  2577  2579#
$CPUOP   000426  1215#
$DEVCT   000410  1206#  1552*  2062*  2186*
$DJAGN   005572  2701  2709#
$ENDAD   000156   994  1044#  2707
$ENV     000420  1211#  1299  1545  2801  2837
$ENVM    000421  1212#  1317  1616  2946
$EOP     005476  2637  2645  2688#
$ETABL   000420  1210#
$ETEND   000450  1110  1239#
```

```
$FATAL  000402  1203# 2731* 2740* 2748  2831* 2834
$GTSIZ  007346  1393  3156#
$HD   = 000002   973
$HIBTS  000276  1105#
$HIMAX  000334  1174#  1315*
$KBB  = 177562  1156#  3298
$MADR1  000432  1228#
$MADR2  000436  1232#
$MADR3  000442  1235#
$MADR4  000446  1238#
$MAIL   000400  1061   1106   1110   1201#  1271   1286
$MAMS1  000430  1222#
$MAMS2  000434  1230#
$MAMS3  000440  1233#
$MAMS4  000444  1236#
$MAXM   000336  1175#  1316*  1401
$MBADR  000300  1106#
$MSGAD  000414  1208#
$MSGLG  000416  1209#
$MSGTY  000400  1007*  1202#  2803*
$MTYP1  000431  1223#  1324
$MTYP2  000435  1231#
$MTYP3  000441  1234#
$MTYP4  000445  1237#  1320
$NWTST= 000001  1561#  1563   1650#  1652   1691#  1693   1733#  1735   1826#  1828   1866#  1868   1952#
                1954   2007#  2009   2083#  2085   2208#  2210   2255#  2257   2348#  2350
$PASS   000406  1205#  1263   2692*  2698
$PASTM  000304  1108#
$PRERR  000300  1126#  1129   1253*  2765   2781   2798*  2882*
$RETMM  007200  3080#  3091
$SVPC = 000044   992#   997
$SWR  = 000000   973#   982#  1574   1656   1700   1745   1833   1881   1969   2019   2111   2237   2278
                2379
$SWREG  000422  1213#  1301
$TESTN  000404  1065   1113   1204#  1503*  1549   1573   1655   1699   1744   1832   1880   1968   2018
                2110   2168   2176   2201   2236   2277   2378
$TN   = 000014   963#   973   1561   1574#  1650   1656#  1691   1700#  1733   1745#  1826   1833#  1866
                1881#  1952   1969#  2007   2019#  2083   2111#  2208   2237#  2255   2278#  2348   2379#
$TPB  = 177566  1158#  2950*
$TPCHR  006546  2937   2946#  3037
$TPDEC  006640  2517   2664   2699   2977#
$TPNUM  007012  3027   3032#
$TPS  = 177564  1157#  2948
$TPSTK  005344  2572   2638#
$TSTM   000302  1107#
$TYPE   006504  1388   2932#  2953   2959   2990   3028
$UNIT   000412  1059   1207#
$UNITM  000306  1109#
$USWR   000424  1214#
$Z    = 000362  1193#
$ZZ   = 007744  3308#
$$M   - 000200  2473#
.     - 007746   980#   985#   992    993#   995#   997#   999#   1003#  1011#  1050#  1094   1095#  1097#
                1099#  1117#  1121#  1125#  1129#  1133#  1135#  1137#  1142#  1144#  1147#  1193   1196#
                1247#  1256   1511   1574   1629   1658   1701   1745   1833   1882   1971   2020   2112
                2238   2278   2379   2500   2757   2955#  3245   3263#  3305#  3308#
```

```
CZKMA   MACY11 30A(1052)  05-MAR-79  09:02  PAGE 79
CZKMAF.P11    05-MAR-79 09:02          CROSS REFERENCE TABLE -- USER SYMBOLS                SEQ 0078

.$X    = 000276           1094#    '099


. ABS.  007746     000


 ERRORS DETECTED:  0

 DSKW:CZKMAF,CZKMAF/SOL/CRF/NL:TOC=CZKMAF.P11
 RUN-TIME: 10 10 .6 SECONDS
 RUN-TIME RATIO: 111/21=5.1
 CORE USED:  11K  (21 PAGES)
```