MF11S-K

MEMORY DIAGNOSTIC

MD-11-DZMML-B

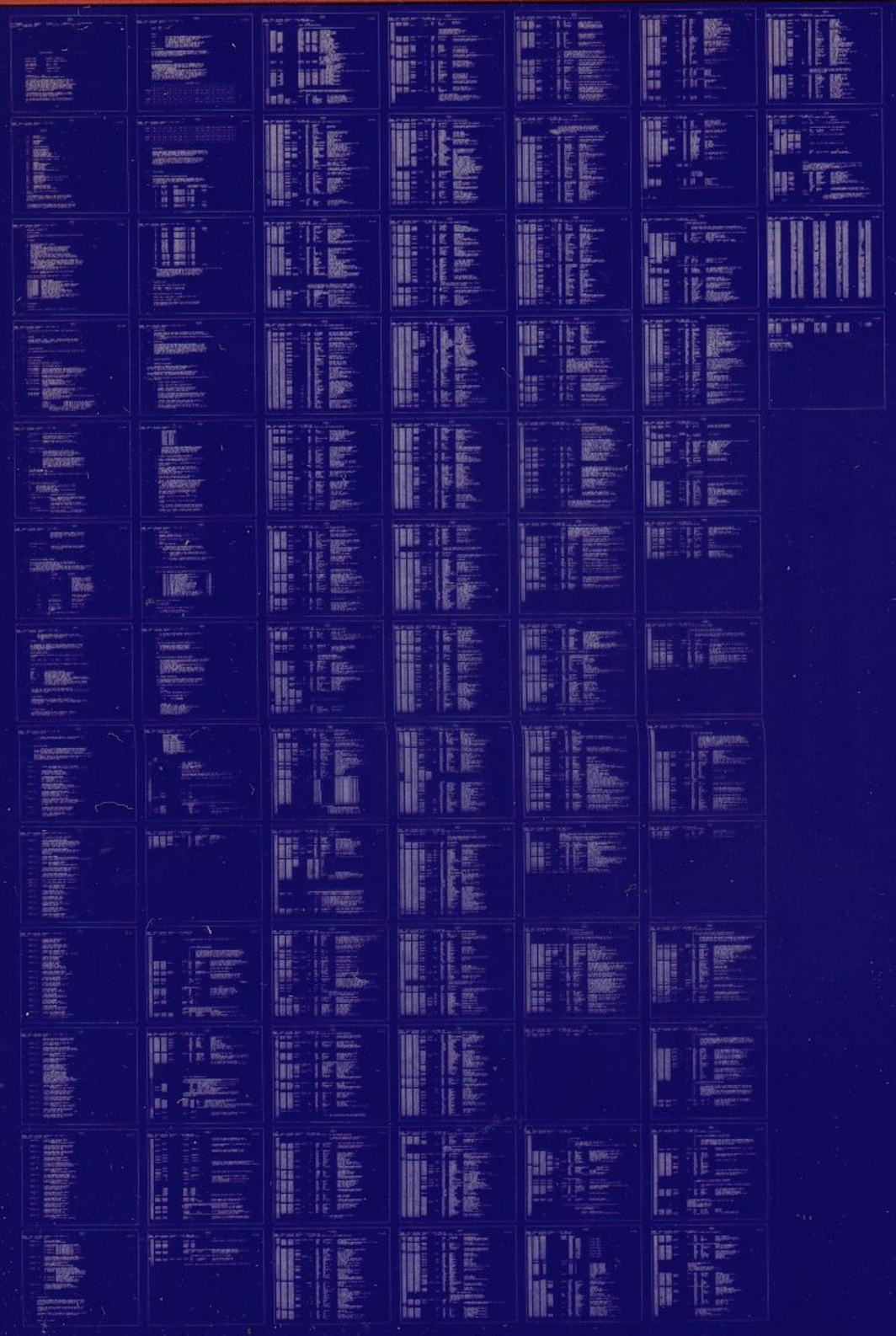
EP-DZMML-B-DL-A

FICHE 1 OF 1

OCT 1977

digital

MADE IN USA



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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DZMML-B-D

PRODUCT NAME: MF11S-K MEMORY DIAGNOSTIC

DATE CREATED: MAY 1 , 1977
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MAINTAINER: DIAGNOSTIC GROUP

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1.0 ABSTRACT

THIS DIAGNOSTIC WILL TEST 0 - 124K OF MF11S-K MEMORY
ON ANY PDP-11 FAMILY COMPUTER THAT DOES NOT PERFORM
A DATIP CYCLE BEFORE A DATO CYCLE FOR ALL INST-
RUCTIONS.

THIS PROGRAM CAN BE RUN UNDER XXDP, APT AND ACT MONITORS.
ON PROCESSORS WITH NO HARDWARE SWITCH REGISTER, SOFTWARE
SWITCH REGISTER = LOCATION 176 AND SOFTWARE DISPLAY

D01

REGISTER = LOCATION 174.

[1.1] GETTING STARTED

IF NO HARDWARE SWITCH REGISTER SET LOCATION 176 TO OBTAIN SWITCH OPTIONS.

TO START:

A. SET SWITCH REGISTER = 00000
B. START AT 200.
C. THE ADDRESS OF THE CONTROL AND STATUS REGISTER (CSR) AND THE MEMORY LIMITS IT CONTROLS WILL BE PRINTED. IF TWO CONTROLLERS ARE PRESENT, BOTH CSR ADDRESSES WILL BE TYPED AS WELL AS BOTH MEMORY LIMITS.
D. SEE SECTION 4.4 FOR REST OF PRINTOUTS EXPECTED.
E. "END PASS #01" WILL BE TYPED . THIS IS A QUICK VERIFY PASS AND THE TEST IS NOT COMPLETE UNTIL "END PASS #02" IS TYPED.
F. TO HALT THE TEST, TYPE CONTROL-C. THIS WILL INSURE THE PROGRAM IS RELOCATED BACK TO LOWER MEMORY AND THAT THE MEMORY HAS BEEN PURGED OF ANY DOUBLE ERRORS FORCED DURING TESTING.
   BE PATIENT, THE CONTROL-C IS ONLY RECOGNIZED AT THE END OF THE CURRENT SUBTEST.
G. IF AN UNEXPECTED HALT OCCURS SEE SECTION 6.0. IF AN ERROR # IS TYPED SEE SECTION 6.2.

   !CAUTION! BEFORE "DIGGING" INTO THE LISTING READ SECTION 9.

SWITCH SETTING SUMMARY (SEE SECTION 4.1 FOR DETAILS)

BIT15(100000)	HALT ON ERROR
BIT14(040000)	LOOP IN SUBTEST DEFINED BY BITS <4:0>
BIT13(020000)	INHIBIT ERROR PRINTOUTS
BIT12(010000)	DISABLE TESTING ABOVE 28K (MEMORY MANAGEMENT)
BIT11(004000)	ENABLE PRINTOUTS OF SINGLE ARRAY ERRORS
BIT10(002000)	HALT AFTER EACH SUBTEST
BIT09(001000)	INHIBIT PROGRAM RELOCATION
BIT08(000400)	TYPE FIRST FAILING BIT ERROR PER 4K.
BIT07(000200)	ENABLE XOR PRINTOUT FOR ARRAY TESTS
BIT06(000100)	INHIBIT MEMORY SIZING
BIT05(000040)	INHIBIT "END PASS #XX" AND "RELOC" PRINTOUTS
BIT04	TO CLEAR MEMORY OF DBE'S(NO TESTS RUN)
BIT03-BIT00	BEGINNING TEST NUMBER.

[2.0] REQUIREMENTS

[2.1] EQUIPMENT

STANDARD 11 FAMILY COMPUTER WITH A CONSOLE OUTPUT DEVICE

AND FROM 32K TO 124K OF MS11K MEMORY (WITH EXCEPTION IN 1.0) .

[2.2] STORAGE

PROGRAM STORAGE - 0000 - 14200. PROGRAM EXPANDS FOR ERROR
HISTORY AND TO SAVE ABSOLUTE LOADER OR XXDP CHAIN MONITOR.
(SEE SECTION 9. FOR DETAILS)

[3.0] LOADING PROCEDURE

USE STANDARD PROCEDURE FOR PDP-11 ABSOLUTE BINARY FORMATTED TAPES.

[4.0] STARTING PROCEDURE

[4.1] SWITCH SETTINGS

SOFTWARE SWITCH REGISTER = LOCATION 176

BIT15(100000) HALT ON ERROR (SEE 5.0)

BIT14(040000) LOOP ON TEST DEFINED BY SWITCH REGISTER BITS <4:0>
BIT13(020000) INHIBIT ERROR PRINTOUTS AND ERROR HISTORY PRINTOUTS.
ERROR HISTORY CAN STILL BE OBTAINED BY TYPING ↑C.
BIT12(010000) DISABLE TESTING ABOVE 28K. (MEMORY MANAGEMENT)

BIT11(004000) ENABLE PRINTOUTS OF SINGLE ERRORS ON ARRAY TESTS
(DISABLES ECC FOR ARRAY TESTS)

BIT10(002000) HALT AFTER EACH SUBTEST
!PRESS CONTINUE TO DO NEXT SUBTEST
BIT09(001000) INHIBIT PROGRAM RELOCATION
!IF SET LOCATIONS 430-7776 WILL NOT BE
!TESTED.

BIT08(000400) TYPE FIRST UNCORRECTABLE ERROR IN EACH 4K BANK ONLY.
!THE TOTAL ERROR COUNT (UP TO 377) WILL
!BE SAVED IN THE ERROR HISTORY.
BIT07(000200) ENABLE XOR PRINTOUT FOR ARRAY TESTS
BIT06(000100) INHIBIT MEMORY SIZING.
!THE MEMORY LIMITS MUST BE SETUP IN THE FOLLOWING LOCATIONS:
(VALUES TO TEST 0-28K ARE SHOWN)
(LOWTWO=LOCATION 332)

```
LOWTWO: 0               ;STORE BITS 17:16 OF LOW TEST ADDRESS
LOWADD: 0               ;STORE REST OF LOW TEST ADDRESS
HIGHTWO: 0              ;STORE BITS 17:16 OF HIGH TEST ADDRESS
HIGHADD: 157776         ;STORE REST OF HIGH TEST ADDRESS
NOTE: HIGHADD MUST BE SET TO A 4K BOUNDARY. (E.G. 37776)
        AND LOCATION LDFLG MUST = 1 IF THE PROGRAM
        IS RESIDING IN THE MS11K MEMORY.
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BIT05(000040) INHIBIT "END PASS #XX" AND "RELOC" PRINTOUTS

BIT04 SCANS MEMORY WITH ECCDIS. NO TESTS RUN.
TERMINATE AFTER PASS#1 WITH ↑C.

BIT03-BIT00 NUMBER OF TEST (0-17) TO RUN FIRST.
!NORMALLY USED WITH BIT14 (LOOP ON TEST)

[4.2] CONTROL-C FUNCTION

CONTROL C [↑C] AFTER COMPLETION OF THE CURRENT TEST.
THE ERROR HISTORY (SEE SEC. 6.3) WILL BE
TYPED. THE PROGRAM WILL LOOP IN LOWER MEMORY.
HALT AND RESTART AT 250 IF DESIRED.

IN ORDER TO COMPLETELY TEST THE ERROR CORRECTING
LOGIC, DOUBLE ERRORS ARE FORCED INTO MEMORY ON
CERTAIN TESTS. TO EXIT FROM THE PROGRAM AND HALT
EXECUTION, ↑C MUST BE TYPED AND THE TEST
PERMITTED TO CLEAN UP THE MEMORY UNDER TEST. IF
NOT, THERE EXISTS THE POSSIBILITY OF UNCORRECT-
ABLE ERRORS REMAINING IN THE MEMORY.

[4.3] STARTING ADDRESS= 200
RESTART ADDRESS = 250 OR 200

RESTART AT 200 CLEARS PASS COUNT ($PASS) AND PRINTS "DZMML-A" TITLE.

[4.4] PROGRAM AND/OR OPERATOR ACTION

1) LOAD PROGRAM INTO MEMORY USING ABSOLUTE LOADER.
2) SET OPTIONS (SEE SEC. 4.1)
3) START THE PROGRAM AT 200
4) THE FOLLOWING IS AN EXAMPLE WITH EXPLANATIONS
OF THE PRINTOUTS EXPECTED.

"XXXXX-YYYYY" ;ADDRESSES OF TEST BOUNDARIES.

"NO RELOC-SBE IN LOC 0-500" ;RELOCATION IS INHIBITED BECAUSE
;SINGLE ERRORS IN THIS AREA WILL CORRUPT
;PROGRAM WHEN RELOCATED.

"RELOC" ;THE DIAGNOSTIC RELOCATES TO HIGHEST
;BANK UNDER TEST. AND RUNS TST0-TST13 AGAIN.

"END PASS #XX" ;WHERE "XX" IS THE PASS NO.

"TST7-NO ERROR FREE LOC IN SLICE AT XXXXXX" THE LAST PART OF
TEST 7 CHECKS FOR PROPER 1K ADDRESSES IN

THE CSR AFTER A DOUBLE ERROR. THIS MES-
SAGE INDICSTES THAT THIS SLICE COULD NOT
BE TESTED AND IT IS PROCEEDING TO THE
NEXT 1K SLICE.

ADDITIONAL PRINTOUTS

"NO MNG" ;PRINTED IF TESTING ABOVE 28K IS ENABLED
;(BIT 12 OF SWR) AND MEMORY MANAGEMENT IS
;NOT AVAILABLE.

[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 ITS 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 2362[SWHALT] AND ADDING THIS DIFFERENCE TO THE
CONTENTS OF SAVR6 [LOC. 352].

PC	REASON	RECOVERY
112	TRAP TO LOC. 4	EXAMINE R6, IT CONTAINS THE POINTER TO THE PC WHERE THE TRAP OCCURRED. (SEE NOTE) THE PROGRAM WILL LOOP AT LOC BUSER UNTIL MANUALLY HALTED. CHECK THE LOCATION POINTED TO BY MINMEM(324) TO INSURE THAT NO DBE'S REMAIN IN THE TESTED AREA.
100	POWER FAIL	POWER UP WILL RECOVER IF IN CORE MEMORY.
2364	HALT AT END OF TEST SWITCH SET.	PRESS CONTINUE TO GO TO NEXT SUBTEST.
13624	HALT ON ERROR	RESTART AT 250
13712	CONTROL-C TYPED OR FATAL ERROR OCCURRED	RESTART AT 250

NOTE: ANY OF THE ABOVE HALT CONDITIONS THAT PERTAIN TO

APT ACTUALLY RESULT IN A TIGHT LOOP SO THAT THE
ERROR INFORMATION CAN BE RECOVERED. CONSULT LISTING
FOR MORE DETAIL, IF NECESSARY.

[6.0] ERRORS

ANY REFERENCE TO 'ERROR' IN THIS DOCUMENT INDICATES AN ERROR
AS DEFINED BY THE PROGRAM AT EXECUTION TIME. NORMALLY, IT IS
AN UNCORRECTABLE ERROR UNLESS ERROR CORRECTING IS DISABLED
THEN IT MEANS ALL ERRORS.

[6.1] ERROR MESSAGE FORMAT

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

"ADDR GOOD BAD PC ERR # PASFLG XOR "

"ADR ERR" WILL BE PRINTED PRIOR IF AN ADDRESSING ERROR IS SUSPECTED.

WHERE:

ADDR	=	FAILING MEMORY LOCATION
GOOD	=	GOOD DATA [DATA THAT WAS EXPECTED]
BAD	=	BAD DATA [DATA THAT WAS FOUND]
PC	=	PROGRAM COUNTER AT ERROR CALL.
ERR #	=	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)
XOR	=	EXCLUSIVE 'ORING' OF GOOD VS. BAD (BITS IN ERROR). AVAILABLE ONLY IF SINGLE ERRORS ARE TO BE PRINTED OUT VIA SWREG BIT 07 HIGH.

!THE TEST WILL CONTINUE AFTER THE ERROR PRINTOUT.
!"NO MNG" WILL BE TYPED IF TESTING ABOVE 28K SELECTED AND NO MEMORY
!MANAGEMENT IS FOUND.

(FATAL ERRORS)

"ERROR #XXXXXX" WILL BE TYPED WHERE "XXXXXX" IS
THE ERROR NUMBER. THE DIAGNOSTIC WILL LOOP AT FATHLT UNTIL MANUALLY
HALTED. 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 LOOPS AT FATHLT.

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                $FATAL CONTAINS THE ERROR NO. IN THE LOW BYTE AND
            THE FAILING BANK NO. UNDER TEST IN THE HIGH BYTE.



    [6.2]   ERROR DICTIONARY

                THIS IS A LIST OF ERROR NUMBERS PRINTED AND POSSIBLE
            CAUSES FOR THE ERROR. IF THE ERROR IS SUCH THAT THE TESTING
            CAN BE CONTINUED AFTER THE ERROR PRINTOUT, IT WILL DO SO.
                THE ROUTINE NAME WHERE THE ERROR CALL ORIGINATED IS GIVEN IN
            BRACKETS.
            NOTE- "BAKPAT" REFERS TO THE BACKGROUND PATTERN WRITTEN INTO MEMORY
            FOR VARIOUS TESTS. BAKPAT HAS THE VALUE = 377, AND
            SWAPAT HAS THE VALUE = 177400.

    .ENDR


    ;ERROR # 0       ;[BUSER] BUS ERROR TRAP TO LOC. 4 OCCURRED
                     ;       THIS ERROR IS NOT PRINTED AND IS FOR "APT" USE.

    ;ERROR # 1       ;[BEGIN]FATAL LOAD ERROR
                     ;DOUBLE ERROR EXISTS IN AREA
                     ;OF MEMORY THAT PROGRAM RESIDES

    ;ERROR # 2       ;[TSTTRP]FATAL DATA ERROR
                     ;LOCATIONS 0000-430 FAILED 1'S + 0'S TEST.
                     ;R0 = GOOD DATA
                     ;R1 = ADDRESS OF FAILING LOCATION.

    ;ERROR # 3       ;[APTSIZ] APT FATAL ERROR
                     ;APT MEMORY TABLES NOT SETUP CORRECTLY.
                     ;CHECK LOCATIONS $MAMS1 [430] TO $MADR4[446]
                     ;, FOR CORRECT MEMORY SIZE DATA.

    ;ERROR # 4       ;[TSTSIZ]  OPERATOR FATAL ERROR
                     ;SELECTED MEMORY SIZE GREATER THAN 28K, BUT
                     ;SR BIT12 (10000) SET.
                     ;CLEAR BIT12 AND RESTART AT 200.

    ;ERROR # 5       ;[TSTSIZ]  OPERATOR FATAL ERROR
                     ;LOWEST SELECTED TEST LIMIT IS HIGHER THAN
                     ;HIGHEST TEST LIMIT.  SET LOCATIONS "LOWTWO"[332]
                     ;TO "HIGHADD" [340] CORRECTLY AND RESTART
                     ;AT 200.

    ;ERROR # 6       ;[CLRMEM] TEST SELECTION FATAL ERROR
                     ;TEST SELECTED FOR LOOPING IS HIGHER
                     ;THAN HIGHEST EXISTING TEST NUMBER.

    ;ERROR # 7       ;[TSTO]  TEST SEQUENCE ERROR
                     ;TSTO HAS BEEN ENTERED OUT OF SEQUENCE
                     ;TESTN SHOULD = 00
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                        ;THE DIAGNOSTIC HAS BEEN CORRUPTED.

        ;ERROR # 10     ;[TST0] DUAL ADDRESSING ERROR
                        ;FOR THIS ERROR THE GOOD DATA PRINTED IS AN
                        ;ADDRESS.  THIS IS THE ADDRESS SELECTED WHEN
                        ;THE SAME DATA WAS WRITTEN INTO THE FAILING
                        ;LOCATION.  CHECK BANK SELECT CIRCUITRY

        ;ERROR # 11     ;[TST0] ADDRESS AND DATA ERROR
                        ;IDENTICAL TO PREVIOUS ERROR EXCEPT THE DATA
                        ;WRITTEN INTO THE FAILING LOCATION WAS IN
                        ;ERROR ALSO.

        ;ERROR # 12     ;[TST0] DATA ERROR
                        ;IF BAD DATA = 0000 COULD BE AN ADDRESSING
                        ;ERROR , ELSE COMPARE GOOD AND BAD DATA FOR FAILING BITS.

        ;ERROR # 13     ;[TST1] TEST SEQUENCE ERROR
                        ;$TEST [404] SHOULD = 01
                        ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.

        ;ERROR # 14     ;[TST1] DATA ERROR LOWER WORD (SHIFTING 1)
                        ;COMPARE GOOD AND BAD PRINTED DATA, FAILING
                        ;DATA BITS MAY SHORTED OR SWAPPED.

        ;ERROR # 15     ;[TST1] DATA ERROR UPPER WORD
                        ;COMPARE GOOD AND BAD PRINTED DATA, FAILING
                        ;DATA BITS MAY BE SHORTED OR SWAPPED

        ;ERROR # 16     [TST1] DATA ERROR LOWER WORD (SHIFTING 0)

        ;ERROR # 17     [TST1] DATA ERROR UPPER WORD (SHIFTING 0)

        ;ERROR # 20     ;[TST2] TEST SEQUENCE ERROR
                        ;$TESTN [404] SHOULD = 02
                        ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.

        ;ERROR # 21     ;[TST2] ADDRESS BIT TEST
                        ;COMPARE GOOD VS. BAD DATA
                        ;SUSPECT BYTE ADDRESSING PROBLEM

        ;ERROR # 22     ;[TST2] ADDRESS BIT TEST
                        ;COMPLEMENTING BYTE DATA
                        ;SUSPECT BYTE ADDRESSING

        ;ERROR # 23     ;[TST2] ADDRESS BIT TEST
                        ;ADDRESS BIT DID NOT GET ASSERTED
                        ;AUDRESSING PROBLEM

        ;ERROR # 24     ;[TST2] ADDRESS BIT TEST
                        ;DATA DID NOT GET COMPLEMENTED
                        ;ADDRESSING PROBLEM ?

        ;ERROR # 25     ;[TST3] TEST SEQUENCE ERROR
                        ;$TESTN [404] SHOULD = 03
                        ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.
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;ERROR # 26      ;[TST3] BYTE ADDRESSING TEST
                 ;COMPARE GOOD VS. BAD
                 ;ADDRESSING PROBLEM

;ERROR # 27      ;[TST3] BYTE ADDRESSING TEST
                 ;DATA DID NOT GET COMPLEMENTED
                 ;COMPARE GOOD VS. BAD

;ERROR # 30      ;[TST4] TEST SEQUENCE ERROR
                 ;$TESTN [404] SHOULD = 04.
                 ;       THE DIAGNOSTIC HAS BEEN CORRUPTED.

;ERROR # 31      ;[TST4] CSR ACCESS ERROR
                 ;TRAP TO 4 OCCURRED
                 ;CSR DID NOT RESPOND

;ERROR # 32      ;[TST4] CSR BIT ERROR
                 ;BIT FAILURE IN CSR
                 ;COMPARE GOOD VS. BAD
                 ;IF BAD DATA HAS SBE OR DBE
                 ;SET, SUSPECT OTHER THAN CSR

;ERROR # 33      ;[TST5] TEST SEQUENCE ERROR
                 ;$TESTN [404] SHOULD = 05
                 ; THE DIAGNOSTIC HAS BEEN CORRUPTED.

;ERROR # 34      ;[TST5] ECC INH ERROR
                 ;ECC WAS DISABLED BUT LOW WORD
                 ;OF DATA WAS CORRECTED

;ERROR # 35      ;[TST5] ECC INH ERROR
                 ;ECC WAS DISABLED BUT HIGH WORD
                 ;OF DATA WAS CORRECTED

;ERROR # 36      ;[TST5] ECC ERROR
                 ;ECC WAS ENEBLED , BUT...
                 ;LOW WORD WAS NOT CORRECTED

;ERROR # 37      ;[TST5] ECC ERROR
                 ;SINGLE ERROR BIT WAS NOT SET
                 ;AS RESULT OF PREVIOUS TEST

;ERROR # 40      ;[TST5] ECC ERROR
                 ;ECC WAS ENABLED, BUT...
                 ;HIGH WORD WAS NOT CORRECTED

;ERROR # 41      ;[TST5] ECC ERROR
                 ;SINGLE ERROR BIT WAS NOT SET
                 ;AS RESULT OF PREVIOUS TEST

;ERROR # 42      ;[TST6] TETS SEQUENCE ERROR
                 ;$TESTN [404] SHOULD = 06
                 ;       DIAGNOSTIC HAS BEEN CORRUPTED

;ERROR # 43      ;TST6] WRITE BYTE TO CLEAR SBE
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                        ;WRITING INTO BYTE WITH SINGLE ERROR
                        ;DID NOT RESULT IN CLEARING THE SBE.

        ;ERROR # 44      ;[TST6] WRITE BYTE TO CLEAR SBE
                        ;DATA COMPARE ERROR

        ;ERROR # 45      ;[TST16] WRITE BYTE TO CLEAR SBE
                        ;WRITING INTO BYTE WITH NO SINGLE ERROR
                        ;CLEARED ERROR IN THE BYTE WITH THE ERROR.

        ;ERROR # 46      ;[TST7] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 07
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 47      ;[TST7] DOUBLE ERROR STATUS
                        ;DOUBLE ERROR BIT (BIT 15)
                        ;NOT SET AFTER DBE

        ;ERROR # 50      ;[TST7] DOUBLE ERROR STATUS
                        ;TRAP THROUGH LOCATION 114
                        ;DID NOT OCCUR AFTER DBE
                        ;DISREGARD GOOD AND BAD DATA

        ;ERROR # 51      ;[TST7] DOUBLE ERROR STATUS
                        ;CSR DID NOT CONTAIN CORRECT
                        ;1K BANK POINTING TO ERROR
                        ;ADDR = ADDR WITH DBLE ERROR
                        ;GOOD DATA = 1K BANK CONTAINING DBE
                        ;BAD DATA = BANK POINTED TO BY CSR BITS 11-5
                        ;POSSIBLE MARGINAL SINGLE ERROR CAUSED
                        ;DOUBLE ERROR NOT TO BE SET.

        ;ERROR # 52      ;[TST10] TESTS SEQUENCE ERROR
                        ;$TESTN SHOULD = 10
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 53      ;[TST10] DATIP WRITE INHIBIT ON DBE
                        ;'INC' INSTRUCTION DID NIT WRITE
                        ;INHIBIT ON LOWER WORD WITH DBE

        ;ERROR # 54      ;[TST10] DATIP WRITE INHIBIT ON DBE
                        ;'INC' INSTRUCTION DID NOT WRITE
                        ;INHIBIT ON UPPER WORD WITH DBE

        ;ERROR # 55      ;[TST11] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 11
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 56      ;[TST11] INHIBIT WRITE BYTE ON DBE
                        ;WRITE BYTE DID NOT GET INHIBITED
                        ;ON LOWER WORD WITH DBE

        ;ERROR # 57      ;[TST11] INHIBIT WRITE BYTE ON DBE
                        ;WRITE BYTE DID NOT GET INHIBITED
                        ;ON UPPER WORD WITH DBE
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        ;ERROR # 60     ;[TST12] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 12
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 61     ;[TST12] WORD WRITE INHIBIT ON DBE
                        ;WORD WRITE DID NOT GET INHIBITED
                        ;ON LOWER WORD WITH DBE

        ;ERROR # 62     ;[TST12] WORD WRITE INHIBIT ON DBE
                        ;WORD WRITE DID NOT GET INHIBITED
                        ;ON UPPER WORD WITH DBE

        ;ERROR # 63     ;[TST13] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 13
                        ;DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 64     ;[TST13] DUAL ADDRESSING ERROR
                        ;IF PASFLG = 0 THEN FAILING LOCATION
                        ;AND FAILING DATA ARE DUAL ADDRESS

        ;ERROR # 65     ;[TST14] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 14
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 66     ;[TST14] ADDRESS OR DATA ERROR
                        ;IF "ADD ERR" NOT PRINTED THEN  THE
                        ;BYTE SELECT CIRCUITRY PROBABLY FAILED

        ;ERROR # 67     ;[TST15] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 15
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED

        ;ERROR # 70     ;[TST15] CHECK BIT WRITE ERROR
                        ;CHECK BITS SHOULD BE 4000
                        ;FROM WRITE OPERATION

        ;ERROR # 71     ;[TST15] CHECK BIT DATA ERROR
                        ;MARCHING MIN TO MAX
                        ;CHECK BITS SHOULD BE 3740

        ;ERROR # 72     ;[TST15] CHECKBIT DATA ERROR
                        ;MARCHING MIN TO MAX
                        ;CHECKBITS SHOULD BE 4000

        ;ERROR # 73     ;[TST15] CHECK BIT DATA ERROR
                        ;MARCHING MAX TO MIN
                        ;CHECKBITS SHOULD BE 3740

        ;ERROR # 74     ;[TST15] CHECKBIT DATA ERROR
                        ;MARCHING MIN TO MAX
                        ;CHECKBITS SHOULD BE 4000

        ;ERROR # 75     ;[TST16] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 16
                        ;       DIAGNOSTIC HAS BEEN CORRUPTED
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        ;ERROR # 76     ;[TST16] DATA ERROR
                        ;DATA WRITE OR READ ERROR.

        ;ERROR # 77     ;[TST16] 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.

        ;ERROR # 100    ;[TST16] MARCHING 1'S AND 0'S DATA ERROR
                        ;IDENTICAL TO PREVIOUS ERROR EXCEPT THE DATA IS
                        ;CHECKED IMMEDIATELY AFTER BEING WRITTEN.

        ;ERROR # 101    ;[TST17] TEST SEQUENCE ERROR
                        ;$TESTN SHOULD = 17
                        ;THE DIAGNOSTIC HAS BEEN CORRUPTED.

        ;ERROR # 102    ;[TST17] 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.

;ERROR # 103     ;[RELOC] FATAL RELOCATION ERROR
                ;A DOUBLE ERROR EXISTS IN THE AREA
                ;IN WHICH THE PROGRAM WANTS TO RELOCATE
                ;RELOCATION ABORTED.


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[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:
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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" WILL BE TYPED OUT IF ADDRESS 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.

[6.5] MOS CHIP CROSS REFERENCE

IN THE FOLLOWING MATRIX, THERE ARE TWO "E" NUMBERS UNDER THE APPROPRIATE DATA BIT FOR EACH 8K WORTH OF ADDRESSING. THESE ADDRESSES ARE RELATIVE TO THE BASE ADDRESS OF THE SPECIFIC ARRAY BOARD BEING REFERENCED.

THE UPPER "E" NUMBER SHOULD BE USED IF THE LEAST SIGNIFICANT OCTAL DIGIT OF THE ADDRESS IS EITHER A 2 OR A 6 (BIT 1 = 1). THE LOWER "E" NUMBER SHOULD BE USED IF THE LEAST SIG OCTAL DIGIT IS A 0 OR A 4 (BIT 1 = 0).FOR EXAMPLE, IF THE BAD ADDRESS IS 100404 AND THE XOR OF GOOD VS BAD IS 100, THE SUSPECT MOS CHIP IS "E 167". THE BINARY BITS IN THE OCTAL XOR PRINTOUT REFERENCE DATA BITS 15-0 ON THE CHART HEADER.

	DATA BITS 15-0															
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
140000-	88	77	67	56	46	35	24	12	184	172	160	148	135	122	110	97
177776	84	73	63	52	42	31	20	8	180	168	156	144	131	118	106	93
100000-	87	76	66	55	45	34	23	11	183	171	159	147	134	121	109	96
137776	83	72	62	51	41	30	19	7	179	167	155	143	130	117	105	92

40000-	86	75	65	54	44	33	22	10	182	170	158	146	133	120	108	95
77776	82	71	61	50	40	29	18	6	178	166	154	142	129	116	104	91
00000-	85	74	64	53	43	32	21	9	181	169	157	145	132	119	107	94
37776	81	70	60	49	39	28	17	5	177	165	153	141	128	115	103	90

[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.)

IT IS POSSIBLE TO CONFIGURE A SYSTEM USING TWO (2) MF11S-K CONTROLLERS EACH WITH ITS OWN CSR. THE FIRST CSR WILL BE AT 172136 AND THE SECOND AT 172134. IN THE EVENT OF TWO CSR'S BOTH SYSTEMS WILL BE TESTED BEFORE A COMPLETE PASS IS ACKNOWLEDGED.

[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	1	0200	772342
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	2	1600	772344
8	32K-36K	200000-217776	3	2000	772346
9	36K-40K	220000-237776	4	2200	772350

10	40K-44K	240000-257776	5	2400	772352
11	44K-48K	260000-277776	6	2600	772354
12	48K-52K	300000-317776	2	3000	
13	52K-56K	320000-337776	3	3200	
14	56K-60K	340000-357776	4	3400	
15	60K-64K	360000-377776	5	3600	
16	64K-68K	400000-417776	6	4000	
17	68K-72K	420000-437776	2	4200	
18	72K-76K	440000-457776	3	4400	
19	76K-80K	460000-477776	4	4600	
20	80K-84K	500000-517776	5	5000	
21	84K-88K	520000-537776	6	5200	
22	88K-92K	540000-557776	2	5400	
23	92K-96K	560000-577776	3	5600	
24	96K-100K	600000-617776	4	6000	
25	100K-104K	620000-637776	5	6200	
26	104K-108K	640000-657776	6	6400	
27	108K-.12K	660000-677776	2	6600	
28	112K-116K	700000-717776	3	7000	
29	116K-120K	720000-737776	4	7200	
30	120K-124K	740000-757776	5	7400	
31	124K-128K	760000-777776	7	7600	772356

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. 3 WOULD EQUAL 2000, PAR 4 WOULD EQUAL 2200 ETC.

[8.2] EXECUTION TIME

HERE ARE SOME TYPICAL EXECUTION TIMES.

32K (PASS 1 + PASS 2) = 3 MIN 40 SEC.
64K (PASS 1 + PASS 2) = 5 MIN 10 SEC.

[8.3] PASS COUNT AND TEST NO. LOCATIONS

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

$TESTN [404] = CURRENT TEST NO.

DURING EXECUTION, THE CURRENT TEST # WILL BE AVAILABLE IN THE HARDWARE DISPLAY REG (177570) OR THE SOFTWARE DISPLAY REG (174).

[8.4] STACK POINTER

THE STACK STARTS AT 500 WHEN THE PROGRAM IS NOT RELOCATED.
SAVR6[346] 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.

[9.0] PROGRAM DESCRIPTION

[9.1] NARRATIVE FLOW CHART

THE TEST IS LOADED INTO LOCATIONS 0000 - 14216 BUT
EXPANDS DEPENDING ON HOW MUCH MEMORY IS UNDER TEST.
SEE STEP 6. BELOW FOR A DETAILED EXPLANATION.

THE FOLLOWING NARRATIVE FLOW CHART DESCRIBES MAJOR
PROGRAM OPERATION. FOR THE PERSON WHO NEEDS DETAIL THE
TAG ASSOCIATED WITH THE OPERATION IS GIVEN IN BRACKETS.

FOR THIS DISCUSSION SWITCH SETTINGS ARE IGNORED AND EVERYTHING IS
ASSUMED ENABLED.

1. [START] PRINT "DZMML-A" TITLE

2. [TSTRP] SAVE DATA FROM LOCATIONS 0-376

3. [TSTRP] TEST LOCATIONS 0-376 BY WRITING AND
   READING 1'S AND 0'S. NOTE THIS IS THE ONLY
   EXPLICIT TESTING OF THESE LOCATIONS.

4. [SLFSIZ] SIZE MEMORY BY SETTING THE DIAGNOSTIC CHECK BIT
   IN THE MS11K CONTROL AND STATUS REGISTER (172136) AND
   LOOKING FOR MEMORY THAT RESPONDS BY LOADING CHECK BITS
   INTO THE CSR (BITS 11-5).

5. [TYPSIZ] TYPE MEMORY TEST LIMITS AND THE ADDRESS OF
   THE CSR CONTROLLING THE MEMORY UNDER TEST.

6. [SETSTK] SPACE IS SAVED AT THE END OF THE TEST
   FOR AN ERROR HISTORY. FOR EACH 4K BANK 18 BYTES ARE SAVED
   IN THE FOLLOWING FORMAT:

```
                    !ADR ERR!PAR ERR!
                    !BIT15  !ERR CNT!
                    !BIT13  !BIT14  !
                    !BIT11  !BIT12  !
                    !BIT09  !BIT10  !
                    !BIT07  !BIT07  !
                    !BIT05  !BIT06  !
                    !BIT03  !BIT04  !
                    !BIT01  !BIT02  !
                    !UNUSED !BIT00  !
```

THE ABSOLUTE LOADER (300 ADDRESSES) IS APPENDED AND IF IN XXDP CHAIN MODE, 5674 ADDRESSES ARE APPENDED TO THE TEST. THIS SAVES THE XXDP MONITOR AND ALLOWS THE LOCATIONS OCCUPIED BY XXDP TO BE TESTED.

7. [CLRMEM] INITIALIZE BAKPAT AND SWAPAT

8. [CONT] CLEAR CHUNK OF MEMORY UNDER TEST AND DISPATCH CONTROL TO THE APPROPRIATE TEST.

9. [TST0] EXECUTE TEST 0. SEE SECTION 10 FOR TEST DESCRIPTIONS.

10. [TSTSCP] COMES HERE AFTER EACH TEST AND IF CNTRL-C TYPED THEN GO TO ERROR HISTORY PRINTOUT.
IF SR=2000 THEN HALT
IF SR=40000 THEN LOOP ON TEST DEFINED BY <3:0>
ELSE CONTINUE TO NEXT TEST.

11. [TST1-TST17] EXECUTE TST1-TST17 EACH TIME GOING TO STEP 9. *** SEE NOTE BELOW

12. [RELOC] THE PROGRAM RELOCATES TO 2ND 16K(IF NECESSARY AND IF NO SINGLE ERRORS EXIST IN LOCATIONS 0-500) TO TEST THE LOCATIONS IT OCCUPIES. (430-ENDPRG).
WHERE "ENDPRG" IS THE CONTENTS OF ENDSTK[314].
I.E THE LAST PROGRAM ADDRESS. NOTE "RELOC" IS PRINTED JUST PRIOR TO THE ACTUAL RELOCATION.

13. TESTS 0-17 ARE RUN AS DESCRIBED ABOVE EXCEPT ONLY BANK 0 LOCATIONS 430-ENDPRG ARE TESTED.
*** SEE NOTE BELOW

14. [RELOER] RELOCATE THE PROGRAM BACK TO LOWER MEMORY.

15. [LOWER] IF CONTROL-C TYPED GO PRINT ERROR HISTORY.

16. [TSTMM] IF MEMORY MANAGEMENT SELECTED AND AVAILABLE, RUN TESTS 0-17 ON THE FIRST 20K SLICE ABOVE 28K.

17. [CONTMM] CALL "UPMM" TO UPDATE MEMORY MANAGEMENT PAR REGISTERS TO POINT TO THE NEXT 20K SLICE OF

UPPER MEMORY.

18. [MAXADR] REPEAT STEPS 18 + 19 UNTIL ALL
MEMORY ABOVE 28K IS TESTED.

19. [ENDPAS] PRINT ERROR HISTORY OF FAILING BITS

20. [$EOP]
PRINT "END PASS #XX"

*** NOTE: THERE EXISTS TWO DIFFERENT EXECUTION MODES.
THEY ARE PASS #1 AND PASS #2 AND ALL SUCCESSIVE
PASSES. THEY ARE DESCRIBED BELOW.

PASS 1 - QUICK VERIFY - ONE ITERATION ONLY OF ECC
TESTS (TEST5-12) AND NO EXECUTION OF TEST20
AND TEST 21.

PASS 2 AND ABOVE - COMPLETE EXECUTION OF ALL TESTS (TEST0-21)
THE FIRST COMPLETE PASS IS ACTUALLY PASS 2.

[9.2] TEST TITLES AND TEST TIMES PER 16K

SEE THE TEST HEADINGS IN THE LISTING FOR DETAILS ON EACH TEST.

TEST 0: TEST FOR PROPER BANK SELECTION	<1 SEC
TEST 1: CHECK DATI/DATO LINES	<1 SEC
TEST 2: TEST ADDRESS LINES FOR UNIQUENESS	<1 SEC
TEST 3: TEST BYTE ADDRESSING	<1 SEC
TEST 4: MS11K STATUS REGISTER TESTS	<1 SEC
TEST 5: SINGLE ERROR TESTS	15 SEC
TEST 6: TEST THAT WRITE BYTE CLEARS SBE	7 SEC
TEST 7: DOUBLE BIT ERROR- STATUS & TRAP	15 SEC
TEST 10: DBE- WRITE INH ON DATIP CYCLE	1 SEC
TEST 11: DBE- WRITE INH ON WRITE BYTE	15 SEC
TEST 12: DBE- WRITE INH ON WORD WRITE	15 SEC
TEST 13: DUAL ADDRESS TEST	2 SEC
TEST 14: TEST MEMORY FOR HOLDING 1'S AND 0'S	2 SEC
TEST 15: MARCHING 1'S AND 0'S IN CHECKBIT CHIPS	3 SEC
TEST 16: MARCHING 1'S AND 0'S IN DATA CHIPS	2 SEC
TEST 17: CELLS VOLATILITY TEST (REFRESH)	4 SEC

[10.0] RXDP & ACT11 & APT OPERATION

RXDP CHAIN MODE

OPERATION IS IDENTICAL TO STAND ALONE EXCEPT:

1. NO "DZMML-A" TITLE IS PRINTED.
2. THE PROGRAM ALWAYS HALTS ON ERROR.

3. AT THE END OF TEST ($ENDAD) CONTROL IS RETURNED TO THE RXDP CHAIN MONITOR VIA LOCATION 42.

ACT11

OPERATION IS IDENTICAL TO STAND ALONE EXCEPT:

1. NO PRINTOUTS EXCEPT ERROR PRINTOUTS.
2. THE PROGRAM ALWAYS HALTS ON ERROR.
3. AT THE END OF TEST ($ENDAD) CONTROL IS RETURNED TO THE ACT11 MONITOR VIA LOCATION 42.

APT

OPERATION IS SIMILAR TO STAND ALONE EXCEPT:

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 = 0001 AND THE PROGRAM HALTS AT LOCATION 6214 (FATHLT). LOCATION 402 ($FATAL) CONTAINS THE ERROR NO. IN THE LOW BYTE AND THE FAILING MEMORY BANK NO. IN THE HIGH BYTE.

APT MANAGER INFORMATION

THE FOLLOWING IS AN EXAMPLE SCRIPT TO TEST A 4K MEMORY.
IT IS RECOMMENDED THAT DIFFERENT SCRIPTS BE USED FOR
DIFFERENT MEMORY SIZES TO SAVE AUTO SIZING TIME.

THE EXAMPLE ASSUMES YOU ARE LOGGED INTO THE APT MONITOR.

```
    READY

    RUN APPLU
    APT 11 PAPER TAPE PROGRAM LOAD UTILITY

    THE FOLLOWING COMMANDS ARE VALID

        ED      EDIT A PROGRAM
        LI      LIST A PROGRAM


    COMMAND:  ED
    PROGRAM NAME TO EDIT:  EXAMPL
    DO YOU WANT TO LOAD A NEW REV OF THE PROGRAM(Y/N)? N
    FIRST PASS RUN TIME IN SECONDS <110>:
    LONGEST TEST TIME IN SECONDS <10>:
    ADDITIONAL RUN TIME IN SECONDS <0>:
    WHICH ETABLE DO YOU WISH TO EDIT? A
    SOFTWARE ENVIRONMENT<000>:  1
```

```
                    ENVIRONMENTAL MODE<000>:  240
                    SWITCH 1 <000000>:
                    SWITCH 2 <000000>:
                    CPU OPTIONS<0000>:
                    MEMORY TYPE 1 <000>:
                    MAXIMUM ADDRESS<00000000>:
                    MEMORY TYPE 2 <000>:
                    MAXIMUM ADDRESS<00000000>:
                    MEMORY TYPE 3 <000>:
                    MAXIMUM ADDRESS<00000000>:
                    MEMORY TYPE 4 <000>:  1
                    MAXIMUM ADDRESS<00000000>:  17776
                    WHICH ETABLE DO YOU WISH TO EDIT?
                        COMMAND: OFF


        .ENDR
        .ABS
        .NLIST  MD,MC,CND
 1164                                   .LIST   ME,BIN,SEQ,LOC
 1169                                   .TITLE  DZMML
  (1)                                   ;*COPYRIGHT (C) FEBRUARY 1977
  (1)                                   ;*DIGITAL EQUIPMENT CORP.
  (1)                                   ;*MAYNARD, MASS. 01754
  (1)                                   ;*
  (1)                                   ;*PROGRAM BY JIM RYAN
  (1)                                   ;*
  (1)                                   ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
  (1)                                   ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
  (1)                                   ;*
  (1)           160000                  $SWR=160000     ;;HALT ON ERROR, LOOP ON TEST, INHIBIT ERROR TYPOUT
1170
1171
1172
1173
1205                                            ;;TRAP CATCHER OF .+2 AND HALT FOR 0-776 LOCATIONS
1206
1214
1215
1222
1223           000240                  SCOPE   =NOP
1224
1225           000042                          .=42
1226  000042   000000                          .WORD   0       ;FOR ACT/XXDP
1227
1228                                   .SBTTL  ACT11 HOOKS
  (2)                                   ;;**********************************************************************
  (1)                                   ;HOOKS REQUIRED BY ACT11
  (1)           000044                          $SVPC=.                 ;SAVE PC
  (1)           000046                          .=46
  (1)  000046   000156                          $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .$EOP
  (1)           000052                          .=52
  (1)  000052   040000                          .WORD   40000           ;;2)SET LOC.52 TO 40000
  (1)           000044                          .=$SVPC                 ;; RESTORE PC
2229
```

J02


```
 1230  000044  016777  002640  002656  PWRDN:  MOV     ECCDIS,@CSRADR  ;DISABLE ECC
 1231  000052  005077  000242                  CLR     @MINMEM         ;CLEAR FIRST ADDRESS
 1232  000056  005077  000240                  CLR     @MINMEM+2       ;SECOND WORD
 1233  000062  042701  000003                  BIC     #3,R1           ;
 1234  000066  005011                          CLR     (R1)            ;CLR A LOC
 1235  000070  005061  000002                  CLR     2(R1)           ;NEXT
 1236  000074  012737  000136  000024          MOV     #PWRUP,@#24     ;
 1237  000102  000000                          HALT
 1238
```

```
1240
1241
1242                                    ;114 AND 116 ARE RESERVED FOR PARITY TRAP VECTORS.USED IN TST7.
1243            000120                          .=120
1244
1245
1249
1250                                    ;* WRITE MEMORY BACKGROUND
1251                                    ;* ----------------------
1252                                    ;*
1253                                    ;*      THIS ROUTINE IS USED TO WRITE THE MEMORY BACKGROUND TO
1254                                    ;*      THE VALUE STORED AT LOCATION BAKPAT. THE ROUTINE ASSUMES
1255                                    ;*      THAT R4 IS POINTING TO THE LOWEST LOCATION AND R5 TO THE
1256                                    ;*      HIGHEST LOCATION TO BE WRITTEN. THE PROGRAM LEAVES THE
1257                                    ;*      SUBROUTINE WITH R0 CONTAINING THE CONTENTS OF BAKPAT.
1258                                    ;*
1259
1260  000120  010401            WRTMEM: MOV     R4,R1           ;SET R1 TO LOWEST LOCATION UNDER TEST
1261  000122  013700  000312           MOV     @#BAKPAT,R0     ;LOAD R0 WITH THE CONTENTS OF LOCATION BAKPAT
1262  000126  010021            2$:     MOV     R0,(R1)+        ;STARTING FROM THE LOWEST LOCATION WRITE THE
1263  000130  020105                    CMP     R1,R5           ;MEMORY TO BACK GROUND PATTERN
1264  000132  103775                    BLO     2$
1265  000134  000207                    RTS     PC              ;RETURN FROM THE SUBROUTINE
1266
1267  000136  013706  000346   PWRUP:  MOV     @#SAVR6,SP      ;RESTORE STACK POINTER
1268  000142  012700  013740           MOV     #PNTMES-BEGIN,R0        ;
1269  000146  060600                    ADD     SP,R0           ;GET THE INDIRECT ADDRESS OF LOCATION
1270                                                            ;TPCRLF RELATIVE TO LOCATION OF THE
1271                                                            ;DIAGNOSTIC IN MEMORY AND GO TO THE
1272  000150  004710                    JSR     PC,(R0)         ;;TYPE ROUTINE AND TYPE CR, LF & A "P".
1273  000152  000120                    .ASCIZ  /P/
1274                                    .EVEN
1275  000154  000411                    BR      START
1276
1277
1278                                    ;* SERVICE XXDP/ACT11
1279  000156  004710            $ENDAD: JSR     PC,(R0)         ;RETURN TO ACT11/XXDP MONITOR
1280  000160  000240                    NOP                     ;IF QUICK VERIFY=RESET ELSE NOP
1281  000162  000240                    NOP                     ;IF QUICK VERIFY=CLR #-1 ELSE INC #0
1282  000164  000240                    NOP                     ;IF QUICK VERIFY=BR .-4 ELSE NOP
1283  000166  000430                    BR      RESTRT          ;REPEAT TEST UNDER ACT11/XXDP
1284                                    ;
1285  000170     000            REL:    .BYTE   0               ;TELLS IF WE'RE RELOC
1286
1287            000174                  .=174
1288  000174  000000            DSPREG: .WORD   0
1289  000176  000000            SWREG:  .WORD   0
1290
1291
1292                                    ;;*****************************************************************
1293                                    .SBTTL  START AND RESTART ROUTINES
1294                                    ;*      RESTART AT 200 TO CLEAR APT TABLES
1295                                    ;;*****************************************************************
1296  000200  005077  002524   START:  CLR     @CSRADR         ;JUST IN CASE
1297  000204  013706  000346           MOV     @#SAVR6,SP      ;SETUP STACK POINTER.
1298  000210  012703  000412           MOV     #$UNIT,R3       ;CLEAR THE APT MAILBOX FROM $MAIL TO $DEVCT
```

```
1299  000214  005043           1$:     CLR     -(R3)           ;CLEAR A MAILBOX LOCATION
1300  000216  022703  000400           CMP     #$MAIL,R3       ;DONE?
1301  000222  001374                   BNE     1$              ;BRANCH IF NO
1302  000224  105737  000042           TSTB    @#42            ;ACT11 MODE?
1303  000230  001007                   BNE     RESTRT          ;BRANCH IF YES
1304  000232  105737  000170           TSTB    @#REL           ;ARE WE RELOCATED?
1305  000236  100404                   BMI     RESTRT          ;BR IF YES- SINCE TPCRLF IS RELOCATED ALSO-
1306  000240  004767  015472           JSR     PC,PRTITL       ;PRINT "DZMML-A" TITLE
1307  000244  000240                   NOP                     ;SO WE FALL THRU TO RESTART
1308  000246  000240                   NOP                     ;DITTO
1309
1310  000250  012703  000344  RESTRT: MOV     #SAVR5,R3       ;POINT R3 TO THE LOC SAVR5
1311  000254  012305                   MOV     (R3)+,R5        ;RESTORE R5
1312  000256  012306                   MOV     (R3)+,SP        ;AND RESTORE R6 JUST IN CASE IT IS A RESTART
1313  000260  010600                   MOV     SP,R0           ;PLACE THE STARTING ADDRESS OF THE TEST IN R0
1314  000262  012746  000340           MOV     #340,-(SP)      ;SET HIGH PRIORITY FOR RTI
1315  000266  010046                   MOV     R0,-(SP)
1316  000270  000002                   RTI                     ;GO TO "START"-MAY BE RELOCATED.
1317                                                            ;IF RELOCATED SEE LOCATION SAVR6 FOR START.
1318
1319
1320
1321
1322
1323
1324
1325
1326                                    .SBTTL  APT PARAMETER BLOCK
 (1)
 (2)                                    ;;*****************************************************************
 (1)                                    ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
 (2)                                    ;;*****************************************************************
 (1)          000272                            .$X=.   ;;SAVE CURRENT LOCATION
 (1)          000024                            .=24    ;;SET POWER FAIL TO POINT TO START OF PROGRAM
 (1)  000024  000200                            200     ;;FOR APT START UP
 (1)          000044                            .=44    ;;POINT TO APT INDIRECT ADDRESS PNTR.
 (1)  000044  000272                            $APTHDR ;;POINT TO APT HEADER BLOCK
 (1)          000272                            .=.$X   ;;RESET LOCATION COUNTER
 (2)                                    ;;*****************************************************************
 (1)                                    ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
 (1)                                    ;INTERFACE SPEC.
 (1)
 (1)  000272                            $APTHD:
 (1)  000272  000000                    $HIBTS: .WORD   0       ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
 (1)  000274  000400                    $MBADR: .WORD   $MAIL   ;;ADDRESS OF APT MAILBOX (BITS 0-15)
 (1)  000276  000031                    $TSTM:  .WORD   25.     ;;RUN TIM OF LONGEST TEST
 (1)  000300  000156                    $PASTM: .WORD   110.    ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
 (1)  000302  000000                    $UNITM: .WORD           ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
 (1)  000304  000024                            .WORD   $ETEND-$MAIL/2 ;;LENGTH MAILBOX-ETABLE(WORDS)
1327
1328
1329          000272                            .=$APTHD
1330  000272                          MMAVA:                  ;THIS BYTE IS USED TO DETERMINE IF MEMORY
1331                                                          ;MANAGEMENT IS AVAILABLE OR NOT
1332
1333          000273                            .=MMAVA+1
```

```
1334  000273                    TYPENB:                 ;THIS BYTE IS USED TO DETERMINE IF THE
1335                                                    ;TYPE OUT OF ERROR HAS BEEN ENABLED OR NOT
1336
1337          000274                        .=TYPENB+1
1338  000274                    $PRERR:                 ;THIS BYTE DETERMINES IF THE PROGRAM HAS FOUND
1339                                                    ;A PARITY ERROR
1340
1341          000275                        .=$PRERR+1
1342  000275                    $ADERR:                 ;THIS BYTE IS USED TO DETERMINE IF THE
1343                                                    ;PROGRAM HAS ENCOUNTERED ADDRESS ERROR
1344
1345          000276                        .=$ADERR+1
1346  000276                    STRTDI:
1347          000300                        .=STRTDI+2
1348  000300                    LOWBNK:
1349          000302                        .=LOWBNK+2
1350  000302                    PASFLG:                 ;LOWER BYTE OF THIS WORD GIVES THE PASS NUMBER FOR
1351                                                    ;THE SPECIFIC TEST WHEREAS THE UPPER BYTE
1352                                                    ;HAS BEEN USED BY DIFFERENT TEST FOR DIFFERENT PURPOSES
1353
1354          000304                        .=PASFLG+2
1355  000304                    ENDSTK:
1356          000306                        .=ENDSTK+2
1357  000306                    PBNK:                   ;HOLDS BANK UNDER TEST FOR "TST BNK XX" PRINTOUT.
1358  000306                    DECWRD:
1359          000310                        .=DECWRD+2
1360  000310     000  TYPCNT: .BYTE   0                 ;THIS BYTE DETERMINES THE NUMBER OF WORDS
1361                                                    ;TO BE TYPED
1362  000311     000  SAVKBB: .BYTE   0                 ;THIS LOCATION IS USED TO SAVE THE CHARACTER
1363                                                    ;HIT BY THE OPERATOR
1364                                                    ;ALSO IS USED AS TEMP IN ROUTINE $GTSIZ.
1365                  .EVEN
1366
1367
1368          177560  TKS=    177560
1369          177562  $KBB=   177562
1370          177564  $TPS=   177564
1371          177566  $TPB=   177566
1372          177572  SR0=    177572
1373  000312  000377  BAKPAT: .WORD   377               ;BACKGROUND PATTERN WRITTEN TO MEMORY.
1374
1375  000314  000000  SWAPAT: .WORD
1376  000316  000430  RELBOT: BEGIN-50                  ;HOLDS LOWEST TEST ADDRESS WHEN RELOCATED.
1377  000320  100000  MINMEM: .WORD   100000            ;FIRST ADDR FOR ECC IN CASE OF APT
1378
1379                  ;;*****************************************************************
1380                  ;LOCATIONS TO BE MODIFIED IF LIMITS SET BY OPERATOR
1381  000322  000000  LOWTWO: 0                        ;HOLDS BITS 17:16 OF LOW TEST ADDRESS
1382  000324  000000  LOWADD: 0                        ;HOLDS BITS 15:0 OF LOW TEST ADDRESS
1383
1384  000326  000000  HIGHTWO:       0                 ;HOLDS BITS 17:16 OF HIGH TEST ADDRESS
1385  000330  037776  HIGHADD:       37776                    ;HOLDS BITS 15:0 OF HIGH TEST ADDRESS
1386                  ;;*****************************************************************
1387
1388  000332  000000  $HIMAX: 0                        ;HOLDS BITS 17:16 OF MAXIMUM AVAILABLE MEMORY
1389  000334  017776  $MAXM:  17776                    ;HOLDS BITS 15:0 OF MAXIMUM AVAILABLE MEMORY
```

```
DZMML   MACY11 30(1046)  05-AUG-77  12:59  PAGE 1-25                                                    SEQ 0027
DZMMLB.P11    05-AUG-77 12:57          APT PARAMETER BLOCK

  1390
  1391  000336  000000                 MAXMEM: .WORD                    ;MAXIMUM CURRENT VIRTUAL MEMORY UNDER TEST
  1392
  1393  000340  000000                 SAVMAX: .WORD
  1394  000342  000000                 SAVR4:  .WORD
  1395  000344  000000                 SAVR5:  .WORD
  1396
  1397                                 ;* SAVR6 POINTS TO WHERE THE PROGRAM STARTS EVEN WHEN RELOCATED.
  1398  000346  000500                 SAVR6:  .WORD   BEGIN            ;CONTAINS START ADDRESS WHEN RELOCATED ALSO.
  1399  000350  000000                 SAVLOC: 0                        ;TEST 17 STORES ERROR INFO HERE
  1400                                         ;
  1401                                         ;GET HERE IF AN ILLEGAL TRAP TO LOC. 4 OCCURRED
  1402                                         ;
  1403  000352  012737  000001  000400 BUSER:  MOV     #1,@#$MSGTY      ;TELL APT FATAL ERROR #000
  1404  000360  000774                        BR      BUSER            ;LOOP SO APT CAN GET INFO
  1411
  1412
  1413                                 ;*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.

                        000500                          .=500
000500  010706                                  BEGIN:  MOV     PC,SP           ;SET UP STACK POINTER
000502  005746                                          TST     -(SP)           ;TO EQUAL BEGIN ADDRESS
000504  012704  016132                                  MOV     #ENDPROG,R4     ;PUT END OF PROG ADDRESS INTO R4
000510  010637  000346                                  MOV     SP,@#SAVR6      ;SAVE SP FOR FUTURE USE
000514  012737  000044  000024                          MOV     #PWRDN,@#24     ;PREPARE FOR FUTURE POWER DOWN
000522  004767  014560                                  JSR     PC,CLRMM        ;CLEAR MEM MGMT.
```

```
 1428  000526  005037  000310              CLR     @#TYPCNT
 1429  000532  105737  000170              TSTB    @#REL           ;RELOCATED ?
 1430  000536  100002                      BPL     4$              ;BR IF NOT
 1431  000540  000167  001344              JMP     TSTSIZ
 1432  000544  005067  002146      4$:     CLR     LDFLG
 1433  000550  012737  000566  000004      MOV     #7$,@#4         ;PREPARE FOR NON-EXISTANT
 1434  000556  012737  000014  177746      MOV     #14,@#177746    ;11/60 CACHE CONTROL REG
 1435  000564  000402                      BR      6$              ;BR IF ALL OK
 1436  000566  062706  000004      7$:     ADD     #4,SP           ;RECOVER FROM TRAP
 1437  000572  012701  100000      6$:     MOV     #100000,R1      ;2ND 16K
 1438  000576  005021                      CLR     (R1)+           ;CLEAR FIRST LOC
 1439  000600  005011                      CLR     (R1)            ;CLEAR SECOND LOC
 1440  000602  012777  020004  002120      MOV     #20004,@CSRADR  ;DIAG BIT
 1441  000610  005741                      TST     -(R1)           ;READ THE LOC TO GET CHECKBITS IF ANY
 1442  000612  032777  007740  002110      BIT     #7740,@CSRADR   ;IF SET WE'RE IN M511K
 1443  000620  001007                      BNE     5$              ;BR IF IN MEM UNDER TEST
 1444  000622  042767  020000  002060      BIC     #20000,ECCDIS   ;JUST IN CASE WE ARE TESTING
 1445  000630  042767  020000  002054      BIC     #20000,DIAGA    ;THE SECOND CSR (172134)
 1446  000636  000533                      BR      SETSWR          ;BR IF NOT IN MEM UNDER TEST
 1447  000640  005077  002064      5$:     CLR     @CSRADR         ;CLEAR CSR
 1448  000644  012767  000001  002044      MOV     #1,LDFLG        ;INDICATE PROG IN MEM UNDER TEST
 1449  000652  052767  020000  002030      BIS     #20000,ECCDIS   ;DISABLE ECCINH IN LOW 16K
 1450  000660  052767  020000  002024      BIS     #20000,DIAGA    ;SAME FOR DIAG CHECK
 1451  000666  005001                      CLR     R1              ;
 1452  000670  005000                      CLR     R0              ;IT IS, CHECK FOR ERRORS
 1453  000672  005067  002030              CLR     INHREL
 1454  000676  005077  002026      1$:     CLR     @CSRADR         ;DON'T WANT TO TRAP
 1455  000702  005711                      TST     (R1)            ;READ THE LOC
 1456  000704  032777  100000  002016      BIT     #100000,@CSRADR;CHECK FOR DOUBLE ERROR
 1457  000712  001403                      BEQ     8$
 1458  000714  004767  013274              JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
  (1)  000720  000001                      1                       ;******ERROR NUMBER 1******
  (1)
 1459  000722  005767  002000      8$:     TST     INHREL          ;ANY ERRORS FOUND YET ?
 1460  000726  001012                      BNE     2$              ;YES, DON'T LOOK ANY FURTHER
 1461  000730  020127  000500              CMP     R1,#BEGIN       ;
 1462  000734  101007                      BHI     2$              ;
 1463  000736  032777  000020  001764      BIT     #20,@CSRADR     ;LOOKING FOR SBE'S IN 0-500
 1464  000744  001403                      BEQ     2$              ;BR IF NO ERRORS
 1465  000746  012767  000001  001752      MOV     #1,INHREL       ;INHIBIT RELOCATION
 1466  000754  022701  016132      2$:     CMP     #ENDPROG,R1     ;END OF PROGRAM YET?
 1467  000760  003403                      BLE     3$              ;BR IF YES
 1468  000762  062701  000004              ADD     #4,R1           ;NO POINT TO NEXT LOCATION
 1469  000766  000743                      BR      1$              ;KEY READING
 1470  000770  005767  001732      3$:     TST     INHREL          ;RELOCATION ALLOWED ?
 1471  000774  001415                      BEQ     ONEPAS          ;BR IF YES
 1472  000776  004767  013430              JSR     PC,TPCRLF       ;PRINT ROUTINE
 1473  001002  047516  051040  046105      .ASCIZ  /NO RELOC-SBE IN 0-500/
       001010  041517  051455  042502
       001016  044440  020116  026460
       001024  030065  000060
 1474                                      .EVEN
 1475  001030  005000              ONEPAS: CLR     R0              ;INITIALIZE POINTER
 1476  001032  005737  000404              TST     @#$TESTN        ;IS THIS THE FIRST PASS
 1477  001036  001402                      BEQ     TSTRP           ;BR IF YES (TEST TRAP CATCHERS.
 1478  001040  000167  000062              JMP     SETSWR          ;SET UP SWREG
```

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 1479  001044  012704  016132          TSTRP:  MOV     #ENDPROG,R4     ;ADDRESS OF END OF PROGRAM
 1480  001050  012700  000377                  MOV     #377,R0         ;
 1481  001054  005001                          CLR     R1              ;POINT TO ADDRESS 0
 1482  001056  012124                  1$:     MOV     (R1)+,(R4)+     ;SAVE 0000 TO BEGIN-
 1483  001060  020127  000400                  CMP     R1,#$MAIL       ;BEGINNING OF ETABLE
 1484  001064  103774                          BLO     1$              ;BR IF NOT DONE
 1485  001066  005741                  3$:     TST     -(R1)           ;ADJUST POINTER TO TRAP VECTORS
 1486  001070  010011                  4$:     MOV     R0,(R1)         ;WRITE 1'S AND 0'S
 1487  001072  020011                          CMP     R0,(R1)         ;NOW COMPARE
 1488  001074  001403                          BEQ     5$              ;BR IF OK
 1489  001076  004767  013112                  JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
  (1)  001102  000002                          2                       ;******ERROR NUMBER 2******
  (1)
 1490
 1491  001104  000300                  5$:     SWAB    R0              ;
 1492  001106  001370                          BNE     4$              ;BR IF BOTH BYTES NOT TESTED
 1493  001110  005701                          TST     R1              ;HAVE WE REACHED THE BOTTOM YET
 1494  001112  001365                          BNE     3$              ;BRANCH IF NO
 1495  001114  012701  000400                  MOV     #$MAIL,R1       ;APT, RESTORE TO $MAIL
 1496  001120  014441                  6$:     MOV     -(R4),-(R1)     ;HERE!
 1497  001122  005701                          TST     R1              ;FINISHED?
 1498  001124  001375                          BNE     6$              ;BR IF NOT
 1499  001126  005077  001576          SETSWR: CLR     @CSRADR         ;CLEAR CSR
 1500  001132  012700  000006                  MOV     #6,R0           ;ADDRESS OF PSW FOR TIMEOUT TRAP
 1501  001136  012710  000340                  MOV     #340,(R0)       ;SET UP TIME OUT TRAP PSW
 1502  001142  012740  001170                  MOV     #2$,-(R0)       ;AND RETURN ADDRESS
 1503  001146  105737  000420                  TSTB    @#$ENV          ;RUNNING UNDER APT
 1504  001152  001403                          BEQ     1$              ;IF NOT, SET UP ADDRESS FOR SWR
 1505  001154  012737  000422  002732          MOV     #$SWREG,@#SWR   ;OTHERWISE, PREPARE TO USE APT SWR
 1506  001162  005777  001544          1$:     TST     @SWR            ;DOES SWITCH REG POINTED TO BY SWR EXIST
 1507  001166  000410                          BR      APTSIZ          ;YES, GO TO APTSIZ
 1508  001170  062706  000004          2$:     ADD     #4,SP           ;RESTORE STACK POINTER
 1509  001174  012737  000176  002732          MOV     #SWREG,@#SWR    ;PLACE ADDRESS OF SWITCH REG DESIGNED
 1510  001202  012737  000174  002734          MOV     #DSPREG,@#DISPLAY;FOR COMPUTERS NOT HAVING HARDWARE
 1511                                                                  ;SWITCH REG AND RUNNING STAND ALONE.
 1512                                                                  ;R4=# END PROG ON EXIT
 1513                                                                  ;
 1514                                                                  ;
 1515
 1516
 1517                                          ;APTSIZ-THIS ROUTINE WILL SEARCH THE APT MEMORY ETABLE
 1518                                          ;AND WHEN A NON ZERO TYPE IS FOUND WILL SETUP TO TEST TO
 1519                                          ;GIVEN HIGH ADDRESS.  IF APT DEFINES SIZE LO ADDRESS MUST -00C00
 1520
 1521  001210  012703  000336          APTSIZ: MOV     #MAXMEM,R3      ;POINT R3 TO MAXMEM
 1522  001214  013737  000326  000332          MOV     @#HIGHTWO,@#$HIMAX ;IN CASE NO SELF SIZING DONE
 1523  001222  013737  000330  000334          MOV     @#HIGHADD,@#$MAXM ;
 1524  001230  105737  000421                  TSTB    @#$ENVM         ;DOES APT ALLOW SELF SIZING
 1525  001234  100021                          BPL     TRYSR           ;BR IF YES
 1526  001236  012701  000451                  MOV     #$MTYP4+4,R1    ;POINT R1 TO BLOCK TYPE 4+4
 1527  001242  162701  000004          1$:     SUB     #4,R1           ;POINT TO NEXT BLOCK TYPE
 1528  001246  105711                          TSTB    (R1)            ;IS IT NON-ZERO
 1529  001250  001006                          BNE     2$              ;BR IF YES (MEMORY EXISTS)
 1530  001252  020127  000431                  CMP     R1,#$MTYP1      ;ALL APT BLOCK TYPES BEEN CHECKED
 1531  001256  101371                          BHI     1$              ;BR IF NO
 1532  001260  004767  01273C                  JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
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   (1)  001264  000003                          3                          ;******ERROR NUMBER 3******
   (1)
  1533
  1534  001266  004767  013720          2$:     JSR     PC,GETADR          ;SET MAX APT ADDR INTO $MAXM +$HIMAX
  1535  001272  004767  013714                  JSR     PC,GETADR          ;ALSO INTO HIGHADD + HIGHTWO
  1536  001276  000564                BRTPSZ:   BR      TYPSIZ             ;TYPE SIZE OF MEM UNDER TEST
  1537
  1538  001300  032777  000100  001424 TRYSR:   BIT     #100,@SWR          ;USER DEFINED BOUNDARIES
  1539  001306  001160                          BNE     TYPSIZ             ;BR IF YES (DON'T SIZE MEM)
  1540
  1541  001310  005067  001400          SLFSIZ: CLR     MSYES              ;INITIALIZE MSYES
  1542  001314  012703  000324                  MOV     #LOWADD,R3         ;GET READY FOR LOW TEST ADDRESS
  1543  001320  005001                          CLR     R1                 ;FIRST TEST LOC (0)
  1544  001322  012710  001514                  MOV     #4$,(R0)           ;SET UP RETURN FROM TIMEOUT TRAP
  1545  001326  005077  001376          1$:     CLR     @CSRADR
  1546  001332  011146                          MOV     (R1),-(SP)         ;SAVE THE CONTENTS OF TEST LOC.
  1547  001334  016146  000002                  MOV     2(R1),-(SP)        ;
  1548  001340  005011                          CLR     (R1)               ;TO SET CHECK BITS OF MS11K
  1549  001342  005061  000002                  CLR     2(R1)              ;
  1550  001346  016777  001340  001354          MOV     DIAGA,@CSRADR      ;DIAGNOSTIC BIT
  1551  001354  005711                          TST     (R1)               ;READ TO GET CHECK BITS
  1552  001356  017702  001346                  MOV     @CSRADR,R2         ;GET CSR CONTENTS
  1553  001362  005077  001342                  CLR     @CSRADR            ;
  1554  001366  012661  000002                  MOV     (SP)+,2(R1)        ;RESTORE THE HI WORD
  1555  001372  012611                          MOV     (SP)+,(R1)         ;RESTORE THE LO WORD
  1556  001374  042702  170037                  BIC     #170037,R2         ;ONLY CARE ABOUT 11-5
  1557  001400  005702                          TST     R2                 ;
  1558  001402  001440                          BEQ     3$                 ;BR IF NO MS11K
  1559  001404  005767  001304                  TST     MSYES              ;MS11K-FIRST SUCCESSFUL TEST
  1560  001410  001032                          BNE     22$                ;NO, BRANCH
  1561  001412  020127  100000                  CMP     R1,#100000         ;IF THIS IS FIRST READABLE LOC
  1562  001416  001015                          BNE     11$                ;THEN FIRST ADDRESS IS 0000, ELSE BR
  1563  001420  105737  000272                  TSTB    @#MMAVA            ;MEM MGMT AVAIL ?
  1564  001424  001012                          BNE     11$                ;YES, GO PUT ADDR AWAY
  1565  001426  005767  001264                  TST     LDFLG              ;RUNNING IN MEM UNDER TEST
  1566  001432  001407                          BEQ     11$                ;BR IF NOT
  1567  001434  005037  000324                  CLR     @#LOWADD           ;
  1568  001440  005037  000322                  CLR     @#LOWTWO           ;CLEAR THESE LOCATIONS
  1569  001444  005267  001244                  INC     MSYES              ;INDICATE SOME MS11K FOUND
  1570  001450  000404                          BR      2$                 ;CONTINUE TO FIND HIGH LIMIT
  1571  001452  004767  013444          11$:    JSR     PC,PUTADR          ;PLACE ADDR AWAY (START ADDR)
  1572  001456  005267  001232                  INC     MSYES              ;INDICATE SOME MS11 FOUND
  1573  001462  010137  000320          2$:     MOV     R1,@#MINMEM        ;FIRST TEST ADDRESS
  1574  001466  010167  001230                  MOV     R1,SAVMIN          ;SAVE FOR RECOVERY FROM RELOC
  1575  001472  062703  000012                  ADD     #12,R3             ;POINT TO #MAXMEM
  1576  001476  062701  020000          22$:    ADD     #20000,R1          ;NEXT 4K BOUNDARY
  1577  001502  000711                          BR      1$                 ;GO TEST IT
  1578  001504  005767  001204          3$:     TST     MSYES              ;FOUND ANY MS11K YET
  1579  001510  001772                          BEQ     22$                ;BR IF NO
  1580  001512  000430                          BR      7$                 ;
  1581  001514  062706  000004          4$:     ADD     #4,SP              ;RESTORE STACK POINTER AFTER TRAP
  1582  001520  004767  013212                  JSR     PC,MEMMNG          ;SERVICE MM IF AVAILABLE
  1583  001524  105737  000272                  TSTB    @#MMAVA            ;SEE IF MM HAS TO BE TESTED
  1584  001530  001421                          BEQ     7$                 ;BR IF NO MM
  1585  001532  012710  001544          5$:     MOV     #6$,(R0)           ;SET UP RETURN ADDRESS FROM TRAP
  1586  001536  012701  040000                  MOV     #40000,R1          ;BEGIN CHECKING ABOVE 28k
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1587  001542  000671                          BR      1$              ;
1588  001544  062706  000004          6$:     ADD     #4,SP           ;RESTORE STACK POINTER
1589  001550  022701  160000                  CMP     #160000,R1      ;IF R1 DID NOT READ THE HIGHEST
1590                                                                  ;LOCATION POINTED TO BY PAR6,
1591                                                                  ;IT HAS REACHED MAX MS11K.
1592  001554  001007                          BNE     7$              ;GO TO 7$ IF DONE
1593  001556  022737  007400  172352          CMP     #7400,@#172352  ;CHECK PAR6 FOR MAX
1594  001564  001403                          BEQ     7$              ;BR IF DONE
1595  001566  004767  013322                  JSR     PC,UPMM         ;NOT DONE UPDATE MEM MGMT.
1596  001572  000757                          BR      5$
1597
1598
1599  001574  024341          7$:     CMP     -(R3),-(R1)     ;CAUSE R3 TO POINT TO $MAXM AND
1600                                                          ;R1 TO MAX AVAILABLE MEMORY
1601  001576  020127  037776                  CMP     R1,#37776       ;MEANS WE MOVED INTO PAR2
1602  001602  001014                          BNE     8$              ;IF WE DID WE MUST ADJUST ADDRESS
1603  001604  005721                          TST     (R1)+           ;RESTORE R1
1604  001606  004767  013310                  JSR     PC,PUTADR       ;PUT AWAY ORIGINAL ADDRESS
1605  001612  162713  000002                  SUB     #2,(R3)         ;ADJUST BITS 15-0
1606  001616  162703  000004                  SUB     #4,R3           ;POINT TO HIGHADD
1607  001622  004767  013274                  JSR     PC,PUTADR       ;PUT IT AWAY
1608  001626  162713  000002                  SUB     #2,(R3)         ;ADJUST
1609  001632  000406                          BR      TYPSIZ          ;AND CONTINUE TO TYPE THE SIZE
1610  001634  004767  013262          8$:     JSR     PC,PUTADR       ;PLACE ADDR IN R1 AT LOCATIONS
1611                                                                  ;$MAXM AND $HIMAX
1612  001640  162703  000004                  SUB     #4,R3           ;POINT TO HIGHADD
1613  001644  004767  013252                  JSR     PC,PUTADR       ;PLACE ADDR IN R1 AT HIGHADD & HIGHTWO
1614
1615
1616  001650  012710  000352          TYPSIZ: MOV     #BUSER,(R0)     ;SET UP VECTOR FOR FUTURE TRAP
1617  001654  005737  000406                  TST     @#$PASS         ;ONLY CARE ABOUT FIRST PASS
1618  001660  001035                          BNE     SETSTK          ;BR IF NOT
1619  001662  004767  012544                  JSR     PC,TPCRLF       ;PRINT ROUTINE
1620  001666  051503  020122  042101          .ASCIZ  /CSR ADDR = /
      001674  051104  036440  000040
1621                                          .EVEN
1622  001702  012703  002664                  MOV     #DATBUF,R3      ;NEED A LOCATION TO PRINT FROM
1623  001706  005023                          CLR     (R3)+           ;CLEAR HIGH ORDER BITS
1624  001710  016713  001014                  MOV     CSRADR,(R3)     ;ADDRESS TO BE TYPED
1625  001714  105237  000310                  INCB    @#TYPCNT        ;ONE WORD TO BE TYPED
1626  001720  004767  012656                  JSR     PC,TYPOCT       ;TYPE THE WORD
1627  001724  010403                          MOV     R4,R3           ;POINT R3 TO LOWEST AVAIL MEM
1628  001726  012701  000322                  MOV     #LOWTWO,R1
1629  001732  004767  012462                  JSR     PC,PCRLF        ;TYPE (CR)(LF)
1630  001736  004767  012630                  JSR     PC,OCTTYP       ;TYPE LOW TEST ADDRESS
1631                                                                  ;(LOWTWO + LOWADD)
1632  001742  004767  012364          TYPMEM: JSR     PC,$TYPE
1633  001746  000055                          .ASCIZ  |-|             ;TYPE "-"
1634                                          .EVEN
1635  001750  004767  012616                  JSR     PC,OCTTYP       ;TYPE HIGHEST TEST ADDRESS
1636                                                                  ;(HIGHTWO + HIGHADD)
1637  001754  012703  000326          SETSTK: MOV     #HIGHTWO,R3     ;POINT R3 TO HIGH ORDER BITS OF HIGH MEM
1638  001760  004767  013242                  JSR     PC,$GTSIZ       ;GET THE BITS 13-17 ON TOP ADDRESS
1639                                                                  ;PLACED IN BITS 0-4 OF R2
1640  001764  010401                          MOV     R4,R1           ;#ENDPROG
1641  001766  062704  000022          4$:     ADD     #18.,R4         ;APPEND THE ERROR STACK FOR MEMORY
```

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

                                                                ;UNDER TEST TO END OF PROGRAM
001772  005302                  DEC     R2                      ;R2 = # OF 4K BANKS
001774  002374                  BGE     4$                      ;
001776  010437  000304          MOV     R4,@#ENDSTK             ;SAVE ADDR OF END OF ERROR STACK
002002  005021          6$:     CLR     (R1)+                   ;CLEAR THE ERROR STACK
002004  020104                  CMP     R1,R4                   ;
002006  101775                  BLOS    6$
002010  012737  157776  000336  MOV     #157776,@#MAXMEM        ;SET MAXMEM TO MAX VIRTUAL ADDRESS
002016  005723                  TST     (R3)+                   ;TESTING MEM MGMT?(READ LOC $HIMAX)
002020  001005                  BNE     SAVLDR                  ;YES, SAVE LOADER
002022  021327  157776          CMP     (R3),#157776            ;BETWEEN 28K - 32K ?
002026  003002                  BGT     SAVLDR                  ;BR IF YES
002030  011363  000002          MOV     (R3),2(R3)              ;OTHERWISE MAKE CONTENTS OF MAXMEM
                                                                ;EQUAL TO MAX AVAIL MEMORY AND
                                                                ;FALL THRU TO SAVE LOADER.
002034  004767  013246  SAVLDR: JSR     PC,CLRMM                ;DISABLE MM
002040  005723                  TST     (R3)+                   ;POINT R3 TO LOC MAXMEM
002042  011305                  MOV     (R3),R5
002044  162705  000276          SUB     #276,R5                 ;GOING TO SAVE 300 BYTES
002050  005737  000042          TST     @#42                    ;RUNNING UNDER ACT OR XXDP
002054  001406                  BEQ     2$                      ;IF NOT GO TO 2$
002056  023737  000042  000046  CMP     @#42,@#46               ;XXDP CHAIN MODE
002064  001402                  BEQ     2$
002066  162705  005674          SUB     #<1502.*2>,R5           ;SAVE 1500. WORDS FOR XXDP CHAIN
002072  012524          2$:     MOV     (R5)+,(R4)+
002074  020513                  CMP     R5,(R3)
002076  101775                  BLOS    2$
002100  012323          4$:     MOV     (R3)+,(R3)+             ;SAVE MAXMEM INTO SAVMAX
002102  010423                  MOV     R4,(R3)+                ;SAVE CONTENTS OF R4 INTO SAVR4

002104  010537  000344  TSTREL: MOV     R5,@#SAVR5              ;SAVE HIGHEST VIRTUAL ADDR +2
002110  004767  013172  TSTSIZ: JSR     PC,CLRMM                ;DISABLE MEM MGMT UNIT
002114  013704  000320          MOV     @#MINMEM,R4             ;MAKE MINMEM THE LOWEST TEST ADDRESS
002120  005745                  TST     -(R5)                   ;SET R5 TO HIGHEST VIRTUAL ADDR. AGAIN
002122  012703  000322  1$:     MOV     #LOWTWO,R3              ;PREPARE TO LOAD R4 & R5 WITH
                                                                ;THE MEM BOUNDARIES
002126  005723                  TST     (R3)+                   ;IF BITS 17 & 16 OF LOWEST  ADDRESS ARE NON 0
002130  001003                  BNE     2$                      ;GO TO 2$
002132  021327  157776          CMP     (R3),#157776            ;IF HIGHER THAN 157776 GO ENABLE MM
002136  103411                  BLO     4$
002140  032777  010000  000564  2$:     BIT     #10000,@SWR     ;IS MEM MGMT SELECTED
002146  001403                  BEQ     3$                      ;YES, OK
002150  004767  012040          JSR     PC,FATERR               ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
002154  000004                  4                               ;******ERROR NUMBER 4******
(1)
(1)

002156  000167  010044  3$:     JMP     TSTMM                   ;GO TEST MEM MGMT
002162  020423          4$:     CMP     R4,(R3)+
002164  103002                  BHIS    6$
002166  016304  177776          MOV     -2(R3),R4               ;POINT R4 TO LOWEST LOC UNDER TEST
002172  005723          6$:     TST     (R3)+                   ;IS BITS 17 & 16 OF HIGHEST LOC TO BE
                                                                ;TESTED ARE NON ZERO
002174  001003                  BNE     9$                      ;IF SO, GO TO 9$
002176  021305                  CMP     (R3),R5                 ;OTHERWISE SEE IF HIGHEST ADDR. TO BE
                                                                ;TESTED IS HIGHER THAN 157776
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

 1696  002200  101001                BHI     9$              ;IF SO, GO TO 9$
 1697  002202  011305                MOV     (R3),R5         ;MODIFY R5
 1698  002204  020405        9$:     CMP     R4,R5           ;IS LOW LIMIT LOWER THAN HIGH LIMIT
 1699  002206  103403                BLO     10$
 1700  002210  004767  012000        JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
  (1)  002214  000005                5                       ;******ERROR NUMBER 5******
  (1)
 1701
 1702
 1703  002216  012703  000340  10$:  MOV     #SAVMAX,R3
 1704  002222  011343                MOV     (R3),-(R3)      ;RESTORE CONTENTS OF MAXMEM
 1705  002224  062713  000002  MEMTST: ADD    #2,(R3)         ;MAKE THE CONTENTS OF MAXMEM=
 1706                                                        ;MAX AVAIL MEM+2
 1707  002230  005725                TST     (R5)+           ;SET R5=MAXMEM +2
 1708
 1709
 1710                                ;INIT BAKPAT AND SWAPAT
 1711                                ;AND CONTINUE TO CLEAR ACTIVE
 1712                                ;CHUNK OF MEMORY UNDER TEST
 1713
 1714  002232  012702  000312  CLRMEM: MOV    #BAKPAT,R2
 1715  002236  012212                MOV     (R2)+,(R2)      ;COPY IT INTO SWAPAT
 1716  002240  000312                SWAB    (R2)            ;SWAP THE BYTES
 1717  002242  017702  000464        MOV     @SWR,R2         ;GET BITS IN SW REG
 1718  002246  042702  177740        BIC     #177740,R2      ;ONLY WANT THE TEST NUMBER FOR LOOPING
 1719  002252  022702  000021        CMP     #21,R2          ;CAN'T BE HIGHER THAN 20
 1720  002256  101003                BHI     1$              ;BR IF OK
 1721  002260  004767  011730        JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
  (1)  002264  000006                6                       ;******ERROR NUMBER 6******
  (1)
 1722
 1723  002266  013701  000320    1$: MOV     @#MINMEM,R1     ;GET FIRST TEST LOC IN SLICE
 1724  002272  004767  013200    2$: JSR     PC,TSTADD       ;CHECK FOR ERROR FREE TEST ADDRESS
 1725  002276  005703                TST     R3              ;R3 = 0 MEANS ERROR FREE LOC FOUND
 1726  002300  001446                BEQ     4$              ;BR AND SAVE IT
 1727  002302  016777  000402  000420  3$: MOV  ECCDIS,@CSRADR ;ECC DISABLE
 1728  002310  062701  000004        ADD     #4,R1           ;NEXT WORD
 1729  002314  020105                CMP     R1,R5           ;END OF SLICE YET ?
 1730  002316  103765                BLO     2$              ;BR IF NOT
 1731  002320  004767  012106        JSR     PC,TPCRLF       ;PRINT ROUTINE
 1732  002324  047516  042440  051122  .ASCII  /NO ERROR FREE LOC FOR ECC TESTS/
       002332  051117  043040  042522
       002340  020105  047514  020103
       002346  047506  020122  041505
       002354  020103  042524  052123
       002362     123
 1733  002363     015  041012  043505  .ASCIZ  <15><12>/BEGINNING AT TST13/
       002370  047111  044516  043516
       002376  040440  020124  051524
       002404  030524  000063
 1734                                .EVEN
 1735  002410  012702  000013        MOV     #13,R2          ;START AT TST13
 1736  002414  000402                BR      CONT
 1737  002416  010137  000320    4$: MOV     R1,@#MINMEM     ;SET UP TEST LOC
 1738  002422  016777  000262  000300  CONT: MOV  ECCDIS,@CSRADR ;INHIBIT ECC
 1739  002430  010500                MOV     R5,R0           ;
```

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

1740  002432  005040                  5$:     CLR     -(R0)           ;BEGIN CLEARING FROM TOP
1741  002434  020004                          CMP     R0,R4           ;TO BOTTOM
1742  002436  101375                          BHI     5$              ;
1743  002440  005077  000264                  CLR     @CSRADR         ;RESTORE CSR
1744
1745                                          ;ENTER HERE FROM TSTSCP ROUTINE AT END OF EACH TEST
1746
1747  002444  005037  000302                  CLR     @#PASFLG        ;INIT SOFTEST PASS FLAG
1748  002450  110237  000404                  MOVB    R2,@#$TESTN     ;SET UP $TESTN WITH THE TEST
1749  002454  110277  000254                  MOVB    R2,@DISPLAY     ;NUMBER TO BE EXECUTED & DISPLAYED
1750
1751  002460  005077  000244          LOOP:   CLR     @CSRADR ;
1752  002464  032777  004000  000240          BIT     #4000,@SWR      ;ENABLE PRINTOUT OF SBE'S(INH ECC)
1753  002472  001403                          BEQ     1$              ;BR IF NO
1754  002474  016777  000210  000226          MOV     ECCDIS,@CSRADR  ;YES, INHIBIT ECC
1755  002502  010401                  1$:     MOV     R4,R1           ;LOWEST ADDRESS UNDER TEST
1756  002504  010246                          MOV     R2,-(SP)        ;SAVE R2
1757  002506  012703  000376                  MOV     #376,R3         ;POINT R3 TO SCRATCH STACK
1758  002512  004767  012404                  JSR     PC,PUTADR       ;GEN 18 BIT ADDRESS FROM R1
1759                                                                  ;AND STORE IT IN (R3) AND (R3-2)
1760  002516  005743                          TST     -(R3)           ;POINT R3 TO HIGH ORDER BITS
1761  002520  004767  012502                  JSR     PC,$GTSIZ       ;PLACE BITS 13-17 OF ADDRESS BITS
1762                                                                  ;INTO 0-4 OF R2.
1763  002524  010400                          MOV     R4,R0           ;PLACE ADDRESS OF LOWEST LOC
1764                                                                  ;UNDER TEST IN R0
1765  002526  010401                          MOV     R4,R1           ;AND INTO R1
1766  002530  010403                          MOV     R4,R3           ;AND INTO R3
1767  002532  012602                          MOV     (SP)+,R2        ;RESTORE R2
1768  002534  006302                          ASL     R2              ;DOUBLE IT
1769  002536  060702                          ADD     PC,R2
1770  002540  066207  000004                  ADD     TBL-.(R2),PC    ;GO TO TEST # STORED IN BITS
1771                                                                  ;3-0 OF SWITCH REG.
1772  002544  000172                  TBL:    TST0-TBL                ;RELATIVE ADDRESS OF TEST 0
1773  002546  000326                          TST1-TBL                ;RELATIVE ADDRESS OF TEST 1
1774  002550  000620                          TST2-TBL                ;RELATIVE ADDRESS OF TEST 2
1775  002552  001000                          TST3-TBL                ;RELATIVE ADDRESS OF TEST 3
1776  002554  001232                          TST4-TBL                ;RELATIVE ADDRESS OF TEST 4
1777  002556  001406                          TST5-TBL                ;RELATIVE ADDRESS OF TEST 5
1778  002560  002056                          TST6-TBL                ;RELATIVE ADDRESS OF TEST 6
1779  002562  002776                          TST7-TBL                ;RELATIVE ADDRESS OF TEST 7
1780  002564  003772                          TST10-TBL               ;RELATIVE ADDRESS OF TEST 10
1781  002566  004420                          TST11-TBL               ;RELATIVE ADDRESS OF TEST 11
1782  002570  005052                          TST12-TBL               ;RELATIVE ADDRESS OF TEST 12
1783  002572  005512                          TST13-TBL               ;RELATIVE ADDRESS OF TEST 13
1784  002574  005624                          TST14-TBL               ;RELATIVE ADDRESS OF TEST 14
1785  002576  005736                          TST15-TBL               ;RELATIVE ADDRESS OF TEST 15
1786  002600  006570                          TST16-TBL               ;RELATIVE ADDRESS OF TEST 16
1787  002602  006740                          TST17-TBL               ;RELATIVE ADDRESS OF TEST 17
1788  002604  007076                          RELOC-TBL               ;RELATIVE ADDRESS OF RELOC
1789
1790                                                  ;SCOPE ROUTINE
1791                                                  ;       PROG COMES HERE AFTER EACH TEST AND
1792                                                  ;       IF CTRL C GO TO ERROR HISTORY TYPEOUT.
1793                                                  ;       IF SR=2000 (BIT 10) THEN HALT
1794                                                  ;       IF SR=40000 (BIT 14) THEN LOOP ON TEST
1795                                                  ;       DEFINED BY SR BITS <3:0>, ELSE GO ON
```

```
1796                                                    ;       TO NEXT TEST.
1797                                                    ;
1798  002606  005077  000116          TSTSCP: CLR     @CSRADR ;
1799  002612  105737  000420                  TSTB    @#$ENV          ;RUNNING UNDER APT?
1800  002616  001002                          BNE     CNTSCP          ;IF SO GO TO CNTSCP
1801  002620  004767  013230                  JSR     PC,CHECKC       ;TEST FOR CTRL-C AND IF TYPED
1802                                                                  ;GO TO ERROR HISTORY AND HALT
1803  002624  113702  000404          CNTSCP: MOVB    @#$TESTN,R2     ;PUT TEST NUMBER IN R2 LO BYTE
1804  002630  005237  000410                  INC     @#$DEVCT        ;TELL APT EVERYTHING'S OK
1805  002634  032777  002000  000070        BIT     #2000,@SWR      ;HALT AFTER EACH TEST?
1806  002642  001401                          BEQ     TSTGO           ;BRANCH IF NOT HALTING
1807  002644  000000                  SWHALT: HALT
1808  002646  032777  040000  000056  TSTGO: BIT     #40000,@SWR     ;LOOP ON TEST DESIRED?
1809  002654  001301                          BNE     LOOP            ;YES, GO START SAME TEST
1810  002656  105202                          INCB    R2              ;
1811  002660  000167  177536                  JMP     CONT            ;GO CONTINUE EXECUTING NEXT TEST
1812
1813  002664  000000  000000          DATBUF: .WORD   0,0
1814  002670  000000  000000          TSTDAT: .WORD   0,0
1815  002674  000000  000000          SBEMSK: .WORD   0,0
1816  002700  000000  000000          DBEMSK: .WORD   0,0
1817  002704  000000  000000          DATSAV: .WORD   0,0
1818  002710  000002                  ECCDIS: .WORD   2
1819  002712  000004                  DIAGA:  .WORD   4
1820  002714  000000                  MSYES:  .WORD   0
1821  002716  000000                  LDFLG:  .WORD   0
1822  002720  000000                  BASE:   .WORD   0               ;OFFSET FOR RELOC
1823  002722  100000                  SAVMIN: .WORD   100000          ;TO SAVE MINMEM FROM RELOC
1824  002724  000000                  ERRFLG: .WORD   0       ;FLAG TO INDICATE FIRST ERROR FOR HEADER
1825  002726  000000                  INHREL: .WORD   0       ;FLAG TO INDICATE NO RELOCATION ALLOWED
1826  002730  172136                  CSRADR: 172136          ;DEFAULT CSR ADDRESS
1827
1828
1829
1830
1831
1832
1833
1834
1835                                    ;;*****************************************************************
1836  002732  177570                  SWR:    177570  ;CHANGES TO SWREG IF NO HARDWARE SWITCH REGISTER
1837  002734  177570                  DISPLAY:177570  ;CHANGES TO DSPREG IF NO HARDWARE DISPLAY REG
1838
1839                                          ;*(1)   THIS TEST ASSUMES THAT THE MEMORY IS IN A STATE
1840                                          ;*      OF ALL 0'S AND R0 HAS THE ADDRESS OF THE LOWEST
1841                                          ;*      LOCATION UNDER TEST
1842                                          ;*(2)   IT CHECKS FOR PROPER BANK SELECTION BY WRITING
1843                                          ;*      1'S IN A LOCATION AND CHECKING FOR 0'S IN THE SAME
1844                                          ;*      LOCATIONS OF OTHER 4K BANKS OF THE MEMORY
1845                                          ;*      [I.E. LOCATIONS LIKE 7766 AND 27766 ETC.]
1846
1847  002736  122737  000000  000404  TST0:   CMPB    #0,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
1848  002744  001403                          BEQ     .+10
1849  002746  004767  011242                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
      [1]   002752  000007                  7                       ;******ERROR NUMBER 7******
      [1]
```

```
1850  002754  012703  177777              MOV     #177777,R3
1851  002760  010401              1$:     MOV     R4,R1           ;R1 = ADDRESS OF LOWEST LOCATION OF MEMORY UNDER TEST
1852  002762  010310                      MOV     R3,(R0)         ;SET ALL THE BITS AT (R0)
1853  002764  020001              2$:     CMP     R0,R1           ;IS R0 POINTING TO THE SAME MEMORY LOCATION AS R1
1854  002766  001417                      BEQ     4$              ;IN WHICH CASE CHECK FOR ALL 1'S AT (R1)
1855  002770  005711                      TST     (R1)            ;OTHERWISE CHECK (R1) FOR ALL 0'S
1856  002772  001430                      BEQ     5$
1857  002774  020311                      CMP     R3,(R1)         ;IF R1 IS NOT EQUAL TO R0 AND (R1)
1858                                                              ;DOES NOT CONTAIN ALL 0'S THEN
1859                                                              ;CHECK TO SEE IF (R0) = (R1)
1860  002776  001004                      BNE     3$
1861  003000  012767  000010  000042      MOV     #10,12$         ;*****ERROR NUMBER 10*****
 (1)
1862  003006  000403                      BR      10$
1863  003010                      3$:
 (1)  003010  012767  000011  000032      MOV     #11,12$         ;*****ERROR NUMBER 11*****
 (1)
1864  003016  010046              10$:    MOV     R0,-(SP)        ;SAVE R0 ON STACK
1865  003020  105237  000275              INCB    @#$ADERR        ;AN ADDRESSING ERROR IS SUSPECTED
1866  003024  000407                      BR      11$
1867  003026  020311              4$:     CMP     R3,(R1)         ;CHECK (R1) FOR ALL 1'S
1868  003030  001411                      BEQ     5$
1869  003032  012767  000012  000010      MOV     #12,12$         ;*****ERROR NUMBER 12*****
 (1)
1870  003040  010046                      MOV     R0,-(SP)        ;SAVE R0 ON STACK
1871  003042  010300                      MOV     R3,R0
1872  003044  004767  010470      11$:    JSR     PC,ERROR        ;GO TO THE ERROR SUBROUTINE
1873  003050  000000              12$:    .WORD                   ;ERROR NUMBER TO BE REPORTED WILL BE PLACED HERE
1874  003052  012600                      MOV     (SP)+,R0        ;RESTORE R0
1875
1876  003054  013706  000346      5$:     MOV     @#SAVR6,SP      ;RESTORE THE STACK POINTER
1877  003060  062701  020000              ADD     #20000,R1       ;CAUSE R1 TO POINT TO THE SAME CHIP
1878                                                              ;LOCATION IN THE NEXT 4K BANK OF MEMORY
1879                                                              ;BY ADDING 1 TO THE 14TH BIT OF ADDRESS IN R1
1880  003064  020105                      CMP     R1,R5           ;COMPARE R1 WITH THE HIGHEST MEMORY
1881                                                              ;LOCATION WHICH IS STORED IN R5
1882  003066  103736                      BLO     2$              ;IF R1 LESS THAN R5 THEN REPEAT THE TEST FROM 2$
1883
1884  003070  000646              ENDO:   BR      TSTSCP
1885                                      ;INITIAL DATA TEST
1886                                      ;       THIS TEST CHECKS THE DI/DO LINES BY
1887                                      ;       SHIFTING A 1 THROUGH THE WORD.
1888                                      ;
1889  003072  122737  000001  000404  TST1:  CMPB    #1,@#$TESTN     ;CHECK FOR PROPER SEQUENCE
1890  003100  001403                      BEQ     .+10            ;BR IF OK
1891  003102  004767  011106              JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  003106  000013                      13                      ;******ERROR NUMBER 13******
 (1)
1892  003110  013701  000320              MOV     @#MINMEM,R1     ;GET TEST ADDRESS
1893  003114  012767  000001  177542  1$: MOV     #1,DATBUF       ;SET THE FIRST TEST BIT
1894  003122  005067  177540              CLR     DATBUF+2        ;CLEAR 2ND WORD
1895  003126  016711  177532      2$:     MOV     DATBUF,(R1)     ;WRITE TEST WORD 1
1896  003132  016761  177530  000002      MOV     DATBUF+2,2(R1)  ;AND TEST WORD 2
1897  003140  026711  177520              CMP     DATBUF,(R1)     ;NOW READ THEM
1898  003144  001405                      BEQ     4$              ;BR IF FIRST 16 OK
1899  003146  016700  177512              MOV     DATBUF,R0       ;GET GOOD DATA FOR ERROR MSG
```

```
 1900  003152  004767  010362                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  003156  000014                            14                      ;******ERROR NUMBER 14******
  (1)
 1901
 1902  003160  026761  177502  000002  4$:       CMP     DATBUF+2,2(R1)  ;NOW READ SECOND WORD
 1903  003166  001405                            BEQ     5$              ;BR IF OK
 1904  003170  016700  177472                    MOV     DATBUF+2,R0     ;GOOD DATA FOR ERROR MSG
 1905  003174  004767  010340                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  003200  000015                            15                      ;******ERROR NUMBER 15******
  (1)
 1906
 1907
 1908  003202  005767  177460          5$:       TST     DATBUF+2        ;HAS LAST BIT BEEN TESTED ?
 1909  003206  100404                            BMI     6$              ;MINUS MEANS BIT 31
 1910  003210  004567  010140                    JSR     R5,DASHL        ;NO, SHIFT TEST BIT LEFT
 1911  003214  002664                            .WORD   DATBUF          ;IN DATBUF
 1912  003216  000743                            BR      2$              ;GO WRITE NEW TEST DATA
 1913
 1914                                            ;NOW GOING TO SHIFT A 0 IN DATA DIRECTION
 1915  003220  012767  177776  177436  6$:       MOV     #177776,DATBUF  ;PUT A 0 IN BIT 0
 1916  003226  012767  177777  177432            MOV     #-1, DATBUF+2   ;AND 1'S IN ALL OTHERS
 1917  003234  012702  002664                    MOV     #DATBUF,R2      ;LOC OF WRITE DATA
 1918  003240  066702  177454                    ADD     BASE,R2         ;OFFSET IT IN CASE OF RELOC
 1919  003244  016711  177414          66$:      MOV     DATBUF,(R1)     ;WRITE THE DATA
 1920  003250  016761  177412  000002            MOV     DATBUF+2,2(R1)  ;2 WORDS WORTH
 1921  003256  026711  177402                    CMP     DATBUF,(R1)     ;NOW READ FIRST WORD
 1922  003262  001405                            BEQ     7$              ;BR IF OK
 1923  003264  016700  177374                    MOV     DATBUF,R0       ;GOOD DATA
 1924  003270  004767  010244                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  003274  000016                            16                      ;******ERROR NUMBER 16******
  (1)
 1925
 1926  003276  026761  177364  000002  7$:       CMP     DATBUF+2,2(R1)  ;NOW, READ SECOND WORD
 1927  003304  001405                            BEQ     8$              ;BR IF OK
 1928  003306  016700  177354                    MOV     DATBUF+2,R0     ;GOOD DATA
 1929  003312  004767  010222                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  003316  000017                            17                      ;******ERROR NUMBER 17******
  (1)
 1930
 1931  003320  022762  077777  000002  8$:       CMP     #77777,2(R2)    ;TESTED BIT 31 YET?
 1932  003326  001410                            BEQ     10$             ;BR IF YES, WE'RE DONE
 1933  003330  006162  000002                    ROL     2(R2)           ;SHIFT DATBUF
 1934  003334  006112                            ROL     (R2)            ;AND DATBUF +2
 1935  003336  103403                            BCS     9$              ;
 1936  003340  005362  000002                    DEC     2(R2)           ;
 1937  003344  000261                            SEC                     ;SET CARRY FOR NEXT ROL
 1938  003346  000736                    9$:     BR      66$             ;KEEP GOING
 1939  003350  062701  020000          10$:      ADD     #20000,R1       ;NEXT 4K BANK
 1940  003354  020105                            CMP     R1,R5           ;COMPARE AGAINST HIGHEST VIRTUAL MEM
 1941  003356  103656                            BLO     1$
 1942
 1943  003360  000167  177222          END1:     JMP     TSTSCP
 1944
 1945
 1946                                            ;TEST2  THIS TEST CHECKS TO SEE THAT EACH ADDRESS
 1947                                            ;       BIT IN EACH 4K BANK CAN BE ASSERTED UNIQUELY.
```

```
1948                                                    ;       IT CHECKS FOR ADDRESS BITS THAT MAY BE STUCK
1949                                                    ;       HIGH, STUCK LOW OR STUCK TOGETHER.
1950                                                    ;
1951
1952  003364  122737  000002  000404  TST2:   CMPB    #2,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
1953  003372  001403                   BEQ     1$
1954  003374  004767  010614                   JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  003400  000020                   20                              ;******ERROR NUMBER 20******
 (1)
1955  003402  012701  040000          1$:     MOV     #40000,R1       ;
1956  003406  005000                   CLR     R0                      ;
1957  003410  010146                   MOV     R1,-(SP)        ;SAVE START ADDRESS
1958  003412  005021          11$:     CLR     (R1)+           ;CLEAR A LOCATION
1959  003414  020105                   CMP     R1,R5           ;END OF 20K SLICE YET ?
1960  003416  103775                   BLO     11$             ;BR IF NO
1961  003420  011601                   MOV     (SP),R1         ;RESTORE R1 NOW
1962  003422  012702  000001          2$:     MOV     #1,R2           ;SET FIRST BIT
1963  003426  050201                   BIS     R2,R1           ;POINT R1 TO FIRST BYTE
1964  003430  105711                   TSTB    (R1)            ;READ AND COMPARE FOR ZEROS
1965  003432  001403                   BEQ     3$              ;BR IF OK
1966  003434  004767  010100                   JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  003440  000021                   21                              ;******ERROR NUMBER 21******
 (1)
1967  003442  105100          3$:     COMB    R0              ;FOR ERROR MSG
1968  003444  105111                   COMB    (R1)            ;COMPLEMENT THE BYTE
1969  003446  105711                   TSTB    (R1)            ;READ FOR NON ZEROS
1970  003450  001003                   BNE     4$              ;BR IF OK
1971  003452  004767  010062                   JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  003456  000022                   22                              ;******ERROR NUMBER 22******
 (1)
1972  003460  040201          4$:     BIC     R2,R1           ;MASK OFF THE ASSERTED BIT
1973  003462  006302                   ASL     R2              ;SHIFT R2 FOR NEXT BIT
1974  003464  050201                   BIS     R2,R1           ;SET THE NEW BIT INTO R1
1975  003466  005711                   TST     (R1)            ;READ THE NEW ADDRESS
1976  003470  001404                   BEQ     5$              ;READ FOR ZEROS
1977  003472  005000                   CLR     R0              ;
1978  003474  004767  010040                   JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  003500  000023                   23                              ;******ERROR NUMBER 23******
 (1)
1979  003502  005100          5$:     COM     R0              ;
1980  003504  005111                   COM     (R1)            ;COMPL THE WORD
1981  003506  005711                   TST     (R1)            ;READ IT AGAIN
1982  003510  001003                   BNE     6$
1983  003512  004767  010022                   JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  003516  000024                   24                              ;******ERROR NUMBER 24******
 (1)
1984  003520  032702  010000          6$:     BIT     #10000,R2       ;CHECK FOR MSB IN 4K BANK
1985  003524  001755                   BEQ     4$              ;NOT LAST BIT, BRANCH
1986  003526  040201                   BIC     R2,R1           ;LAST BIT, CLR THE MASK
1987  003530  062701  020000                   ADD     #20000,R1       ;MOVE TO NEXT 4K
1988  003534  020105                   CMP     R1,R5           ;TOP + 2
1989  003536  103731                   BLO     2$
1990  003540  000167  177042          END2:   JMP     TSTSCP
1991
1992                                                    ;TEST 3 THIS TEST CHECKS FOR PROPER
1993                                                    ;       BYTE ADDRESSING.
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N03


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 1994
 1995  003544  122737  000003  000404  TST3:   CMPB    #3,@#$TESTN     ;CHECK FOR PROPER SEQUENCE NUMBER
 1996  003552  001403                          BEQ     1$              ;OK, BRANCH
 1997  003554  004767  010434                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
  (1)  003560  000025                          25                      ;******ERROR NUMBER 25******
  (1)
 1998
 1999  003562  010446                  1$:     MOV     R4,-(SP)        ;SAVE R4
 2000  003564  013702  000320                  MOV     @#MINMEM,R2             ;MINMEM IS LOWEST ADDRESS
 2001  003570  010203                          MOV     R2,R3           ;PUT IT IN R3 ALSO
 2002  003572  062702  000004                  ADD     #4,R2           ;POINT R2 TO LAST BYTE +1
 2003  003576  012713  177777                  MOV     #-1,(R3)        ;WRITE ALL ONES IN
 2004  003602  012763  177777  000002          MOV     #-1,2(R3)       ;THE 4 TEST BYTES
 2005  003610  105013                  2$:     CLRB    (R3)            ;CLEAR A BYTE
 2006  003612  013701  000320                  MOV     @#MINMEM,R1     ;INITIALIZE R1 FOR EACH PASS
 2007  003616  020201                  3$:     CMP     R2,R1           ;IF EQUAL, JUST READ LAST BYTE
 2008  003620  001456                          BEQ     5$              ;BR IF EQUAL
 2009  003622  020301                          CMP     R3,R1           ;IS THIS THE BYTE OF ZEROS
 2010  003624  001022                          BNE     4$              ;BR IF NOT
 2011  003626  122711  000000                  CMPB    #0,(R1)         ;IT IS, COMPARE FOR ZEROS
 2012  003632  001415                          BEQ     6$
 2013  003634  012700  000377                  MOV     #377,R0         ;SET UP LO BYTE
 2014  003640  032701  000001                  BIT     #1,R1           ;WHICH BYTE ARE WE TESTING ?
 2015  003644  001001                          BNE     9$              ;LO BYTE R0 IS OK
 2016  003646  000300                          SWAB    R0              ;HIGH BYTE, MAKE R0 RIGHT
 2017  003650  010146                  9$:     MOV     R1,-(SP)        ;SAVE R1
 2018  003652  042701  000001                  BIC     #1,R1           ;FOR PRINTOUT
 2019  003656  004767  007656                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  003662  000026                          26                      ;******ERROR NUMBER 26******
  (1)
 2020  003664  012601                          MOV     (SP)+,R1        ;RESTORE R1 FOR FURTHER TESTING
 2021  003666  005201                  6$:     INC     R1              ;NEXT BYTE
 2022  003670  000752                          BR      3$              ;RETURN
 2023  003672  122711  177777          4$:     CMPB    #-1,(R1)        ;ITS NOT THE BYTE OF 0'S, READ 1'S
 2024  003676  001425                          BEQ     7$              ;
 2025  003700  010304                          MOV     R3,R4           ;GET ADDRESS
 2026  003702  042704  177775                  BIC     #177775,R4      ;TO FIND BYTE
 2027  003706  030104                          BIT     R1,R4           ;IS IT SET IN TEST ADDRESS ?
 2028  003710  001003                          BNE     12$             ;NO, BRANCH CAUSE IT'S NOT IN SAME WORD
 2029  003712  012700  177777                  MOV     #-1,R0          ;DATA SHOULD BE ALL ONES
 2030  003716  000406                          BR      10$             ;GO REPORT ERROR
 2031  003720  012700  000377          12$:    MOV     #377,R0         ;IT'S IN SAME WORD, BUT WHICH BYTE ?
 2032  003724  032701  000001                  BIT     #1,R1           ;CHECK FOR LO BYTE
 2033  003730  001401                          BEQ     10$             ;NO, LEAVE R0 ALONE
 2034  003732  000300                          SWAB    R0              ;SWAP BYTES
 2035  003734  010146                  10$:    MOV     R1,-(SP)        ;SAVE R1
 2036  003736  042701  000001                  BIC     #1,R1           ;FOR PRINTOUT
 2037  003742  004767  007572                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  003746  000027                          27                      ;******ERROR NUMBER 27******
  (1)
 2038  003750  012601                          MOV     (SP)+,R1        ;RESTORE R1
 2039  003752  005201                  7$:     INC     R1              ;MOVE TO NEXT BYTE
 2040  003754  000720                          BR      3$              ;
 2041  003756  112713  177777          5$:     MOVB    #-1,(R3)        ;RESTORE 1'S TO BYTE JUST TESTED
 2042  003762  005203                          INC     R3              ;INC TO NEXT BYTE
 2043  003764  020302                          CMP     R3,R2           ;WAS THAT JUST THE LAST ONE?
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2044  003766  001310                          BNE     2$              ;BR IF NO
2045  003770  012604                          MOV     (SP)+,R4        ;RESTORE R4
2046  003772  000167  176610          END3:   JMP     TSTSCP
2047
2048
2049                                          ;STATUS REGISTER RESPONSE
2050                                          ;THIS TEST INSURES THAT THE MS11K
2051                                          ;CSR RESPONDS AND THAT EACH BIT
2052                                          ;CAN BE WRITTEN UNIQUELY.
2053                                          ;
2054  003776  122737  000004  000404  TST4:   CMPB    @#4,@#STESTN    ;TEST FOR PROPER TEST SEQUENCE
2055  004004  001403                          BEQ     1$
2056  004006  004767  010202                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  004012  000030                          30                      ;******ERROR NUMBER 30******
 (1)
2057
2058  004014  012702  004042          1$:     MOV     #2$,R2
2059  004020  066702  176674                  ADD     BASE,R2         ;OFFSET FOR RELOC
2060  004024  010237  000004                  MOV     R2,@#4
2061  004030  012701  172136                  MOV     #172136,R1      ;FOR ERROR PRINTOUT
2062  004034  005777  176670                  TST     @CSRADR         ;TRY ACCESSING CSR
2063  004040  000403                          BR      3$              ;IF WE GOT HERE ALL IS WELL
2064  004042                          2$:
 (1)  004042  004767  010146                  JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
 (1)  004046  000031                          31                      ;******ERROR NUMBER 31******
 (1)
2065
2066  004050  012700  000001          3$:     MOV     #1,R0           ;SET FIRST TEST BIT
2067  004054  012737  000352  000004          MOV     #BUSER,@#4      ;SET UP FOR FUTURETRAPS
2068  004062  005767  176630          4$:     TST     LDFLG           ;RUNNING IN MEM UNDER TEST?
2069  004066  001004                          BNE     5$              ;YES, BRANCH TO 5$
2070  004070  032700  050020                  BIT     #50020,R0       ;NO, CHECK FOR UNUSED BITS
2071  004074  001017                          BNE     7$              ;
2072  004076  000403                          BR      8$              ;
2073  004100  032700  050026          5$:     BIT     #50026,R0       ;
2074  004104  001013                          BNE     7$
2075  004106  010077  176616          8$:     MOV     R0,@CSRADR      ;WRITE THE TEST BIT
2076  004112  017702  176612                  MOV     @CSRADR,R2      ;GET CSR CONTENTS
2077  004116  042702  000020                  BIC     #20,R2          ;SINGLE ERRORS WILL CONFUSE US
2078  004122  020002                          CMP     R0,R2           ;READ AND COMPARE
2079  004124  001403                          BEQ     7$
2080  004126  004767  007406                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  004132  000032                          32                      ;******ERROR NUMBER 32******
 (1)
2081
2082  004134  006300                  7$:     ASL     R0              ;SHIFT TO NEXT BIT
2083  004136  103351                          BCC     4$              ;CONTINUE TESTING THRU BIT 15
2084  004140  012737  000352  000004          MOV     #BUSER,@#4      ;FOR ANY FUTURE TRAPS
2085  004146  000167  176434          END4:   JMP     TSTSCP
2086
2087                                          ;SINGLE BIT ERROR TEST
2088                                          ;THIS TEST FIRST CHECKS FOR UNCORRECTED DATA
2089                                          ;WITH THE INH ECC BIT SET, CHECKS THAT THE SINGLE
2090                                          ;ERROR INDICATE OCCURRED AND  FINALLY, WITH ECC
2091                                          ;ENABLED, CHECKS FOR CORRECTED DATA.
2092                                          ;
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 2093  004152  122737  000005  000404  TST5:   CMPB    #5,@#$TESTN     ;CHECK FOR PROPER TEST SEQUENCE
 2094  004160  001403                  BEQ     1$
 2095  004162  004767  010026          JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
   (1) 004166  000033                  33                      ;******ERROR NUMBER 33******
   (1)
 2096  004170  005077  176534          1$:     CLR     @CSRADR
 2097  004174  012767  000001  176462  TSA:    MOV     #1,DATBUF       ;INITIAL DATA
 2098  004202  005067  176460          CLR     DATBUF+2        ;32 BITS WORTH
 2099  004206  012767  000001  176460  20$:    MOV     #1,SBEMSK       ;INITIAL ERROR MASK
 2100  004214  005067  176456          CLR     SBEMSK+2        ;32 BITS WORTH
 2101  004220  016767  176440  176442  30$:    MOV     DATBUF,TSTDAT   ;
 2102  004226  016767  176434  176436          MOV     DATBUF+2,TSTDAT+2;TO SAVE ORIG DATA
 2103  004234  105737  000302          TSTB    @#PASFLG        ;COMP DATA ON SECOND PASSONLY
 2104  004240  001404                  BEQ     40$             ;BR IF FIRST PASS
 2105  004242  005167  176422          COM     TSTDAT          ;SECOND PASS, COMP BOTH WORDS
 2106  004246  005167  176420          COM     TSTDAT+2        ;
 2107  004252  016702  176412          40$:    MOV     TSTDAT,R2
 2108  004256  016703  176410          MOV     TSTDAT+2,R3
 2109  004262  012767  002670  006522  MOV     #TSTDAT,SOURCE  ;SET UP ADDRESS FOR CHKGEN
 2110  004270  004767  006570          JSR     PC,CHKGEN       ;GEN CHECKBITS ON TSTDAT
 2111  004274  004567  007104          JSR     R5,BITCOM       ;BIT COMPLEMENT ROUTINE
 2112  004300  002674                  .WORD   SBEMSK          ;MASK
 2113  004302  002670                  .WORD   TSTDAT          ;DATA
 2114  004304  013701  000320          50$:    MOV     @#MINMEM,R1     ;FIRST TEST ADDRESS
 2115  004310  016777  176374  176412  MOV     ECCDIS,@CSRADR  ;FORCE VALIDATE WITH ECC DISABLED
 2116  004316  016721  176346          MOV     TSTDAT,(R1)+    ;WRITE FIRST 16 BITS
 2117  004322  016700  006466          MOV     CHECK,R0        ;GET CHECKBITS FROM CHKGEN
 2118  004326  056700  176360          BIS     DIAGA,R0        ;SET DIAGNOSTIC CHECK A
 2119  004332  010077  176372          MOV     R0,@CSRADR      ;LOAD CSR WITH IMAGE IN R0
 2120  004336  016711  176330          MOV     TSTDAT+2,(R1)   ;WRITE SECOND 16 BITS AND
 2121                                                          ;CHECK BITS. WE NOW HAVE CHECKBITS
 2122                                                          ;GENERATED ON DATBUF AND DATA WITH
 2123                                                          ;ONE BIT IN ERROR (AS PER SBEMSK).
 2124  004342  016777  176342  176360          MOV     ECCDIS,@CSRADR  ;DISABLE ERROR CORRECTING
 2125  004350  016700  176314          MOV     TSTDAT,R0       ;SET UP GOOD DATA FOR ERROR REPT.
 2126  004354  020041                  CMP     R0,-(R1)        ;READ THE LOW WORD
 2127  004356  001403                  BEQ     55$             ;BR IF OK
 2128  004360  004767  007154          JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 004364  000034                  34                      ;******ERROR NUMBER 34******
   (1)
 2129  004366  016700  176300          55$:    MOV     TSTDAT+2,R0     ;HIGH WORD
 2130  004372  062701  000002          ADD     #2,R1           ;POINT R1 TO SECOND 16 BITS
 2131  004376  020011                  CMP     R0,(R1)         ;READ THE HIGH WORD
 2132  004400  001403                  BEQ     56$             ;BR IF OK
 2133  004402  004767  007132          JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 004406  000035                  35                      ;******ERROR NUMBER 35******
   (1)
 2134  004410  005077  176314          56$:    CLR     @CSRADR         ;ENABLE ECC
 2135  004414  010200                  MOV     R2,R0           ;THIS IS ORIGINAL DATA
 2136  004416  020041                  CMP     R0,-(R1)        ;SEE IF ITS BEEN CORRECTED
 2137  004420  001403                  BEQ     57$             ;IT SHOULD HAVE BEEN
 2138  004422  004767  007112          JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 004426  000036                  36                      ;******ERROR NUMBER 36******
   (1)
 2139  004430  032777  000020  176272  57$:    BIT     #20,@CSRADR     ;CHECK IF SBE INDICATE SET
 2140  004436  001011                  BNE     58$             ;BR IF IT IS SET
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

2141  004440  010146                        MOV     R1,-(SP)        ;SAVE R1
2142  004442  016701  176262                MOV     CSRADR,R1       ;GET CSR ADDRESS
2143  004446  012700  000020                MOV     #20,R0          ;READY R0 FOR PRINTOUT
2144  004452  004767  007062                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  004456  000037                        37                      ;******ERROR NUMBER 37******
 (1)
2145  004460  012601                        MOV     (SP)+,R1        ;RESTORE R1
2146  004462  005077  176242        58$:    CLR     @CSRADR         ;RESTORE CSR
2147  004466  010300                        MOV     R3,R0           ;HIGH WORD
2148  004470  062701  000002                ADD     #2,R1           ;POINT TO HIGH WORD
2149  004474  020011                        CMP     R0,(R1)         ;SEE IF ITS BEEN CORRECTED
2150  004476  001403                        BEQ     59$             ;BR IF OK
2151  004500  004767  007034                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  004504  000040                        40                      ;******ERROR NUMBER 40******
 (1)
2152  004506  032777  000020  176214  59$:   BIT     #20,@CSRADR     ;SBE BIT SET ?
2153  004514  001010                        BNE     60$             ;BR IF YES
2154  004516  010146                        MOV     R1,-(SP)        ;SAVE R1
2155  004520  016701  176204                MOV     CSRADR,R1       ;GET ADDRESS OF CSR BEING TESTED
2156  004524  012700  000020                MOV     #20,R0          ;FOR PRINTOUT
2157  004530  004767  007004                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  004534  000041                        41                      ;******ERROR NUMBER 41******
 (1)
2158  004536  005737  000406        60$:    TST     @#$PASS
2159  004542  001425                        BEQ     ENDS            ;Q V ONLY ONE ITERATION
2160  004544  005767  176126                TST     SBEMSK+2        ;TEST FOR LAST MASK BIT
2161  004550  100404                        BMI     65$             ;MINUS MEANS BIT 31
2162  004552  004567  006576                JSR     R5,DASHL        ;SHIFT LEFT ROUTINE FOR 32 BIT'S
2163  004556  002674                        .WORD   SBEMSK          ;WORD TO BE SHIFTED
2164  004560  000617                        BR      30$
2165  004562  005767  176100        65$:    TST     DATBUF+2        ;LAST DATA BIT ?
2166  004566  100404                        BMI     70$             ;WHICH IS BIT 31
2167  004570  004567  006560                JSR     R5,DASHL        ;SHIFT IT
2168  004574  002664                        .WORD   DATE.F          ;
2169  004576  000603                        BR      20$
2170  004600  105737  000302        70$:    TSTB    @#PASFLG        ;FIRST OR SECOND PASS ?
2171  004604  001004                        BNE     ENDS            ;NON ZERO MEANS WE'RE DONE
2172  004606  105237  000302                INCB    @#PASFLG        ;NOT DONE, GO DO SECOND PASS
2173  004612  000167  177356                JMP     TSA
2174  004616  000167  175764        ENDS:   JMP     TSTSCP
2175                                        ;SINGLE BIT ERROR TEST TO INSURE THAT A WRITE
2176                                        ;BYTE CLEARS SINGLE BIT ERRORS.
2177                                        ;
2178  004622  122737  000006  000404  TST6:   CMPB    #6,@#STESTN     ;CHECK FOR PROPER TEST SEQUENCE
2179  004630  001403                        BEQ     1$
2180  004632  004767  007356                JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  004636  000042                        42                      ;******ERROR NUMBER 42******
 (1)
2181  004640  010701                1$:     MOV     PC,R1           ;GET PC
2182  004642  012700  005534                MOV     #END6,R0        ;END OF THIS TEST
2183  004646  066700  176046                ADD     BASE,R0         ;FOR OFFSET
2184  004652  005711                2$:     TST     (R1)            ;READ A LOC
2185  004654  032777  000020  176046        BIT     #20,@CSRADR     ;LOOKING FOR SBE'S IN THIS TEST
2186  004662  001403                        BEQ     3$              ;BR IF NO ERROR
2187  004664  005267  000650                INC     T6FLG           ;INDICATE WITH FLAG
2188  004670  000404                        BR      4$              ;AND BRANCH
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2189  004672  062701  000004          3$:     ADD     #4,R1           ;MOVE TO NEXT WORD
2190  004676  020100                          CMP     R1,R0           ;END OF TEST 6 YET ?
2191  004700  103764                          BLO     2$              ;NO, BRANCH
2192  004702  004467  006420          4$:     JSR     R4,SAVOT4       ;SAVE REGS R0 TO R4
2193  004706  005077  176016                  CLR     @#CSRADR        ;CLEAR CSR
2194  004712  012767  000001  175744          MOV     #1,DATBUF       ;INITIAL DATA
2195  004720  005067  175742                  CLR     DATBUF+2        ;32 BITS WORTH
2196  004724  012767  000001  175742  T6A:    MOV     #1,SBEMSK       ;INITIAL ERROR MASK
2197  004732  005067  175740                  CLR     SBEMSK+2        ;32 BITS WORTH
2198  004736  016767  175722  175724  T6B:    MOV     DATBUF,TSTDAT   ;SAVE ORIGINAL DATA
2199  004744  016767  175716  175720          MOV     DATBUF+2,TSTDAT+2;BOTH WORDS
2200  004752  016767  175706  175724          MOV     DATBUF,DATSAV   ;IN CASE PROG HAS SBE
2201  004760  016767  175702  175720          MOV     DATBUF+2,DATSAV+2       ;DITTO
2202  004766  012767  002670  006016          MOV     #TSTDAT,SOURCE  ;NEED ADDRESS FOR CHKGEN
2203  004774  004767  006064                  JSR     PC,CHKGEN       ;GENERATE CHECK BITS
2204  005000  004567  006400                  JSR     R5,BITCOM       ;BIT COM ROUTINE
2205  005004  002674                          .WORD   SBEMSK          ;MASK FOR COMPLEMENTING
2206  005006  002670                          .WORD   TSTDAT          ;WORD TO BE COMPLEMENTED
2207  005010  013701  000320          30$:    MOV     @#MINMEM,R1     ;FIRST TEST ADDRESS
2208  005014  010104                          MOV     R1,R4           ;PUT IT IN R4 ALSO
2209  005016  016777  175666  175704          MOV     ECCDIS,@#CSRADR ;INHIBIT ECC
2210  005024  016724  175640                  MOV     TSTDAT,(R4)+    ;WRITE 16 BITS
2211  005030  016703  005760                  MOV     CHECK,R3        ;GET CHECKBITS
2212  005034  056703  175652                  BIS     DIAGA,R3        ;SET DIAGNOSTIC A BIT
2213  005040  010377  175664                  MOV     R3,@#CSRADR     ;LOAD CSR WITH NEW IMAGE
2214  005044  016714  175622                  MOV     TSTDAT+2,(R4)   ;WRITE HIGH WORD+CHECKBITS
2215  005050  005077  175654                  CLR     @#CSRADR        ;IT'S DANGEROUS IF WE DON'T
2216  005054  012702  002674                  MOV     #SBEMSK,R2      ;ADDRESS OF ERROR MASK
2217  005060  066702  175634                  ADD     BASE,R2         ;
2218  005064  162704  000002                  SUB     #2,R4           ;ADJUST ADDRESS
2219  005070  112714  177777          40$:    MOVB    #-1,(R4)        ;WRITE A BYTE OF 1'S
2220  005074  132712  177777                  BITB    #-1,(R2)        ;
2221  005100  001476                          BEQ     60$             ;
2222  005102  005767  000432                  TST     T6FLG           ;SINGLE ERRORS IN TST6 AREA ?
2223  005106  001016                          BNE     45$             ;BR IF YES
2224  005110  005077  175614                  CLR     @#CSRADR        ;CLEAR CSR
2225  005114  105714                          TSTB    (R4)            ;READ
2226  005116  032777  000020  175604          BIT     #20,@#CSRADR    ;SINGLE ERROR INDICATE SET ?
2227  005124  001453                          BEQ     50$             ;
2228  005126  016701  175576                  MOV     CSRADR,R1       ;FOR PRINTOUT
2229  005132  005000                          CLR     R0
2230  005134  004767  006400                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  005140  000043                          43                      ;******ERROR NUMBER 43******
 (1)
2231  005142  000444                          BR      50$             ;CONTINUE
2232  005144  010446          45$:    MOV     R4,-(SP)        ;NEED A SCRATCH LOC
2233  005146  163716  000320                  SUB     @#MINMEM,(SP)   ;TO FIND BYTE OFFSET
2234  005152  012703  002704                  MOV     #DATSAV,R3      ;GET ADDRESS
2235  005156  066703  175536                  ADD     BASE,R3         ;OFFSET FOR RELOC
2236  005162  062603                          ADD     (SP)+,R3        ;ADD BYTE COUNT
2237  005164  112713  177777                  MOVB    #-1,(R3)        ;WRITE BYTE OF 1'S LIKE TEST LOCATION
2238  005170  016777  175516  175532          MOV     DIAGA,@#CSRADR  ;DIAG BIT
2239  005176  105714                          TSTB    (R4)            ;READ THE BYTE TO GET THE CHECKBITS
2240
2241  005200  017703  175524                  MOV     @#CSRADR,R3     ;GET CHECKBITS
2242  005204  042703  170037                  BIC     #170037,R3      ;CLEAR OTHER BITS
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 2243  005210  005077  175514                CLR     @CSRADR         ;
 2244  005214  012767  002704  005570        MOV     #DATSAV,SOURCE  ;FOR CHKGEN
 2245  005222  004767  005636                JSR     PC,CHKGEN       ;GENERATE CHECKBITS
 2246  005226  020367  005562                CMP     R3,CHECK        ;COMPARE ACTUAL VS. EXPECTED
 2247  005232  001410                        BEQ     50$             ;BR IF OK
 2248  005234  010300                        MOV     R3,R0           ;GOOD DATA
 2249  005236  012701  013014                MOV     #CHECK,R1       ;ADDRESS OF CHECKBITS
 2250  005242  066701  175452                ADD     BASE,R1         ;PLUS OFFSET
 2251  005246  004767  006266                JSR     PC,ERROR        ;ERROR ROUTINE
 2252  005252  000043                        43
 2253  005254  122714  177777        50$:    CMPB    #-1,(R4)        ;CHECK DATA
 2254  005260  001461                        BEQ     70$             ;BR IF OK
 2255  005262  010401                        MOV     R4,R1           ;GET R4
 2256  005264  042701  000001                BIC     #1,R1           ;TO MAKE EVEN ADDR FOR PRINTOUT
 2257  005270  004767  006244                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  005274  000044                        44                      ;******ERROR NUMBER 44******
  (1)
 2258  005276  005767  000236        60$:    TST     T6FLG           ;SINGLE ERRORS IN TST6 AREA ?
 2259  005302  001011                        BNE     65$             ;BR IF YES
 2260  005304  105714                        TSTB    (R4)            ;READ THE BYTE
 2261  005306  032777  000020  175414        BIT     #20,@CSRADR     ;SBE ERROR BIT SET ?
 2262  005314  001357                        BNE     50$             ;SHOULD BE SET, BR IF OK
 2263  005316  004767  006216                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  005322  000045                        45                      ;******ERROR NUMBER 45******
  (1)
 2264  005324  000437                        BR      70$             ;CONTINUE
 2265  005326  010446                65$:    MOV     R4,-(SP)        ;SAVE R4
 2266  005330  163716  000320                SUB     @#MINMEM,(SP)   ;FOR BYTE OFFSET
 2267  005334  012703  002704                MOV     #DATSAV,R3      ;ADDRESS OF DATA
 2268  005340  066703  175354                ADD     BASE,R3         ;FOR RELOC
 2269  005344  062603                        ADD     (SP)+,R3        ;BYTE OFFSET
 2270  005346  112713  177777                MOVB    #-1,(R3)        ;WRITE A BYTE OF 1'S
 2271  005352  016777  175334  175350        MOV     DIAGA,@CSRADR   ;DIAG BIT
 2272  005360  105714                        TSTB    (R4)            ;READ THE BYTE
 2273  005362  017746  175342                MOV     @CSRADR,-(SP)   ;GETCONTENTS
 2274  005366  005077  175336                CLR     @CSRADR         ;CLEAR THE CSR
 2275  005372  042716  170037                BIC     #170037,(SP)    ;ONLY WANT CHECKBITS
 2276  005376  012767  002704  005406        MOV     #DATSAV,SOURCE  ;FOR CHKGEN
 2277  005404  004767  005454                JSR     PC,CHKGEN       ;GENERATE CHECKBITS ON DATA
 2278  005410  022667  005400                CMP     (SP)+,CHECK     ;COMPARE ACTUAL VS. EXPECTED
 2279  005414  001403                        BEQ     70$             ;BR IF OK
 2280  005416  004767  006116                JSR     PC,ERROR        ;ERROR ROUTINE
 2281  005422  000045                        45
 2282  005424  132712  177777        70$:    BITB    #-1,(R2)        ;CHECK FOR LAST BYTE
 2283  005430  001012                        BNE     80$             ;
 2284  005432  005202                        INC     R2
 2285  005434  005204                        INC     R4              ;MOVE TO NEXT BYTE
 2286  005436  013701  000320                MOV     @#MINMEM,R1     ;FIRST TEST ADDRESS
 2287  005442  032704  000002                BIT     #2,R4           ;TEST FOR LOWER WORD
 2288  005446  001610                        BEQ     40$             ;BR IF IT'S LOW 16 BITS
 2289  005450  062701  000002                ADD     #2,R1           ;ADJUST POINTER FOR ERROR REPT.
 2290  005454  000605                        BR      40$
 2291  005456  005737  000406        80$:    TST     @#$PASS         ;FIRST PASS ?
 2292  005462  001420                        BEQ     100$            ;BR IF YES
 2293  005464  005767  175206                TST     SBEMSK+2        ;LAST ERROR BIT ?
 2294  005470  100405                        BMI     90$             ;MINUS MEANS BIT 31
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

2295  005472  004567  005656            JSR     R5,DASHL        ;DOUBLE ARITHMETIC SHIFT LEFT
2296  005476  002674                    .WORD   SBEMSK          ;ON THE ERROR MASK
2297  005500  000167  177232            JMP     T6B
2298  005504  005767  175156    90$:    TST     DATBUF+2        ;LAST DATA BIT ?
2299  005510  100405                    BMI     100$            ;MINUS = BIT 31
2300  005512  004567  005636            JSR     R5,DASHL
2301  005516  002664                    .WORD   DATBUF          ;SHIFT IT LEFT
2302  005520  000167  177200            JMP     T6A
2303  005524  004767  005610    100$:   JSR     PC,RSTOT4       ;RESTORE REGS R0 TO R4
2304  005530  005067  000004            CLR     T6FLG           ;FOR NEXT TIME
2305  005534  000167  175046    END6:   JMP     TSTSCP
2306  005540  000000    T6FLG:  .WORD   0
2307                                    ;
2308                                    ;DOUBLE BIT ERROR FORCE TO CHECK DOUBLE ERROR
2309                                    ;STATUS BIT AND TRAP THROUGH LOCATION 114.
2310                                    ;
2311  005542  122737  000007  000404  TST7:  CMPB    #7,@#STESTN
2312  005550  001403                    BEQ     1$
2313  005552  004767  006436            JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
  (1) 005556  000046                    46                      ;******ERROR NUMBER 46******
  (1)
2314  005560  005077  175144    1$:     CLR     @CSRADR         ;CLEAR CSR
2315  005564  013701  000320            MOV     @#MINMEM,R1
2316  005570  004467  005532            JSR     R4,SAVOT4       ;SAVE REGS R0 TO R4
2317  005574  005067  175064    10$:    CLR     DATBUF          ;MAKE INITIAL DATA
2318  005600  005067  175062            CLR     DATBUF+2        ;ALL ZEROS
2319  005604  012767  000001  175062  20$:    MOV     #1,SBEMSK       ;INITIAL SINGLE ERROR MASK
2320  005612  005067  175060            CLR     SBEMSK+2        ;SECOND WORD
2321  005616  012767  000001  175054  30$:    MOV     #1,DBEMSK       ;INITIAL DOUBLE ERROR MASK
2322  005624  005067  175052            CLR     DBEMSK+2        ;32 BITS HERE ALSO
2323  005630  016767  175030  175032  35$:    MOV     DATBUF,TSTDAT   ;
2324  005636  016767  175024  175026          MOV     DATBUF+2,TSTDAT+2
2325  005644  105737  000302            TSTB    @#PASFLG        ;NO COMPLEMENTING FIRST PASS
2326  005650  001404                    BEQ     40$
2327  005652  005167  175012            COM     TSTDAT          ;COMP FIRST WORD
2328  005656  005167  175010            COM     TSTDAT+2        ;SECOND WORD
2329  005662  005077  175042    40$:    CLR     @CSRADR
2330  005666  026767  175002  175004    CMP     SBEMSK,DBEMSK   ;CAN'T HAVE THE SAME ERROR BIT SET
2331  005674  001004                    BNE     45$             ;IN BOTH MASKS
2332  005676  026767  174774  174776    CMP     SBEMSK+2,DBEMSK+2       ;COULD BE EQUAL IN SECOND WORD
2333  005704  001502                    BEQ     65$             ;GO MAKE THEM NOT EQUAL
2334  005706  012767  002670  005076  45$:    MOV     #TSTDAT,SOURCE  ;SOURCE ADDRESS FOR CHKGEN
2335  005714  004767  005144            JSR     PC,CHKGEN       ;GO GENERATE CHECK BITS
2336  005720  004567  005460            JSR     R5,BITCOM       ;FORCE SINGLE ERROR
2337  005724  002674                    .WORD   SBEMSK          ;AS PER SBEMSK
2338  005726  002670                    .WORD   TSTDAT          ;ON DATA IN TSTDAT
2339  005730  004567  005450            JSR     R5,BITCOM       ;FORCING DOUBLE ERROR
2340  005734  002700                    .WORD   DBEMSK          ;THIS MASK INDICATES SECOND BIT IN ERROR
2341  005736  002670                    .WORD   TSTDAT          ;SAME DATA WORD
2342  005740  016704  005050            MOV     CHECK,R4        ;GET CHECKBITS
2343  005744  056704  174742            BIS     DIAGA,R4        ;SET DIAGNOSTIC A BIT
2344  005750  016777  174734  174752    MOV     ECCDIS,@CSRADR  ;INHIBIT ECC
2345  005756  016721  174706            MOV     TSTDAT,(R1)+    ;WRITE 16 BITS
2346  005762  010477  174742            MOV     R4,@CSRADR      ;LOAD CSR
2347  005766  016711  174700            MOV     TSTDAT+2,(R1)   ;WRITE HIGH WORD
2348  005772  005077  174732            CLR     @CSRADR         ;CLEAR CSR AGAIN
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2349  005776  162701  000002                  SUB     #2,R1           ;ADJUST TEST ADDRESS
2350  006002  005711                          TST     (R1)            ;READ THE LOCATION
2351  006004  032777  100000  174716          BIT     #100000,@CSRADR ;LOOK FOR DBE STATUS BIT
2352  006012  001011                          BNE     50$             ;IT SHOULD BE SET
2353  006014  010146                          MOV     R1,-(SP)        ;SAVE R1
2354  006016  016701  174706                  MOV     CSRADR,R1       ;GET CSR ADDRESS
2355  006022  012700  100000                  MOV     #100000,R0      ;SHOW BIT 15 SET
2356  006026  004767  005506                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  006032  000047                          47                      ;******ERROR NUMBER 47******
 (1)
2357  006034  012601                          MOV     (SP)+,R1        ;RESTORE R1
2358  006036  012702  006100          50$:    MOV     #60$,R2         ;SET UP FOR BUS PBL
2359  006042  066702  174652                  ADD     BASE,R2         ;
2360  006046  010237  000114                  MOV     R2,@#114        ;
2361  006052  052777  000001  174650          BIS     #1,@CSRADR      ;SET DOUBLE ERROR INDICATE
2362
2363  006060  005711                          TST     (R1)            ;READ THE TEST LOCATION AGAIN
2364  006062  005077  174642                  CLR     @CSRADR         ;CLEAR STATUS REG
2365  006066  005000                          CLR     R0              ;CLEAR R0
2366  006070  004767  005444                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  006074  000050                          50                      ;******ERROR NUMBER 50******
 (1)
2367  006076  000402                          BR      61$             ;IF ERROR, DON'T ADJUST STACK
2368  006100  062706  000004          60$:    ADD     #4,SP           ;ADJUST STACK FROM TRAP
2369  006104  005737  000406          61$:    TST     @#$PASS         ;FIRST PASS ?
2370  006110  001424                          BEQ     80$             ;BR IF YES
2371  006112  005767  174564          65$:    TST     DBEMSK+2        ;CHECK MASK FOR LAST BIT
2372  006116  100404                          BMI     70$             ;MINUS = BIT31
2373  006120  004567  005230                  JSR     R5,DASHL        ;DOUBLE SHIFT
2374  006124  002700                          .WORD   DBEMSK
2375  006126  000640                          BR      35$
2376  006130  005767  174542          70$:    TST     SBEMSK+2        ;CHECK SINGLE ERROR MASK TOO
2377  006134  100404                          BMI     75$             ;BR IF DONE
2378  006136  004567  005212                  JSR     R5,DASHL        ;SHIFT
2379  006142  002674                          .WORD   SBEMSK          ;
2380  006144  000624                          BR      30$
2381  006146  105737  000302          75$:    TSTB    @#$PASFLG       ;FIRST PASS
2382  006152  001003                          BNE     80$             ;NON ZERO MEANS WE'RE DONE
2383  006154  105237  000302                  INCB    @#$PASFLG       ;FIRST PASS, NOT DONE
2384  006160  000605                          BR      10$             ;KEEP GOING
2385  006162  005737  000406          80$:    TST     @#$PASS         ;CHECKING PASS AGAIN
2386  006166  001406                          BEQ     82$             ;CHECK 1K ADDR FUNCTION ON
2387                                                                  ;FIRST PASS ONLY
2388  006170  016777  174514  174532          MOV     ECCDIS,@CSRADR  ;OTHERWISE DISABLE ECC
2389  006176  005021                          CLR     (R1)+           ;CLEAR THE DBE'S
2390  006200  005011                          CLR     (R1)            ;
2391  006202  000545                          BR      90$             ;AND EXIT
2392  006204  005077  174520          82$:    CLR     @CSRADR         ;CLEAR CSR
2393  006210  005002                          CLR     R2              ;OUR COUNTER
2394  006212  005711                          TST     (R1)            ;READ THE LOCATION
2395  006214  017703  174510                  MOV     @CSRADR,R3      ;MOV CHECKBITS INTO R3
2396  006220  005077  174504                  CLR     @CSRADR         ;CLEAR CSR AGAIN
2397  006224  042703  170037                  BIC     #170037,R3      ;ONLY WANT CHECKBITS
2398  006230  006303                          ASL     R3              ;POSITION THEM
2399  006232  006303                          ASL     R3              ;INTO LOW BYTE
2400  006234  006303                          ASL     R3
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I04


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2401  006236  000303                          SWAB    R3              ;HERE
2402  006240  004767  007142                  JSR     PC,GET1K        ;GET THE 1K BANK
2403  006244  020300                          CMP     R3,R0           ;BETTER BE THE SAME
2404  006246  001413                          BEQ     85$             ;BR IF OK
2405  006250  010146                          MOV     R1,-(SP)        ;SAVE R1 FOR NOW
2406  006252  016777  174432  174450          MOV     ECCDIS,@CSRADR  ;DISABLE ECC
2407  006260  010311                          MOV     R3,(R1)         ;PUT BAD DATA TO BE PRINTED INTO R1
2408  006262  005077  174442                  CLR     @CSRADR         ;RESTORE CSR
2409  006266  004767  005246                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  006272  000051                          51                      ;******ERROR NUMBER 51******
  (1)
2410  006274  012601                  85$:    MOV     (SP)+,R1        ;RESTORE R1
2411  006276  016777  174406  174424          MOV     ECCDIS,@CSRADR  ;DISABLE ERROR CORRECTING
2412  006304  005021                          CLR     (R1)+           ;TO CLEAR ANY DOUBLE ERRORS
2413  006306  005011                          CLR     (R1)            ;
2414  006310  005077  174414                  CLR     @CSRADR         ;RESTORE CSR
2415  006314  042701  003777                  BIC     #3777,R1        ;STRIP AWAY TO LAST 1K
2416  006320  062701  004000                  ADD     #4000,R1        ;MOVE UP TO NEXT 1K
2417  006324  020105                          CMP     R1,R5           ;OVER TOP YET ?
2418  006326  103073                          BHIS    90$             ;BR IF YES
2419  006330  004767  007142          88$:    JSR     PC,TSTADD       ;CHECK FOR ERROR FREE LOC
2420  006334  005703                          TST     R3              ;ZERO MEANS ERROR FREE
2421  006336  001456                          BEQ     86$             ;BR IF OK
2422  006340  005202                          INC     R2              ;COUNT ONE WORD CHECKED
2423  006342  020227  001000                  CMP     R2,#1000        ;TESTED WHOLE 1K SLICE YET ?
2424  006346  103447                          BLO     87$             ;BR IF NOT
2425  006350  004767  006056                  JSR     PC,TPCRLF       ;PRINT ROUTINE
2426  006354  051524  033534  047055          .ASCIZ  /TST7-NO ERROR FREE LOC IN 1K SLICE AT /
      006362  020117  051105  047522
      006370  020122  051106  042505
      006376  046040  041517  044440
      006404  020116  045461  051440
      006412  044514  042503  040440
      006420  020124     000
2427          006424                          .EVEN
2428  006424  042701  003776                  BIC     #3776,R1        ;WANT STARTING ADDRESS OF 1K
2429  006430  012703  006534                  MOV     #SAV7+2,R3      ;SCRATCH LOC FOR ADDRESS
2430  006434  066703  174260                  ADD     BASE,R3         ;FOR OFFSET
2431  006440  010146                          MOV     R1,-(SP)        ;SAVE R1
2432  006442  004767  006454                  JSR     PC,PUTADR       ;PUT ADDRESS IN SAV7 & SAV7+2
2433  006446  105277  171636                  INCB    @TYPCNT         ;PRINT ONE WORD
2434  006452  005741                          TST     -(R1)           ;ADJUST FOR PRINTOUT
2435  006454  004767  006122                  JSR     PC,TYPOCT       ;PRINT IT HERE
2436  006460  005002                          CLR     R2              ;RESTORE R2 FOR NEXT SLICE
2437  006462  012601                          MOV     (SP)+,R1        ;RESTORE R1
2438  006464  000704                          BR      85$             ;GO LOOK FOR GOOD LOC
2439  006466  062701  000004          87$:    ADD     #4,R1           ;NEXT WORD
2440  006472  000716                          BR      88$             ;GO CHECK IT
2441  006474  016721  174170          86$:    MOV     TSTDAT,(R1)+    ;WRITE FIRST WORD
2442  006500  010477  174224                  MOV     R4,@CSRADR      ;CSR IMAGE WITH BAD CHECKBITS
2443  006504  016711  174162                  MOV     TSTDAT+2,(R1)   ;WRITE 2ND WORD + CHECKBITS
2444  006510  162701  000002                  SUB     #2,R1           ;ADJUST R1
2445  006514  000633                          BR      82$             ;CONTINUE TESTING
2446  006516  005077  174206          90$:    CLR     @CSRADR         ;CLEAR CSR TO NORMAL
2447  006522  004767  004612                  JSR     PC,RSTOT4       ;RESTORE THE REGS 0 TO 4
2448  006526  000167  174054          END7:   JMP     TSTSCP
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

2449  006532  000000  000000          SAV7:   .WORD   0,0
2450                                          ;
2451                                          ;THIS TEST CHECKS THE WRITE INHIBIT ON DOUBLE
2452                                          ;BIT ERRORS DURING A DATIP OPERATION BY USE
2453                                          ;OF AN 'INC' INSTRUCTION.
2454                                          ;
2455  006536  122737  000010  000404  TST10:  CMPB    #10,@#$TESTN
2456  006544  001403                        BEQ     1$
2457  006546  004767  005442                JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
  (1) 006552  000052                        52                      ;******ERROR NUMBER 52******
  (1)
2458  006554  004467  004546          1$:     JSR     R4,SAVOT4       ;SAVE REGS R0 TO R4
2459  006560  005067  174100          10$:    CLR     DATBUF          ;INITIAL DATA
2460  006564  005067  174076                  CLR     DATBUF+2        ;2 WORDS WORTH
2461  006570  012767  000001  174076  20$:    MOV     #1,SBEMSK       ;INITIAL ERROR MASK
2462  006576  005067  174074                  CLR     SBEMSK+2        ;
2463  006602  012767  000001  174070  30$:    MOV     #1,DBEMSK       ;DOUBLE ERROR MASK
2464  006610  005067  174066                  CLR     DBEMSK+2        ;2 WORDS
2465  006614  016767  174044  174046  35$:    MOV     DATBUF,TSTDAT   ;PRESERVE ORIG DATA
2466  006622  016767  174040  174042          MOV     DATBUF+2,TSTDAT+2
2467  006630  105737  000302                  TSTB    @#PASFLG        ;SECOND PASS YET ?
2468  006634  001404                        BEQ     40$             ;BR IF NO
2469  006636  005167  174026                  COM     TSTDAT          ;COMPL DATA  ON SECOND PASS
2470  006642  005167  174024                  COM     TSTDAT+2                ;
2471  006646  005077  174056          40$:    CLR     @CSRADR         ;
2472  006652  026767  174022  174014          CMP     DBEMSK,SBEMSK   ;CHECK FOR SAME MASKS
2473  006660  001004                        BNE     45$             ;BR IF OK
2474  006662  026767  174014  174006          CMP     DBEMSK+2,SBEMSK+2
2475  006670  001476                        BEQ     70$             ;BR IF THEY'RE EQUAL
2476  006672  012767  002670  004112  45$:    MOV     #TSTDAT,SOURCE  ;SET UP ADDRESS FOR CHKGEN
2477  006700  004767  004160                  JSR     PC,CHKGEN       ;GENERATE CHECK BITS
2478  006704  004567  004474                  JSR     R5,BITCOM       ;COMPL ROUTINE
2479  006710  002674                          .WORD   SBEMSK          ;MASK
2480  006712  002670                          .WORD   TSTDAT          ;DATA
2481  006714  004567  004464                  JSR     R5,BITCOM       ;TO MAKE DOUBLE ERROR
2482  006720  002700                          .WORD   DBEMSK
2483  006722  002670                          .WORD   TSTDAT
2484  006724  016702  004064                  MOV     CHECK,R2        ;GET CHECKBITS
2485  006730  056702  173756                  BIS     DIAGA,R2        ;SET DIAGNOSTIC A BIT
2486  006734  013701  000320          50$:    MOV     @#MINMEM,R1     ;TEST ADDRESS
2487  006740  016777  173744  173762          MOV     ECCDIS,@CSRADR  ;INHIBIT ECC
2488  006746  016721  173716                  MOV     TSTDAT,(R1)+    ;WRITE FIRST 16 BITS
2489  006752  010277  173752                  MOV     R2,@CSRADR      ;LOAD CSR WITH IMAGE FROM R2
2490  006756  016711  173710                  MOV     TSTDAT+2,(R1)   ;SECOND 16 BITS+CHECKBITS
2491  006762  105067  004064                  CLRB    UPPFLG          ;INDICATE LOWER WORD
2492  006766  013703  000320                  MOV     @#MINMEM,R3     ;TEST ADDRESS
2493  006772  005077  173732          55$:    CLR     @CSRADR         ;CLEAR IT
2494  006776  005223                          INC     (R3)+           ;INC INSTRUCTION
2495  007000  026741  173664                  CMP     TSTDAT,-(R1)    ;CHECK FOR UNCHANGED DATA
2496  007004  001405                        BEQ     60$             ;SHOULD BE UNCHANGED
2497  007006  016700  173656                  MOV     TSTDAT,R0       ;FOR PRINTOUT
2498  007012  004767  004522                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1) 007016  000053                          53                      ;******ERROR NUMBER 53******
  (1)
2499  007020  062701  000002          60$:    ADD     #2,R1           ;POINT TO UPPER WORD
2500  007024  026711  173642                  CMP     TSTDAT+2,(R1)   ;READ IT
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2501  007030  001434                        BEQ     80$             ;BR IF UNCHANGED
2502  007032  016700  173634                MOV     TSTDAT+2,R0     ;
2503  007036  004767  004476                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  007042  000054                        54                      ;******ERROR NUMBER 54*******
 (1)
2504  007044  105767  004002        65$:    TSTB    UPPFLG          ;LOWER WORD
2505  007050  001003                        BNE     66$             ;BR IF NO
2506  007052  105267  003774                INCB    UPPFLG
2507  007056  000745                        BR      55$
2508  007060  005737  000406        66$:    TST     @#$PASS         ;CHECK PASS #
2509  007064  001424                        BEQ     90$             ;BR IF FIRST
2510  007066  005767  173610        70$:    TST     DBEMSK+2        ;LAST BIT IN MASK ?
2511  007072  100404                        BMI     75$             ;BR IF BIT 31
2512  007074  004567  004254                JSR     R5,DASHL        ;SHIFT ROUTINE
2513  007100  002700                        .WORD   DBEMSK
2514  007102  000644                        BR      35$
2515  007104  005767  173566        75$:    TST     SBEMSK+2        ;LAST BIT IN SINGLE ERROR MASK ?
2516  007110  100404                        BMI     80$             ;BR IF YES
2517  007112  004567  004236                JSR     R5,DASHL        ;SHIFT
2518  007116  002674                        .WORD   SBEMSK          ;
2519
2520  007120  000630                        BR      30$
2521  007122  105737  000302        80$:    TSTB    @#PASFLG        ;WHICH PASS
2522  007126  001003                        BNE     90$             ;BR IF WE'RE DONE
2523  007130  105237  000302                INCB    @#PASFLG        ;INDICATE SECOND PASS COMING
2524  007134  000611                        BR      10$             ;GO DO IT!
2525  007136  016777  173546  173564  90$:    MOV     ECCDIS,@CSRADR  ;INHIBIT ECC TO CLEAR DBE'S
2526  007144  005011                        CLR     (R1)
2527  007146  005041                        CLR     -(R1)
2528  007150  005077  173554                CLR     @CSRADR         ;RESTORE CSR TO NORMAL
2529  007154  004767  004160                JSR     PC,RSTOT4       ;RESTORE THE REGS
2530  007160  000167  173422        END10:  JMP     TSTSCP
2531                                        ;
2532                                        ;CHECK FOR WRITE INHIBIT DURING A WRITE BYTE.
2533                                        ;CHECKS FOR UNCORRECTED DATA.
2534                                        ;
2535  007164  122737  000011  000404  TST11:  CMPB    #11,@#$TESTN
2536  007172  001403                        BEQ     1$
2537  007174  004767  005014                JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  007200  000055                        55                      ;******ERROR NUMBER 55******
 (1)
2538  007202  004467  004120          1$:   JSR     R4,SAVOT4       ;SAVE REGS R0 TO R4
2539  007206  005067  173452        10$:    CLR     DATBUF          ;INITIAL DATA
2540  007212  005067  173450                CLR     DATBUF+2        ;32 BITS WORTH
2541  007216  012767  000001  173450  20$:    MOV     #1,SBEMSK       ;SINGLE ERROR MASK
2542  007224  005067  173446                CLR     SBEMSK+2        ;
2543  007230  012767  000001  173442  30$:    MOV     #1,DBEMSK       ;DOUBLE ERROR MASK
2544  007236  005067  173440                CLR     DBEMSK+2        ;
2545  007242  016767  173416  173420  35$:    MOV     DATBUF,TSTDAT   ;PRESERVE ORIG DATA
2546  007250  016767  173412  173414        MOV     DATBUF+2,TSTDAT+2       ;
2547  007256  105737  000302                TSTB    @#PASFLG        ;WHICH PASS ?
2548  007262  001404                        BEQ     40$             ;FIRST PASS, NO COMPLEMENTING
2549  007264  005167  173400                COM     TSTDAT
2550  007270  005167  173376                COM     TSTDAT+2        ;SECOND PASS, COMPLEMENT TSTDAT
2551  007274  005077  173430        40$:    CLR     @CSRADR         ;
2552  007300  026767  173370  173372        CMP     SBEMSK,DBEMSK   ;CHECK FOR SAME MASKS
```

```
 2553  007306  001004                        BNE     45$                 ;BR IF NOT EQUAL
 2554  007310  026767  173362  173364        CMP     SBEMSK+2,DBEMSK+2           ;SECOND WORD ALSO
 2555  007316  001473                        BEQ     70$                 ;BR TO MAKE THEM NOT EQUAL
 2556  007320  012767  002670  003464  45$:  MOV     #TSTDAT,SOURCE      ;ADDRESS FOR CHKGEN
 2557  007326  004767  003532                JSR     PC,CHKGEN           ;GO GENERATE CHECK BITS
 2558  007332  004567  004046                JSR     R5,BITCOM           ;BIT COMP ROUTINE
 2559  007336  002674                        .WORD   SBEMSK              ;MASK
 2560  007340  002670                        .WORD   TSTDAT              ;DATA WORD
 2561  007342  004567  004036                JSR     R5,BITCOM           ;MUST FORCE SECOND ERROR
 2562  007346  002700                        .WORD   DBEMSK              ;MASK
 2563  007350  002670                        .WORD   TSTDAT
 2564  007352  016702  003436                MOV     CHECK,R2            ;GET CHECKBITS
 2565  007356  056702  173330                BIS     DIAGA,R2            ;SET DIAGNOSTIC A BIT
 2566  007362  013701  000320          50$:  MOV     @#MINMEM,R1         ;TEST LOCATION
 2567  007366  016777  173316  173334        MOV     ECCDIS,@CSRADR      ;DISABLE ECC
 2568  007374  016721  173270                MOV     TSTDAT,(R1)+        ;WRITE FIRST 16 BITS
 2569  007400  010277  173324                MOV     R2,@CSRADR          ;LOAD CSR WITH IMAGE FROM R2
 2570  007404  016711  173262                MOV     TSTDAT+2,(R1)       ;WRITE SECOND 16 BITS + CHECKBITS
 2571  007410  005077  173314                CLR     @CSRADR             ;CLEAR CSR
 2572  007414  013702  000320                MOV     @#MINMEM,R2         ;GET ADDRESS OF TEST LOC
 2573  007420  010203                        MOV     R2,R3               ;R2 DESIGNATES FIRST BYTE
 2574  007422  062703  000003                ADD     #3,R3               ;R3 DESIGNATES LAST BYTE
 2575  007426  112722  000360          55$:  MOVB    #360,(R2)+          ;TRY WRITING A BYTE
 2576  007432  013701  000320                MOV     @#MINMEM,R1         ;
 2577  007436  026711  173226                CMP     TSTDAT,(R1)         ;CHECK FOR UNCHANGED DATA
 2578  007442  001405                        BEQ     60$                 ;BR IF OK
 2579  007444  016700  173220                MOV     TSTDAT,R0           ;FOR ERROR MSG
 2580  007450  004767  004064                JSR     PC,ERROR            ;*ERROR* REPORT ERROR MESSAGE
  (1)  007454  000056                        56                          ;******ERROR NUMBER 56******
  (1)
 2581  007456  062701  000002          60$:  ADD     #2,R1               ;UPPER WORD
 2582  007462  026711  173204                CMP     TSTDAT+2,(R1)       ;READ SECOND WORD
 2583  007466  001405                        BEQ     65$                 ;BR IF UNCHANGED
 2584  007470  016700  173176                MOV     TSTDAT+2,R0         ;
 2585  007474  004767  004040                JSR     PC,ERROR            ;*ERROR* REPORT ERROR MESSAGE
  (1)  007500  000057                        57                          ;******ERROR NUMBER 57******
  (1)
 2586  007502  020203                  65$:  CMP     R2,R3               ;TEST LAST BYTE ?
 2587  007504  001350                        BNE     55$                 ;BR IF NO
 2588  007506  005737  000406          70$:  TST     @#$PASS             ;FIRST PASS ?
 2589  007512  001424                        BEQ     100$                ;BR IF YES
 2590  007514  005767  173162                TST     DBEMSK+2            ;CHECKING FOR LAST ERROR BIT
 2591  007520  100404                        BMI     80$                 ;BR IF DONE HERE
 2592  007522  004567  003626                JSR     R5,DASHL            ;NOT DONE, SHIFT LEFT
 2593  007526  002700                        .WORD   DBEMSK              ;DOUBLE ERROR MASK
 2594  007530  000644                        BR      35$
 2595  007532  005767  173140          80$:  TST     SBEMSK+2            ;LAST SBE MASK
 2596  007536  100404                        BMI     90$                 ;BR IF DONE WITH THIS PASS
 2597  007540  004567  003610                JSR     R5,DASHL            ;DOUBLE WORD SHIFT ROUTINE
 2598  007544  002674                        .WORD   SBEMSK              ;
 2599  007546  000630                        BR      30$
 2600  007550  105737  000302          90$:  TSTB    @#PASFLG            ;TEST PASS FLAG
 2601  007554  001003                        BNE     100$                ;NON ZERO MEANS WE'RE DONE
 2602  007556  105237  000302                INCB    @#PASFLG            ;NOT DONR
 2603  007562  000611                        BR      10$
 2604  007564  016777  173120  173136  100$:  MOV     ECCDIS,@CSRADR      ;DISABLE ECC
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

 2605  007572  013701  000320            MOV     @#MINMEM,R1     ;TEST LOCATION
 2606  007576  005021                    CLR     (R1)+
 2607  007600  005011                    CLR     (R1)            ;TO ERASE ANY DBE'S FROM TESTING
 2608  007602  005077  173122            CLR     @CSRADR         ;RESTORE CSR
 2609  007606  004767  003526            JSR     PC,RSTOT4       ;RESTORE REGS R0 TO R4
 2610  007612  000167  172770    END11:  JMP     TSTSCP
 2611                                    ;
 2612                                    ;DOUBLE BIT ERROR WRITE CANCEL WITH
 2613                                    ;WORD WRITE.
 2614                                    ;CHECKS WRITE INHIBIT WITH WORD WRITES TO
 2615                                    ;WORD WITH DOUBLE ERROR.
 2616                                    ;
 2617  007616  122737  000012  000404 TST12:  CMPB    #12,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
 2618  007624  001403                    BEQ     1$              ;BR IF OK
 2619  007626  004767  004362            JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
  (1)  007632  000060                    60                      ;******ERROR NUMBER 60******
  (1)
 2620  007634  004467  003466    1$:     JSR     R4,SAVOT4       ;SAVE REGS R0 TO R4
 2621  007640  005067  173020    T12A:   CLR     DATBUF          ;BACKGROUND FOR DOUBLE ERRORS
 2622  007644  005067  173016            CLR     DATBUF+2        ;2 WORDS WORTH
 2623  007650  012767  000001  173016    MOV     #1,SBEMSK       ;SINGLE ERROR MASK
 2624  007656  005067  173014            CLR     SBEMSK+2        ;
 2625  007662  012767  000001  173010 T12B:   MOV     #1,DBEMSK       ;DOUBLE ERROR MASK
 2626  007670  005067  173006            CLR     DBEMSK+2        ;
 2627  007674  016767  172764  172766 35$:    MOV     DATBUF,TSTDAT   ;DATA FOR TEST
 2628  007702  016767  172760  172762        MOV     DATBUF+2,TSTDAT+2       ;BOTH WORDS
 2629  007710  105737  000302            TSTB    @#PASFLG        ;COMP DATA ON SECOND PASS ONLY
 2630  007714  001404                    BEQ     40$             ;BR IF FIRST PASS
 2631  007716  005167  172746            COM     TSTDAT          ;COMP FIRST WORD
 2632  007722  005167  172744            COM     TSTDAT+2        ;NOW SECOND WORD
 2633  007726  026767  172742  172744 40$:    CMP     SBEMSK,DBEMSK   ;CHECK FOR IDENTICAL MASKS
 2634  007734  001004                    BNE     45$             ;BR IF DIFFERENT
 2635  007736  026767  172734  172736        CMP     SBEMSK+2,DBEMSK+2       ;UPPER WORD TOO
 2636  007744  001501                    BEQ     70$             ;BR TO MAKE THEM NOT EQUAL
 2637  007746  012767  002670  003036 45$:    MOV     #TSTDAT,SOURCE  ;NEED ADDR OF DATA FOR CHKGEN
 2638  007754  004767  003104            JSR     PC,CHKGEN       ;GO GENERATE CHECK BITS
 2639  007760  004567  003420            JSR     R5,BITCOM       ;BIT COMP ROUTINE TO FORCE ERRORS
 2640  007764  002674                    .WORD   SBEMSK          ;FIRST ERROR
 2641  007766  002670                    .WORD   TSTDAT          ;DATA
 2642  007770  004567  003410            JSR     R5,BITCOM       ;CALL IT AGAIN
 2643  007774  002700                    .WORD   DBEMSK          ;FOR SECOND ERROR
 2644  007776  002670                    .WORD   TSTDAT          ;
 2645  010000  016700  003010            MOV     CHECK,R0        ;GET CHECKBITS
 2646  010004  056700  172702            BIS     DIAGA,R0        ;SET DIAGNOSTIC BIT
 2647  010010  013701  000320    50$:    MOV     @#MINMEM,R1     ;FIRST TEST ADDRESS
 2648  010014  016777  172670  172706    MOV     ECCDIS,@CSRADR  ;INHIBIT ECC
 2649  010022  016721  172642            MOV     TSTDAT,(R1)+    ;WRITE FIRST 16 BITS
 2650  010026  010077  172676            MOV     R0,@CSRADR      ;LOAD CSR FROM R0
 2651  010032  016711  172634            MOV     TSTDAT+2,(R1)   ;WRITE SECOND 16 BITS + CHECKBITS
 2652  010036  105067  003010            CLRB    UPPFLG          ;SET FOR 2 LOOPS
 2653  010042  162701  000002            SUB     #2,R1           ;POINT TO LOW WORD
 2654  010046  005077  172656    55$:    CLR     @CSRADR         ;CLEAR CSR
 2655  010052  012721  177400            MOV     #177400,(R1)+   ;TRY WRITING LOCATION
 2656  010056  013701  000320            MOV     @#MINMEM,R1
 2657  010062  026711  172602            CMP     TSTDAT,(R1)     ;CHECK FOR ORIGINAL DATA
 2658  010066  001405                    BEQ     60$             ;SHOULD BE UNCHANGED
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

2659  010070  016700  172574          MOV     TSTDAT,R0       ;FOR ERROR MSG
2660  010074  004767  003440          JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  010100  000061                  61                      ;******ERROR NUMBER 61******
 (1)
2661  010102  062701  000002  60$:    ADD     #2,R1           ;UPPER WORD
2662  010106  026711  172560          CMP     TSTDAT+2,(R1)   ;THIS SHOULD BE UNCHANGED ALSO
2663  010112  001405                  BEQ     65$
2664  010114  016700  172552          MOV     TSTDAT+2,R0     ;
2665  010120  004767  003414          JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  010124  000062                  62                      ;******ERROR NUMBER 62******
 (1)
2666  010126  105767  002720  65$:    TSTB    UPPFLG          ;WHICH LOOP ?
2667  010132  001003                  BNE     66$             ;SECOND, BR OUT
2668  010134  105267  002712          INCB    UPPFLG          ;FIRST, KEEP GOING
2669  010140  000742                  BR      55$
2670  010142  005737  000406  66$:    TST     @#$PASS         ;FIRST PASS ?
2671  010146  001426                  BEQ     85$             ;BR IF YES
2672  010150  005767  172526  70$:    TST     DBEMSK+2        ;LAST BIT ?
2673  010154  100404                  BMI     75$             ;MINUS = BIT 31
2674  010156  004567  003172          JSR     R5,DASHL        ;SHIFT ROUTINE
2675  010162  002700                  .WORD   DBEMSK          ;THIS 32 BIT WORD GETS SHIFTED
2676  010164  000643                  BR      35$
2677  010166  005767  172504  75$:    TST     SBEMSK+2        ;LAST BIT IN THIS MASK ?
2678  010172  100405                  BMI     80$             ;BR IF LAST BIT
2679  010174  004567  003154          JSR     R5,DASHL        ;
2680  010200  002674                  .WORD   SBEMSK
2681  010202  000167  177454          JMP     T12B
2682  010206  105737  000302  80$:    TSTB    @#PASFLG        ;FIRST PASS ?
2683  010212  001004                  BNE     85$             ;BR IF SECOND
2684  010214  105237  000302          INCB    @#PASFLG        ;INDICATE SECOND PASS COMING
2685  010220  000167  177414          JMP     T12A            ;
2686  010224  016777  172460  172476  85$:    MOV     ECCDIS,@CSRADR  ;
2687  010232  013701  000320          MOV     @#MINMEM,R1     ;RESTORE TEST ADDRESS
2688  010236  005021                  CLR     (R1)+           ;CLEAR ANY DBE'S FROM TEST
2689  010240  005011                  CLR     (R1)
2690  010242  005077  172462          CLR     @CSRADR         ;CLEAR CSR
2691  010246  004767  003066          JSR     PC,RSTOT4       ;RESTORE REGS R0 TO R4
2692  010252  000167  172330  END12:  JMP     TSTSCP
2693                                  ;TEST   DUAL ADDRESS TEST
2694                                  ;
2695                                  ;CHECKS FOR DUAL ADDRESSING BY WRITING
2696                                  ;AND READING THE ADDRESS IN THE LOCATION
2697                                  ;AND WRITING AND READING ITS COMPLEMENT
2698  010256  122737  000013  000404  TST13:  CMPB    #13,@#$TESTN
2699  010264  001403                  BEQ     6$
2700  010266  004767  003722          JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  010272  000063                  63                      ;******ERROR NUMBER 63******
 (1)
2701
2702  010274  005003          6$:     CLR     R3              ;R3 INDICATES FIRST PASS OR
2703  010276  010100          1$:     MOV     R1,R0           ;COMPLEMENT PASS
2704  010300  005703                  TST     R3              ;IF R3= ZERO, STORE ADDRESS
2705  010302  001401                  BEQ     2$              ;IN THE LOCATION
2706  010304  005100                  COM     R0              ;OTHERWISE STORE COMPLEMENT
2707  010306  010021          2$:     MOV     R0,(R1)+        ;OF ADDRESS
2708  010310  020105                  CMP     R1,R5           ;UNTIL HIGHEST LOC IS REACHED
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                        BEGIN OF AREA TESTED (+20) WHEN PROGRAM RELOCATES.

 2709  010312  103771                    3$:     BLO     1$
 2710  010314  020041                            CMP     R0,-(R1)        ;CHECK FOR CORRECT CONTENTS
 2711  010316  001405                            BEQ     4$              ;BRANCH IF OK
 2712  010320  105237  000275                    INCB    @#$ADERR        ;PROBABLY AN ADDRESSING PROB.
 2713  010324  004767  003210                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 010330  000064                            64                      ;******ERROR NUMBER 64******
   (1)
 2714
 2715  010332  010100                    4$:     MOV     R1,R0
 2716  010334  162700  000002                    SUB     #2,R0           ;CHECK THAT ADDRESS IS STORED AT
 2717  010340  005703                            TST     R3              ;LOCATION IF R3 IS 0
 2718  010342  001401                            BEQ     5$              ;OTHERWISE CHECK FOR
 2719  010344  005100                            COM     R0              ;ADDRESS COMPLEMENT.
 2720  010346  020104                    5$:     CMP     R1,R4
 2721  010350  101361                            BHI     3$
 2722  010352  112737  000001  000302            MOVB    #1,@#PASFLG     ;SET PASFLG FOR ERROR REPORT
 2723  010360  005103                            COM     R3              ;COMPLEMENT R3
 2724  010362  001345                            BNE     1$              ;REPEAT TEST, COMPLEMENTING ADE
 2725  010364  000167  172216            END13:  JMP     TSTSCP
 2726
 2727
 2728                                            ;*(1)   THIS TEST CHECKS THE MEMORY FOR THE CAPABILITY
 2729                                            ;*      OF HOLDING 1'S AND 0'S BY WRITING A BACKGROUND
 2730                                            ;*      OF BAKPAT AND READING IT
 2731                                            ;*(2)   MEMORY IS WRITTEN USING A BYTE AT A TIME
 2732                                            ;*(3)   STEPS 1 & 2 ARE REPEATED WITH A SWAPPED BACKGROUND PATTERN
 2733
 2734  010370  122737  000014  000404    TST14:  CMPB    #14,@#STESTN    ;CHECK FOR PROPER TEST SEQUENCE
 2735  010376  001403                            BEQ     1$
 2736  010400  004767  003610                    JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
   (1) 010404  000065                            65                      ;******ERROR NUMBER 65******
   (1)
 2737  010406  013700  000312            1$:     MOV     @#BAKPAT,R0     ;GET THE PATTERN INTO R0
 2738  010412  110021                            MOVB    R0,(R1)+        ;WRITE A BYTE
 2739  010414  113721  000313                    MOVB    @#BAKPAT+1,(R1)+;WRITE THE MEMORY WITH THE WORD STORED IN BAKPAT
 2740  010420  020105                            CMP     R1,R5           ;COMPARE TEST LOC TO TOP + 2
 2741  010422  103771                            BLO     1$              ;BRANCH IF LOWER
 2742
 2743  010424  020041                    2$:     CMP     R0,-(R1)        ;TEST THE MEMORY TO SEE IF IT CONTAINS
 2744                                                                    ;THE WORD STORED IN BAKPAT
 2745  010426  001416                            BEQ     8$
 2746  010430  062701  000002                    ADD     #2,R1
 2747  010434  123741  000313                    CMPB    @#BAKPAT+1,-(R1);CHECK FOR BYTE SELECTION PROBLEM
 2748  010440  001402                            BEQ     4$
 2749  010442  120041                            CMPB    R0,-(R1)        ;AGAIN CHECK FOR BYTE SELECTION PROBLEM
 2750  010444  001002                            BNE     6$
 2751  010446  105237  000275            4$:     INCB    @#$ADERR        ;PREPARE TO INFORM THAT IT IS ADDRESSING ERROR
 2752  010452  042701  000001            6$:     BIC     #1,R1           ;MAKE THE ADDRESS IN R1 EVEN
 2753  010456  004767  003056                    JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 010462  000066                            66                      ;******ERROR NUMBER 66******
   (1)
 2754  010464  020104                    8$:     CMP     R1,R4           ;KEEP ON TESTING THE MEMORY UNTIL
 2755  010466  101356                            BHI     2$              ;R1 EQUALS THE LOWEST ADDRESS
 2756  010470  000337  000312                    SWAB    @#BAKPAT        ;CHANGE THE DATA PATTERN
 2757  010474  001744                            BEQ     1$              ;IF THE DATA PATTERN DOES NOT HAVE LOW
 2758                                                                    ;  BYTE =0 THEN FALL THRU
```

```
 2759  010476  000167  172104          END14:  JMP     TSTSCP
 2760
 2761
 2762                                          ;*THIS TEST IS CONCERNED ONLY WITH THE INTEGRITY
 2763                                          ;*OF THE 4K MOS RAMS THAT STORE THE CHECKBITS.
 2764                                          ;*USING DIAGA (BIT 2) AND BIT 13 TO PROTECT THE
 2765                                          ;*PROGRAM IF NECESSARY, THE CHECKBITS ARE WRITTEN
 2766                                          ;*AND READ VIA THE CSR.
 2767                                          ;
 2768                                          ;
 2769  010502  122737  000015  000404  TST15:  CMPB    #15,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
 2770  010510  001403                          BEQ     1$
 2771  010512  004767  003022                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 010516  000067                          67                      ;******ERROR NUMBER 67******
   (1)
 2772  010520  010446                  1$:     MOV     R4,-(SP)        ;SAVE R4
 2773  010522  016703  172164                  MOV     DIAGA,R3        ;DIAGNOSTIC CHECK MODE
 2774  010526  052703  004000                  BIS     #4000,R3        ;CHECK BIT CT
 2775  010532  013701  000320                  MOV     @#MINMEM,R1     ;FIRST TEST LOC
 2776  010536  010146                          MOV     R1,-(SP)        ;SAVE IT FOR LATER
 2777  010540  005004                          CLR     R4
 2778  010542  010377  172162                  MOV     R3,@CSRADR      ;SET UP CSR
 2779  010546  010411                  2$:     MOV     R4,(R1)         ;WRITE CHECKBITS BY WRITING LOC
 2780  010550  012761  100000  000002          MOV     #100000,2(R1)   ;SET BIT 31 TO MATCH CHECKBITS
 2781  010556  062701  000004                  ADD     #4,R1           ;POINT TO NEXT WORD
 2782  010562  020105                          CMP     R1,R5           ;TOP + 2
 2783  010564  103770                          BLO     2$              ;BR IF NOT
 2784  010566  162701  000004          3$:     SUB     #4,R1           ;ADJUST R1
 2785  010572  005711                          TST     (R1)            ;READ
 2786  010574  032777  003740  172126          BIT     #3740,@CSRADR   ;SHOULD BE ALL ZEROS
 2787  010602  001421                          BEQ     4$              ;BR IF OK
 2788  010604  012700  004000                  MOV     #4000,R0        ;GOOD DATA
 2789  010610  004767  005036                  JSR     PC,BITCHK       ;USE XOR TO COUNT BAD CHECKBITS
 2790  010614  032777  004000  172110          BIT     #4000,@SWR      ;ECC DIS ?
 2791  010622  001004                          BNE     33$             ;PRNIT SINGLE ERRORS
 2792  010624  022767  000001  005102          CMP     #1,BITCNT       ;MORE THAN 1 BAD BIT ?
 2793  010632  001405                          BEQ     4$              ;YES
 2794  010634  012700  004000          33$:    MOV     #4000,R0        ;FOR ERROR MSG
 2795  010640  004767  002674                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 010644  000070                          70                      ;******ERROR NUMBER 70******
   (1)
 2796  010646  052777  003740  172054  4$:     BIS     #3740,@CSRADR   ;MAKE CHECKBITS ALL 1'S EXCEPT FOR CT
 2797  010654  042777  004000  172046          BIC     #4000,@CSRADR   ;MAKE CT = 0
 2798  010662  010411                          MOV     R4,(R1)         ;WRITE THE CHECKBITS
 2799  010664  010461  000002                  MOV     R4,2(R1)        ;BOTH WORDS
 2800  010670  020116                          CMP     R1,(SP)         ;BOTTOM YET ?
 2801  010672  001335                          BNE     3$              ;BR IF NO
 2802  010674  010377  172030          5$:     MOV     R3,@CSRADR      ;RESTORE CSR
 2803  010700  005711                          TST     (R1)            ;READ THE LOC AGAIN
 2804  010702  017700  172022                  MOV     @CSRADR,R0      ;GET CSR CONTENTS INTO R0
 2805  010706  042700  170037                  BIC     #170037,R0      ;ONLY WANT BITS 11-5
 2806  010712  022700  003740                  CMP     #3740,R0        ;READ FOR ALL 1'S
 2807  010716  001421                          BEQ     6$              ;BR IF OK
 2808  010720  012700  003740                  MOV     #3740,R0        ;FOR ERROR MSG
 2809  010724  004767  004722                  JSR     PC,BITCHK       ;
 2810  010730  032777  004000  171774          BIT     #4000,@SWR      ;ECC DIS ?
```

```
 2811  010736  001004                        BNE     55$
 2812  010740  022767  000001  004766        CMP     #1,BITCNT       ;MORE THAN ONE ?
 2813  010746  001405                        BEQ     6$              ;NO
 2814  010750  012700  003740          55$:  MOV     #3740,R0        ;FOR MSG
 2815  010754  004767  002560                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  010760  000071                        71                      ;******ERROR NUMBER 71******
  (1)
 2816  010762  010377  171742          6$:   MOV     R3,@CSRADR      ;RESTORE CSR
 2817  010766  010411                        MOV     R4,(R1)         ;ACCESS THE LOC
 2818  010770  012761  100000  000002        MOV     #100000,2(R1)   ;SECOND WORD
 2819  010776  062701  000004                ADD     #4,R1           ;POINT TO NEXT ADDRESS
 2820  011002  020105                        CMP     R1,R5           ;TOP + 2 YET?
 2821  011004  103733                        BLO     5$              ;BR IF NOT
 2822  011006  011601                        MOV     (SP),R1         ;RESTORE MINMEM
 2823  011010  010377  171714          7$:   MOV     R3,@CSRADR      ;RESTORE CSR
 2824  011014  005711                        TST     (R1)            ;READ
 2825  011016  032777  003740  171704        BIT     #3740,@CSRADR   ;SHOULD BR 0
 2826  011024  001421                        BEQ     8$
 2827  011026  012700  004000                MOV     #4000,R0        ;GOOD DATA
 2828  011032  004767  004614                JSR     PC,BITCHK       ;CHECK # OF BAD BITS
 2829  011036  032777  004000  171666        BIT     #4000,@SWR      ;ECC DIS ?
 2830  011044  001004                        BNE     77$             ;YES
 2831  011046  022767  000001  004660        CMP     #1,BITCNT       ;MORE THAN ONE
 2832  011054  001405                        BEQ     8$              ;NO
 2833  011056  012700  004000          77$:  MOV     #4000,R0        ;FOR PRINTOUT
 2834  011062  004767  002452                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  011066  000072                        72                      ;******ERROR NUMBER 72******
  (1)
 2835  011070  052777  003740  171632  8$:   BIS     #3740,@CSRADR   ;COMP CHECKBITS
 2836  011076  042777  004000  171624        BIC     #4000,@CSRADR   ;CLEAR CT
 2837  011104  010411                        MOV     R4,(R1)         ;WRITE
 2838  011106  010461  000002                MOV     R4,2(R1)        ;
 2839  011112  062701  000004                ADD     #4,R1           ;NEXT WORD
 2840  011116  020105                        CMP     R1,R5           ;TOP + 2 ?
 2841  011120  103733                        BLO     7$              ;BR IF NO
 2842  011122  010377  171602                MOV     R3,@CSRADR      ;RESTORE CSR
 2843  011126  162701  000004          9$:   SUB     #4,R1           ;ADJUST R1
 2844  011132  005711                        TST     (R1)            ;READ
 2845  011134  017700  171570                MOV     @CSRADR,R0      ;GET CSR CONTENTS
 2846  011140  042700  170037                BIC     #170037,R0      ;ONLY WANT CHECKBITS
 2847  011144  022700  003740                CMP     #3740,R0        ;ALL ONES ?
 2848  011150  001421                        BEQ     10$             ;BR IF OK
 2849  011152  012700  003740                MOV     #3740,R0        ;FOR ERROR MSG
 2850  011156  004767  004470                JSR     PC,BITCHK       ;COUNT BAD BITS
 2851  011162  032777  004000  171542        BIT     #4000,@SWR      ;ECC DIS
 2852  011170  001004                        BNE     99$             ;YES
 2853  011172  022767  000001  004534        CMP     #1,BITCNT       ;MORE THAN ONE ?
 2854  011200  001405                        BEQ     10$             ;NO
 2855  011202  012700  003740          99$:  MOV     #3740,R0        ;FOR MSG.
 2856  011206  004767  002326                JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  011212  000073                        73                      ;******ERROR NUMBER 73******
  (1)
 2857  011214  010377  171510          10$:  MOV     R3,@CSRADR      ;RESTORE CSR
 2858  011220  010411                        MOV     R4,(R1)         ;WRITE NEW CHECKBITS
 2859  011222  012761  100000  000002        MOV     #100000,2(R1)   ;BIT 31
 2860  011230  020116                        CMP     R1,(SP)         ;BOTTOM YET ?
```

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

 2861  011232  001335                          BNE     9$              ;BR IF NOT
 2862  011234  005711                  11$:    TST     (R1)            ;REREAD
 2863  011236  032777  003740  171464          BIT     #3740,@CSRADR   ;SHOULD BE ALL 0'S
 2864  011244  001421                          BEQ     12$             ;BR IF OK
 2865  011246  012700  004000                  MOV     #4000,R0        ;GOOD DATA
 2866  011252  004767  004374                  JSR     PC,BITCHK       ;COUNT BAD BITS
 2867  011256  032777  004000  171446          BIT     #4000,@SWR      ;ECC DIS ?
 2868  011264  001004                          BNE     111$            ;YES
 2869  011266  022767  000001  004440          CMP     #1,BITCNT       ;MORE THAN 1
 2870  011274  001405                          BEQ     12$             ;BR NO
 2871  011276  012700  004000          111$:   MOV     #4000,R0        ;FOR MSG
 2872  011302  004767  002232                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 011306  000074                          74                      ;******ERROR NUMBER 74******
   (1)
 2873  011310  062701  000004          12$:    ADD     #4,R1           ;POINT TO NEXT WORD
 2874  011314  010377  171410                  MOV     R3,@CSRADR      ;RESTORE CSR
 2875  011320  020105                          CMP     R1,R5           ;TOP + 2 YET?
 2876  011322  103744                          BLO     11$             ;BR IF NOT
 2877  011324  005726                          TST     (SP)+           ;FINALLY RESTORE STACK
 2878  011326  012604                          MOV     (SP)+,R4        ;RESTORE R4
 2879  011330  000167  171252          END15:  JMP     TSTSCP          ;AND EXIT
 2880
 2881
 2882                                          ;*(1)   THIS TEST WRITES A BACK GROUND OF THE WORD STORED
 2883                                          ;*      AT BAKPAT.
 2884                                          ;*(2)   READS EVERY LOCATION FOR CORRECT DATA, SWAPS BYTES
 2885                                          ;*      AT THE LOCATION AND PROCEEDS IN MAX. TO MIN
 2886                                          ;*      DIRECTION OF MEMORY LOCATIONS.
 2887                                          ;*(3)   READS EVERY LOCATION FOR SWAPPED BAKPAT PATTERN
 2888                                          ;*      WRITES BAKPAT BACKGROUND IN THE LOCATION AND PROCEEDS
 2889                                          ;*      IN  MIN. TO MAX. DIRECTION
 2890                                          ;*(4)   REPEATS STEP 2 GOING IN MIN. TO MAX. DIRECTION
 2891                                          ;*(5)   REPEATS STEP 3 GOING IN MAX. TO MIN. DIRECTION
 2892
 2893
 2894  011334  122737  000016  000404  TST16: CMPB    #16,@#$TESTN    ;CHECK FOR PROPER TEST SEQUENCE
 2895  011342  001403                          BEQ     1$
 2896  011344  004767  002644                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
   (1) 011350  000075                          75                      ;******ERROR NUMBER 75******
   (1)
 2897  011352  004737  000120          1$:     JSR     PC,@#WRTMEM     ;GO TO WRITE THE MEMORY WITH A BACKGROUND OF THE
 2898                                                                  ;WORD STORED IN BAKPAT
 2899  011356  020041                  2$:     CMP     R0,-(R1)        ;READ THE CONTENTS OF LOCATION POINTED BY R1
 2900  011360  001403                          BEQ     3$              ;TO SEE IF IT HAS THE SAME VALUE AS R0
 2901  011362  004767  002152                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 011366  000076                          76                      ;******ERROR NUMBER 76******
   (1)
 2902  011370  000300                  3$:     SWAB    R0
 2903  011372  010011                          MOV     R0,(R1)         ;SWAP THE BYTES AT (R1)
 2904  011374  021100                          CMP     (R1),R0         ;READ (R1) FOR CORRECT VALUE
 2905  011376  001403                          BEQ     4$
 2906  011400  004767  002134                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
   (1) 011404  000077                          77                      ;******ERROR NUMBER 77******
   (1)
 2907
 2908  011406  000300                  4$:     SWAB    R0              ;SWAP THE BYTES OF THE REGISTER
```

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 2909
 2910  011410  001023                    BNE     9$              ;CONTAINING BACKGROUND PATTERN
 2911                                                            ;IF THE LOWER BYTE OF THE REGISTER
 2912                                                            ;IS NOT 0 THEN THE PROGRAM IS READING
 2913                                                            ;THE MEMORY TO CONTAIN A BACK GROUND OF
 2914                                                            ;BAKPAT AND WRITING THE SWAPPED WORD
 2915
 2916                                                            ;IN WHICH CASE GO TO 9$
 2917
 2918  011412  005703            5$:     TST     R3              ;R3 WAS 0 WHEN THE PROGRAM ENTERED
 2919                                                            ;THIS TEST, AND IT IS NOT ALTERED UNTIL PASFLG=3
 2920                                                            ;IF R3 EQUAL 0 THEN THE PROGRAM IS
 2921                                                            ;READING/WRITING MIN. TO MAX. OTHERWISE
 2922                                                            ;IT IS GOING IN MAX. TO MIN. DIRECTION
 2923  011414  001023                    BNE     10$             ;IF R3 IS NOT CLEAR THEN GO TO 10$
 2924  011416  062701  000002    6$:     ADD     #2,R1           ;OTHERWISE ADD 2 TO THE CONTENTS OF R1
 2925  011422  020105                    CMP     R1,R5           ;COMPARE R1 WITH THE MAX. MEMORY LOCATION TO
 2926                                                            ;BE TESTED
 2927  011424  103006                    BHIS    8$              ;IF R1>R5 THEN GO TO 8$ OTHERWISE
 2928  011426  020011            7$:     CMP     R0,(R1)         ;READ (R1) FOR THE CORRECT DATA
 2929  011430  001757                    BEQ     3$              ; WRITE COMPLEMENT OF THE DATA FOUND AT (R1)
 2930                                                            ;AND REPEAT UNTIL R1 > R5
 2931  011432  004767  002102            JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
  (1)  011436  000100                    100                     ;******ERROR NUMBER 100******
  (1)
 2932  011440  000753                    BR      3$
 2933  011442  105237  000302    8$:     INCB    @#PASFLG
 2934  011446  000300                    SWAB    R0
 2935  011450  001742                    BEQ     2$              ;IF THE LOWER BYTE OF R0 IS ALL 0'S
 2936                                                            ;THEN BEGIN READING BAKPAT SWAPPED WRITING BAKPAT
 2937                                                            ;AND READING BAKPAT GOING FROM MAX. TO MIN.[PASFLG=4]
 2938  011452  005103                    COM     R3              ;OTHERWISE CLEAR R0
 2939  011454  010401                    MOV     R4,R1           ;PUT THE LOWEST TESTING ADDRESS IN R1
 2940  011456  000763                    BR      7$              ;AND BEGIN READING 0'S, WRITING 1'S AND
 2941                                                            ;READING 1'S IN MIN. TO MAX. DIRECTION [PASFLG=3]
 2942
 2943  011460  005703            3$:     TST     R3              ;IF R3 IS NON 0, I.E. PASFLG=3
 2944  011462  001353                    BNE     5$              ;THEN READ BAKPAT, WRITE
 2945                                                            ;SWAPPED BAKPAT AND READ SWAPPED BAKPAT
 2946                                                            ;IN MIN. TO MAX. DIRECTION
 2947  011464  020104            10$:    CMP     R1,R4           ;OTHERWISE TEST IS PROCEEDING IN MAX. TO
 2948                                                            ;MIN. DIRECTION.
 2949  011466  101333                    BHI     2$              ;KEEP ON LOOPING UNTIL R1=R4
 2950  011470  105237  000302            INCB    @#PASFLG
 2951  011474  000300                    SWAB    R0
 2952  011476  001753                    BEQ     7$              ;IF R0 SWAPPED HAS LOWER BYTE=0
 2953                                                            ;THEN READ BAKPAT SWAPPED, WRITE BAKPAT,
 2954                                                            ;AND READ BAKPAT GOING FROM MIN. TO MAX.
 2955  011500  000167  171102    END16:  JMP     TSTSCP
 2956
 2957
 2958                                    ;*(1)   THIS TEST WRITES THE MEMORY WITH A BACK GROUND OF BAKPAT
 2959                                    ;*(2)   WITH PASFLG=0 THE TEST READS THE MEMORY FOR BAKPAT
 2960                                    ;*      AND THEN INCREMENTS PASFLG
 2961                                    ;*(3)   IT THEN READS/SWAPS BYTES/WRITES A LOCATION X FOR
 2962                                    ;*      OVER 2 MSEC AND THEN READS THE MEMORY FOR BAKPAT
```

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2963                                                    ;*(4)   REPEATS STEP 3 WITH X=X+4K UNTIL END OF MEMORY IS ENCOUNTERED
2964                                                    ;*(5)   IT THEN INCREMENTS PASFLG AND WRITES THE MEMORY TO
2965                                                    ;*      BAKPAT AND WITH PASFLG=2 IT READS MEMORY FOR ALL
2966                                                    ;*      SWAPPED BAKPAT AFTER WHICH PASFLG IS INCREMENTED TO 3
2967                                                    ;*(6)   REPEATS STEPS 3 AND 4 READING THE MEMORY FOR SWAPPED
2968                                                    ;*      BAKPAT INSTEAD OF BAKPAT.
2969  011504  122737  000017  000404  TST17:  CMPB    #17,@#STESTN    ;CHECK FOR PROPER TEST SEQUENCE
2970  011512  001403                   BEQ     .+10
2971  011514  004767  002474                  JSR     PC,SEQERR       ;*ERROR* REPORT ERROR MESSAGE AND HALT AT FATHLT
 (1)  011520  000101                   101                             ;******ERROR NUMBER 101******
 (1)
2972  011522  004737  000120          RPT17:  JSR     PC,@#WRTMEM     ;GO TO WRITE THE MEMORY WITH A BACKGROUND OF THE
2973                                                                    ;WORD STORED AT LOCATION BAKPAT
2974  011526  005037  000302                  CLR     @#PASFLG
2975  011532  010403                1$:     MOV     R4,R3           ;SET R3
2976  011534  010401                2$:     MOV     R4,R1           ;AND R1 TO THE STARTING ADDRESS OF MEMORY UNDER TEST
2977  011536  020011                3$:     CMP     R0,(R1)         ;CHECK (R1) FOR CORRECT DATA
2978  011540  001403                   BEQ     4$
2979  011542  004767  001772                  JSR     PC,ERROR        ;*ERROR* REPORT ERROR MESSAGE
 (1)  011546  000102                   102                             ;******ERROR NUMBER 102******
 (1)
2980  011550  062701  000002          4$:     ADD     #2,R1           ;INCREMENT R1 BY 2
2981  011554  020105                   CMP     R1,R5           ;SEE IF R1 HAS REACHED THE MAX. OF MEMORY
2982  011556  103767                   BLO     3$
2983  011560  132737  000001  000302        BITB    #1,@#PASFLG     ;CHECK TO SEE IF PASFLG=0 OR 2
2984  011566  001002                   BNE     5$
2985  011570  105237  000302                  INCB    @#PASFLG        ;IN WHICH CASE INCREMENT PASFLG COUNTER BY 1
2986
2987  011574  020305                5$:     CMP     R3,R5           ;SEE IF R3 HAS REACHED THE MAX. OF THE MEMORY
2988  011576  103012                   BHIS    7$
2989  011600  012702  037776              MOV     #37776,R2       ;WRITE INTO 1 LOC FOR >2MS (ABOUT 100MS)
2990  011604  000313                6$:     SWAB    (R3)
2991  011606  005302                   DEC     R2
2992  011610  001375                   BNE     6$
2993  011612  010337  000350              MOV     R3,@#SAVLOC     ;SAVE LOCATION WRITTEN FOR 2MS FOR ERROR REPORT.
2994  011616  062703  020000              ADD     #20000,R3       ;BY ADDING 1 TO THE 14TH ADDRESS BIT CAUSE
2995                                                                    ;R3 TO POINT TO A LOCATION IN THE NEXT
2996                                                                    ;4K BANK OF MEMORY
2997  011622  000744                   BR      2$
2998  011624  105237  000302          7$:     INCB    @#PASFLG        ;MAKE PASFLG=2
2999  011630  000337  000312              SWAB    @#BAKPAT        ;IF BAKPAT IS NOT BEING SWAPPED FOR THE 2ND
3000  011634  001732                   BEQ     RPT17           ;THEN GO BACK TO THE LOCATION RPT17
3001  011636  000167  170744          END17:  JMP     TSTSCP
3002
3003
3004
3005
3006
3007
3008
3009
```

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                                RELOCATE?

 3014  011642  005077  171062          RELOC:  CLR     @CSRADR ;
 3015  011646  012737  000377  000312          MOV     #377,@#BAKPAT
 3016  011654  105737  000272                  TSTB    @#MMAVA         ;IS THE MEMORY MANAGEMENT BEING TESTED ?
 3017  011660  001170                          BNE     CONTMM          ;IF SO THEN GO TO CONTMM AND CONTINUE TESTING
 3018                                                                  ;MEMORY MANAGEMENT
 3019  011662  005767  171030                  TST     LDFLG           ;ONLY RELOCATE IF IN MEM UNDER TEST
 3020  011666  001542                          BEQ     CKDONE          ;DON'T RELOC, BRANCH
 3021  011670  032777  001000  171034          BIT     #1000,@SWR      ;RELOCATION WANTED?
 3022  011676  001136                          BNE     CKDONE          ;BRANCH IF NO
 3023  011700  005767  171022                  TST     INHREL          ;RELOCATION ALLOWED ?
 3024  011704  001133                          BNE     CKDONE          ;NO, SINGLE ERROR IN LOC 0-500, BRANCH
 3025  011706  105737  000170                  TSTB    @#REL           ;IF THE PROGRAM HAS ALREADY BEEN RELOCATED THEN ALSO
 3026  011712  100473                          BMI     RELOER          ; PLACE THE PROGRAM BACK IN LOWER CORE
 3027  011714  112737  000200  000170          MOVB    #200,@#REL      ;OTHERWISE PREPARE TO RELOCATE
 3028
 3029                                    ;RELOCATE THE DIAGNOSTIC TO SECOND 16K
 3030
 3031
 3032  011722  012701  100500                  MOV     #100000+BEGIN,R1;START OF RELOCATED VERSION
 3033  011726  012702  116132                  MOV     #100000+ENDPROG,R2;END
 3034  011732  005711                  3$:     TST     (R1)            ;READ A WORD
 3035  011734  032777  100000  170766          BIT     #100000,@CSRADR ;CHECK FOR DBE
 3036  011742  001005                          BNE     5$              ;BR IF ERROR
 3037  011744  062701  000004                  ADD     #4,R1   ;NEXT WORD
 3038  011750  020102                          CMP     R1,R2           ;END YET ?
 3039  011752  103767                          BLO     3$              ;BR IF NOT
 3040  011754  000405                          BR      4$              ;BR IF ALL IS OK
 3041  011756  105037  000170          5$:     CLRB    @#REL           ;INDICATE NO RELOC
 3042  011762  004767  002226                  JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
  (1)  011766  000103                          103                     ;******ERROR NUMBER 103******
  (1)
 3043  011770  032777  000040  170734  4$:     BIT     #40,@SWR        ;PRINTING WANTED
 3044  011776  001005                          BNE     1$              ;BR IF NO
 3045  012000  004767  002434                  JSR     PC,PNTMES       ;TYPE "RELOC"
 3046  012004  042522  047514  000103          .ASCIZ /RELOC/
 3047                                          .EVEN
 3048  012012  004767  003270          1$:     JSR     PC,CLRMM        ;CLEAR MM REGS
 3049  012016  012737  000500  000320          MOV     #BEGIN,@#MINMEM ;NEW TEST ADDRESS
 3050  012024  052767  000010  170656          BIS     #10,ECCDIS      ;PROTECT 2ND 16K
 3051  012032  052767  000010  170652          BIS     #10,DIAGA       ;DITTO
 3052  012040  012705  100000                  MOV     #100000,R5      ;START OF 2ND 16K
 3053  012044  010567  170650                  MOV     R5,BASE         ;BASE FOR RELOC
 3054  012050  012704  000430                  MOV     #BEGIN-50,R4    ;FIRST LOC TO BE RELOCATED
 3055  012054  060405                          ADD     R4,R5           ;
 3056  012056  012425                  2$:     MOV     (R4)+,(R5)+     ;MOV A WORD
 3057  012060  020437  000342                  CMP     R4,@#SAVR4      ;LAST LOC YET ?
 3058  012064  103774                          BLO     2$              ;BR IF NO
 3059  012066  012704  000430                  MOV     #BEGIN-50,R4    ;FIRST TEST ADDRESS
 3060  012072  016705  170622                  MOV     BASE,R5
 3061  012076  000137  100500                  JMP     @#BEGIN+100000  ;JUMP TO RELOCATED VERSION
 3062
 3063                                    ;*RELOCATE THE DIAGNOSTIC BACK TO LOWER MEMORY
 3064
 2065
 2066  012102  105737  000170          RELOER: TSTB    @#REL           ;IS DIAGNOSTIC IN RELOCATED STATE?
 2067  012106  100032                          BPL     CKDONE          ;BRANCH IF NO
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3068  012110  005067  170604                  CLR     BASE
3069  012114  042767  000010  170566          BIC     #10,ECCDIS
3070  012122  042767  000010  170562          BIC     #10,DIAGA
3071
3072  012130  016737  170566  000320          MOV     SAVMIN,@#MINMEM ;RESTORE TEST ADDRESS FOR ECC
3073  012136  012704  000430                  MOV     #BEGIN-50,R4    ;PREPARE TO RELOCATE THE PROGRAM TO LOWER CORE
3074  012142  010405                          MOV     R4,R5           ;
3075  012144  062705  100000                  ADD     #100000,R5
3076  012150  012524                  2$:     MOV     (R5)+,(R4)+
3077  012152  020437  000342                  CMP     R4,@#SAVR4
3078  012156  103774                          BLO     2$
3079  012160  105037  000170                  CLRB    @#REL
3080  012164  012706  000500                  MOV     #BEGIN,SP       ;RESET STACK TO LOWER MEMORY
3081  012170  010637  000346                  MOV     SP,@#SAVR6      ;"BEGIN" USES THIS TO RESET THE STACK.
3082  012174  000137  012200          CKDONE: JMP     @#LOWER         ;TRANSFER THE PROGRAM CONTROL TO THE LOWER CORE
3083
3084
3085
3086  012200  105737  000402          LOWER:  TSTB    @#$FATAL        ;FATAL ERROR
3087  012204  001405                          BEQ     1$              ;BR IF NOT
3088  012206  005737  000042                  TST     @#42            ;APT ?
3089  012212  001402                          BEQ     1$              ;NO KEEP TESTING
3090  012214  000167  002040                  JMP     APTHLT
3091  012220  105737  000311          1$:     TSTB    @#SAVKBB        ;HERE DUE TO ↑C TYPED?
3092  012224  001141                          BNE     $TPSTK          ;BRANCH IF YES (TYPE ERROR STACK)
3093  012226  004767  002504          TSTMM:  JSR     PC,MEMMNG       ; SET THE REGISTERS IF THE MEMORY MANAGEMENT
3094                                                                  ;IS AVAILABLE
3095  012232  105737  000272                  TSTB    @#MMAVA         ;IS MEM. MANAG. AVAILABLE ?
3096  012236  001474                          BEQ     ENDPAS          ;BRANCH IF NO
3097  012240  000406                          BR      $CNTMM          ;BEGIN TESTING ABOVE 28K
3098  012242  022737  007400  172352  CONTMM: CMP     #7400,@#172352  ;DON'T WANT TO WRAP AROUND
3099  012250  001464                          BEQ     ENDMAX          ;GO TO END-OF-PASS
3100  012252  004767  002636                  JSR     PC,UPMM         ;GO TO UPDATE MEM. MANAG. REGISTERS
3101  012256  012703  000322          $CNTMM: MOV     #LOWTWO,R3      ;MAKE R3 POINT TO THE LOCATION LOWTWO
3102  012262  004767  002744                  JSR     PC,GETSIZ       ; LOAD BITS 6-10 OF R2 WITH THE BITS 13-17
3103                                                                  ;OF THE LOWEST ADDRESS UNDER TEST
3104  012266  012704  040000                  MOV     #40000,R4       ;MAKE R4 POINT TO THE LOWEST LOCATION IN THE BANK
3105                                                                  ;POINTED BY PAGE ADDRESS REGISTER 2 (PAR2)
3106  012272  020237  172344                  CMP     R2,@#172344     ;IS THE CONTENT OF R2 LOWER THAN THE CONTENT OF
3107                                                                  ;PAR2 ?
3108  012276  103405                          BLO     2$              ;IF SO THEN GO 2$
3109  012300  050104                          BIS     R1,R4           ;SUBROUTINE GETSIZ LOADED R1 WITH BITS 0-12
3110                                                                  ;OF LOWADD WHICH HAVE NOW BEEN LOADED IN R4
3111  012302  162702  000200                  SUB     #200,R2
3112  012306  004767  002430                  JSR     PC,MMREG        ; SET MEM. MANAG. REGISTERS
3113  012312  010437  000320          2$:     MOV     R4,@#MINMEM     ;NEW MINMEM FOR ECC TESTS
3114  012316  004767  002710                  JSR     PC,GETSIZ       ;PLACE BITS 13-17 OF HIGHEST LOCATION TO BE TESTED
3115                                                                  ;IN BITS 6-10 OF R2, #160000 IN R0 AND BITS 0-12
3116                                                                  ;OF LOCATION HIGHADD IN R1
3117  012322  004767  000020                  JSR     PC,MAXADR       ; GET THE ADDRESS OF MAX. MEM. UNDER TEST
3118  012326  010005                          MOV     R0,R5
3119  012330  004767  002676                  JSR     PC,GETSIZ       ; PREPARE TO SET UP LOCATION MAXMEM
3120  012334  004767  000006                  JSR     PC,MAXADR       ; GET THE MAXIMUM ADDRESS OF AVAILABLE MEMORY
3121  012340  010013                          MOV     R0,(R3)         ;AND STORE INTO "MAXMEM"
3122  012342  000167  167664                  JMP     CLRMEM          ;GO TEST A 20K SLICE ABOVE 28K.
3123
```

```
3124
3125                                    ;MAXADR - SUBROUTINE TO GET CURRENT 20K SLICE OF MEMORY ADDRESSES ABOVE 28K.
3126                                    ;REGISTERS:
3127                                    ;R0= ON ENTRY= #160000 AND ON EXIT=HIGHEST VIRTUAL ADDR. UNDER TEST
3128                                    ;R1= LOW ORDER 12 BI"S OF VIRTUAL TEST ADDRESS
3129                                    ;R2= PAR BLOCK NO. CURRENTLY UNDER TEST.
3130
3131  012346  010046                    MAXADR: MOV     R0,-(SP)        ;PUT MAXIMUM AVAILABLE ADDRESS ON STACK
3132  012350  012700  172356                    MOV     #172356,R0      ;R0=PAR7 UNIBUS ADDRESS
3133                                    ;**BEGIN LOOP TO FIND PAR ADDRESS UNDER TEST
3134  012354  162716  020000            2$:     SUB     #20000,(SP)     ;DECREMENT VIRTUAL ADDRESS BY 4K
3135  012360  050116                            BIS     R1,(SP)         ;SET BITS 11:0 TO MAXIMUM VIRTUAL TEST ADDRESS
3136  012362  020240                            CMP     R2,-(R0)        ;DOES CURRENT PAR= TEST BLOCK NO.?
3137  012364  001411                            BEQ     3$              ;BRANCH IF YES
3138  012366  020027  172340                    CMP     R0,#172340      ;ARE WE AT PAR0?
3139  012372  101370                            BHI     2$              ;NO KEEP TRYING
3140                                    ;**END LOOP TO FIND PAR ADDRESS UNDER TEST
3141  012374  062700  000004                    ADD     #4,R0           ;SET TO CURRENT PAR
3142  012400  021002                            CMP     (R0),R2         ;IS THE PAR BLOCK UNDER TEST GTR THAN ALLOWED?
3143  012402  003006                            BGT     4$              ;BRANCH IF YES (FALL INTO ENDPAS)
3144  012404  012716  157776                    MOV     #157776,(SP)    ;EXIT WITH MAXADR= 28K SEGMENT TEST SIZE
3145  012410  012600                    3$:     MOV     (SP)+,R0        ;SET R0 TO MAXIMUM VIRTUAL TEST ADDRESS
3146  012412  062700  000002                    ADD     #2,R0           ;MAKE MAXIMUM MEMORY+2
3147  012416  000207                            RTS     PC              ;AND EXIT MAXADR ROUTINE
3148
3149  012420  022626                    4$:     CMP     (SP)+,(SP)+     ;FIXUP STACK
3150                                                                    ;AND FALL THRU TO ENDPAS.
3151  012422  016737  170274  000320    ENDMAX: MOV     SAVMIN,@#MINMEM ;BECAUSE WE WON'T SIZE AGAIN
```

```
3156                                    ;* TYPE ROUTINE FOR ERROR STACK
3157                                    ;* ---------------------------
3158                                    ;*
3159                                    ;*      THIS ROUTINE IS USED TO DETERMINE IF TYPE OUT OF THE ERROR STACK
3160                                    ;*      FOR ONLY THE FAILING BITS IS REQUIRED OR NOT
3161
3162
3163
3164  012430  026727  170274  172134  ENDPAS: CMP     CSRADR,#172134  ;SECOND CSR ?
3165  012436  001004                          BNE     2$              ;BR IF NOT
3166  012440  012767  172136  170262  1$:     MOV     #172136,CSRADR  ;RESTORE INIT ADDRESS
3167  012446  000424                          BR      4$
3168  012450  012767  172134  170252  2$:     MOV     #172134,CSRADR  ;GET READY TO LOOK FOR SECOND CSR
3169  012456  012737  012512  000004          MOV     #3$,@#4         ;SET UP FOR TRAP
3170  012464  012777  020020  170236          MOV     #20020,@CSRADR  ;MAKE SURE IT BELONGS TO A MS11K
3171  012472  032777  020020  170230          BIT     #20020,@CSRADR  ;THESE BITS ARE UNIQUE TO MS11K CSR
3172  012500  001757                          BEQ     1$              ;BR IF NOT MS11K CSR
3173  012502  005077  170222                  CLR     @CSRADR         ;CLEAR THE BITS JUST IN CASE
3174  012506  000167  000222                  JMP     ACT11           ;GUESS IT DOES...GO TEST IT
3175  012512  062706  000004          3$:     ADD     #4,SP           ;RESTORE SP
3176  012516  000750                          BR      1$              ;
3177  012520  032777  020000  170204  4$:     BIT     #20000,@SWR     ;ARE WE GOING TO TYPE THE ERROR STACK AT END OF PASS?
3178  012526  001051                          BNE     $EOP            ;IF NOT THEN GO TO $EOP
3179  012530  012746  177777          $TPSTK: MOV     #-1,-(SP)       ;THE PROGRAM HAS REACHED THE END AND ERROR
3180                                                                  ;STACK AND END OF PASS WILL BE TYPED OUT
3181  012534  012701  016132                  MOV     #ENDPROG,R1     ;PLACE THE STARTING ADDRESS OF THE ERROR STACK
3182                                                                  ;FOR 0 TO 4K MEMORY IN R1
3183  012540  012703  000376          TYPSTK: MOV     #376,R3
3184  012544  005216                          INC     (SP)            ;IF WE HAVE GONE THRU THE ENTIRE
3185  012546  020137  000304                  CMP     R1,@#ENDSTK     ;HAS THE END OF THE ERROR STACK BEEN REACHED ?
3186  012552  103037                          BHIS    $EOP            ;THEN GO TO TYPE END OF PASS
3187  012554  112702  000022                  MOVB    #18.,R2
3188  012560  105302          RETSTK: DECB    R2                      ;IF ALL 16 BITS OF THIS BANK HAVE BEEN CHECKED.
3189  012562  002766                          BLT     TYPSTK          ;BEEN CHECKED FOR ERROR THEN SEE IF THERE
3190                                                                  ;IS ANY MORE 4K MEMORY BANK
3191  012564  105721                          TSTB    (R1)+           ;OTHERWISE CHECK THE BYTE STORED AT (R1)
3192  012566  001774                          BEQ     RETSTK          ;IF IT IS 0 WE WILL NOT TYPE IT
3193  012570  020227  000020                  CMP     R2,#16.         ;IS THE POINTER POINTING TO ERROR STACK BYTE
3194                                                                  ;MEANT FOR COLLECTING ADDRESS FAILURES FOR
3195                                                                  ;THE SPECIFIC MEMORY BANK
3196  012574  103403                          BLO     2$              ;IF NOT THEN GO TO TYPE BIT NUMBER
3197  012576  004767  001470                  JSR     PC,TPADER       ;OTHERWISE TYPE "ADDRESS ERROR"
3198  012602  000404                          BR      FAILNM
3199  012604  010237  000306          2$:     MOV     R2,@#DECWRD     ;PREPARE TO TYPE THE NUMBER OF THE FAILING BIT
3200                                                                  ;IN DECIMAL
3201  012610  004767  001646                  JSR     PC,TYPDEC       ;GO TO TYPE THE BIT NUMBER IN DECIMAL
3202  012614  011637  000306          FAILNM: MOV     (SP),@#DECWRD   ;PREPARE TO TYPE THE PAGE NUMBER
3203  012620  004767  001642                  JSR     PC,$TPDEC       ;IN DECIMAL
3204  012624  005043                          CLR     -(R3)
3205  012626  114113                          MOVB    -(R1),(R3)      ;PREPARE TO PRINTOUT THE NUMBER OF TIMES THIS
3206                                                                  ;FAILURE OCCURED
3207  012630  105021                          CLRB    (R1)+           ;CLEAR THE ERROR STACK
3208  012632  005043                          CLR     -(R3)
3209  012634  105237  000310                  INCB    @#TYPCNT        ;ENABLE THE TYPE OUT OF 1 WORDS
3210  012640  004767  001762                  JSR     PC,RPTOCT       ; TYPE THE 4K BANK AND THE NUMBER OF TIMES
3211                                                                  ;THIS FAILURE WAS SEEN
```

```
 3212  012644  012703  000376                MOV     #376,R3         ;RESET SCRATCH STACK FOR EACH BIT PRINTED.
 3213  012650  000743                        BR      RETSTK
```

```
3218
3219
3220                                    ;* END OF PASS
3221                                    ;* ----------
3222                                    ;*
3223                                    ;*      TYPE "END PASS" AND DISABLE PARITY.
3224                                    ;*      ALSO SERVICE ACT11.
3225                                    ;*      AND EVERY CONSECUTIVE PASSES UNLESS BIT 4 OF $SWREG IS HIGH
3226                                    ;*
3227
3228
3229  012652  005002                    $EOP:   CLR     R2              ;SET R2= PARITY MODULE DISABLE CODE
3230  012654  105737  000311                    TSTB    @#SAVKBB        ;CONTROL-C TYPED?
3231  012660  001050                            BNE     CTLC            ;BRANCH IF YES-RESTORE LOADERS AND HALT-
3232  012662  005237  000406                    INC     @#$PASS         ;INCREMENT PASS COUNT
3233  012666  005067  170032                    CLR     ERRFLG          ;RESET ERROR HEADER FOR NEXT PASS
3234  012672  032777  000040  170032            BIT     #40,@SWR        ;"END PASS #XX" PRINTOUT WANTED?
3235  012700  001015                            BNE     ACT11           ;BRANCH IF NO
3236  012702  004767  001524            TYPEOP: JSR     PC,TPCRLF       ; TYPE CR, LF, AND "END PASS #"
3237  012706  047105  020104  040520            .ASCIZ  /END PASS #/
      012714  051523  021440     000
3238              012722                        .EVEN
3239  012722  013737  000406  000306            MOV     @#$PASS,@#DECWRD        ;GET PASS COUNT
3240  012730  004767  001532                    JSR     PC,$TPDEC               ;TYPE IT
3241  012734  013700  000042            ACT11:  MOV     @#42,R0         ;GET THE MONITOR ADDRESS
3242  012740  001405                            BEQ     $DOAGN          ;IF NONE
3243  012742  004767  000012                    JSR     PC,RLODER       ;RESTORE XXDP MONITOR
3244  012746  000005                            RESET           ;RETURN TO ACT11 MONITOR.
3245
3246
3247                                    ;* SERVICE XXDP/ACT11
3248  012750  000137  000156                    JMP     @#$ENDAD        ;JUMP TO ACT SERVICE
3249
3250  012754  000137  000250            $DOAGN: JMP     @#RESTRT        ;REPEAT TEST IF NOT UNDER ACT11/XXDP
3251
3252  012760  004767  002322            RLODER: JSR     PC,CLRMM        ;STOP MEMORY MANAGEMENT SO CAN RESTORE LOADERS
3253  012764  013704  000342                    MOV     @#SAVR4,R4      ;RESTORE R4 WITH SAVR4
3254  012770  014445                    4$:     MOV     -(R4),-(R5)     ;RESTORE LOADERS
3255  012772  020437  000304                    CMP     R4,@#ENDSTK
3256  012776  101374                            BHI     4$
3257  013000  000207                            RTS     PC              ;RETURN FROM RLODER CALL
3258
3259                                    ;CONTROL C HANDLER
3260
3261  013002  004767  177752            CTLC:   JSR     PC,RLODER       ;RESTORE ABS LOADER
3262  013006  000167  001246                    JMP     APTHLT          ;IF NOT APT HALT AT FATHLT
3263
3264
3265                                    ;;*****************************************************************
3266
3267                                            ;CHECK BIT GENERATOR ROUTINE
3268                                            ;CALL:  JSR PC,CHKGEN
3269                                            ;
3270                                            ;       SOURCE = ADDRESS OF DATA
3271                                            ;       CHECK  = WORD CONTAINING GENERATED CHECKBITS
3272
```

```
3273  013012  000000                SOURCE: .WORD 0
3274  013014  000000                CHECK:  .WORD 0
3275  013016  125252                CHKTAB: .WORD   125252          ;C1 BIT TABLE
3276  013020  125252                        .WORD   125252          ;
3277  013022  146314                        .WORD   146314          ;C2 BIT TABLE
3278  013024  146314                        .WORD   146314          ;
3279  013026  170360                        .WORD   170360          ;C4 BIT TABLE
3280  013030  170360                        .WORD   170360          ;
3281  013032  177777                        .WORD   177777          ;C8 BIT TABLE
3282  013034  177400                        .WORD   177400          ;
3283  013036  000377                        .WORD      377          ;C16 BIT TABLE
3284  013040  177777                        .WORD   177777          ;
3285  013042  177400                        .WORD   177400          ;C32 BIT TABLE
3286  013044  177777                        .WORD   177777          ;
3287  013046  064551                        .WORD    64551          ;CT BIT TABLE
3288  013050  113151                        .WORD   113151          ;
3289
3290  013052     000                UPPFLG: .BYTE   0
3291
3292  013053     000                CHKCNT: .BYTE   0               ;C1 PARITY COUNTER
3293  013054     000                        .BYTE   0               ;C2 PARITY COUNTER
3294  013055     000                        .BYTE   0               ;C4 PARITY COUNTER
3295  013056     000                        .BYTE   0               ;C8 PARITY COUNTER
3296  013057     000                        .BYTE   0               ;C16 PARITY COUNTER
3297  013060     000                        .BYTE   0               ;C32 PARITY COUNTER
3298  013061     000                        .BYTE   0               ;CT PARITY COUNTER
3299  013062     077                PARBYT: .BYTE   77              ;ODD/EVEN PARITY FLAGS
3300                                                               ;0=EVEN
3301                                                               ;1=ODD
3302                                                               ;CT C32 C16 C8 C4 C2 C1
3303        013064                         .EVEN
3304  013064  004467  000236       CHKGEN: JSR     R4,SAVOT4       ;SAVE R0 TO R4
3305  013070  005000                        CLR     R0              ;CLEARING OUT PARITY COUNTERS
3306  013072  012701  013053                MOV     #CHKCNT,R1      ;START 7 COUNTERS
3307  013076  066701  167616                ADD     BASE,R1         ;
3308  013102  022700  000007       10$:    CMP     #7,R0           ;FINISHED?
3309  013106  001403                        BEQ     20$             ;BRANCH IF YES
3310  013110  105021                        CLRB    (R1)+           ;NO, DO THE NEXT BYTE
3311  013112  005200                        INC     R0              ;BUMP THE COUNT
3312  013114  000772                        BR      10$             ;LOOP
3313  013116  012701  000001       20$:    MOV     #1,R1           ;SET THE TEST BIT
3314  013122  012702  013016       30$:    MOV     #CHKTAB,R2      ;START OF CHECK BIT TABLE
3315  013126  066702  167566                ADD     BASE,R2         ;
3316  013132  012703  013053                MOV     #CHKCNT,R3      ;START ADDRESS OF PARITY COUNTERS
3317  013136  066703  167556                ADD     BASE,R3         ;
3318  013142  012704  000006                MOV     #6,R4           ;FOR SEVEN PARITY COUNTERS
3319  013146  105067  177700       40$:    CLRB    UPPFLG          ;INDICATE LOWER WORD
3320  013152  016700  177634                MOV     SOURCE,R0       ;SET ADDRESS OF DATA IN R0
3321  013156  066700  167536                ADD     BASE,R0         ;
3322  013162  030110                42$:    BIT     R1,(R0)         ;CHECK LOWER 16 BITS FOR TEST BIT
3323  013164  001403                        BEQ     50$             ;BRANCH IF NOT SET
3324  013166  030112                        BIT     R1,(R2)         ;LOOK FOR TEST BIT IN CHECK BIT TABLE
3325  013170  001401                        BEQ     50$             ;BRANCH IF NOT FOUND
3326  013172  105213                        INCB    (R3)            ;FOUND A MATCH, COUNT IT
3327  013174  062700  000002       50$:    ADD     #2,R0           ;R0 NOW = SOURCE +2
3328  013200  062702  000002                ADD     #2,R2           ;POINT TO SECOND WORD IN TABLE
```

```
3329  013204  105767  177642          TSTB    UPPFLG          ;CHECK FOR UPPER/LOWER
3330  013210  001003                  BNE     60$             ;BRANCH IF UPPER
3331  013212  105267  177634          INCB    UPPFLG          ;CHANGE FLAG TO UPPER
3332  013216  000761                  BR      42$             ;CHECK SECOND 16 BITS
3333  013220  005704          60$:    TST     R4              ;LOOK FOR LAST PARITY COUNTER
3334  013222  001403                  BEQ     70$             ;BRANCH IF DONE
3335  013224  005203                  INC     R3              ;ADVANCE PARITY COUNTER POINTER
3336  013226  005304                  DEC     R4              ;ADVANCE CHECK BIT FLAG COUNTER
3337  013230  000746                  BR      40$             ;GO CHECK NEXT CHECK BIT IN TABLE
3338  013232  006301          70$:    ASL     R1              ;SHIFT THE BIT OVER
3339  013234  103332                  BCC     30$             ;ADJUST THE PARITY AND ASSEMBLE
3340                                                          ;CHECK BIT WORD
3341  013236  012700  000001          MOV     #1,R0           ;SET FIRST BIT IN R1
3342  013242  012701  013053          MOV     #CHKCNT,R1      ;ADDRESS OF C1 PARITY COUNTER
3343  013246  066701  167446          ADD     BASE,R1         ;
3344  013252  130067  177604  80$:    BITB    R0,PARBYT       ;CHECKING FOR ODD OR EVEN PARITY
3345  013256  001401                  BEQ     90$             ;BRANCH IF EVEN PARITY
3346  013260  105211                  INCB    (R1)            ;ODD, INC THE PARITY COUNTER
3347  013262  132711  000001  90$:    BITB    #1,(R1)         ;TEST PARITY COUNTER FOR SET BIT
3348  013266  001401                  BEQ     100$            ;
3349  013270  050004                  BIS     R0,R4           ;SET THE CHECK BIT IN CHECK
3350  013272  005201          100$:   INC     R1              ;NEXT COUNTER
3351  013274  006300                  ASL     R0              ;SHIFT TEST BIT TO NEXT BIT
3352  013276  032700  000200          BIT     #200,R0         ;CT YET?
3353  013302  001763                  BEQ     80$             ;BRANCH IF NO
3354  013304  000304                  SWAB    R4              ;
3355  013306  006004                  ROR     R4              ;
3356  013310  006004                  ROR     R4              ;
3357  013312  006004                  ROR     R4              ;POSITION CHECK BITS IN BITS 11-5
3358  013314  010467  177474          MOV     R4,CHECK        ;
3359  013320  004767  000014          JSR     PC,RSTOT4       ;RESTORE R0 TO R4
3360  013324  000207                  RTS     PC              ;
3361                                                          ;
3362                                                          ;
3363                                  ;CALL   JSR     R4,SAVOT4
3364  013326  010346          SAVOT4: MOV     R3,-(SP)        ;SAVE R3
3365  013330  010246                  MOV     R2,-(SP)        ;SAVE R2
3366  013332  010146                  MOV     R1,-(SP)        ;SAVE R1
3367  013334  010046                  MOV     R0,-(SP)        ;SAVE R0
3368  013336  010407                  MOV     R4,PC           ;R4 IS ALREADY SAVED
3369                                                          ;
3370                                  ;CALL   JSR     PC,RSTOT4
3371  013340  012604          RSTOT4: MOV     (SP)+,R4        ;RETURN ADDRESS
3372  013342  012600                  MOV     (SP)+,R0        ;RESTORE R0
3373  013344  012601                  MOV     (SP)+,R1        ;R1
3374  013346  012602                  MOV     (SP)+,R2        ;R2
3375  013350  012603                  MOV     (SP)+,R3        ;R3
3376  013352  000204                  RTS     R4              ;RESTORE R4 AND RETURN
3377                                                          ;
3378                                                          ;
3379                                                          ;
3380                                                          ;
3381                                                          ;
3382  013354  010046          DASHL:  MOV     R0,-(SP)        ;SAVE R0
3383  013356  012500                  MOV     (R5)+,R0        ;PICK UP ARGUMENT
3384  013360  066700  167334          ADD     BASE,R0         ;
```

```
3385  013364  006360  000002                  ASL     2(R0)           ;SHIFT HIGH 16 BITS
3386  013370  006310                          ASL     (R0)            ;SHIFT LOW 16 BITS
3387  013372  103002                          BCC     10$             ;BR IF LOW WORD BIT 15 = 0
3388  013374  005260  000002                  INC     2(R0)           ;IT WAS  = 1 INC HI WORD
3389  013400  012600                  10$:    MOV     (SP)+,R0        ;RESTORE R0
3390  013402  000205                          RTS     R5
3391
3392  013404  012567  000112          BITCOM: MOV     (R5)+,MSKADR    ;FIRST ARG IS ADDR OF MASK
3393  013410  012567  000110                  MOV     (R5)+,DATADR    ;SECOND IS ADDR OFDATA
3394  013414  010046                          MOV     R0,-(SP)        ;
3395  013416  010146                          MOV     R1,-(SP)        ;
3396  013420  010246                          MOV     R2,-(SP)        ;SAVE THESE REGS
3397  013422  066767  167272  000072          ADD     BASE,MSKADR     ;
3398  013430  066767  167264  000066          ADD     BASE,DATADR     ;
3399  013436  017700  000060                  MOV     @MSKADR,R0      ;GET MASK
3400  013442  017701  000056                  MOV     @DATADR,R1      ;GET DATA
3401  013446  004767  000054                  JSR     PC,XOR          ;DO THE XOR
3402  013452  010277  000046                  MOV     R2,@DATADR      ;PUT RESULT BACK AS DATA
3403  013456  062767  000002  000036          ADD     #2,MSKADR       ;NEXT WORD
3404  013464  062767  000002  000032          ADD     #2,DATADR       ;DITTO
3405  013472  017700  000024                  MOV     @MSKADR,R0      ;
3406  013476  017701  000022                  MOV     @DATADR,R1      ;
3407  013502  004767  000020                  JSR     PC,XOR          ;DO THE SAME FOR SECOND WORD
3408  013506  010277  000012                  MOV     R2,@DATADR      ;PUT RESULT BACK TOO
3409  013512  012602                          MOV     (SP)+,R2        ;
3410  013514  012601                          MOV     (SP)+,R1        ;
3411  013516  012600                          MOV     (SP)+,R0        ;RESTORE THE REGS R0,R2
3412  013520  000205                          RTS     R5
3413
3414
3415  013522  000000          MSKADR: .WORD   0
3416  013524  000000          DATADR: .WORD   0
3417
3418
3419
3420                                          ;XOR ROUTINE
3421                                          ;* R0 = A OPER
3422                                          ;* R1 = B OPER
3423                                          ;* R2 = RESULT
3424
3425  013526  010102          XOR:    MOV     R1,R2           ;SAVE B OPERAND
3426  013530  040002                  BIC     R0,R2           ;A NOT B
3427  013532  040100                  BIC     R1,R0           ;B NOT A
3428  013534  050002                  BIS     R0,R2           ;A XOR B
3429  013536  000207                  RTS     PC              ;EXIT AND RETURN
3430
3431:                                    ;;*****************************************************************
```

```
                                        ;* ERROR HANDLING ROUTINE
                                        ;* --------------------
                                        ;*
                                        ;*      PROGRAM COMES HERE EACH TIME AN ERROR IS ENCOUNTERED THIS
                                        ;*      ROUTINE TYPES OUT THE ERROR MESSAGE IN THE FORMAT GIVEN EARLIER
                                        ;
013540 017637 000000 000402 ERROR:  MOV     @(SP),@#$FATAL  ;LOAD THE LOCATION $FATAL WITH THE ERROR NUMBER
013546 005767 167152                TST     ERRFLG          ;FIRST ERROR ?
013552 001050                       BNE     1$              ;BR IF NOT FIRST ERROR
013554 032777 020000 167150         BIT     #20000,@SWR     ;ERROR PRINTOUTS DESIRED ?
013562 001044                       BNE     1$              ;BR IN NO
013564 004767 000642                JSR     PC,TPCRLF       ;TYPE ERROR HEADER FOR FIRST ERROR
013570 040440 042104 020122         .ASCII  / ADDR     GOOD     BAD      PC     ERR #    PASFLG    XOR  /
013576 020040 020040 047507
013604 042117 020040 020040
013612 041040 042101 020040
013620 020040 020040 050040
013626 020103 020040 020040
013634 051105 020122 020043
013642 020040 050040 051501
013650 020106 020107 020040
013656 054040 051117 020040
013664 005015 000                   .ASCIZ  <15><12>
013670                              .EVEN
013670 005067 167030                INC     ERRFLG          ;INDICATE NOT FIRST ERROR
013674 010346                1$:    MOV     R3,-(SP)        ;SAVE R3
013676 010046                       MOV     R0,-(SP)        ;AND R0 ON THE STACK
                                        ;SETUP BANK NO. IN FATAL FOR APT
013700 010103                       MOV     R1,R3           ;GET VIRTUAL ADDRESS UNDER TEST FOR GETBNK
013702 004767 001420                JSR     PC,GETBNK       ;GET BANK NO. UNDER TEST INTO PBNK
013706 013703 000306                MOV     @#PBNK,R3       ;GET BANK UNDER TEST
013712 110337 000403                MOVB    R3,@#$FATAL+1   ;STORE FAILING BANK NO. FOR APT
                                        ;
013716 010346                       MOV     R3,-(SP)        ;TEMPORARILY STORE R3
013720 012703 000376                MOV     #376,R3         ;MAKE R3 AS THE STACK POINTER
013724 013743 000302                MOV     @#PASFLG,-(R3)  ;OUTPUT THE WORD STORED AT
013730 005043                2$:    CLR     -(R3)
013732 113713 000402                MOVB    @#$FATAL,(R3)   ;PUT ERROR NO. ON ERROR STACK
013736 016643 000006                MOV     6(SP),-(R3)     ;PLACE THE RETURN PC AT (R3)
013742 011143                       MOV     (R1),-(R3)      ;PLACE BAD DATA,
013744 010043                       MOV     R0,-(R3)        ;AND GOOD DATA ON THE STACK
013746 005043                       CLR     -(R3)
013750 016313 000004                MOV     4(R3),(R3)      ;TAKE THE
013754 040013                       BIC     R0,(R3)         ;EXCLUSIVE OR OF GOOD AND BAD DATA
013756 046300 000004                BIC     4(R3),R0        ;TO FIND THE BITS THAT FAILED
013762 050013                       BIS     R0,(R3)         ;AND PLACE IT ON THE STACK
013764 011367 000744                MOV     (R3),BDCHIP     ;TO PRINT OUT XOR OF GOOD VS BAD
013770 012700 002112                MOV     #ENDPROG-.-24.,R0;THIS CODE BRINGS THE RELATIVE ADDRESS
013774 060700                       ADD     PC,R0           ;OF THE STARTING OF THE ERROR STACK
013776 062700 000022         6$:    ADD     #18.,R0         ;FOR THE SPECIFIC 4K BANK
014002 005316                       DEC     (SP)
```

```
3483  014004  002374                        BGE     6$
3484  014006  005726                        TST     (SP)+           ;RESTORE THE STACK POINTER
3485
3486  014010  105037  000273        ERRTYP: CLRB    @#TYPENB        ;DISABLE ANY TYPE OUT
3487  014014  105737  000274        1$:     TSTB    @#$PRERR        ;IF THIS IS PARITY PROBLEM
3488  014020  001007                        BNE     3$              ;THEN GO TO 3$
3489  014022  105720                        TSTB    (R0)+           ;OTHERWISE INCREMENT THE ERROR STACK POINTER BY 1
3490  014024  105737  000275                TSTB    @#$ADERR        ;IF THIS IS ADDRESSING PROBLEM
3491  014030  001003                        BNE     3$              ;THEN GO TO 3$
3492  014032  105720                        TSTB    (R0)+           ;INCREMENT THE POINTER R0 BY 1
3493  014034  005713                2$:     TST     (R3)            ;IS BIT 15 OF (R3) SET?
3494  014036  100015                        BPL     4$              ;IF NOT THEN GO TO 4$
3495  014040  122710  000377        3$:     CMPB    #377,(R0)       ;OTHERWISE SEE IF THIS ERROR HAS OCCURED 377 TIMES
3496  014044  001401                        BEQ     5$              ;IF SO DON'T BUMP ERROR COUNT
3497  014046  105210                        INCB    (R0)            ;INCREMENT THE ERROR COUNTER BY 1
3498  014050  122710  000001        5$:     CMPB    #1,(R0)         ;MORE THAN 1 ERROR OCCURRED ON THIS BIT?
3499  014054  001404                        BEQ     7$              ;BRANCH IF NO
3500  014056  032777  000400  166646        BIT     #400,@SWR       ;STOP ERROR PRINTOUT AFTER 1 WANTED?
3501  014064  001002                        BNE     4$              ;BRANCH IF YES (DON'T TYPE ERROR)
3502  014066  105237  000273        7$:     INCB    @#TYPENB        ;ENABLE THE TYPE OUT ROUTINE
3503  014072  105737  000275        4$:     TSTB    @#$ADERR        ;ADDRESS ERROR?
3504  014076  001403                        BEQ     6$              ;BRANCH IF NO
3505  014100  004767  000166                JSR     PC,TPADERR      ;PRINT "ADR ERR"
3506  014104  000403                        BR      8$
3507  014106  105720                6$:     TSTB    (R0)+           ;POINT TO NEXT ENTRY IN ERROR STACK
3508  014110  006313                        ASL     (R3)            ;IS THERE STILL AN ERROR BIT SET IN ERROR.
3509  014112  001350                        BNE     2$              ;BR IF YES - KEEP FILLING ERROR STACK
3510  014114  112737  000006  000310  8$:     MOVB    #6,@#TYPCNT     ;TELL TYPOCT TO TYPE 6 WORDS OF ERROR STACK.
3511                                                                  ;THE STACK POINTED BY R3
3512  014122  004767  000774                JSR     PC,PUTADR       ;GO TO THE SUBROUTINE TO PLACE THE ADDRESS IN R1
3513                                                                  ;AT LOCATIONS (R3) AND (R3-2)
3514  014126  004767  000416                JSR     PC,TYPERR       ;TYPE ERROR STACK (7 WORDS)
3515
3516  014132  005037  000274        10$:    CLR     @#$PRERR        ;CLEAR ADDRESS ERROR FLAG
3517  014136  012600                        MOV     (SP)+,R0        ;RESTORE R0
3518  014140  012603                        MOV     (SP)+,R3        ;AND R3
3519  014142  105737  000420        FNDERR: TSTB    @#$ENV          ;ARE WE RUNNING UNDER APT?
3520  014146  001404                        BEQ     2$              ;IF NOT THEN TEST FOR HALT
3521  014150  012737  000001  000400        MOV     #1,@#$MSGTY     ;OTHERWISE INFORM THE APT
3522  014156  000443                        BR      FATHLT          ;GOTO FATHLT AND WAIT FOR APT.
3523
3524  014160  010246                2$:     MOV     R2,-(SP)        ;SAVE R2 TEMP
3525  014162  005777  166544                TST     @SWR            ;DOES THE OPERATOR REQUIRE THE PROGRAM TO HALT
3526                                                                  ;ON ERROR
3527  014166  100405                        BMI     4$              ;IF SO THEN HALT ON ERROR
3528                                ;CHECK FOR CONTROL-C KEY
3529
3530  014170  004767  001660                JSR     PC,CHECKC       ;IF CONTROL-C TYPED THEN PRINT ERROR HISTORY
3531                                                                  ;AND HALT AT FATHLT.
3532  014174  105737  000042        7$:     TSTB    @#42            ;ARE WE RUNNING UNDER ACT?
3533  014200  001401                        BEQ     6$              ;BRANCH IF NO
3534
3535  014202  000777                4$:     BR      4$              ;PROGRAM HAS HALTED ON ERROR, R1 IS POINTING
3536                                                                  ;TO A LOCATION WHICH SHOULD HAVE CONTAINED
3537                                                                  ;THE WORD STORED IN R0
3538  014204  012602                6$:     MOV     (SP)+,R2        ;RESTORE R2
```

```
3539  014206  062716  000002            ADD     #2,(SP)         ;RESTORE THE RETURN ADDRESS
3540  014212  000207                    RTS     PC              ;RETURN FROM THE SUBROUTINE
3541
3542
3543
3544  014214                    FATERR:
3545  014214  004767  000212    SEQERR: JSR     PC,TPCRLF       ;TYPE "ERROR #"
3546  014220  051105  047522  020122    .ASCIZ  /ERROR #/
      014226  000043
3547                                    .EVEN
3548
3549  014230  017637  000000  000402    MOV     @(SP),@#$FATAL  ;LOAD THE LOCATION $FATAL WITH THE ERROR NUMBER
3550  014236  105237  000310            INCB    @#TYPCNT        ;TELL $TPNUM TO TYPE 1 WORD
3551  014242  012703  000376            MOV     #376,R3         ;$TPNUM USES R3 AS STACK
3552  014246  013743  000402            MOV     @#$FATAL,-(R3)  ;PUT ERROR NO. ON STACK
3553  014252  005743                    TST     -(R3)           ;$TPNUM REQUIRES THIS
3554  014254  004767  000356            JSR     PC,FATYP        ;TYPE ERROR NO.
3555  014260  105737  000420    APTHLT: TSTB    @#$ENV          ;RUNNING UNDER APT?
3556  014264  001326                    BNE     FNDERR          ;BRANCH IF YES
3557  014266  000240            FATHLT: NOP                     ;FATAL ERROR OR ^C HALT.
3558  014270  000776                    BR      FATHLT          ;RESTART AT 250 IF DESIRED
3559
3560  014272  105737  000273    TPADER: TSTB    @#TYPENB
3561  014276  001406                    BEQ     1$              ;BR IF NO TYPE ENABLED
3562  014300  004767  000134            JSR     PC,PNTMES       ;PRINT MESSAGE ROUTINE
3563  014304  042101  020122  051105    .ASCIZ  /ADR ERR/
      014312  000122
3564                                    .EVEN
3565  014314  000207            1$:     RTS     PC
3566
3567
3568
3569                                    ;* TYPE OUT ROUTINE
3570                                    ;* ---------------
3571                                    ;*
3572                                    ;*      THIS ROUTINE IS USED BY THE PROGRAM TO TYPE OUT ANY CHARACTER
3573                                    ;*
3574
3575  014316  010146            NOTYP:  MOV     R1,-(SP)
3576  014320  016601  000002            MOV     2(SP),R1
3577  014324  105721            4$:     TSTB    (R1)+           ;IF THIS TYPE OUT HAS BEEN SUPRESSED THEN
3578  014326  001376                    BNE     4$              ;PREPARE TO RETURN
3579  014330  000412                    BR      RETTYP
3580  014332  010146            $TYPE:  MOV     R1,-(SP)        ;SAVE R1
3581  014334  010046                    MOV     R0,-(SP)        ;AND R0 ON THE STACK
3582  014336  016601  000004            MOV     4(SP),R1        ;PLACE THE ADDRESS OF MESSAGE TO BE TYPED IN R1
3583  014342  112100            2$:     MOVB    (R1)+,R0        ;PLACE THE BYTE TO BE TYPED IN R0
3584  014344  001403                    BEQ     4$              ;IF IT IS END OF MESSAGE THEN GO TO 4$
3585  014346  004767  000022            JSR     PC,$TPCHR       ;OTHERWISE GO TO TYPE THE CONTENTS OF R0
3586  014352  000773                    BR      2$
3587  014354  012600            4$:     MOV     (SP)+,R0        ;RESTORE R0
3588  014356  005201            RETTYP: INC     R1              ;CAUSE R1 TO
3589  014360  042701  000001            BIC     #1,R1           ;POINT TO EVEN ADDRESS
3590  014364  010166  000002            MOV     R1,2(SP)        ;MODIFY THE RETURN ADDRESS
3591  014370  012601                    MOV     (SP)+,R1        ;RESTORE R1
3592  014372  000416                    BR      EXTYP           ;AND RETURN VIA RTS PC
```

```
 3593
 3594  014374  132737  000040  000421  STPCHR: BITB    #40,@#SENVM     ;HAVE TYPE OUTS BEEN DISABLED?
 3595  014402  001005                          BNE     4$              ;IF SO THEN RETURN FROM THE SUBROUTINE
 3596  014404  105737  177564          2$:     TSTB    @#STPS          ;WAIT HERE
 3597  014410  100375                          BPL     2$              ;UNTIL THE PRINTER IS READY
 3598  014412  110037  177566                  MOVB    R0,@#STPB       ;LOAD DATA TO BE TYPED INTO DATA REG.
 3599  014416  000404                  4$:     BR      EXTYP           ;RETURN
 3600
 3601  014420  004767  177706          PCRLF:  JSR     PC,$TYPE
 3602  014424  005015     000                  .ASCIZ  <15><12>        ;CR/LF
 3603          014430                          .EVEN
 3604  014430  000207                  EXTYP:  RTS     PC              ;RETURN
 3605
 3606  014432  004767  177762          TPCRLF: JSR     PC,PCRLF        ;TYPE CR/LF
 3607  014436  000735                          BR      $TYPE           ;NOW GO TO TYPE THE REST OF THE MESSAGE
 3608
 3609
 3610  014440  032777  000020  166264  PNTMES: BIT     #20,@SWR        ;PRINTOUTS ALLOWED?
 3611  014446  001323                          BNE     NOTYP           ;BRANCH IF NO
 3612  014450  123737  000042  000046          CMPB    @#42,@#46       ;RUNNING UNDER ACT 11?
 3613  014456  001717                          BEQ     NOTYP           ;BRANCH IF YES -NOT PRINTOUT-
 3614  014460  000764                          BR      TPCRLF          ;SEND CR/LF AND TYPE MESSAGE.
```

```
                                        ;* ROUTINE TO TYPE OUT A DECIMAL NUMBER
                                        ;* ----------------------------------
                                        ;*
                                        ;*      THIS ROUTINE IS USED TO CONVERT THE CONTENTS OF LOCATION
                                        ;*      DECWRD TO DECIMAL NUMBERS AND TYPE THEN FOLLOWING 3 SPACES
                                        ;*
014462  004767  177732          TYPDEC: JSR     PC,PCRLF        ;TYPE CR/LF

014466  005046                  $TPDEC: CLR     -(SP)
014470  013746  000306                  MOV     @#DECWRD,-(SP)  ;GET THE WORD THAT HAS TO BE CONVERTED TO A
                                                                ;DECIMAL NUMBER
014474  162716  000012          2$:     SUB     #10.,(SP)
014500  002403                          BLT     4$              ;IF THE NUMBER IN (SP) WAS LESS THAN 10. THEN
                                                                ;GO TO 4$
014502  005266  000002                  INC     2(SP)           ;OTHERWISE ADD 1 TO THE LOCATION STORING 10'S DIGIT
014506  000772                          BR      2$              ;AND RETURN TO 2$
014510  062716  000012          4$:     ADD     #10.,(SP)
014514  052716  000060                  BIS     #60,(SP)        ;MAKE THE CONTENTS OF (SP) A DECIMAL NUMBER
014520  112667  000020                  MOVB    (SP)+,6$-2      ;PLACE THE 1'S DIGIT TO BE TYPED
014524  052716  000060                  BIS     #60,(SP)        ;MAKE THE CONTENTS OF (SP) A DECIMAL NUMBER
014530  112667  000007                  MOVB    (SP)+,6$-3      ;PLACE THE 10'S DIGIT TO BE TYPED
014534  004767  177572                  JSR     PC,$TYPE        ;GO TO TYPE THE NUMBER IN DECIMAL FOLLOWED BY
                                                                ;3 SPACES
014540  020040  030040  000060          .ASCIZ  /   00/
                                        .EVEN
014546  000207                  6$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
```

```
3651
3652
3653                                    ;* OCTAL TYPE OUT ROUTINE
3654                                    ;* ---------------------
3655                                    ;*
3656                                    ;*      THIS ROUTINE IS USED TO TYPE OUT THE OCTAL VALUES
3657                                    ;*      CONTROL SHOULD COME TO THIS ROUTINE WITH R3 POINTING TO
3658                                    ;*      THE LOW ORDER BITS (I.E. BITS 0-15) OF THE ADDRESS TO
3659                                    ;*      BE TYPED WHERE AS R3-2 SHOULD CONTAIN THE HIGH ORDER BITS
3660                                    ;*      (I.E. BITS 16 & 17). CONTENTS OF LOCATION R3-1 AND R0 ARE
3661                                    ;*      DESTROYED BY THIS SUBROUTINE
3662                                    ;*      BYTE TYPCNT SHOULD BE SET TO THE NUMBER OF WORDS THAT HAVE
3663                                    ;*      TO BE TYPED.
3664                                    ;*
3665
3666  014550  032777  020000  166154  TYPERR: BIT     #20000,@SWR     ;ERROR PRINTOUT WANTED?
3667  014556  001065                  BNE     OCTXT           ;BRANCH IF NO
3668  014560  004767  177634          JSR     PC,PCRLF        ;TYPE CR/LF
3669  014564  004767  000012          JSR     PC,TYPOCT       ;TYPE OCTAL NO.
3670  014570  000460                  BR      OCTXT           ;RETURN VIA RTS PC
3671  014572  012123          OCTTYP: MOV     (R1)+,(R3)+     ;PLACE THE HIGH ORDER BITS AT LOCATION POINTED
3672                                                          ;BY R3
3673  014574  012113                  MOV     (R1)+,(R3)      ;AND NOW PLACE THE LOW ORDER BITS
3674  014576  105237  000310          INCB    @#TYPCNT        ;ENABLE THE TYPE OUT OF ONE OCTAL WORD
3675  014602  052743  000004  TYPOCT: BIS     #4,-(R3)
3676  014606  106113          2$:     ROLB    (R3)
3677  014610  103376                  BCC     2$
3678  014612  005000                  CLR     R0
3679  014614  106113                  ROLB    (R3)            ;GET BITS 17 & 16 INTO R0
3680  014616  006100                  ROL     R0
3681  014620  106113                  ROLB    (R3)
3682  014622  006100                  ROL     R0
3683  014624  000405                  BR      $TPNUM
3684  014626  004767  177500  RPTOCT: JSR     PC,$TYPE        ; TYPE 3 SPACES
3685  014632  020040  000040          .ASCIZ  /  /
3686                                  .EVEN
3687  014636  005000          FATYP:  CLR     R0
3688  014640  012723  000006  $TPNUM: MOV     #6,(R3)+        ;ENABLE THE TYPE OUT OF 6 OCTAL DIGITS
3689  014644  000241          4$:     CLC
3690  014646  006113                  ROL     (R3)
3691  014650  006100                  ROL     R0              ;PLACE THE CARRY FROM (R3) IN R0
3692  014652  052700  000060          BIS     #60,R0          ;OR THE CONTENTS OF R0 WITH AN ASCII 0
3693  014656  004767  177512          JSR     PC,$TPCHR       ; TYPE THE OCTAL NUMBER STORED IN R0
3694  014662  005000                  CLR     R0
3695  014664  006113                  ROL     (R3)
3696  014666  006100                  ROL     R0              ;PLACE THE CARRY FROM (R3) IN R0
3697  014670  006113                  ROL     (R3)
3698  014672  006100                  ROL     R0              ;PLACE THE CARRY FROM (R3) IN R0
3699  014674  105363  177776          DECB    -2(R3)          ;IF WE HAVEN'T TYPED THE 6 OCTAL DIGITS
3700  014700  001361                  BNE     4$              ;THEN REPEAT FROM 4$
3701  014702  105337  000310          DECB    @#TYPCNT        ;IF ALL THE WORDS REQUIRED HAVE NOT BEEN
3702  014706  100411                  BMI     OCTXT           ;BR IF = -1
3703  014710  001346                  BNE     RPTOCT          ;TYPED THEN REPEAT FROM RPTOCT
3704  014712  032777  000200  166012  BIT     #200,@SWR       ;PRINT OUT XOR
3705  014720  001404                  BEQ     OCTXT           ;BR IF NOT WANTED
3706  014722  016743  000006          MOV     @DCHIP,-(R3)    ;PUT IN LAST USED STACK LOC TO BE PRINTED
```

```
 3707  014726  005743                      TST     -(R3)           ;ADJUST POINTER
 3708  014730  000736                      BR      RPTOCT          ;PRINT LAST 6 OCTAL DIGITS
 3709  014732  000207              OCTXT:  RTS     PC
 3710
 3711  014734  000000              BDCHIP: .WORD   0               ;XOR OF GOOD VS BAD DATA
```

```
3716
3717                                    ;* ROUTINE TO SET UP MEMORY MANAGEMENT REGISTERS
3718                                    ;* ---------------------------------------------
3719                                    ;*
3720                                    ;*      PROGRAM CONTROL COMES HERE TO DETERMINE IF THE MEMORY MANAGEMENT
3721                                    ;*      IS AVAILABLE OR NOT, AND IF IT IS AVAILABLE THEN WHETHER
3722                                    ;*      THE MEMORY ABOVE 28K IS REQUIRED TO BE TESTED OR NOT.
3723                                    ;*
3724
3725  014736  012702  001400        MEMMNG: MOV     #1400,R2
3726  014742  105037  000272        MMREG:  CLRB    @#MMAVA         ;CLEAR THE BYTE THAT IS SUPPOSED TO INDICATE
3727                                                                  ;THAT MEM. MANAG. IS AVAILABLE FOR TESTING
3728  014746  032777  010000  165756        BIT     #10000,@SWR     ;HAS THE OPERATOR ASKED TO CHECK MEMORY MANAG. ?
3729  014754  001043                        BNE     RETMM           ;IF NOT THEN RETURN FROM THE SUBROUTINE
3730  014756  012700  000004                MOV     #4,R0           ;PREPARE TO SETUP TIME OUT VECTOR
3731  014762  012720  015066                MOV     #NOMM,(R0)+     ;RETURN ADDRESS TO NOMM
3732  014766  012710  000340                MOV     #340,(R0)       ;AND WITH A PSW OF 340
3733  014772  005037  177572                CLR     @#SR0           ;TRY TO REACH MEM. MANAG. SR0
3734  014776  105237  000272                INCB    @#MMAVA         ;IF IT IS AVAILABLE THEN SET MEM. MANAG. AVAILABLE
3735                                                                  ;BYTE
3736  015002  012701  172340                MOV     #172340,R1      ;R1 IS POINTING TO PAR0
3737  015006  005021                        CLR     (R1)+           ;PAR0 WILL POINT TO BANK 0
3738  015010  012721  000200                MOV     #200,(R1)+      ;SET UP PAR 1
3739  015014  062702  000200        2$:     ADD     #200,R2
3740  015020  010221                        MOV     R2,(R1)+        ;SETUP PAR1-PAR6
3741  015022  020127  172356                CMP     R1,#172356      ;ADDRESS OF PAR7
3742  015026  103772                        BLO     2$
3743  015030  012711  007600                MOV     #7600,(R1)      ;PAR7 IS POINTING TO THE I/O PAGE
3744  015034  012701  172300                MOV     #172300,R1
3745  015040  012721  077406        4$:     MOV     #77406,(R1)+    ;SETUP PDR0-PDR7
3746  015044  020127  172316                CMP     R1,#172316
3747  015050  101773                        BLOS    4$
3748  015052  005237  177572                INC     @#SR0           ;ENABLE MEM. MANAG.
3749  015056  005010                $RETMM: CLR     (R0)            ;RESTORE TIME OUT TRAP VECTOR FOR ANY FUTURE TRAP
3750  015060  012740  000352                MOV     #BUSER,-(R0)
3751  015064  000207                RETMM:  RTS     PC
3752
3753  015066  022626                NOMM:   CMP     (SP)+,(SP)+     ;RESTORE STACK POINTER
3754  015070  004767  177336                JSR     PC,TPCRLF       ;TYPE "NO MEMORY MANAGEMENT MESSAGE
3755  015074  047516  046440  043516        .ASCIZ  /NO MNG/
      015102     000
3756            015104                      .EVEN
3757  015104  004767  177104                JSR     PC,FATERR       ;*ERROR* REPORT  ERROR MESSAGE AND HALT AT FATHLT
 (1)  015110  000104                        104                     ;******ERROR NUMBER 104******
 (1)
3758  015112  000761                        BR      $RETMM          ; RESTORE TIME OUT TRAP VECTOR
3759
3760  015114  013702  172354        JPMM:   MOV     @#172354,R2     ;PREPARF TO UPDATE MEMORY MANAG. REGISTERS
3761  015120  000710                        BR      MMREG
```

```
3766
3767                                    ;* 18 BIT ADDRESS GENERATOR
3768                                    ;* ------------------------
3769                                    ;*
3770                                    ;*      THIS SUBROUTINE IS USED TO PLACE THE ADDRESS STORED IN R1
3771                                    ;*      IN THE LOCATION POINTED BY R3. THE ADDRESS IN R1 IS CONVERTED
3772                                    ;*      TO AN 18 BIT ADDRESS ONLY IF MEM. MANAG. IS AVILABLE IN WHICH
3773                                    ;*      CASE THE HIGH ORDER BITS OF THE ADDRESS ARE PLACED IN LOCATION
3774                                    ;*      POINTED BY R3-2
3775                                    ;*
3776
3777  015122  005063  177776    PUTADR: CLR     -2(R3)
3778  015126  010113                    MOV     R1,(R3)         ;PLACE THE ADDRESS STORED IN R1 IN LOCATION (R3)
3779  015130  105737  000272            TSTB    @#MMAVA         ;IS THE MEM. MANAG. AVAILABLE ?
3780  015134  001425                    BEQ     6$              ;IF NOT THEN RETURN FROM THE SUBROUTINE
3781  015136  010146                    MOV     R1,-(SP)        ;SAVE R1
3782  015140  042701  017777            BIC     #17777,R1       ;CLEAR BITS 0-12 OF THE ADDRESS IN R1
3783  015144  040113                    BIC     R1,(R3)         ;LEAVE BITS 0-12 OF THE ADDRESS IN (R3)
3784  015146  052701  004000            BIS     #4000,R1        ;PREPARE TO SHIFT R1 BY 12 PLACES
3785  015152  006001            2$:     ROR     R1
3786  015154  103376                    BCC     2$              ;GET THE NUMBER OF PAR IN R1
3787  015156  062701  172340            ADD     #172340,R1      ;GET THE ADDRESS OF PAR IN R1
3788  015162  011101                    MOV     (R1),R1         ;LOAD R1 WITH THE CONTENTS OF PAR
3789  015164  052701  010000            BIS     #10000,R1
3790  015170  006101            4$:     ROL     R1
3791  015172  103376                    BCC     4$              ;PLACE THE ADDRESS BITS 13-17 IN BITS 11-15 OF R1
3792  015174  006301                    ASL     R1              ;SO WE DON'T PICK UP C BIT
3793  015176  006143                    ROL     -(R3)           ;PLACE BIT 17 IN LOCATION POINTED BY R3-2
3794  015200  006101                    ROL     R1
3795  015202  006123                    ROL     (R3)+           ;PLACE BIT 16 OF THE ADDRESS
3796  015204  050113                    BIS     R1,(R3)         ;PLACE BITS 13-15 OF THE ADDRESS IN LOCATION (R3)
3797  015206  012601                    MOV     (SP)+,R1        ;RESTORE R1
3798  015210  000207            6$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
3802
3803                                    ;* GET ADDRESS FROM THE APT MAILBOX
3804                                    ;* --------------------------------
3805                                    ;*
3806                                    ;*      THIS SUBROUTINE IS USED TO GET ADDRESS FROM APT MAILBOX AND
3807                                    ;*      PLACE IT IN THE LOCATION USED BY THE PROGRAM TO  DEFINE THE
3808                                    ;*      MEMORY BOUNDRIES.
3809                                    ;*      PROGRAM CONTROL SHOULD COME TO THIS SUBROUTINE WITH R1 POINT-
3810                                    ;*      ING TO THE MEMORY TYPE IN THE APT MAILBOX AND R3 POINTING TO
3811                                    ;*      THE LOCATION+2 WHERE THE LOW ORDER BITS OF THE ADDRESS HAVE
3812                                    ;*      TO BE PLACED
3813                                    ;*
3814
3815  015212  016143  000001    GETADR: MOV     1(R1),-(R3)     ;PLACE THE LOW ORDER BITS OF THE ADDRESS
3816  015216  005043                    CLR     -(R3)           ;CLEAR THE LOCATION WHERE THE HIGH ORDER BITS
3817                                                            ;HAVE TO BE PLACED
3818  015220  116113  177777            MOVB    -1(R1),(R3)     ;PLACE BITS 16 & 17
3819  015224  000207            2$:     RTS     PC              ;RETURN FROM THE SUBROUTINE
```

```
                                        ;* CONVERT 18 BIT ADDRESS TO THE PAR FORM
                                        ;* ---------------------------------------
                                        ;*
                                        ;*      THIS SUBROUTINE IS USED TO CONVERT 18 BIT ADDRESS STORED IN
                                        ;*      LOCATIONS POINTED BY R3 AND R3+2 TO THE FORM IT WILL BE STORED
                                        ;*      IN A PAR. THE RESULT IS LEFT IN R2. R1 IS LOADED WITH BITS
                                        ;*      0-12 OF THE ADDRESS AND R0 WITH 160000
                                        ;*
015226  105237  000311          $GTSIZ: INCB    @#SAVKBB        ;PREPARE TO PLACE ADDRESS BITS 13-17 IN BITS
                                                                ;0-4 OF R2
015232  012301                  GETSIZ: MOV     (R3)+,R1
015234  011302                          MOV     (R3),R2         ;LOAD R2 WITH THE LOW ORDER BITS OF THE ADDRESS
015236  042702  017777                  BIC     #17777,R2       ;CLEAR ADDRESS BITS 0-12
015242  052702  000040          2$:     BIS     #40,R2
015246  006001                  4$:     ROR     R1
015250  006002                          ROR     R2              ;ROTATE R1 AND R2 7 TIMES
015252  103375                          BCC     4$
015254  105737  000311                  TSTB    @#SAVKBB
015260  001405                          BEQ     6$
015262  105037  000311                  CLRB    @#SAVKBB
015266  052702  000100                  BIS     #100,R2
015272  000765                          BR      4$
015274  012301                  6$:     MOV     (R3)+,R1        ;PLACE THE LOW ORDER ADDRESS BITS IN R1
015276  012700  160000                  MOV     #160000,R0
015302  040001                          BIC     R0,R1           ;LEAVE BITS 0-12 OF THE ADDRESS IN R1
015304  000207                          RTS     PC              ;RETURN FROM THE SUBRORNE


                                        ;* SUBROUTINE TO DISABLE MEMORY MANAGEMENT
                                        ;* ---------------------------------------
                                        ;*
                                        ;*      THIS SUBROUTINE IS CALLED TO DISABLE THE MEMORY MANAGEMENT
                                        ;*      UNIT

015306  105737  000272          CLRMM:  TSTB    @#MMAVA         ;WAS THE MEMORY MANAGEMENT ENABLED ?
015312  001404                          BEQ     1$              ;IF NOT THEN GO TO 1$
015314  005037  177572                  CLR     @#SR0           ;DISABLE THE MEMORY MANAGEMENT
015320  105037  000272                  CLRB    @#MMAVA         ;AND DO NOT ATTEMPT TO TEST MEM. MANAG.
015324  000207                  1$:     RTS     PC              ;RETURN FROM THE SUBROUTINE


                                        ;* GET BANK NO. UNDER TEST
                                        ;CALLED BY ERRTYP TO GET BANK NO. UNDER TEST INTO PBNK.
                                        ;REGISTERS
                                        ;R0=POINTER TO PAR UNDER TEST
                                        ;R3=VIRTUAL ADDRESS ON ENTRY
                                        ;R0+R3 ARE RESTORED ON EXIT.

015326  010046                  GETBNK: MOV     R0,-(SP)        ;SAVE R0
015330  010346                          MOV     R3,-(SP)        ;SAVE R3
015332  042703  017777                  BIC     #17777,R3       ;SAVE ONLY VIRTUAL BANK BITS
015336  052703  010000                  BIS     #10000,R3               ;SETUP R3 SHIFT BIT
```

```
3883  015342  000241                          CLC
3884  015344  006003                  1$:     ROR     R3              ;SHIFT A BANK BIT
3885  015346  103376                          BCC     1$              ;UNTIL IN BITS <2:0> OF R3
3886  015350  105737  000272                  TSTB    @#MMAVA         ;MEMORY MANAGEMENT UNDER TEST?
3887  015354  001407                          BEQ     2$              ;NO EXIT
3888
3889                                  ;GET PAR ADDRESS AND PHYSICAL BANK NO.
3890  015356  006303                          ASL     R3              ;MAKE R3 PAR ADDRESS OFFSET.
3891  015360  062703  172340                  ADD     #172340,R3      ;MAKE FULL PAR ADDRESS.
3892  015364  011300                          MOV     (R3),R0         ;GET PAR CONTENTS
3893  015366  006300                          ASL     R0
3894  015370  000300                          SWAB    R0              ;SHIFT BANK BITS TO BITS <7:0>
3895  015372  110003                          MOVB    R0,R3           ;SET R3 TO PHYSICAL BANK NO.
3896  015374  010337  000306          2$:     MOV     R3,@#PBNK       ;STORE PHYSICAL BANK NO.
3897  015400  012603                          MOV     (SP)+,R3        ;RESTORE R3
3898  015402  012600                          MOV     (SP)+,R0        ;RESTORE R0
3899  015404  000207                          RTS     PC              ;RETURN TO CALLER
3900
3901
3902                                  ;GET THE 1K BANK UNDER TEST
3903                                  ;CALLED BY TEST 7
3904                                  ;REGISTERS
3905                                  ; R1 = VIRTUAL ADDRESS ON ENTRY
3906                                  ; R0 = POINTER TO 1K UNDER TEST ON EXIT
3907                                  ;R1 WILL BE RESTORED ON EXIT
3908
3909  015406  010146          GET1K:  MOV     R1,-(SP)        ;SAVE R1
3910  015410  042701  003777          BIC     #3777,R1        ;ONLY WANT 1K BIT COUNT
3911  015414  052701  002000          BIS     #2000,R1        ;SET UP SHIFT BIT
3912  015420  000241                  CLC                     ;CLEAR CARRY BIT
3913  015422  006001          1$:     ROR     R1              ;ROTATE THE BANK
3914  015424  103376                  BCC     1$              ;UNTIL THEYR'E IN BITS 4:0
3915  015426  010100                  MOV     R1,R0           ;IN CASE NO MEM MGNT
3916  015430  105737  000272          TSTB    @#MMAVA         ;MEM MGNT AVAILABLE ?
3917  015434  001416                  BEQ     2$              ;BR IF NO
3918                                  ;GET PAR AND PHYSICAL BANK
3919  015436  010146                  MOV     R1,-(SP)        ;SAVE 1K BANK
3920  015440  006201                  ASR     R1              ;MAKE R1 A PAR ADDRESS
3921  015442  042701  000001          BIC     #1,R1           ;PAR ADDRESSES ARE 4K BOUNDARIES
3922  015446  062701  172340          ADD     #172340,R1      ;MAKE IT A FULL PAR ADDR.
3923  015452  011100                  MOV     (R1),R0         ;GET THE PAR CONTENTS
3924  015454  006300                  ASL     R0              ;SHIFT R0
3925  015456  006300                  ASL     R0
3926  015460  006300                  ASL     R0
3927  015462  000300                  SWAB    R0
3928  015464  042716  000034          BIC     #34,(SP)        ;ONLY WANT THE 2 LSB'S
3929  015470  052600                  BIS     (SP)+,R0        ;SET THE IN PAR
3930  015472  012601          2$:     MOV     (SP)+,R1        ;RESTORE R1
3931  015474  000207                  RTS     PC              ;AND EXIT
3932
3933
3934                                  ;THIS ROUTINE CHECKS THE ADDRESS IN R1
3935                                  ;TO MAKE SURE IT IS ERROR FREE, INCLUDING
3936                                  ;THE CHECKBITS.
3937                                  ;R3 = 0 IF NO ERROR
3938                                  ;R3 = NONZERO IF ERROR IS FOUND
```

```
3939
3940  015476  016777  165206  165224  TSTADD: MOV     ECCDIS,@CSRADR  ;DISABLE ECC
3941  015504  005011                          CLR     (R1)            ;CLEAR A LOC
3942  015506  005061  000002                  CLR     2(R1)           ;UPPER WORD TOO
3943  015512  005711                          TST     (R1)            ;READ ZEROS
3944  015514  001047                          BNE     1$              ;BR IF ERROR
3945  015516  005761  000002                  TST     2(R1)           ;SHOULD BE ZEROS ALSO
3946  015522  001044                          BNE     1$              ;
3947  015524  005111                          COM     (R1)            ;COMPLEMENT OF 0 = 177777
3948  015526  005161  000002                  COM     2(R1)           ;BOTH WORDS
3949  015532  022711  177777                  CMP     #-1,(R1)        ;READ ALL ONES
3950  015536  001036                          BNE     1$              ;BR IF NO
3951  015540  022761  177777  000002          CMP     #-1,2(R1)       ;READ AGAIN
3952  015546  001032                          BNE     1$              ;BR IF ERROR
3953  015550  016703  165154                  MOV     CSRADR,R3       ;GET ADDRESS OF CSR
3954  015554  016713  165132                  MOV     DIAGA,(R3)      ;SET DIAGNOSTIC BIT
3955  015560  052713  000002                  BIS     #2,(R3)         ;AND ECCDIS BIT
3956  015564  012711  000000                  MOV     #0,(R1)         ;TO WRITE ALL ZERO CHECKBITS
3957  015570  005761  000002                  TST     2(R1)           ;READ AND RECORD CHECKBITS
3958  015574  032713  007740                  BIT     #7740,(R3)      ;NO CHECKBIT SHOULD BE SET
3959  015600  001015                          BNE     1$              ;BR IF SET
3960  015602  052713  007740                  BIS     #7740,(R3)      ;MAKE CHECKBITS ALL ONES
3961  015606  012711  177777                  MOV     #-1,(R1)        ;WRITE THEM LIKE THIS
3962  015612  042713  007740                  BIC     #7740,(R3)      ;SO WE KNOW IF WE READ THEM BACK
3963  015616  005761  000002                  TST     2(R1)           ;READ THEM
3964  015622  042713  170037                  BIC     #170037,(R3)    ;ONLY WANT CHECKBITS
3965  015626  022713  007740                  CMP     #7740,(R3)      ;SHOULD BE ALL ONES
3966  015632  001403                          BEQ     2$              ;BR IF OK
3967  015634  012703  000001          1$:     MOV     #1,R3           ;INDICATE ERROR FOUND
3968  015640  000401                          BR      3$              ;AND EXIT
3969  015642  005003                  2$:     CLR     R3              ;CLEARED = GOOD LOC
3970  015644  005077  165060          3$:     CLR     @CSRADR         ;CLEAR CSR BEFORE LEAVING
3971  015650  000207                          RTS     PC              ;AND EXIT
3972
3973
3974                                          ;THIS ROUTINE IS USED TO COUNT THE BAD CHECKBITS
3975                                          ;FROM TEST 15. IT USES THE ROUTINE 'XOR' AND THEN
3976                                          ;COUNTS THE BAD ONES
3977
3978  015652  005067  000056          BITCHK: CLR     BITCNT          ;WANT TO START CLEAN
3979  015656  010146                          MOV     R1,-(SP)        ;SAVE ADDRESS
3980  015660  017701  165044                  MOV     @CSRADR,R1      ;GET CONTENTS OF CSR
3981  015664  042701  170037                  BIC     #170037,R1      ;ONLY WANT CHECK BITS
3982  015670  010146                          MOV     R1,-(SP)        ;SAVE THIS TOO
3983  015672  004767  175630                  JSR     PC,XOR          ;R0 XOR R1 = R2
3984  015676  012701  000020                  MOV     #20,R1          ;GETTING READY TO COUNT
3985  015702  006301                  1$:     ASL     R1              ;SHIFT TO NEXT POSITION
3986  015704  020127  010000                  CMP     R1,#10000       ;FINISHED YET ?
3987  015710  001405                          BEQ     2$              ;BR IF DONE
3988  015712  030102                          BIT     R1,R2           ;SEE IF THIS BIT (R1) IS BAD
3989  015714  001772                          BEQ     1$              ;BR IF NOT BAD
3990  015716  005267  000012                  INC     BITCNT          ;IT IS, COUNT IT
3991  015722  000767                          BR      1$              ;NOT DONE YET, KEEP GOING
3992  015724  012600                  2$:     MOV     (SP)+,R0        ;FIRST GET DATA
3993  015726  012601                          MOV     (SP)+,R1        ;THEN ADDRESS
3994  015730  010011                          MOV     R0,(R1)         ;PUT BAD DATA AWAY FOR PRINTOUT
```

```
 3995  015732  000207                          RTS     PC              ;THEN EXIT
 3996
 3997  015734  000000                  BITCNT: .WORD   0       ;# OF BAD CHECKBITS FOUND ABOVE
 3998
 3999
 4000                                          ;THIS ROUTINE PRINTS THE TITLE AND MESSAGE
 4001
 4002  015736  004767  176470          PRTITL: JSR     PC,TPCRLF       ;PRINT ROUTINE
 4003  015742  055104  046515  026514          .ASCII  /DZMML-A/
       015750     101
 4004  015751     040  051525  020105          .ASCII  / USE TO TEST MF11S-K ECC MEMORY/
       015756  047524  052040  051505
       015764  020124  043115  030461
       015772  026523  020113  041505
       016000  020103  042515  047515
       016006  054522
 4005  016010  005015  054524  042520          .ASCIZ  <15><12>/TYPE <CONTROL C> TO EXIT/
       016016  036040  047503  052116
       016024  047522  020114  037103
       016032  052040  020117  054105
       016040  052111     000
 4006          016044                          .EVEN
 4007  016044  012767  172136  164656          MOV     #172136,CSRADR  ;ORIGINAL CSR ADDRESS
 4008  016052  000207                          RTS     PC              ;RETURN TO START ROUTINE
 4009
 4010
 4011
 4012
 4013
 4014                                  ;CHECKC
 4015                                  ;       THIS ROUTINE CHECKS IF CONTROL-C WAS TYPED AT THE END OF EACH
 4016                                  ;TEST OR IN THE ERROR TYPE ROUTINE.
 4017                                  ;IF CONTROL-C TYPED THE PROGRAM IS RETURNED TO LOWER MEMORY IF IT WAS
 4018                                  ;RELOCATED AND THE ERROR HISTORY IS PRINTED OUT.
 4019                                  ;FINALLY IT HALTS AT FATHLT.
 4020
 4021  016054  105037  000311  CHECKC: CLRB    @#SAVKBB        ;INIT CONTROL-C FLAG.
 4022  016060  105737  177560          TSTB    @#TKS           ;ANY CHAR. TYPED?
 4023  016064  100021                  BPL     EXITC           ;BR IF NO-EXIT VIA RTS PC-
 4024  016066  113702  177562          MOVB    @#$KBB,R2       ;GET THE CHAR TYPED.
 4025  016072  042702  000200          BIC     #200,R2         ;CLEAR THE PARITY BIT.
 4026  016076  122702  000003          CMPB    #3,R2           ;IS IT CONTROL-C?
 4027  016102  001012                  BNE     EXITC           ;BRANCH IF NO -EXIT VIA RTS PC-
 4028  016104  110237  000311          MOVB    R2,@#SAVKBB     ;ELSE STORE THE CHAR. FOR USE AS A FLAG.
 4029  016110  004767  176316          JSR     PC,TPCRLF       ;PRINT "↑C"
 4030  016114  041536     000          .ASCIZ  /↑C/
 4031          016120                  .EVEN
 4032  016120  005067  164600          CLR     ERRFLG          ;CLEAR ERROR HEADER FLAG FOR NEXT START
 4033  016124  000167  173752          JMP     RELOER          ;GO RETURN PROGRAM TO LOWER CORE IF RELOCATED.
 4034  016130  000207          EXITC:  RTS     PC
 4035
 4036  016132  000000          ENDPROG:        0               ;THIS BEGINS THE STORAGE FOR THE ERROR HISTORY
 4037                                                  ;STACK.FOR EACH 4K BANK 18. BYTES ARE SAVED.
 4038                                                  ;ALSO THE ABSOLUTE LOADER AND XXDP CODE IS SAVED
 4039                                                  ;AFTER THE ERROR STACK.
 4040          000001                  .END
```

```
ABASE = 000000   BOCHIP  014734   EXITC   016130   RLODER  012760   TST3    003544
ACDW1 = 000000   BEGIN   000500   EXTYP   014430   RPTOCT  014626   TST4    003776
ACDW2 = 000000   BITCMK  015652   FAILNM  012614   RPT17   011522   TST5    004152
ACPUOP= 000000   BITCNT  015734   FATERR  014214   RSTOT4  013340   TST6    004622
ACT11   012734   BITCOM  013404   FATHLT  014266   SAVKBB  000311   TST7    005542
ADDW0 = 000000   BRTPSZ  001276   FATYP   014636   SAVLDR  002034   TYPCNT  000310
ADDW1 = 000000   BUSER   000352   FNDERR  014142   SAVLOC  000350   TYPDEC  014462
ADDW10= 000000   CHECK   013014   GETADR  015212   SAVMAX  000340   TYPENB  000273
ADDW11= 000000   CHECKC  016054   GETBNK  015326   SAVMIN  002722   TYPEOP  012702
ADDW12= 000000   CHKCNT  013053   GETSIZ  015232   SAVR4   000342   TYPERR  014550
ADDW13= 000000   CHKGEN  013064   GETIK   015406   SAVR5   000344   TYPMEM  001742
ADDW14= 000000   CHKTAB  013016   HIGHAD  000330   SAVR6   000346   TYPOCT  014602
ADDW15= 000000   CKDONE  012174   HIGHTW  000326   SAVOT4  013326   TYPSIZ  001650
ADDW2 = 000000   CLRMEM  002232   INHREL  002726   SAV7    006532   TYPSTK  012540
ADDW3 = 000000   CLRMM   015306   LDFLG   002716   SBEMSK  002674   T12A    007640
ADDW4 = 000000   CNTSCP  002624   LOOP    002460   SCOPE = 000240   T12B    007662
ADDW5 = 000000   CONT    002422   LOWADD  000324   SEQERR  014214   T5A     004174
ADDW6 = 000000   CONTMM  012242   LOW2NK  000300   SETSTK  001754   T6A     004724
ADDW7 = 000000   CSRADR  002730   LOWER   012200   SETSWR  001126   T6B     004736
ADDW8 = 000000   CTLC    013002   LOWTWO  000322   SLFSIZ  001310   T6FLG   005540
ADDW9 = 000000   DASHL   013354   M     = 000200   SOURCE  013012   UPMM    015114
ADEVCT= 000000   DATADR  013524   MAXADR  012346   SR0   = 177572   UPPFLG  013052
ADEVM = 000000   DATBUF  002664   MAXMEM  000336   START   000200   WRTMEM  000120
AEMV  = 000000   DATSAV  002704   MEMMNG  014736   STRTDI  000276   XOR     013526
AEMVM = 000000   DBEMSK  002700   MEMTST  002224   SWAPAT  000314   $A    = 000001
AFATAL= 000000   DECWRD  000306   MINMEM  000320   SWHALT  002644   $ADERR  000275
AMADR1= 000000   DIAGA   002712   MMAVA   000272   SWR     002732   $APTHD  000272
AMADR2= 000000   DISPLA  002734   MMREG   014742   SWREG   000176   $CNTMM  012256
AMADR3= 000000   DSPREG  000174   MSKADR  013522   SW11  = 004000   $CPUOP  000426
AMADR4= 000000   ECCDIS  002710   MSYES   002714   TBL     002544   $DEVCT  000410
AMAMS1= 000000   ENDMAX  012422   N     = 000105   TKS   = 177560   $DOAGN  012754
AMAMS2= 000000   ENDPAS  012430   NOMM    015066   TPADER  014272   $ENDAD  000156
AMAMS3= 000000   ENDPRO  016132   NOTYP   014316   TPCRLF  014432   $ENV    000420
AMAMS4= 000000   ENDSTK  000304   OCTTYP  014572   TRYSR   001300   $ENVM   000421
AMSGAD= 000000   END0    003070   OCTXT   014732   TSTADD  015476   $EOP    012652
AMSGLG= 000000   END1    003360   ONEPAS  001030   TSTDAT  002670   $ETABL  000420
AMSGTY= 000000   END10   007160   PARBYT  013062   TSTGO   002646   $ETEND  000450
AMTYP1= 000000   END11   007612   PASFLG  000302   TSTMM   012226   $FATAL  000402
AMTYP2= 000000   END12   010252   PBNK    000306   TSTREL  002104   $GTSIZ  015226
AMTYP3= 000000   END13   010364   PCRLF   014420   TSTRP   001044   $HD   = 000002
AMTYP4= 000000   END14   010476   PNTMES  014440   TSTSCP  002606   $HIBTS  000272
APASS = 000000   END15   011330   PRTITL  015736   TSTSIZ  002110   $HIMAX  000332
APRIOR= 000000   END16   011500   PUTADR  015122   TSTO    002736   $KBB  = 177562
APTHLT  014260   END17   011636   PWRDN   000044   TST1    003072   $MADR1  000432
APTSIZ  001210   END2    003540   PWRUP   000136   TST10   006536   $MADR2  000436
ASWREG= 000000   END3    003772   REL     000170   TST11   007164   $MADR3  000442
ATESTM= 000000   END4    004146   RELBOT  000316   TST12   007616   $MADR4  000446
AUNIT = 000000   END5    004616   RELOC   011642   TST13   010256   $MAIL   000400
AUSWR = 000000   END6    005534   RELOER  012102   TST14   010370   $MAMS1  000430
AVECT1= 000000   END7    006526   RESTRT  000250   TST15   010502   $MAMS2  000434
AVECT2= 000000   ERRFLG  002724   RETMM   015064   TST16   011334   $MAMS3  000440
BAKPAT  000312   ERROR   013540   RETSTK  012560   TST17   011504   $MAMS4  000444
BASE    002720   ERRTYP  014010   RETTYP  014356   TST2    003364   $MAXM   000334
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E07

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DZMMLB  MACY11 30(1046)  05-AUG-77  12:59  PAGE 2-1                                                    SEQ 0083
DZMMLB.P11    05-AUG-77 12:57          SYMBOL TABLE

$MBADR  000274          $MTYP4  000445          $SWREG  000422          $TPS  = 177564          $Z    = 000362
$MSGAD  000414          $PASS   000406          $TESTN  000404          $TPSTK  012530          .     = 016134
$MSGLG  000416          $PASTM  000300          $TN   = 000000          $TSTM   000276          .$X   = 000272
$MSGTY  000400          $PRERR  000274          $TPB  = 177566          $TYPE   014332
$MTYP1  000431          $RETMM  015056          $TPCHR  014374          $UNIT   000412
$MTYP2  000435          $SVPC = 000044          $TPDEC  014466          $UNITM  000302
$MTYP3  000441          $SWR  = 000000          $TPNUM  014640          $USWR   000424

. ABS.  016134     000

 ERRORS DETECTED:  0

 DZMMLB,DZMMLB/DOC=DZMMLB
 RUN-TIME:  8  9  .3 SECONDS
 RUN-TIME RATIO: 151/17=8.4
 CORE USED:  12K  (23 PAGES)

 DOCUMENT PAGES:  83
```