MS11-K

0-124K MEMORY EXERCISER
CZQMCE0

AH-9047E-MC
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SEQ 0001

PRODUCT CODE: AC-9045E-MC

PRODUCT NAME: CZQMCED D-124K MEM EXER 16K

PRODUCT DATE: FEB 1978

MAINTAINER: DIAGNOSTIC ENGINEERING

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REVISION HISTORY

Revision A:	May 1975
Revision B:	October 1975
Revision C:	October 1976
Revision D:	June 1977
Revision E:	December 1977

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1.0 GENERAL PROGRAM INFORMATION.

1.1 Program Purpose (Abstract)

This program has the ability to test memory from address 000000 to address 757777. It does so using:

A. Unique addressing techniques
B. Worse case noise patterns, and
C. Instruction execution thruout memory.

There is also a special routine to type out all unibus address ranges which do not timeout, as well as two(2) toggle in address tests provided in section 6.1 of this document.

The intent of this program is to test as comprehensively as possible all memory systems manufactured by DEC without concentrating on any one system. Although the tests relate to general designs they may be complete for certain systems. E.G. Any core memory from the 8K MM11-L on up need not have any other addressing or worst case patterns run but in order to completely test the MS11-K MOS memory another diagnostic is required. This test is also not intended to be a 100% test of the memory. Other tests that do I/O may find memory problems that this test is unable to.

1.2 System Requirements

A. Hardware Requirements

PDP11 family processor with a minimum of 16K of memory.
optional...
Any parity memory control module.
KT11 memory management.

B. Software Requirements

The smallest unit of memory this program will recognize is 4K. If any address in a 4K bank causes a time out trap, that entire bank of memory is ignored by the program.

The program is designed to exercise the vector portion of memory (locations 0-776) in exactly the same manner as the rest of memory. To make this possible, without requiring memory management, no software traps are used in the program. This means that if memory management is not available or is disabled (SW12=1), if the program is relocated out of bank 0, if location 0-776 are selected for test, and if an unexpected hardware trap occurs, the results will be unpredictable.

The program has the proper interface code to allow running under the automated manufacturing test line system - ACT11 and APT.

1.3 Related Documents and Standards

A. Programming practices - Document No. 175-003-009-01
B. PDP-11 MAINDEC SYSMAC Package - MAINDEC-11-DZQAC-C2-D
C. MF11-U/UP Core Memory System Maintenance Manual
   Document No. DEC-11-HMFMA-B-D
D. Applicable Circuit Schematics:
   G235 - 16K X-Y DRIVE
   G114 - 16K SENSE/INHIBIT
   M8293 - 16K UNIBUS TIMING
   M7259 - PARITY CONTROL

1.4 Diagnostic Hierarchy Prerequisites

Before running this program, a CPU diagnostic should be run to verify the functionality of the processor and PDP-11 instruction set.

If memory management is to be used, then the KT11 diagnostic should also be run before this program.

PDP-11/05 - MAINDEC-11-DZQKC
PDP-11/20 - MAINDEC-11-DZQKC
PDP-11/34 - MAINDEC-11-DFKTH
PDP-11/40 - MAINDEC-11-DBQEA
OR MAINDEC-11-DCQKC
PDP-11/45 - MAINDEC-11-DCQKC
PDP-11/60 - MAINDEC-11-DQKDA
KT11-C - MAINDEC-11-DCKTA THRU DCKTF
KT11-D - MAINDEC-11-DBKTA THRU DBKTF

1.5 Assumptions

This program assumes the correct operation of the CPU and, if used, the memory management option.

2.0 OPERATING INSTRUCTIONS

2.1 Loading and Starting Procedures

2.1.1 Load the program using any standard absolute loader.

2.1.2 Starting address 200:

Normal program execution.

2.1.3 Starting address 204:

Allows the operator to input, via teletype conversation,

first and last addresses to be exercised, and a data pattern to be used in tests 6 and 7.

2.1.4 Starting Address 210:

Restart program using previously selected parameters.

2.1.5 Starting Address 214:

Restore loaders and halt. This routine is capable of relocating the program back to banks 0 and 1 if the program was halted while running the top two banks of memory. There are special procedures required for this situation.

A. If memory addresses 0-1000 have not been exercised, either through parameter selection (SA=204) or by running with SW05=1, then:

    Load Address 214,
    Press START.

B. If running without memory management, then:

    Load Address <214+relocation factor>
    (Relocation factor is typed when the program is relocated),
    Press START.

C. If running with memory management and the unibus has not been initialized (via reset instruction, start switch, etc.), then:

    Load Address 777707 (PC)
    Deposit 214
    Press CONTinue

D. If running with memory management and the unibus has been initialized:

    Load Address 772340 (KIPAR0)
    Deposit   <(relocation factor)/100>
    (Example: Relocation factor=540000, then
                  deposit 005400)
    Load Address 777572 (SR0)
    Deposit   000001
    Load Address 777707 (PC)
    Deposit   214
    Press   Continue

2.1.6 Starting address 220:

Byte address memory map typeout routine. This routine performs DATI, DATIP, DATO, and DATOB on all possible

addresses, and types the ranges of addresses which do not cause a timeout trap.

2.2 Special Environments

If the program is run in quick verify mode under ACT11 or APT11 the program is done after the first pass. Also, the program does not relocate to test the lower 8K of memory.

2.3 Program Options

SW15 = 1 OR UP.... HALT ON ERROR

SW14 = 1 OR UP.... LOOP ON TEST

SW13 = 1 OR UP.... INHIBIT ERROR TYPEOUT

SW12 = 1 OR UP.... INHIBIT MEMORY MANAGEMENT (INITIAL START ONLY)

SW11 = 1 OR UP.... INHIBIT SUBTEST ITERATION

SW10 = 1 OR UP.... RING BELL ON ERROR

SW9 = 1 OR UP.... LOOP ON ERROR

SW8 = 1 OR UP .... LOOP ON TEST IN SWR<4:0>

SW7 = 1 OR UP.... INHIBIT PROGRAM RELOCATION

SW6 = 1 OR UP.... INHIBIT PARITY ERROR DETECTION

NOTE: With parity error detection enabled, a memory failure while running the worse case noise tests (non-parity) can cause a parity error. The error printout on a parity error does not type the good data. Thus a bit drop or pickup will not be typed as such. It is best to run the program for 1 pass with parity disabled, then, restart the program with parity enabled.

SW5 = 1 OR UP. . INHIBIT EXERCISING VECTOR AREA (LOCATIONS 0-1000).

2.4 EXECUTION TIMES

Execution time is dependent on type of memory, and amount of memory. Worse case run times with 900ns memorys are:

a. For Non-Parity Memory
First Pass: 65 seconds for first 16k + 15 seconds for each additional 16k.

Full Pass: 3 minutes 40 seconds for first 16k + 3 minutes for each additional 16k.

Iteration Inhibited: same as first pass

b. For Parity Memory
First Pass: 1 minute 40 seconds per 16k.

Full Pass: 8 minutes per 16K

Iteration Inhibited: same as first pass

3.0 ERROR INFORMATION

3.1 Error Reporting

There are a total of 31(8) types of error reports generated by the program. Some of the key column heading mnemonics are described below for clarity:

PC = Program Counter of error detection code. (V/PC=P/PC)

V/PC = Virtual Program Counter. This is where the error detection code can be found in the program listing.

P/PC = Physical Program Counter. This is where the error detection code is actually located in memory.

TRP/PC = Physical Program Counter of the code which caused a trap.

MA = Memory Address

REG = Parity REGister address.

PS = Processor Status word.

IUT = Instruction Under Test.

S/B = What contents Should Be.

WAS = What contents WAS.

3.2 Error Halts

With the 'HALT ON ERROR' switch (SW15) not set there are several programmed 'HALTS' in the program:

A. In the error trap service routine for unexpected traps to vector 4. This one will occur if a 2nd trap to 4 occurs before the error report for the first has had a chance to be printed out.

B. In the relocation routine if the program is being relocated back to the first 8K of memory and the program code was not able to be transferred properly.

C. In the case of error reporting and there is no terminal to allow the information transfer.

D. In the power fail routine if the power up sequence was started before the power down sequence had a chance to complete itself.

E. In the Memory mapping routine or any of the address control routines, failures to find a meaningful map.

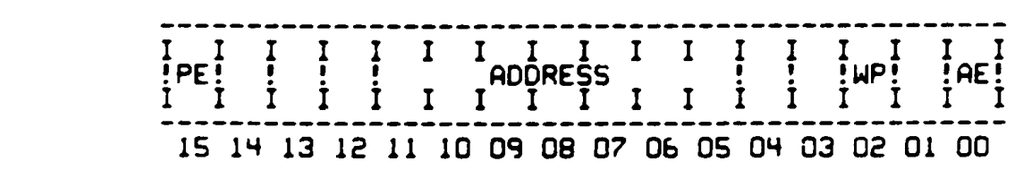
4.0 PERFORMANCE AND PROGRESS REPORTS

Not applicable

5.0 DEVICE INFORMATION TABLES

The following is a picture view of a parity control status registers, which will show bit assignments and definitions, to provide a handy reference:

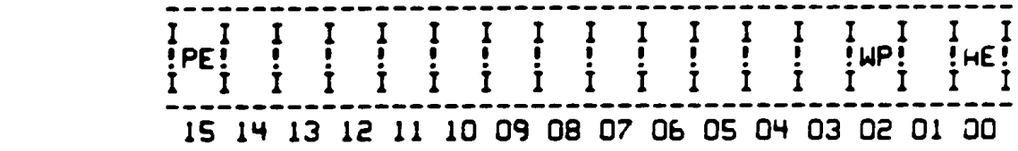
5.1 CORE PARITY REGISTER



Bit assignments are defined as follows:

BIT15	PARITY ERROR	
BITS 11-5	ERROR ADDRESS	HIGH ORDER ADDRESS BITS OF ADDRESS OF PARITY ERROR (BITS 17-11 OF ADDRESS)
BIT02	WRITE WRONG PARITY	NORMAL PARITY (ODD) WHEN CLEAR; OTHER PARITY (EVEN) WHEN SET
BIT00	ACTION ENABLE	NO ACTION WHEN CLEAR TRAP TO VECTOR 114 WHEN SET

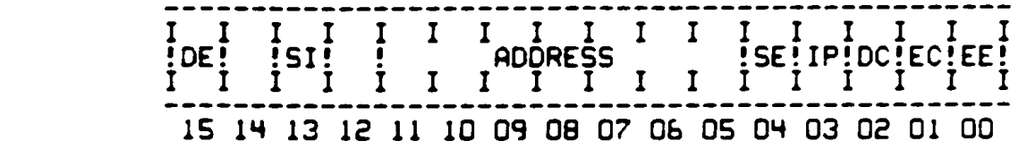
5.2 MOS PARITY REGISTER



BIT ASSIGNMENTS ARE DEFINED AS FOLLOWS:

BIT15	PARITY ERROR	
BIT02	WRITE WRONG PARITY	NORMAL PARITY (ODD) WHEN CLEAR; OTHER PARITY (EVEN) WHEN SET
BIT00	ACTION ENABLE	NO ACTION WHEN CLEAR TRAP TO VECTOR 114 WHEN SET

5.3 MS11-K CSR



BIT ASSIGNMENTS ARE DEFINED AS FOLLOWS:

BIT15	DOUBLE ERROR	
BIT 13	SET INHIBIT MODE	WHEN THIS BIT IS SET TO A 1, IT ENABLES THE INH MODE POINTER TO INHIBIT EITHER THE FIRST OR SECOND 16K FROM EVER GOING INTO THE DIAG. CHECK OR ECC DISABLE MODE.
BITS 11-5	ERROR ADDRESS	WHEN BIT02 CLEARED CONTAINS HIGH ORDER BITS OF ADDRESS OF PARITY ERROR(BITS 17-11). WHEN BIT02 SET CONTAINS CHECK BITS FOR ECC.
BIT04	SINGLE ERROR	SET WHENEVER SINGLE ERROR OCCURS
BIT03	INHIBIT MODE POINTER	THE INHIBIT MODE POINTER WORKS IN

		CONJUNCTION WITH THE SET INHIBIT MODE BIT. WHEN BIT 13 IS SET TO A 1, A 16K PORTION OF MEMORY IS INHIBITTED FROM OPERATING IN THE ECC DISABLE MODE OR DIAGNOSTIC CHECK MODE. THE INHIBIT MODE POINTER INDICATES WHICH 16K IS BEING INHIBITED,,,BIT 3 =1 THE SECOND 16K OF MEMORY IS INHIBITTED. WHEN BIT 13 IS SET TO A 0, BIT 3 BECOMES INOPERATIVE.
BIT02	DIAGNOSTIC CHECK A	WHEN SET ENABLES READ-WRITE OF CHECK BITS(SEE BITS 11-5)
BIT01	DISABLE ERROR CORRECTION	WHEN SET NO ERROR CORRECTION TAKES PLACE
BIT00	DOUBLE ERROR ENABLE	WHEN SET ENABLES TRAP TO VECTOR 114 ON DOUBLE ERROR.

6.0 SUB-TEST SUMMARIES

6.1 Section 1: Address Tests.

These tests verify the uniqueness of every memory address.

TEST 1 Writes and reads the value of each memory Word Address into that Memory location. After all memory has been written, all locations are checked again.

TEST 2 Writes the byte value of each address into that byte location and checks it.

TEST 3 Writes the complement of each word address into that location and checks it.

TEST 4 Writes the 4K bank number into each byte of that bank and checks it.

TEST 5 Writes the complement of the bank number into each byte of that bank and checks it.

6.2 Section 2: Worst Case Noise Tests.

These are intended to apply maximum stress to the various types of PDP-11 core memories.

TEST 6 and TEST 7 Are supplied to allow the operator to select a single word data pattern (SA=204) and SCOPE on either the writing (DATO) in TEST 6 or the reading (DATI) in TEST 7 of that data.

TEST 10 Writes and then checks a series of single word patterns which are designed to stress parity memory.

TEST 11 Writes all memory with 1's in every bit and then "Ripples" a "0" through it.

TEST 12 Writes all memory with 0's in every bit and then "Ripples" a "1" through it.

TEST 13,14,15, AND 16 Write a pattern which complements when address BIT 3 XOR BIT 9 complements.

TEST 17 Writes wrong parity in each byte of memory and checks that the parity detection logic works. This test is skipped for non-parity memory.

TEST 20 Write "random" program code through memory and checks it.

6.3 Section 3: Instruction Execution Tests.

This group of tests place instructions in the memory under test, then executes the instructions, and finally, checks that they executed correctly.

TEST 21 Executes an instruction which does a DATI and a DATO on the memory under test.

TEST 22 Executes an instruction which does a DATI and a DATOB on the low byte of memory under test.

TEST 23 Executes an instruction which does a DATI and a DATOB on the high byte.

TEST 24 Executes an instruction which does a DATIP and a DATO.

TEST 25 Executes an instruction which does a DATIP and a DATOB on the low byte.

TEST 26 EXECUTES AN INSTRUCTION WHICH DOES A DATIP and a DATOB on the high byte.

E 4 Section 4: Mos Tests

TEST 27 -Writes a pattern of 000377 through memory, then compliments it addressing downward, compliments the new pattern addressing upward, compliments the third pattern addressing upward and finally compliments this new AB patterns addressing downward.

TEST 30-31 Write a checkerboard through memory then stalls for 2 seconds and then verifies no data has changed.

E 5 Special Toggle In Tests

E.5.1 Toggle-in-program #1

The following is a toggle in memory address test. This test is useful when an address selection failure is suspected involving the first 8K of memory. This program writes the value of each address into itself starting with the lower limit and continuing to the upper limit. After all addresses have been written each address is checked for the correct contents starting with the upper limit and continuing to the lower limit.

```
LOCATION  CONTENTS      MNEMONIC      COMMENT
    10    012700        MOV #50,R0    ;GET FIRST ADDRESS
  * 12    000050                      ;TO TEST
                                      ;(EXAMPLE START ADDRESS)
    14    010001        MOV R0,R1     ;SAVE IN R1
    16    020037    1$: CMP R0,@#SWR  ;CHECK UPPER LIMIT
    20    177570                      ;(IN SWITCH REGISTER)
    22    001403        BEQ 2$        ;BRANCH IF AT UPPER LIMIT
    24    010010        MOV R0,(R0)   ;LOAD VALUE INTO ADDRESS
    26    005720        TST (R0)+     ;STEP TO NEXT ADDRESS
    30    000772        BR  1$        ;LOOP UNTIL DONE
    32    010004    2$: MOV R0,R4     ;SAVE UPPER LIMIT
    34    020001    3$: CMP R0,R1     ;CHECK IF AT LOWER LIMIT
  * 36    001767        BEQ 1$        ;BRANCH IF DONE
    40    024000        CMP -(R0),R0  ;CHECK DATA WRITTEN
    42    001774        BEQ 3$        ;BRANCH IF OK
    44    000000        HALT          ;ERROR
    46    000772        BR 3$         ;LOOP BACK
```

After toggling the program LA=10**set upper limit**, start

NOTES: The upper limit address obtained from the switch register may be changed during program operation. However occasionally the program may halt because of 'SWITCH BOUNCE'. (The best procedure when changing limits is to stop the program make the change and continue.) The lower limit address (12) may be patched to any desired address.

6.5.2 Toggle-in-Program #2

The following is also a toggle in program to be used with toggle-in-program #1 for more complete address testing. This program writes the complement value of each address into itself starting with the upper limit and continuing to the lower limit. After all addresses have been written each address is checked for the correct contents starting with the lower limit address and continuing to the upper limit. Toggle in the following patches to the program above.

These are the patches to toggle-in-program #1:

```
LOCATION CONTENTS        MNEMONIC      COMMENT
  12        100                        ;CHANGE LOWER LIMIT
  36      001404         BEQ 4$        ;BRANCH TO PROGRAM #2
```

These are the additions to toggle-in-program #1:

```
LOCATION  CONTENTS       MNEMONIC      COMMENT
   50      010402    4$: MOV R4,R2     ;GET UPPER LIMIT
   52      005142    5$: COM -(R2)     ;COMPLEMENT ADDRESS
   54      020201        CMP R2,R1     ;CHECK IF AT LOWER LIMIT
   56      001375        BNE 5$        ;LOOP UNTIL DONE
   60      020204    6$: CMP R2,R4     ;CHECK IF AT UPPER LIMIT
   62      001755        BEQ 1$        ;GO TO PROGRAM 1 IF DONE
   64      010203        MOV R2,R3     ;GET VALUE OF ADDRESS
   66      005103        COM R3        ;COMPLEMENT VALUE
   70      020322        CMP R3,(R2)+  ;CHECK ADDRESS
   72      001772        BEQ 6$        ;BRANCH IF OK
   74      000000        HALT          ;ERROR
   76      000770        BR 6$         ;GO CHECK NEXT ADDRESS
```

7.0 PROGRAM FUNCTIONAL FLOW CHARTS
Attached

8.0 PROGRAM LISTING
Attached

FLOW CHART
****

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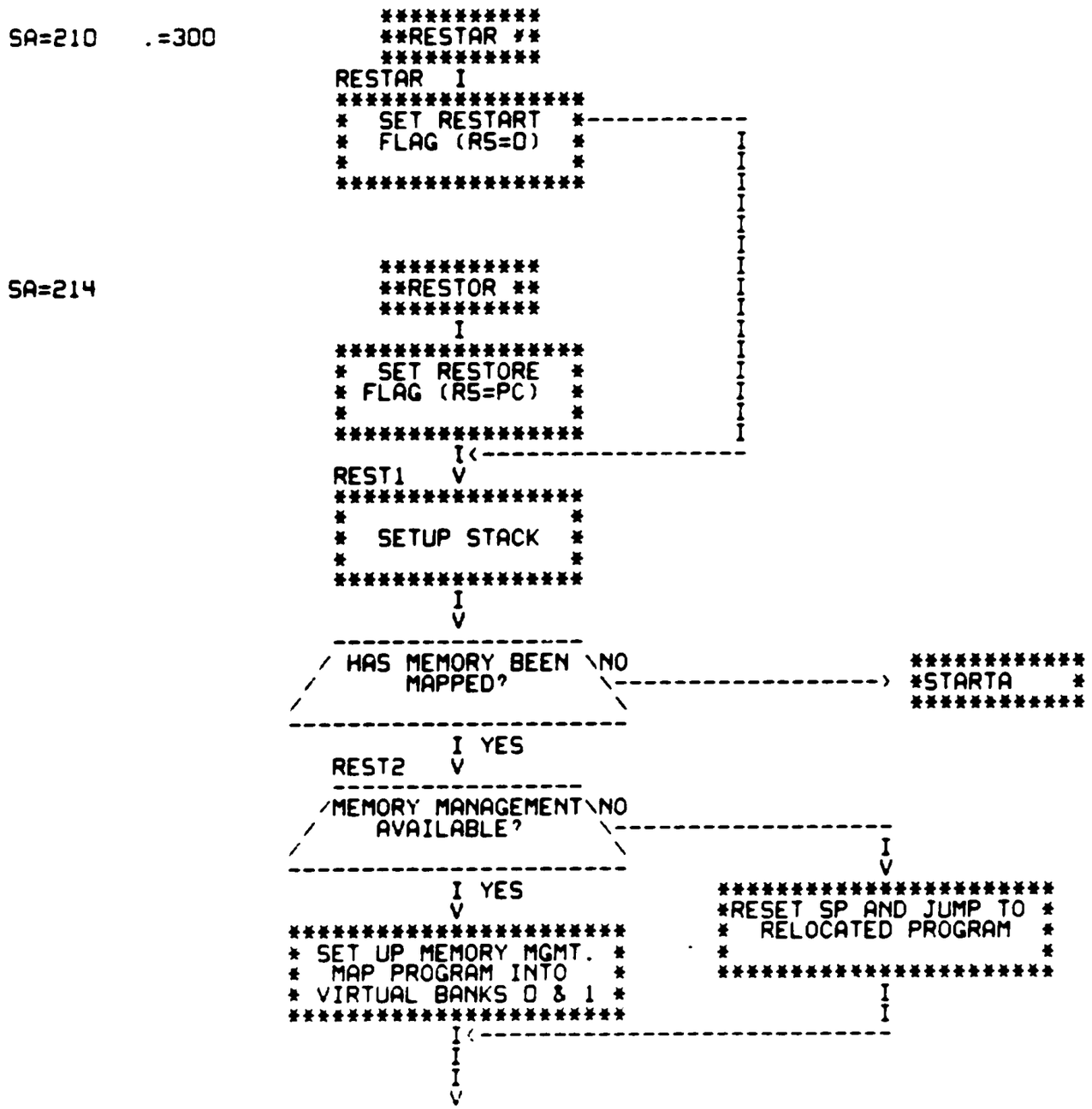
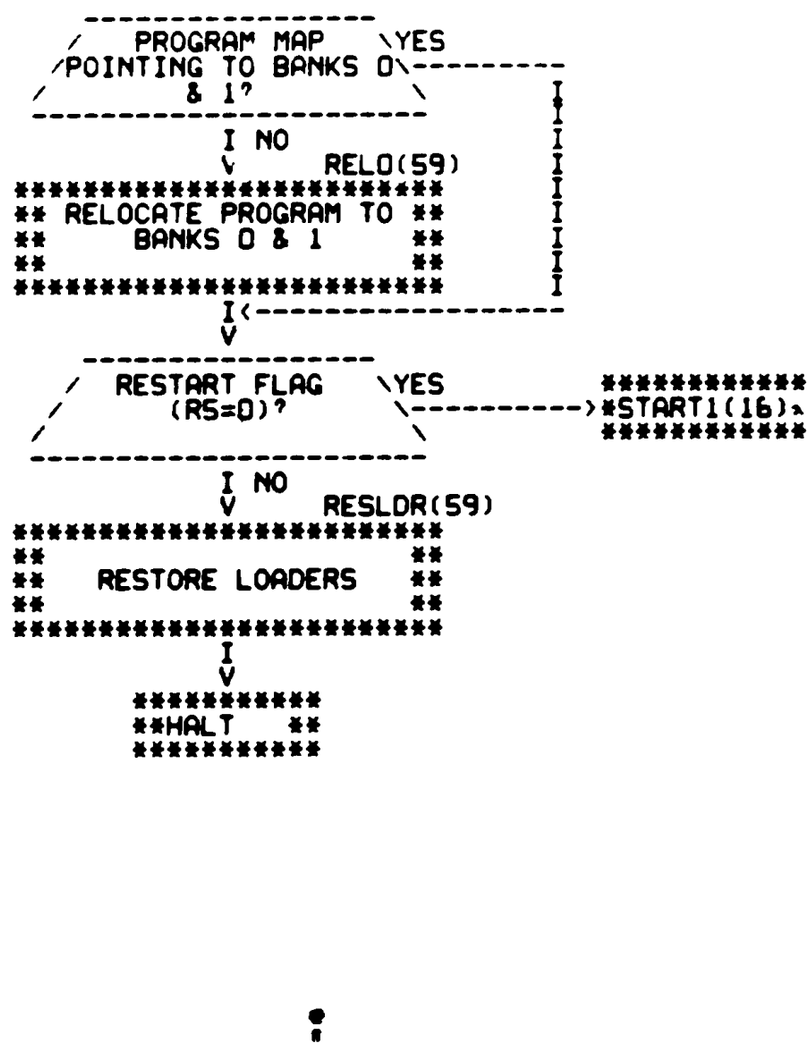
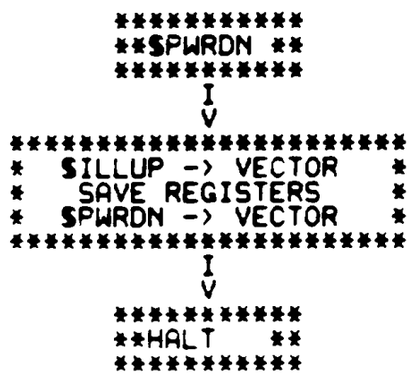
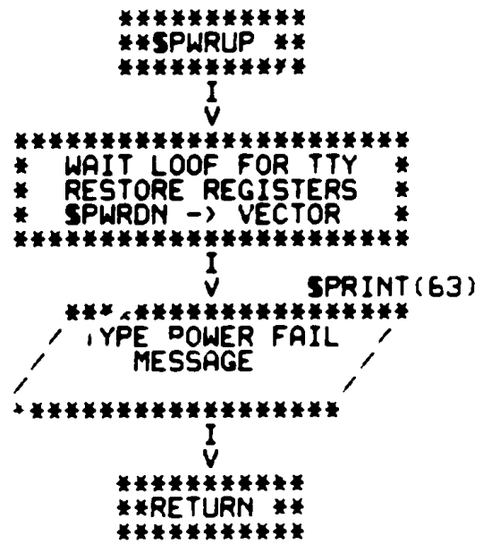
```
                        **************************
                        * SWITCH SETTINGS AND    *
                        *  BASIC DEFINITIONS     *
                        *                        *
                        **************************

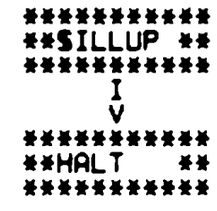
                        **************************
                        *  TRAP CATCHER AND      *
                .=0     * STARTING ADDRESSES     *
                        *                        *
                        **************************
```


SA=210
.=300
**RESTAR **
RESTAR
SET RESTART FLAG (R5=0)
SA=214
**RESTOR **
SET RESTORE FLAG (R5=PC)
REST1
SETUP STACK
HAS MEMORY BEEN MAPPED?
NO
**START A **
REST2
MEMORY MANAGEMENT AVAILABLE?
NO
YES
SET UP MEMORY MGMT. MAP PROGRAM INTO VIRTUAL BANKS 0 & 1
YES
RESET SP AND JUMP TO RELOCATED PROGRAM


PROGRAM MAP POINTING TO BANKS 0 & 1?
YES
NO
RELO(59)
RELOCATE PROGRAM TO BANKS 0 & 1
RESTART FLAG (RS=0)?
YES
START1(16)
NO
RESLDR(59)
RESTORE LOADERS
.=572
HALT


**$PWRDN **
$ILLUP -> VECTOR
SAVE REGISTERS
$PWRDN -> VECTOR
**HALT **


**$PWRUP **
WAIT LOOP FOR TTY
RESTORE REGISTERS
$PWRDN -> VECTOR
$PRINT(63)
TYPE POWER FAIL MESSAGE
**RETURN **


**$ILLUP **
**HALT **

```
                        **************************
                        *  STANDARD 'SYSMAC'     *
.=1100                  *     COMMON TAGS        *
                        *                        *
                        *****  ******************


                        **************************
                        *    APT MAILBOX AND     *
                        *        ETABLE          *
                        *                        *
                        **************************


                        **************************
                        *COMMON TAGS FOR THIS    *
                        *        PROGRAM         *
                        *                        *
                        **************************

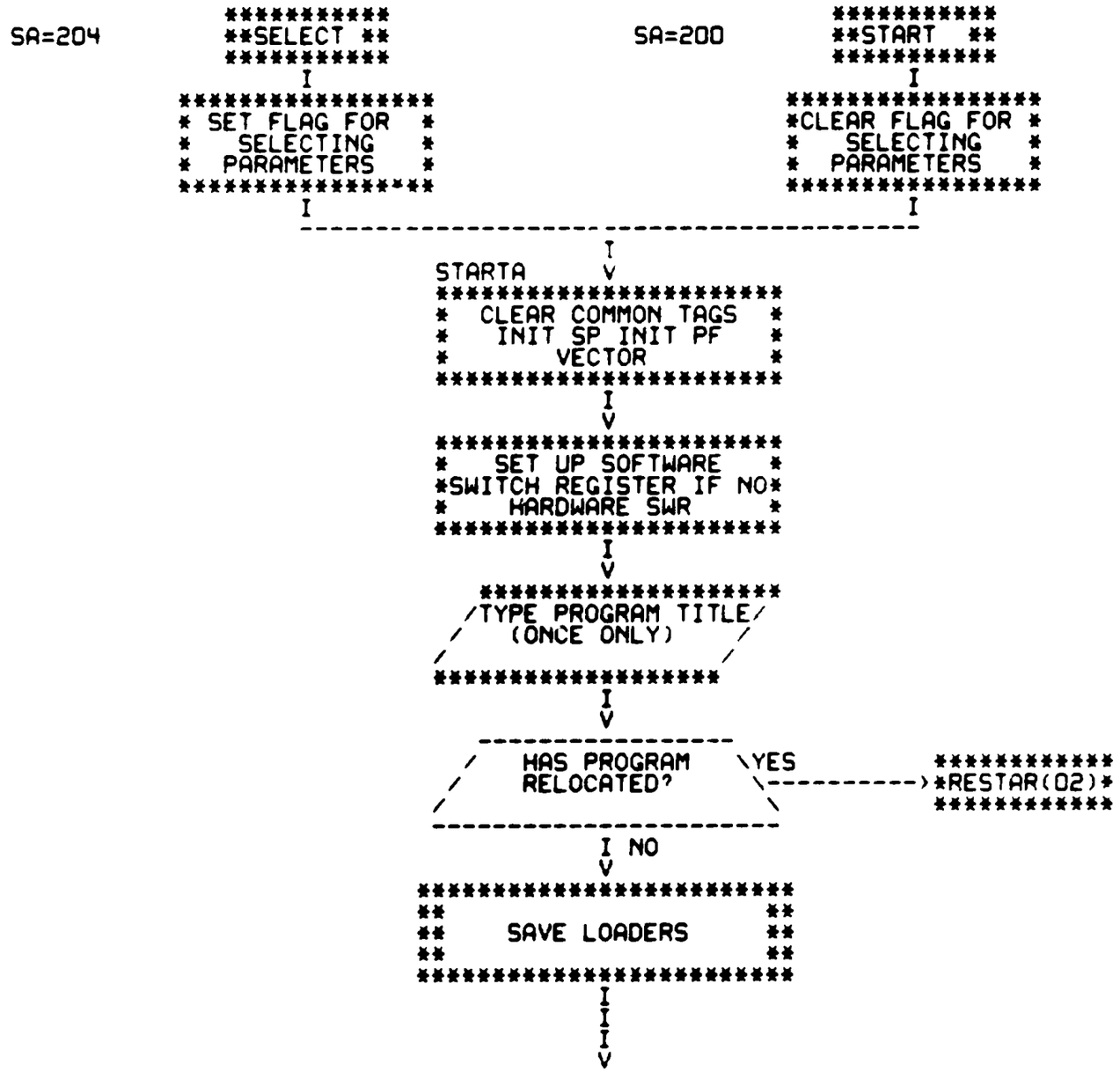

                        **************************
                        * RELATIVE ADDRESSING    *
                        *  TABLE, ERROR DATA     *
                        *        POINTER         *
                        **************************

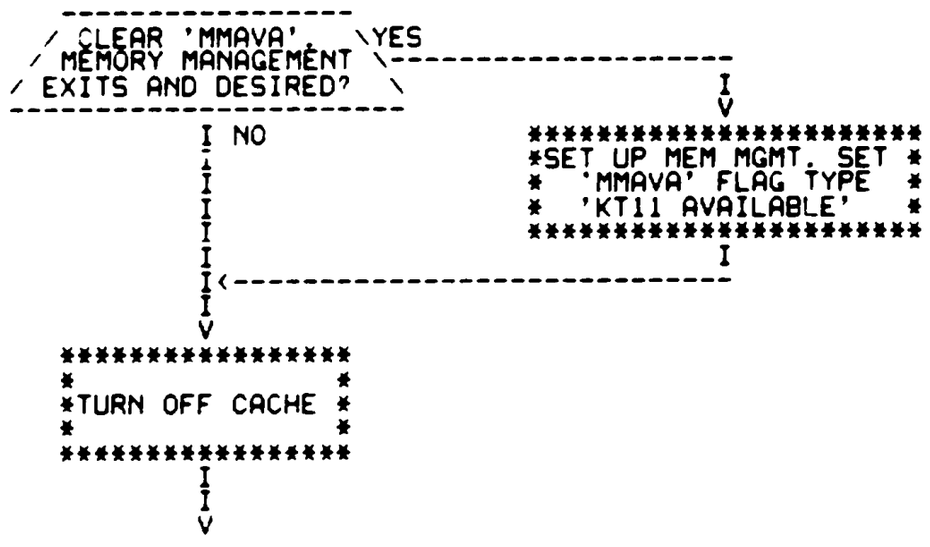

                        **************************
                        * MEMORY PARITY WORSE    *
                        * CASE PATTERNS TABLE    *
                        *                        *
                        **************************

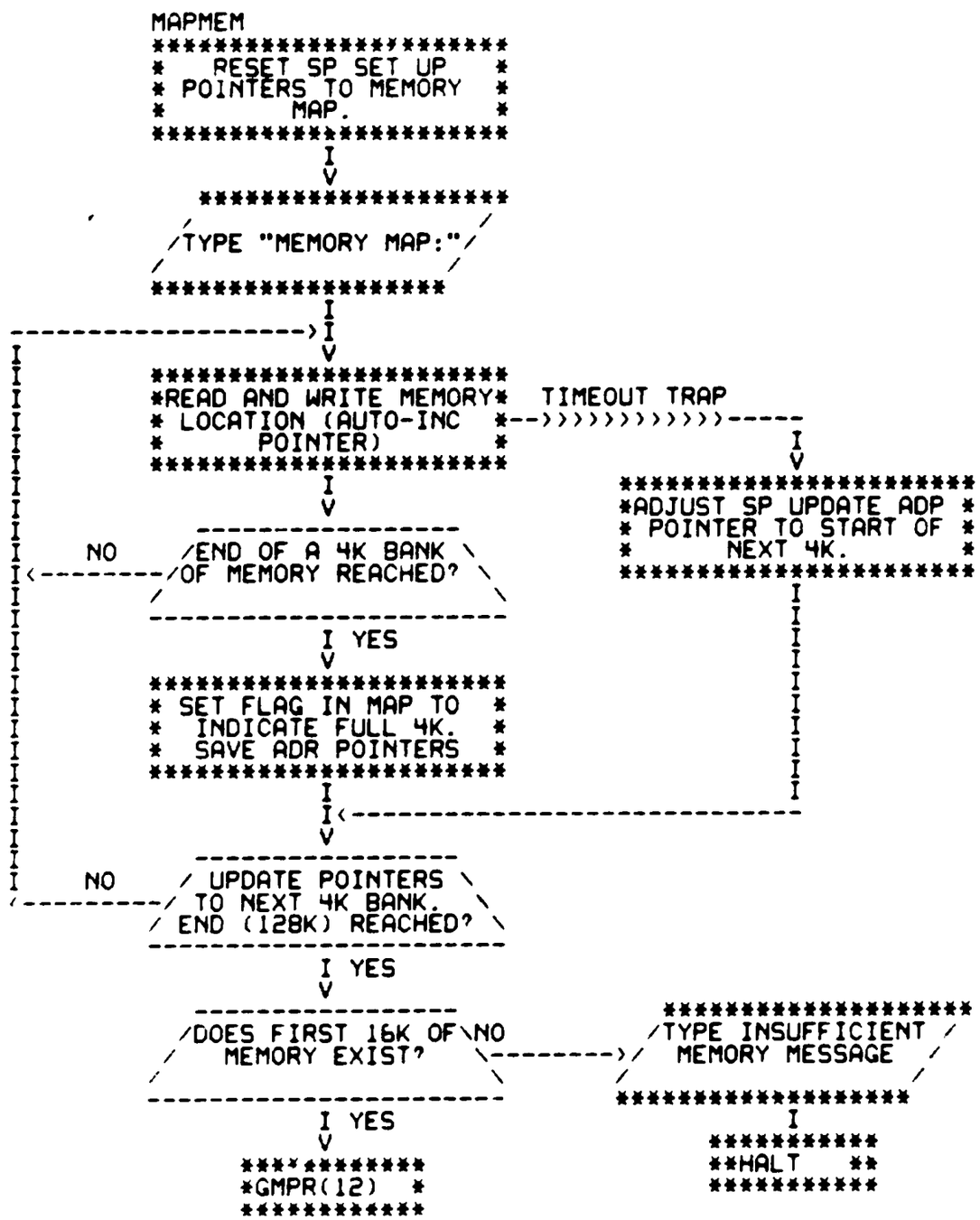

                        **************************
                        *     MEMORY PARITY      *
                        *REGISTER ADDRESS AND    *
                        *       MAP TABLE        *
                        **************************

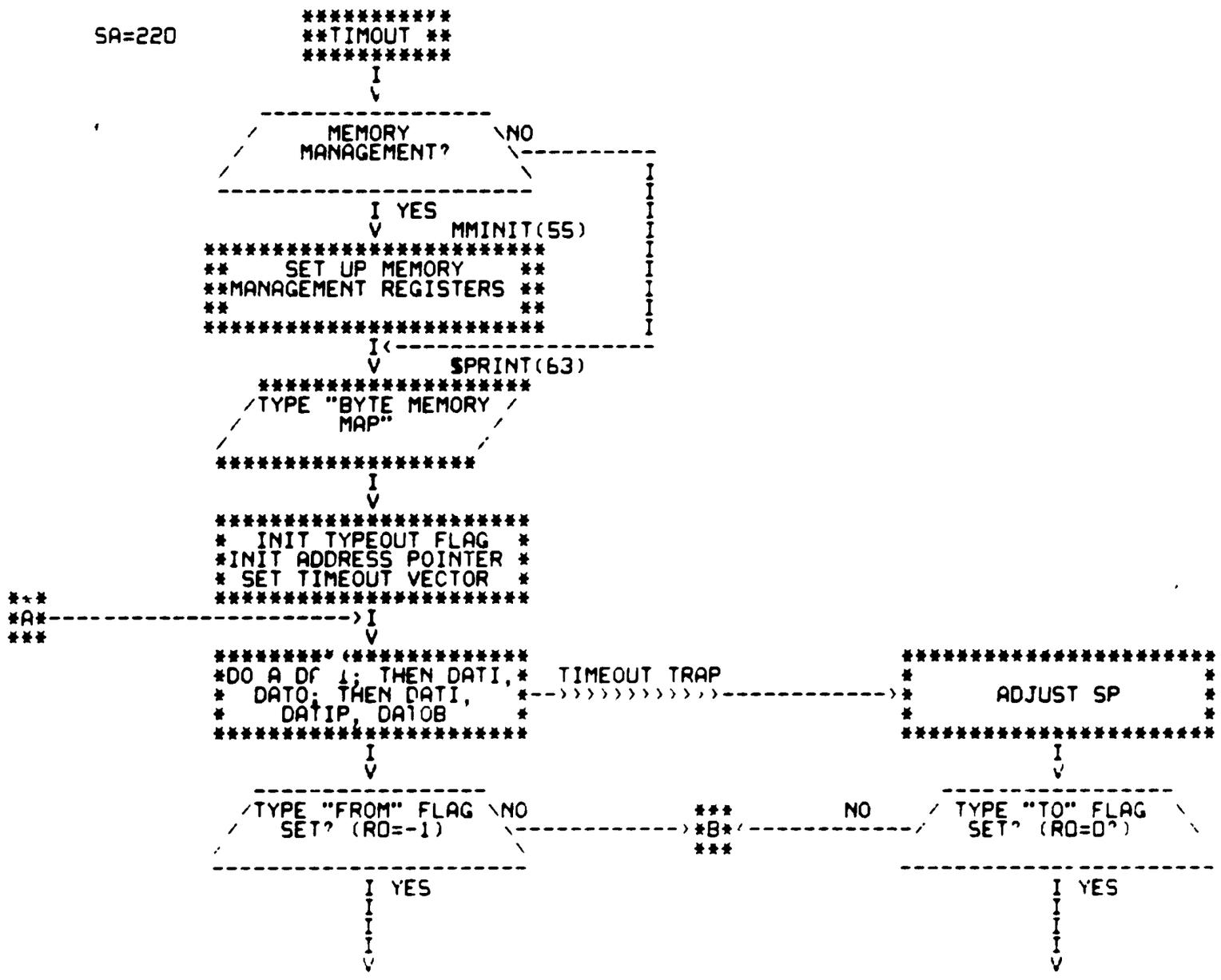

                        **************************
                        *ERROR MESSAGE POINTER   *
                        *          TABLE         *
                        *                        *
                        **************************
```

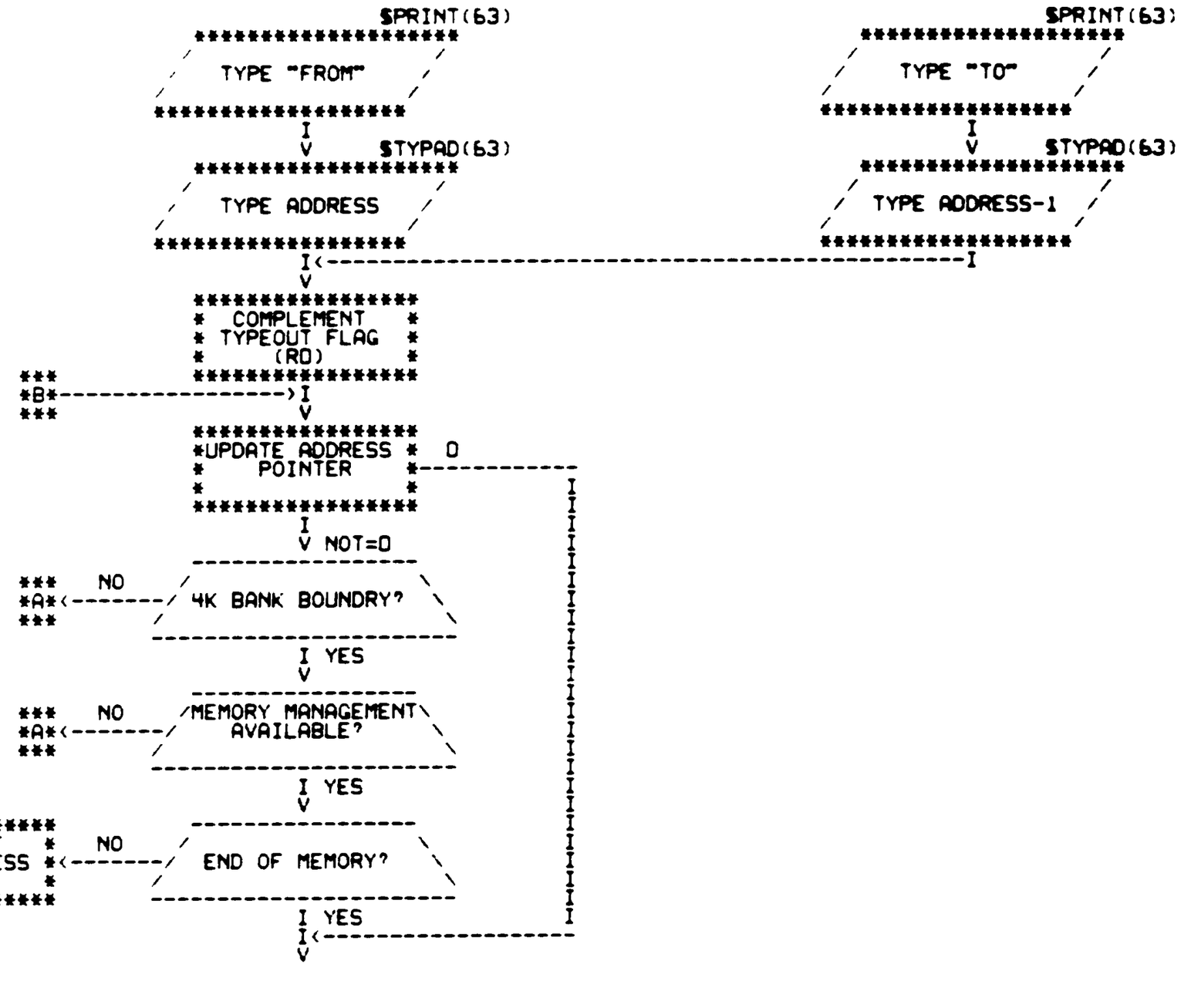
K02

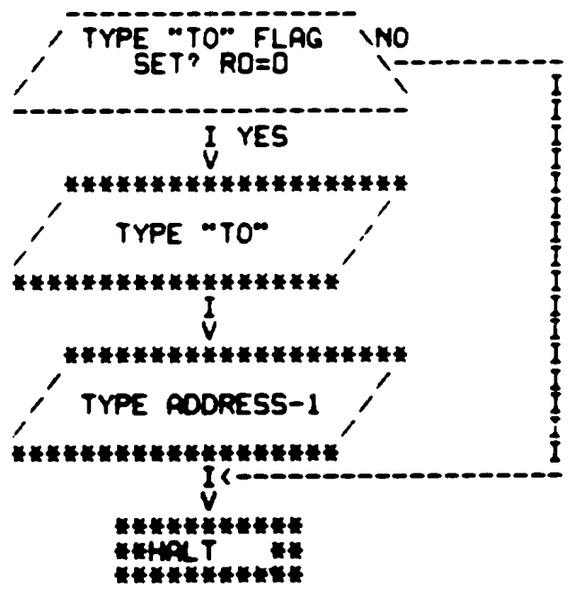

SA=204
**SELECT **
SET FLAG FOR SELECTING PARAMETERS
SA=200
**START **
CLEAR FLAG FOR SELECTING PARAMETERS
STARTA
CLEAR COMMON TAGS INIT SP INIT PF VECTOR
SET UP SOFTWARE SWITCH REGISTER IF NO HARDWARE SWR
/TYPE PROGRAM TITLE/ (ONCE ONLY)
HAS PROGRAM RELOCATED?
YES
RESTAR(02)
NO
SAVE LOADERS

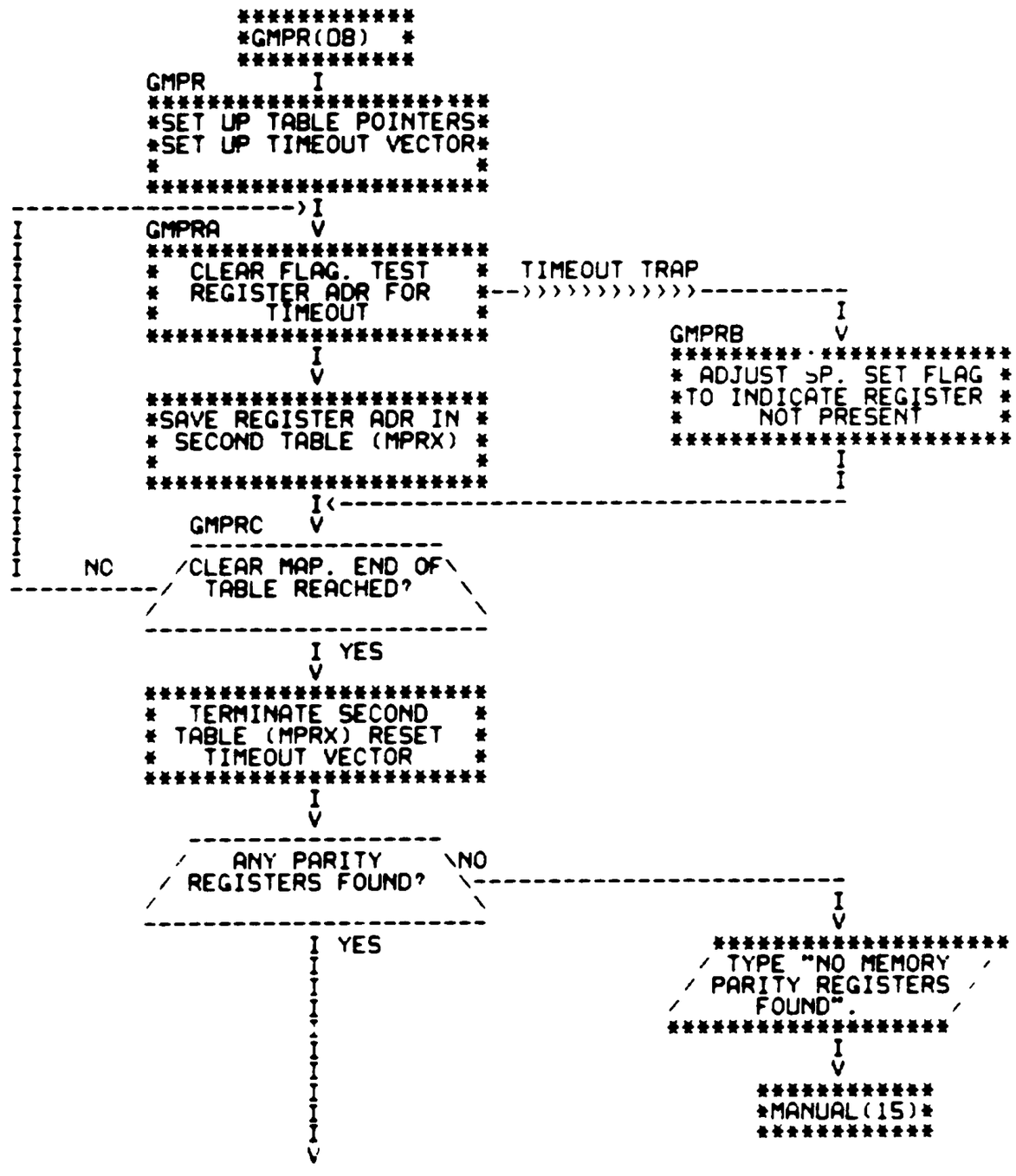

CLEAR 'MMAVA', MEMORY MANAGEMENT EXITS AND DESIRED?
YES
NO
SET UP MEM MGMT. SET 'MMAVA' FLAG TYPE 'KT11 AVAILABLE'
TURN OFF CACHE

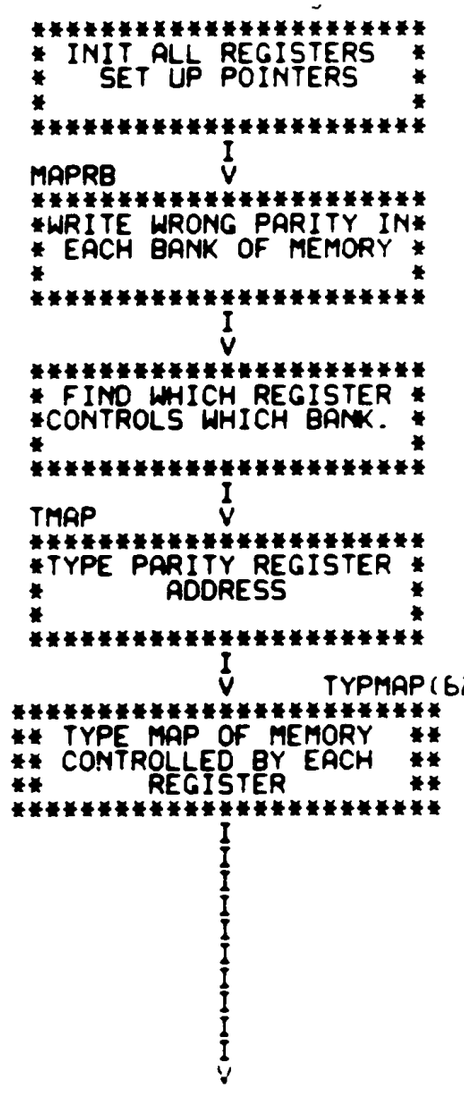

MAPMEM
RESET SP SET UP POINTERS TO MEMORY MAP.
TYPE "MEMORY MAP:"
READ AND WRITE MEMORY LOCATION (AUTO-INC POINTER)
TIMEOUT TRAP
ADJUST SP UPDATE ADP POINTER TO START OF NEXT 4K.
END OF A 4K BANK OF MEMORY REACHED?
NO
YES
SET FLAG IN MAP TO INDICATE FULL 4K. SAVE ADR POINTERS
UPDATE POINTERS TO NEXT 4K BANK.
END (128K) REACHED?
NO
YES
DOES FIRST 16K OF MEMORY EXIST?
NO
YES
GMPR(12)
TYPE INSUFFICIENT MEMORY MESSAGE
HALT

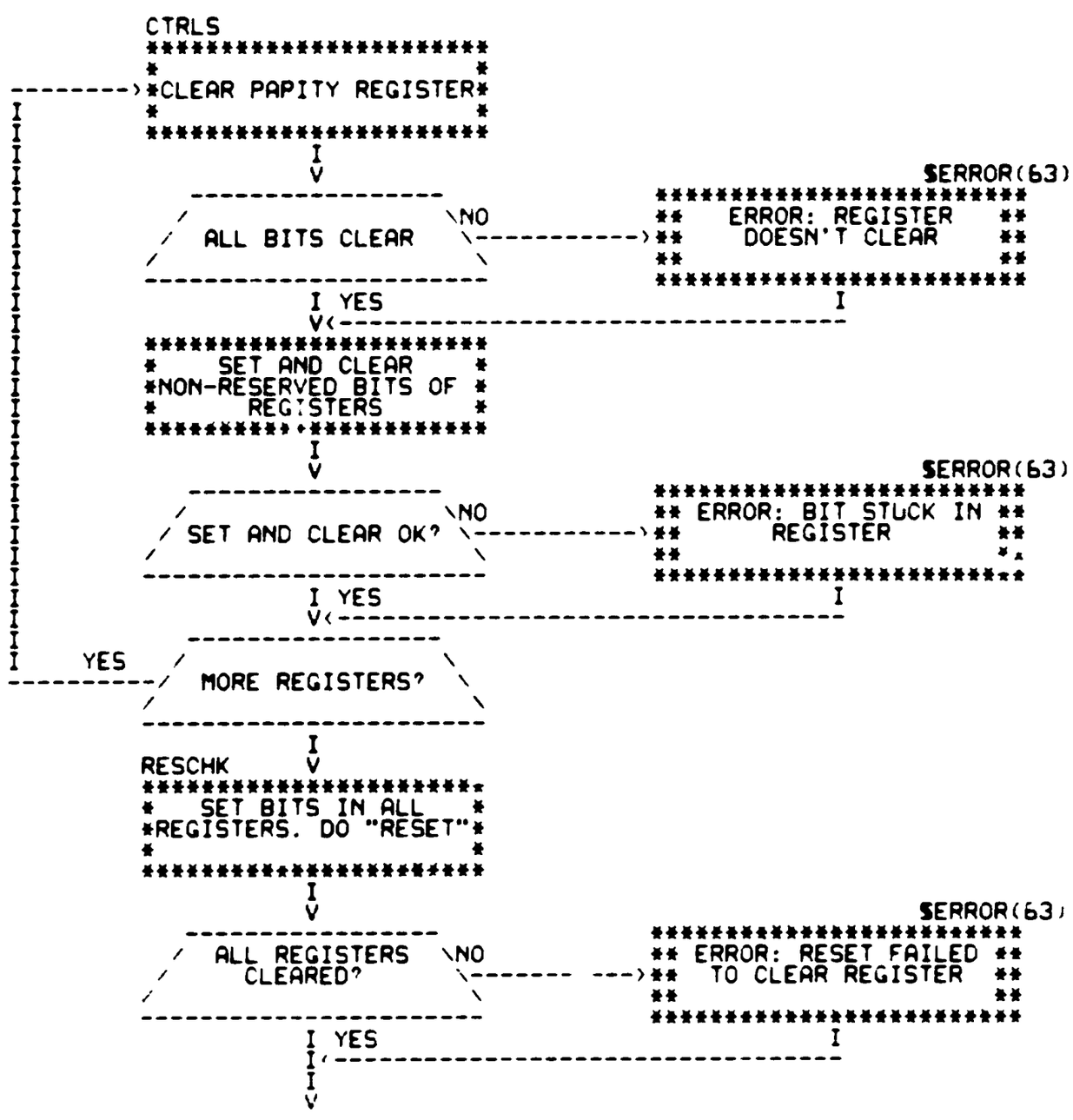

SA=220
**TIMOUT **
MEMORY MANAGEMENT?
NO
YES
MMINIT(55)
SET UP MEMORY MANAGEMENT REGISTERS
$PRINT(63)
TYPE "BYTE MEMORY MAP"
INIT TYPEOUT FLAG
INIT ADDRESS POINTER
SET TIMEOUT VECTOR
DO A DF 1; THEN DATI,
DATO; THEN DATI,
DATIP, DATOB
TIMEOUT TRAP
ADJUST SP
TYPE "FROM" FLAG SET? (R0=-1)
NO
YES
TYPE "TO" FLAG SET? (R0=0?)
NO
YES

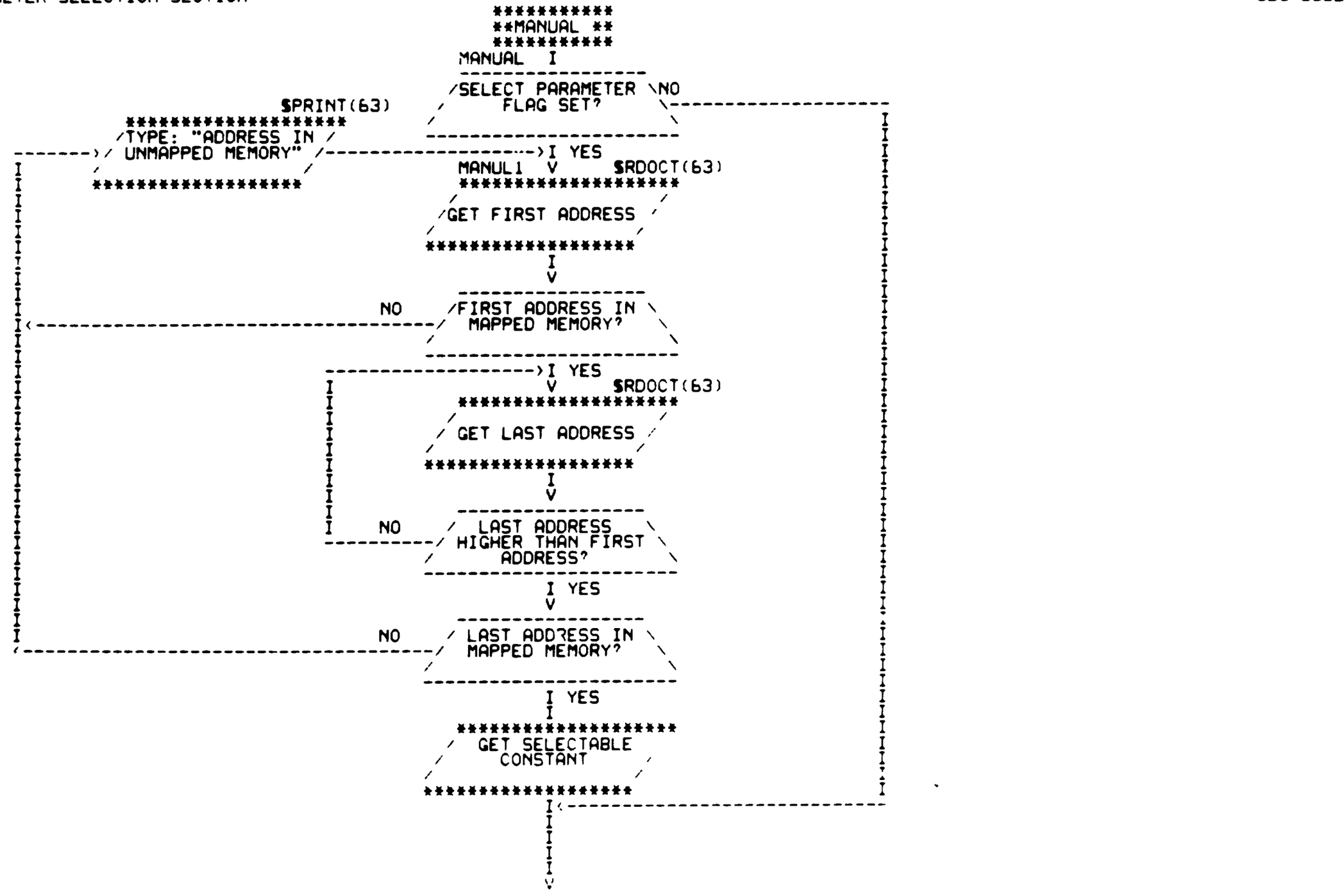

$PRINT(63)
TYPE "FROM"
$TYPAD(63)
TYPE ADDRESS
$PRINT(63)
TYPE "TO"
$TYPAD(63)
TYPE ADDRESS-1
COMPLEMENT TYPEOUT FLAG (RO)
B
UPDATE ADDRESS POINTER
0
NOT=0
NO
A
4K BANK BOUNDRY?
YES
NO
A
MEMORY MANAGEMENT AVAILABLE?
YES
UPDATE MEM MGMT REGISTERS + ADDRESS POINTER
NO
END OF MEMORY?
YES
A

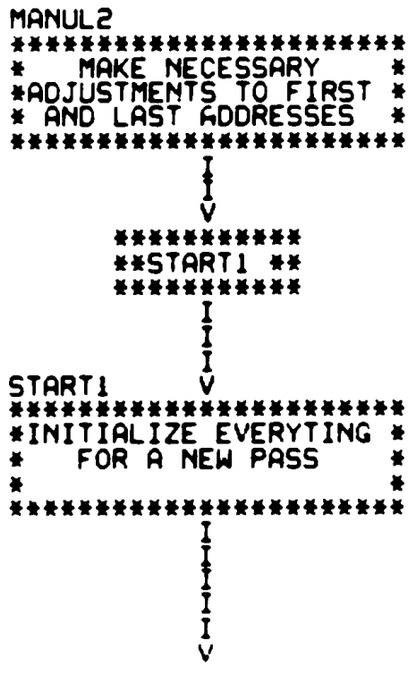

TYPE "TO" FLAG SET? RO=0
NO
YES
TYPE "TO"
TYPE ADDRESS-1
**HALT **

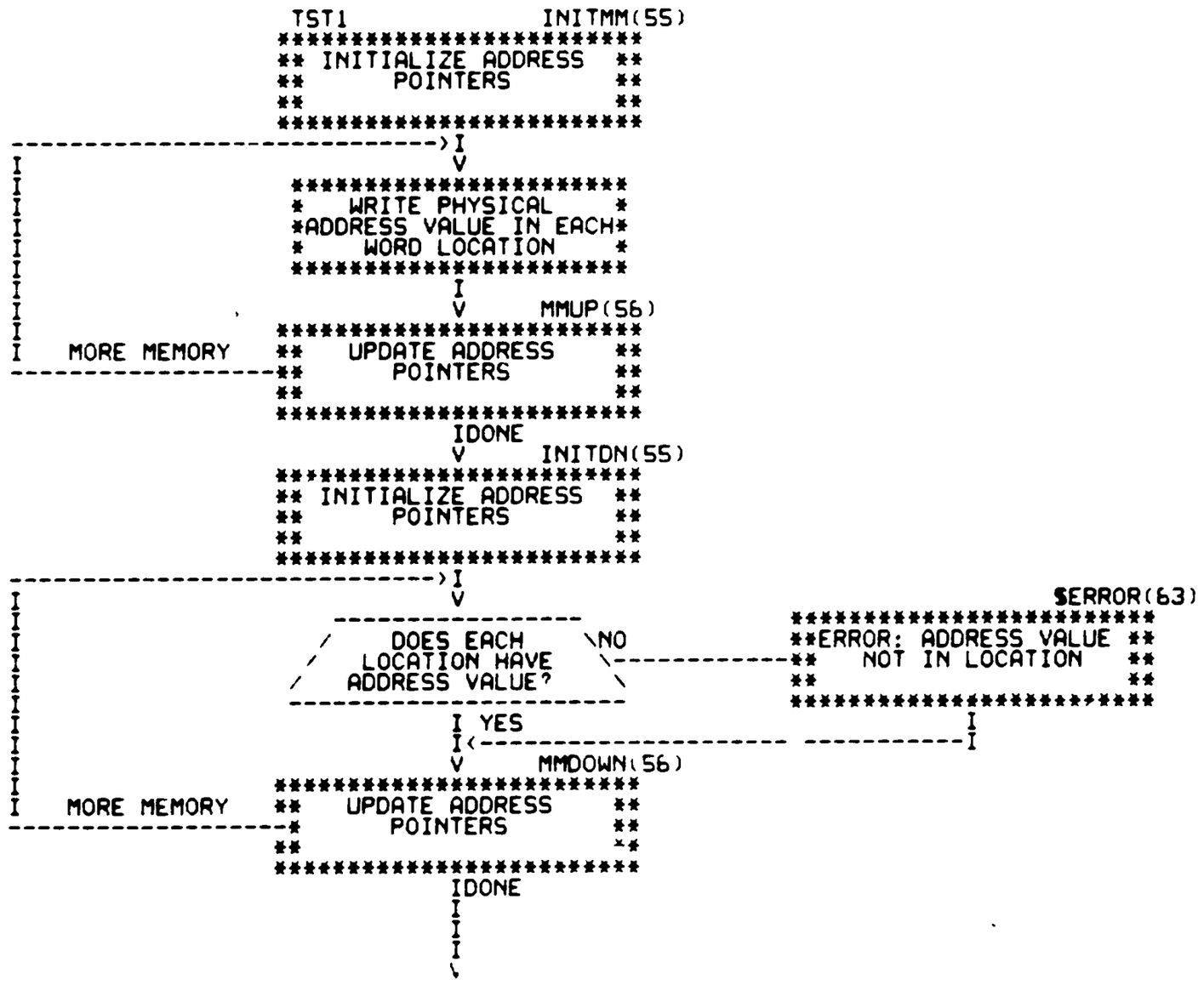

GMPR(08)
GMPR
SET UP TABLE POINTERS
SET UP TIMEOUT VECTOR
GMPRA
* CLEAR FLAG. TEST *
* REGISTER ADR FOR *
* TIMEOUT *
TIMEOUT TRAP
GMPRB
* ADJUST SP. SET FLAG *
*TO INDICATE REGISTER *
* NOT PRESENT *
*SAVE REGISTER ADR IN *
* SECOND TABLE (MPRX) *
GMPRC
/CLEAR MAP. END OF\
NO /TABLE REACHED?\
YES
* TERMINATE SECOND *
* TABLE (MPRX) RESET *
* TIMEOUT VECTOR *
/ANY PARITY \NO
/REGISTERS FOUND?\
YES
/TYPE "NO MEMORY /
/PARITY REGISTERS /
/FOUND". /
MANUAL(15)

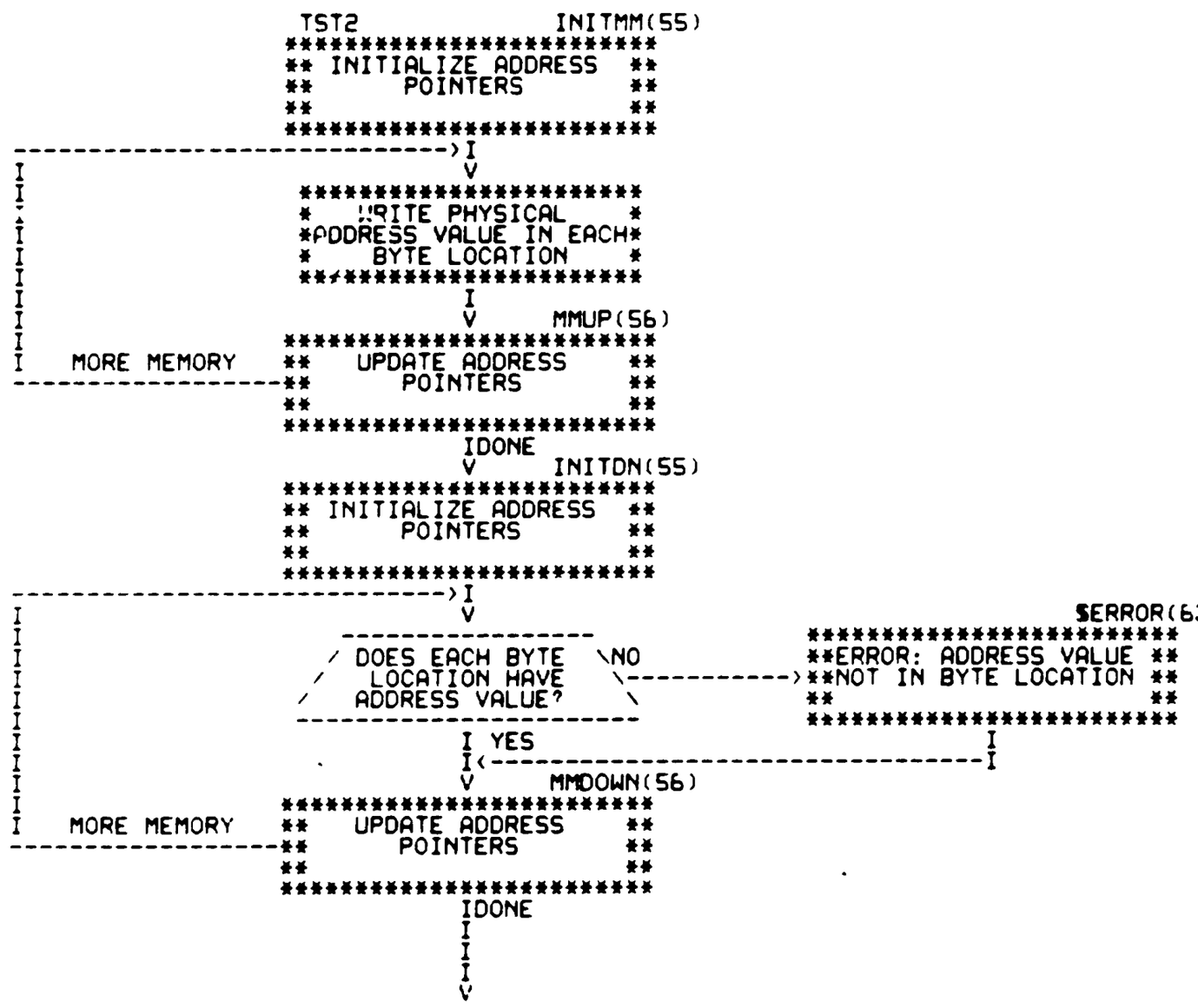

INIT ALL REGISTERS
SET UP POINTERS
MAPRB
WRITE WRONG PARITY IN
EACH BANK OF MEMORY
FIND WHICH REGISTER
CONTROLS WHICH BANK.
TMAP
TYPE PARITY REGISTER
ADDRESS
TYPMAP(62)
TYPE MAP OF MEMORY
CONTROLLED BY EACH
REGISTER


CTRLS
CLEAR PAPITY REGISTER
ALL BITS CLEAR
NO
YES
$ERROR(63)
ERROR: REGISTER DOESN'T CLEAR
SET AND CLEAR NON-RESERVED BITS OF REGISTERS
SET AND CLEAR OK?
NO
YES
$ERROR(63)
ERROR: BIT STUCK IN REGISTER
MORE REGISTERS?
YES
RESCHK
SET BITS IN ALL REGISTERS. DO "RESET"
ALL REGISTERS CLEARED?
NO
$ERROR(63)
ERROR: RESET FAILED TO CLEAR REGISTER
YES

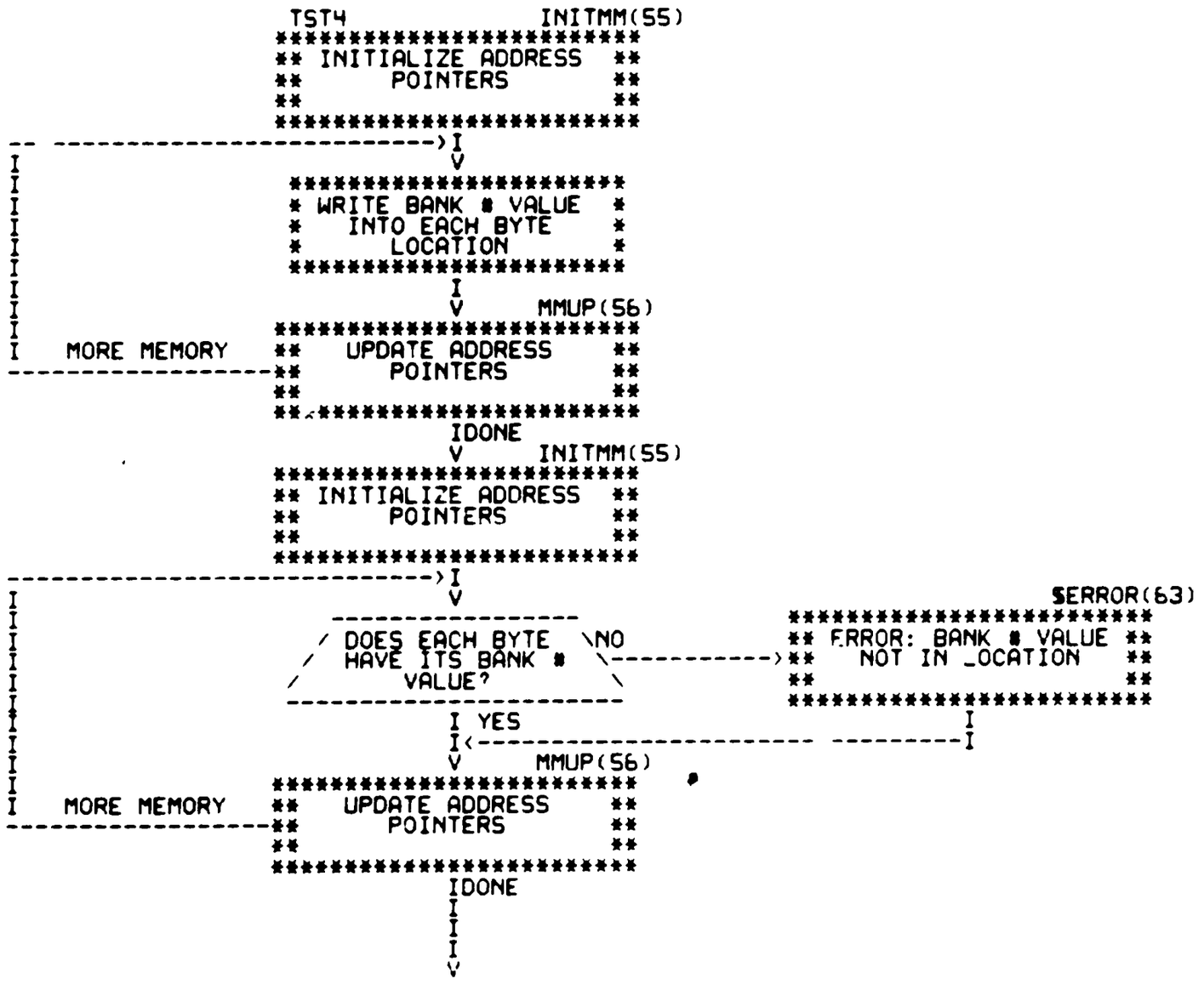

**MANUAL **
MANUAL I
SELECT PARAMETER FLAG SET?
NO
$PRINT(63)
TYPE: "ADDRESS IN UNMAPPED MEMORY"
I YES
MANUL1 V
$RDOCT(63)
GET FIRST ADDRESS
NO
FIRST ADDRESS IN MAPPED MEMORY?
I YES
V
$RDOCT(63)
GET LAST ADDRESS
NO
LAST ADDRESS HIGHER THAN FIRST ADDRESS?
I YES
V
NO
LAST ADDRESS IN MAPPED MEMORY?
I YES
I
GET SELECTABLE CONSTANT

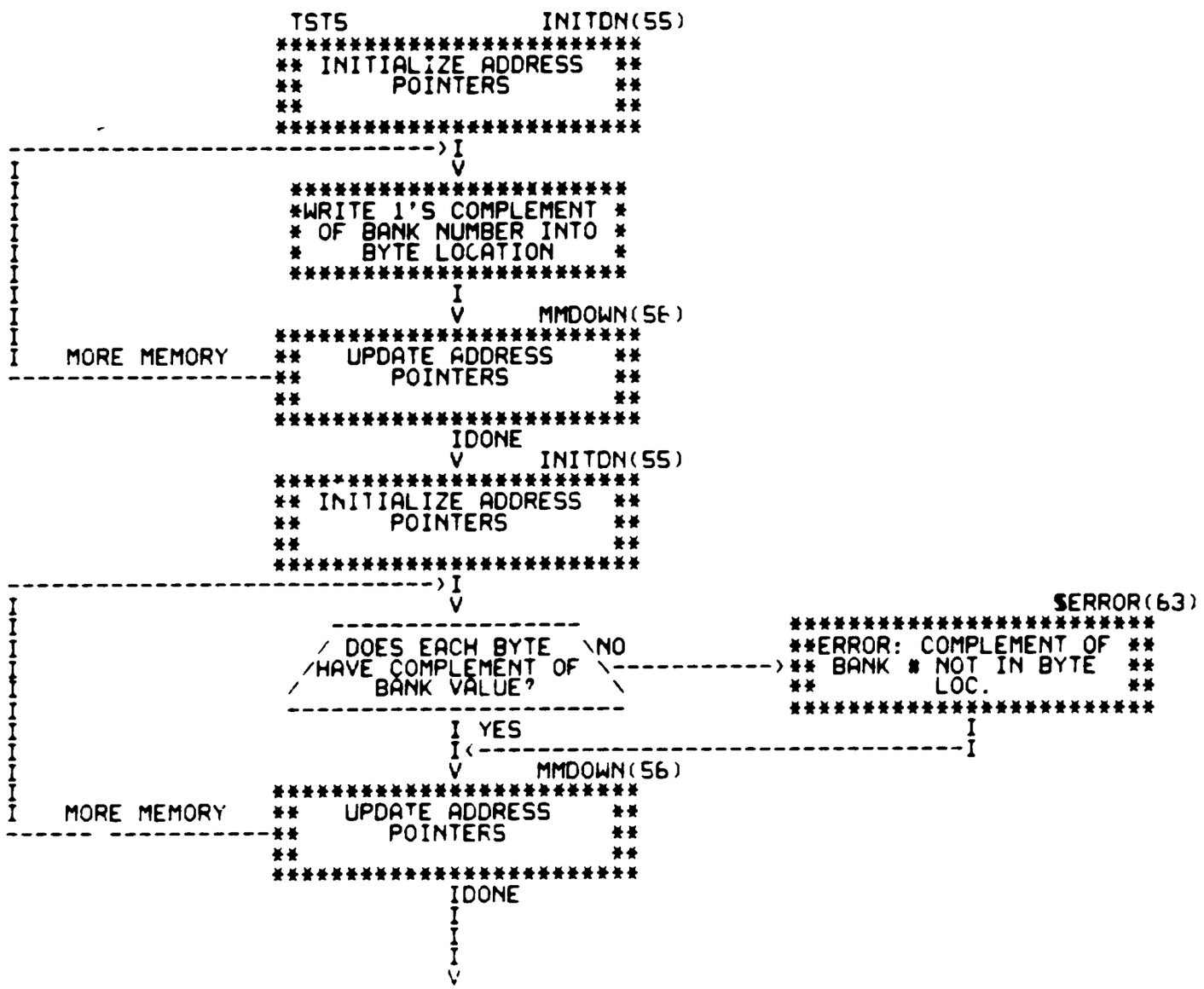

MANUL2
MAKE NECESSARY
ADJUSTMENTS TO FIRST
AND LAST ADDRESSES
START1
START1
INITIALIZE EVERYTING
FOR A NEW PASS

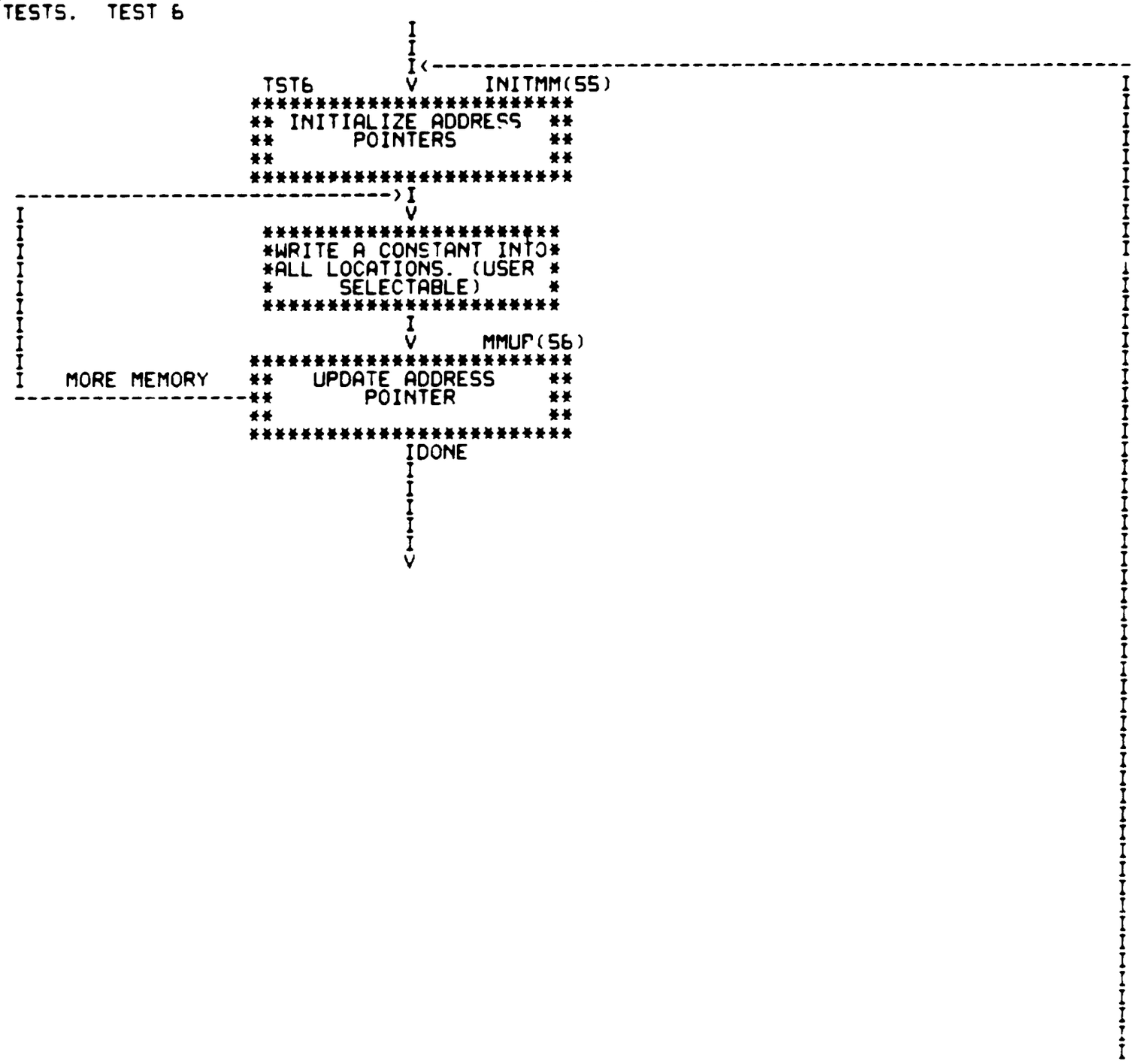

TST1
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
WRITE PHYSICAL ADDRESS VALUE IN EACH WORD LOCATION
MMUP(56)
UPDATE ADDRESS POINTERS
MORE MEMORY
IDONE
INITDN(55)
INITIALIZE ADDRESS POINTERS
DOES EACH LOCATION HAVE ADDRESS VALUE?
NO
$ERROR(63)
**ERROR: ADDRESS VALUE NOT IN LOCATION
YES
MMDOWN(56)
UPDATE ADDRESS POINTERS
MORE MEMORY
IDONE

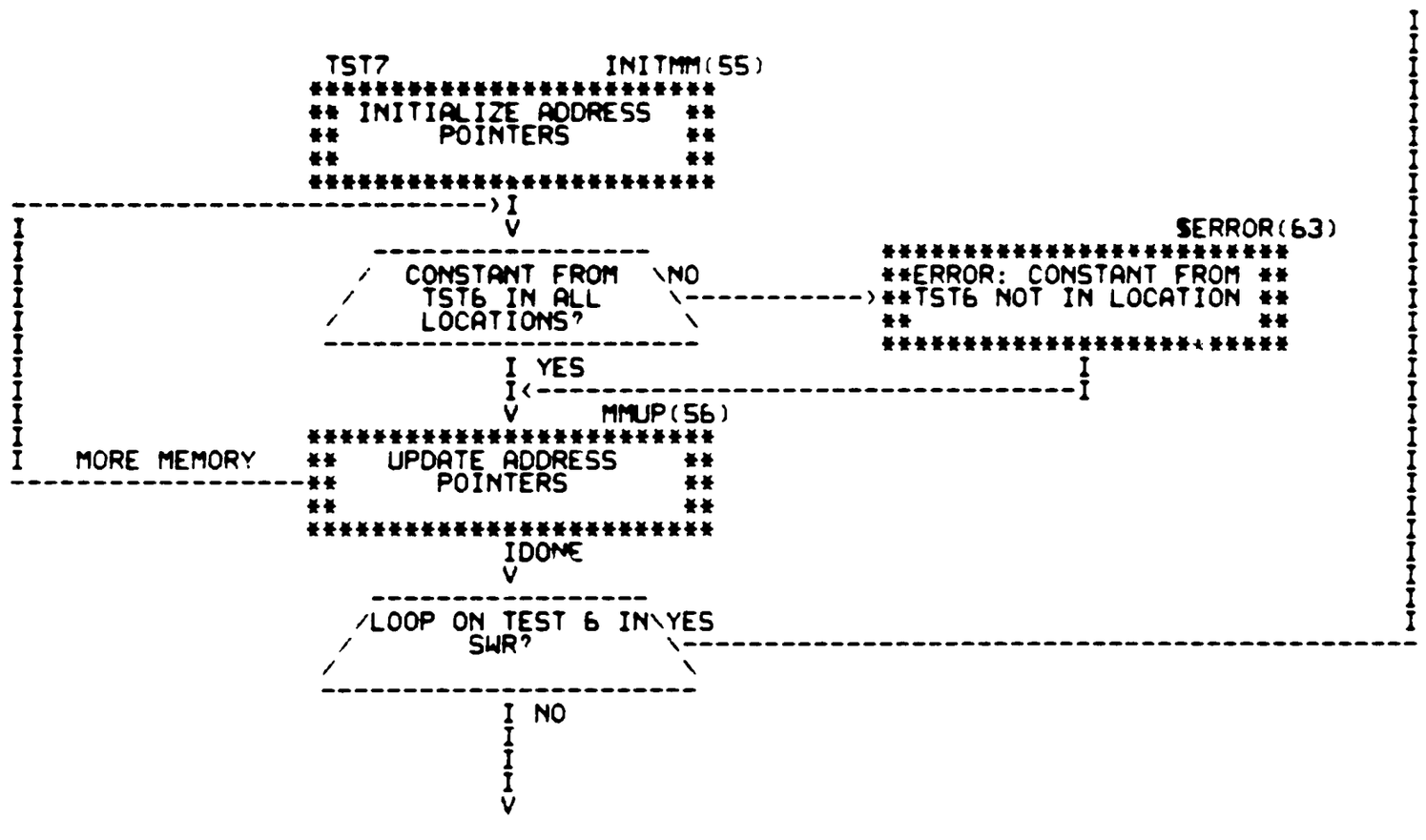

TST2
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
WRITE PHYSICAL
ADDRESS VALUE IN EACH
BYTE LOCATION
MMUP(56)
UPDATE ADDRESS
POINTERS
MORE MEMORY
IDONE
INITDN(55)
** INITIALIZE ADDRESS **
** POINTERS **
DOES EACH BYTE LOCATION HAVE ADDRESS VALUE?
NO
$ERROR(63)
**ERROR: ADDRESS VALUE **
**NOT IN BYTE LOCATION **
YES
MMDOWN(56)
UPDATE ADDRESS
POINTERS
MORE MEMORY
IDONE

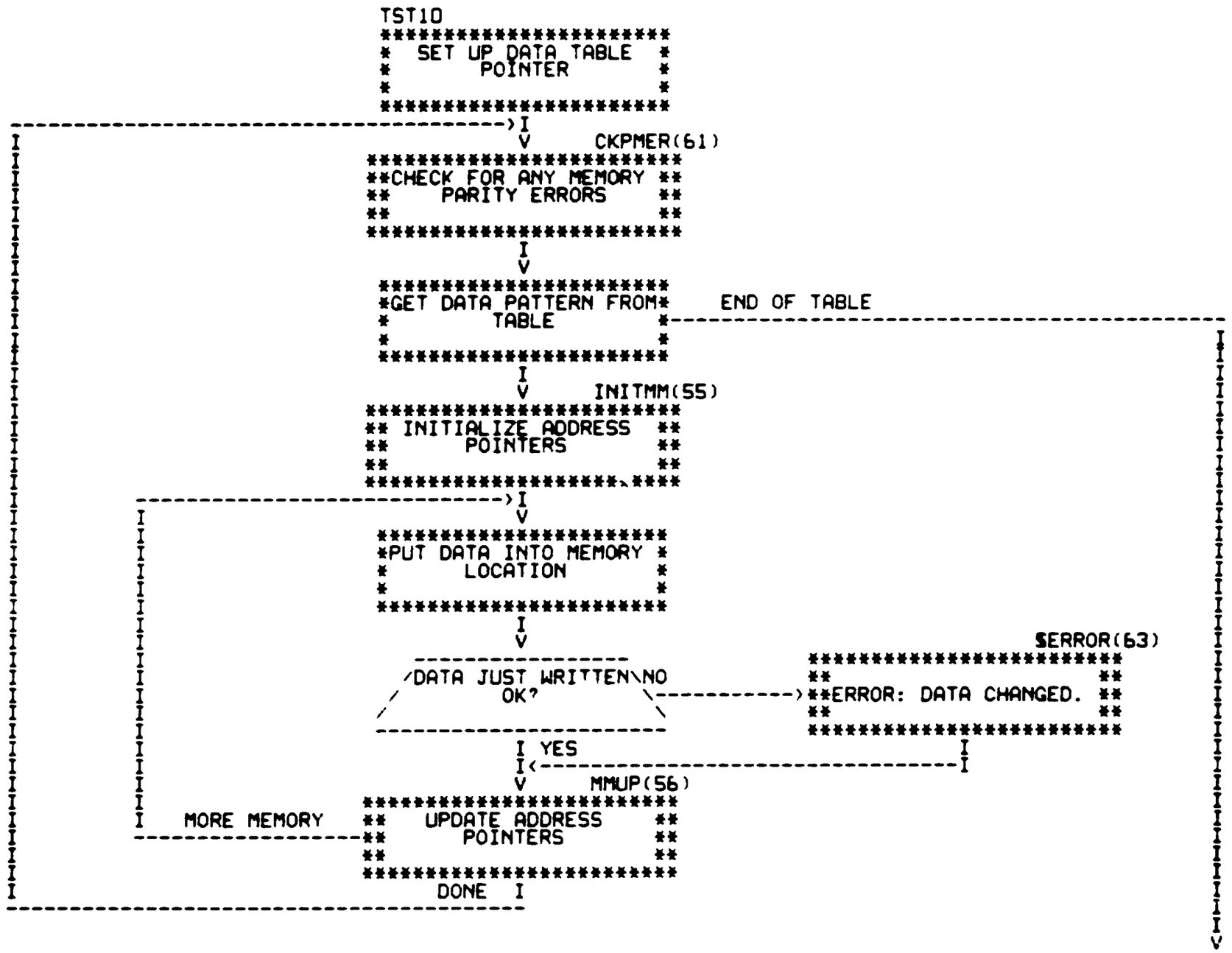

TST3
INITDN(55)
** INITIALIZE ADDRESS **
** POINTERS **
WRITE ONE'S COMPLEMENT OF ADR INTO WORD LOCATION
MMDOWN(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
DOES EACH WORD HAVE COMPLEMENT OF ADR. VALUE?
NO
$ERROR(63)
**ERROR: COMPLEMENT OF **
ADR. NOT IN WORD LOC.
YES
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE

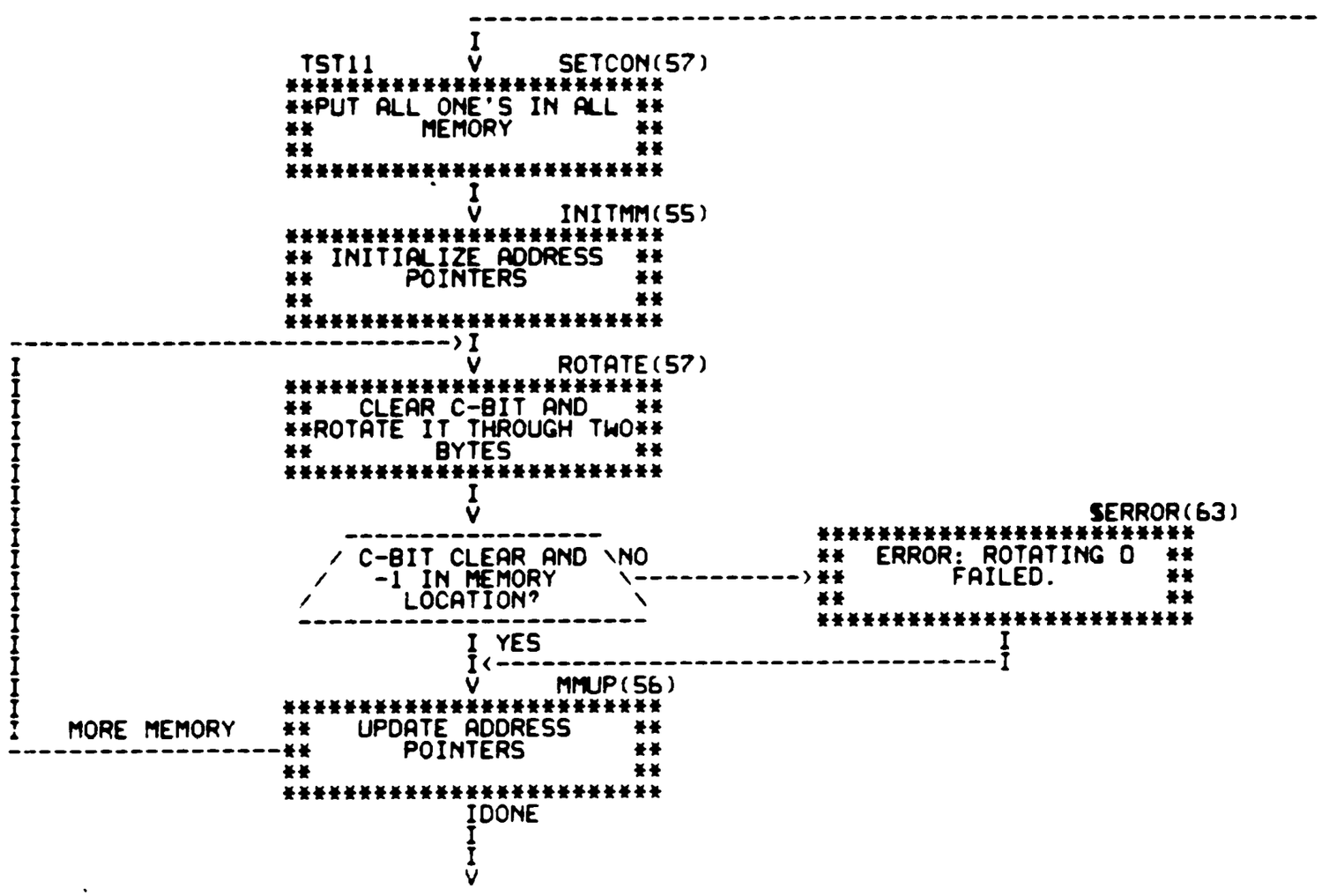

TST4
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
WRITE BANK # VALUE
INTO EACH BYTE
LOCATION
MMUP(56)
UPDATE ADDRESS
POINTERS
MORE MEMORY
IDONE
INITMM(55)
INITIALIZE ADDRESS
POINTERS
DOES EACH BYTE HAVE ITS BANK # VALUE?
NO
SERROR(63)
ERROR: BANK # VALUE
NOT IN LOCATION
YES
MMUP(56)
UPDATE ADDRESS
POINTERS
MORE MEMORY
IDONE

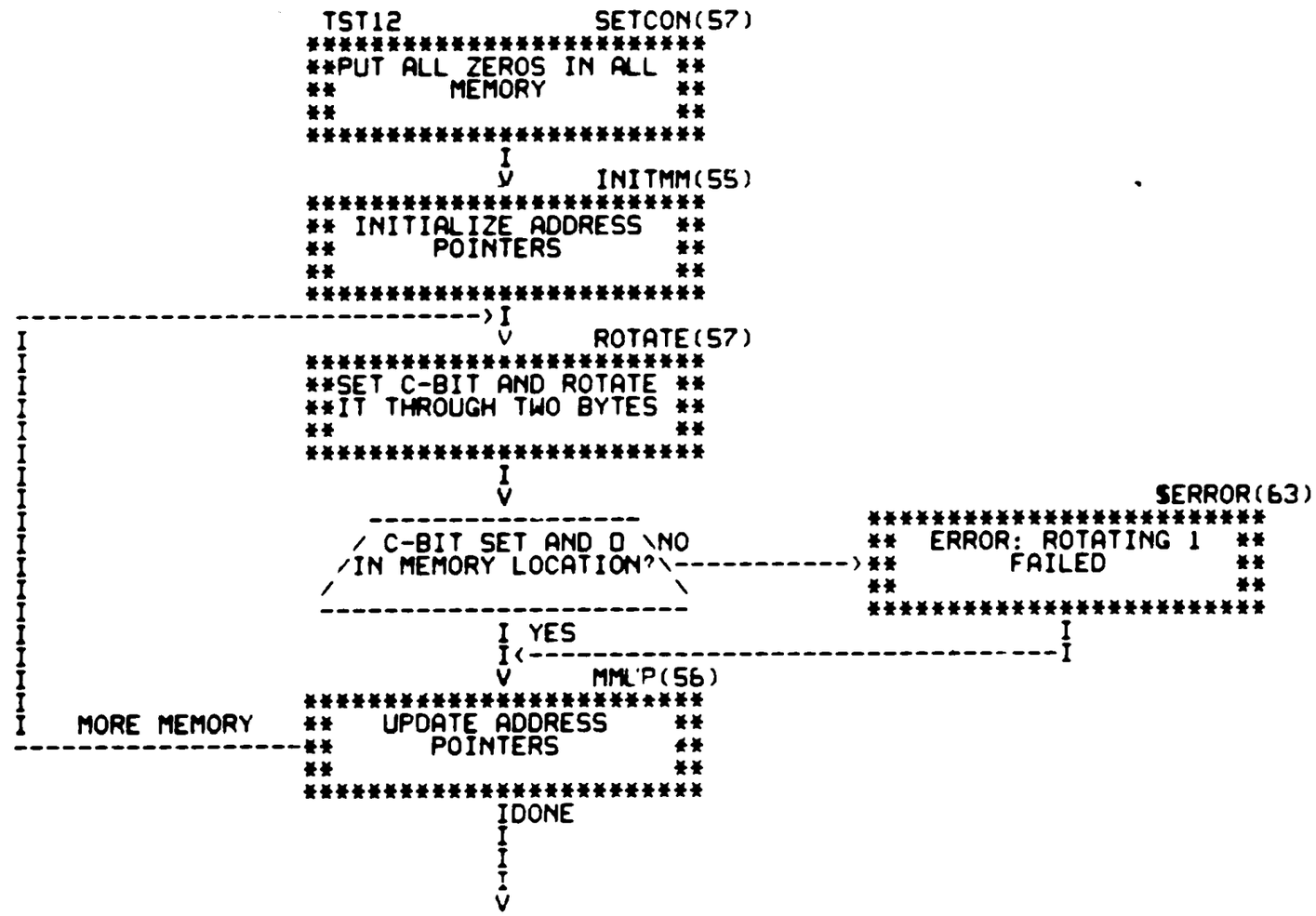

TSTS
INITDN(55)
** INITIALIZE ADDRESS **
** POINTERS **
WRITE 1'S COMPLEMENT
OF BANK NUMBER INTO
BYTE LOCATION
MMDOWN(56)
UPDATE ADDRESS
POINTERS
MORE MEMORY
IDONE
INITDN(55)
** INITIALIZE ADDRESS **
** POINTERS **
DOES EACH BYTE HAVE COMPLEMENT OF BANK VALUE?
NO
$ERROR(63)
**ERROR: COMPLEMENT OF BANK # NOT IN BYTE LOC.
YES
MMDOWN(56)
UPDATE ADDRESS
POINTERS
MORE MEMORY
IDONE

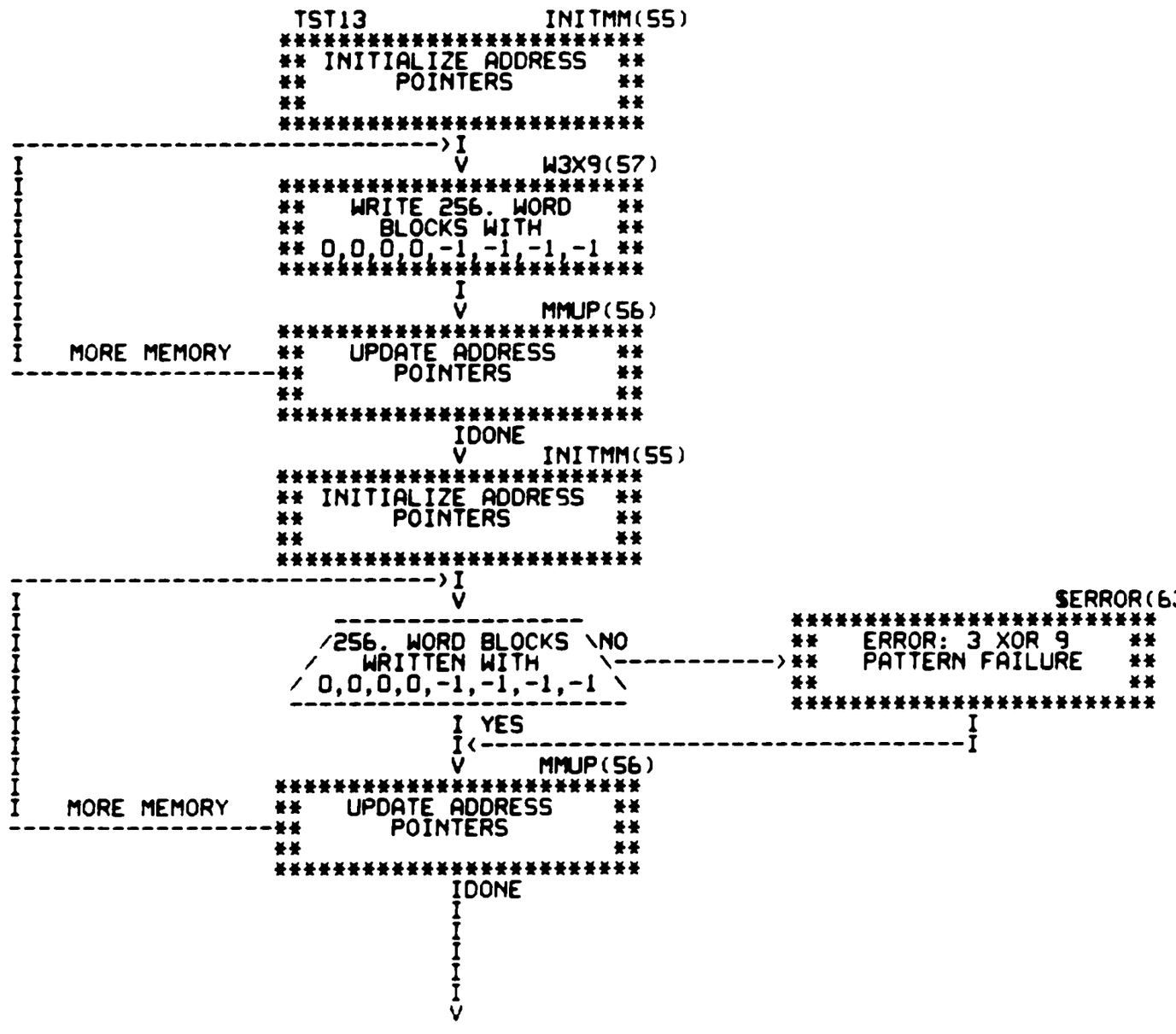

TST6
INITMM(55)
INITIALIZE ADDRESS POINTERS
WRITE A CONSTANT INTO ALL LOCATIONS. (USER SELECTABLE)
MMUP(56)
UPDATE ADDRESS POINTER
MORE MEMORY
IDONE

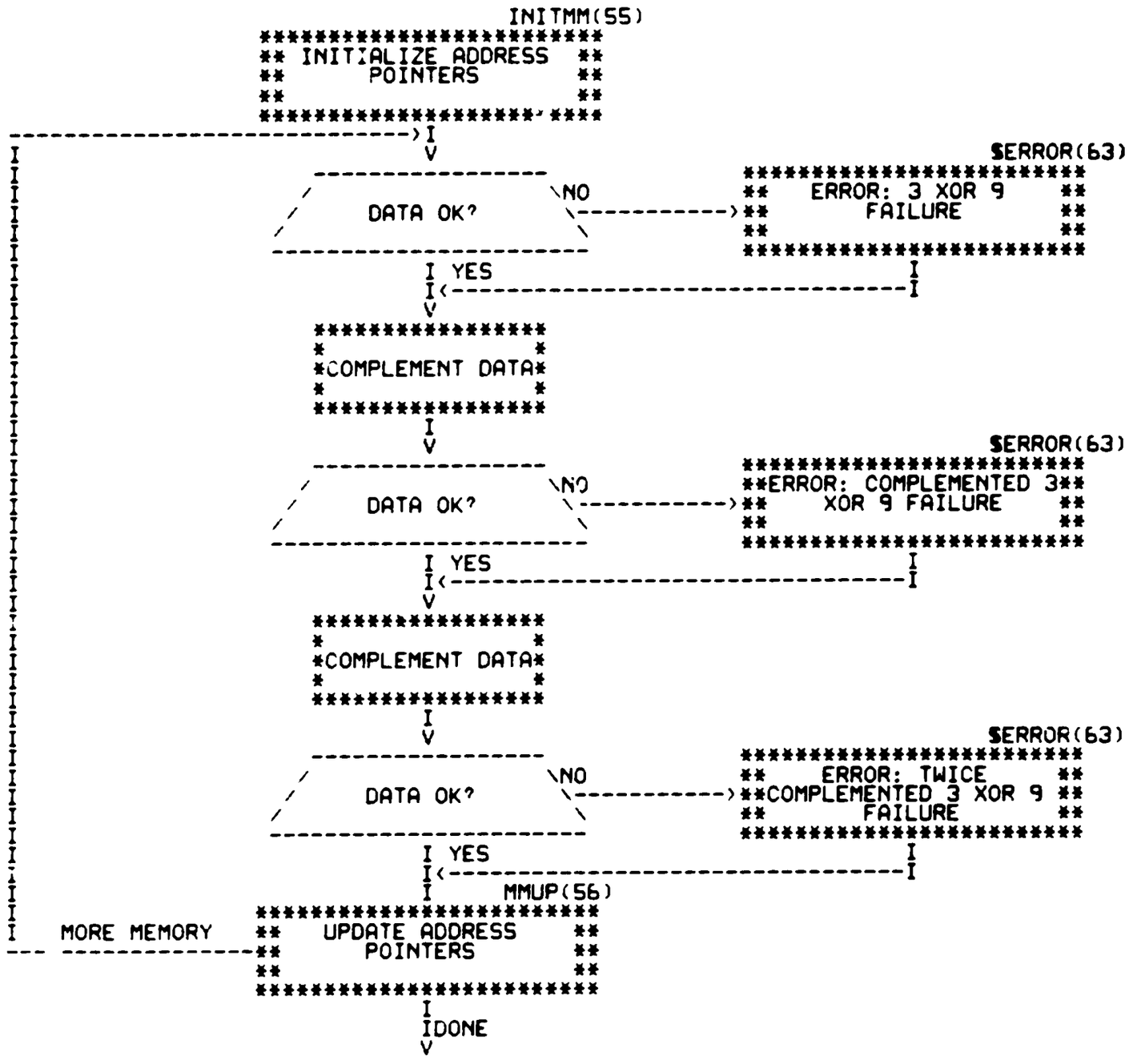

TST7
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
CONSTANT FROM TST6 IN ALL LOCATIONS?
NO
$ERROR(63)
**ERROR: CONSTANT FROM **
**TST6 NOT IN LOCATION **
YES
MMUP(56)
MORE MEMORY
** UPDATE ADDRESS **
** POINTERS **
IDONE
LOOP ON TEST 6 IN SW?
YES
NO

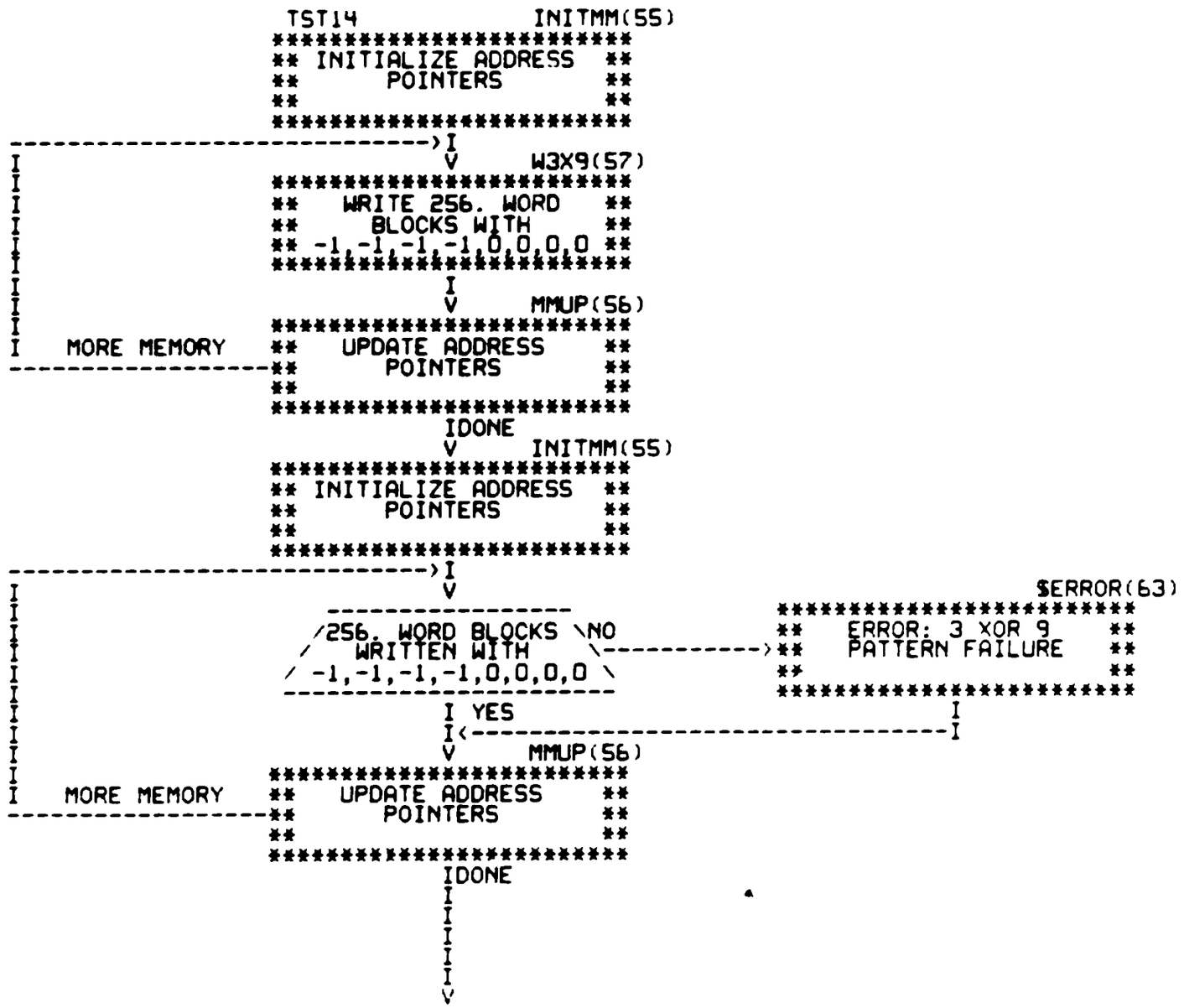

TST10
SET UP DATA TABLE POINTER
CKPMER(61)
CHECK FOR ANY MEMORY PARITY ERRORS
GET DATA PATTERN FROM TABLE
END OF TABLE
INITMM(55)
INITIALIZE ADDRESS POINTERS
PUT DATA INTO MEMORY LOCATION
DATA JUST WRITTEN OK?
NO
SERROR(63)
ERROR: DATA CHANGED.
YES
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
DONE

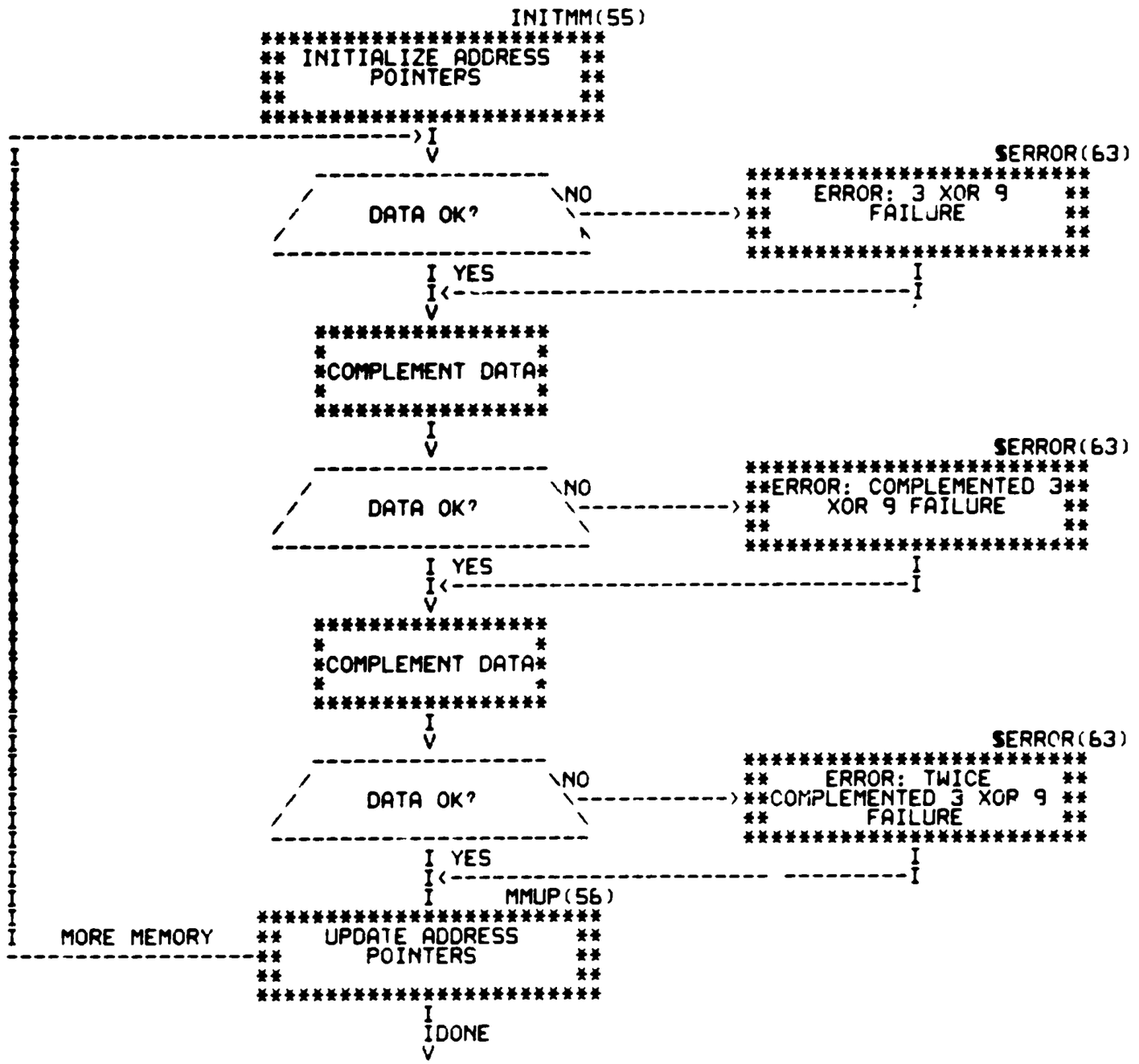

TST11
SETCON(57)
PUT ALL ONE'S IN ALL MEMORY
INITMM(55)
INITIALIZE ADDRESS POINTERS
ROTATE(57)
CLEAR C-BIT AND ROTATE IT THROUGH TWO BYTES
C-BIT CLEAR AND -1 IN MEMORY LOCATION?
NO
YES
SERROR(63)
ERROR: ROTATING 0 FAILED.
MMUP(56)
UPDATE ADDRESS POINTERS
MORE MEMORY
IDONE

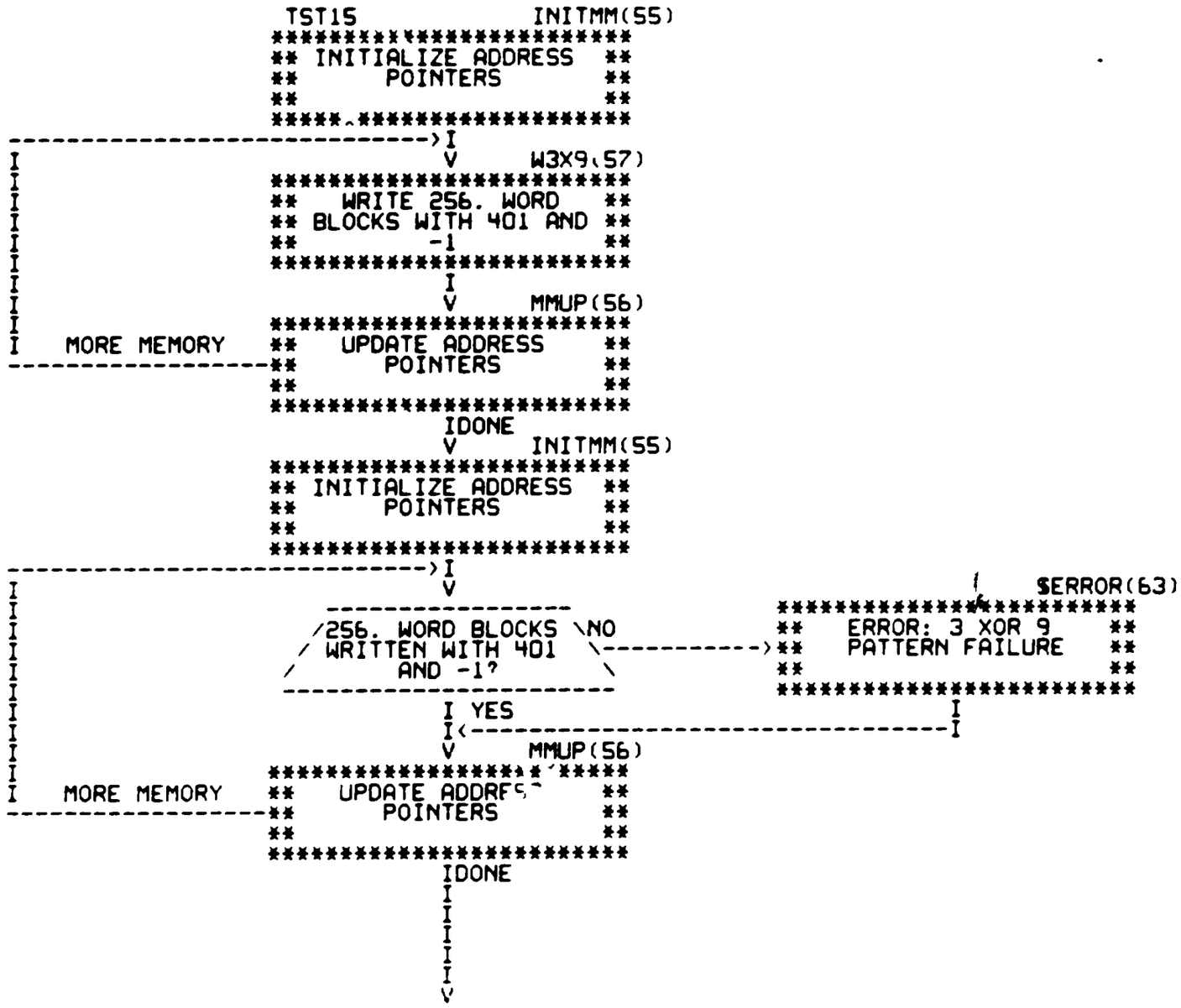

TST12
SETCON(57)
**PUT ALL ZEROS IN ALL MEMORY
INITMM(55)
** INITIALIZE ADDRESS POINTERS
ROTATE(57)
**SET C-BIT AND ROTATE IT THROUGH TWO BYTES
C-BIT SET AND 0 IN MEMORY LOCATION?
NO
SERROR(63)
ERROR: ROTATING 1 FAILED
YES
MML'P(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
IDONE

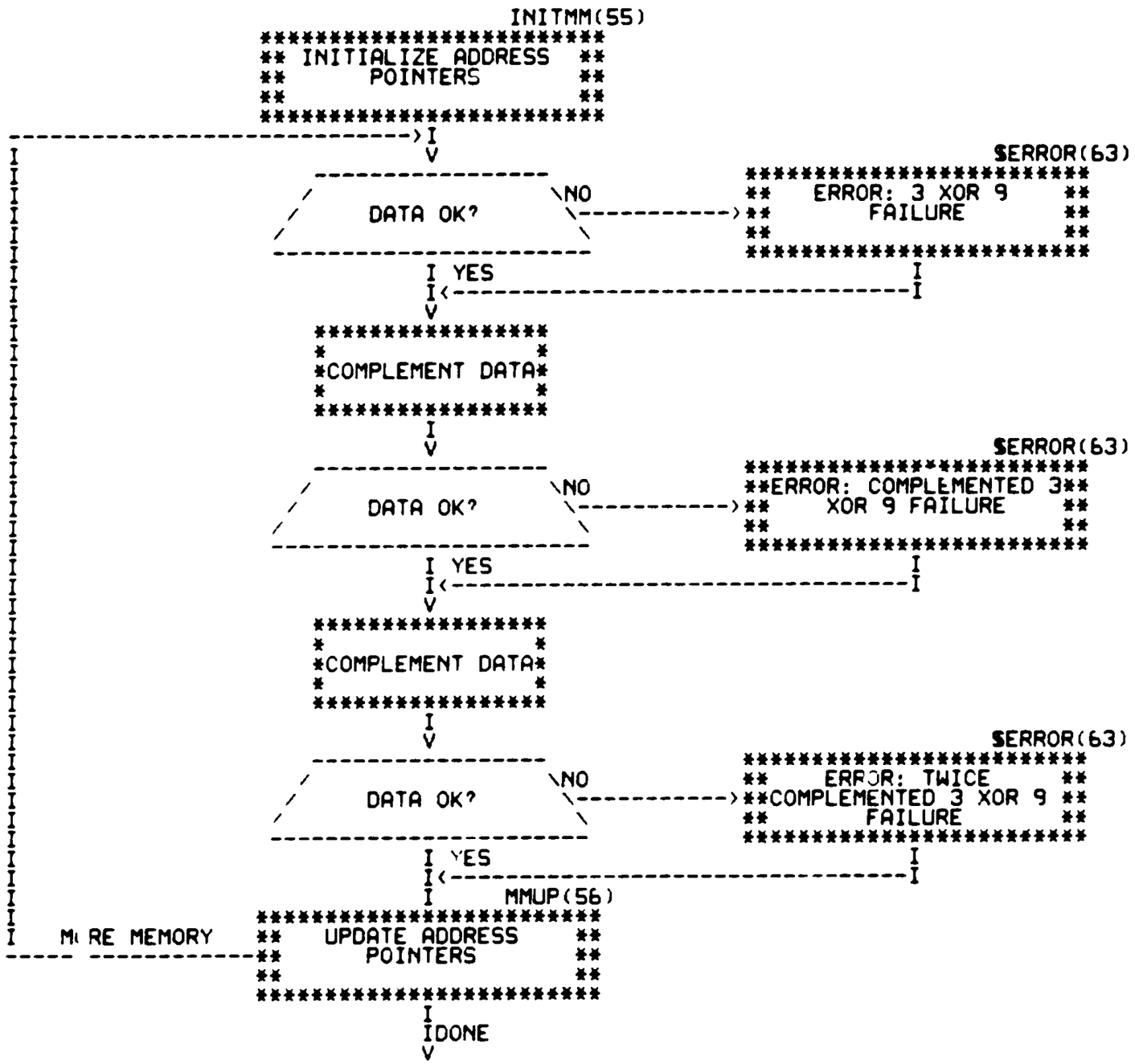

TST13
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
W3X9(57)
** WRITE 256. WORD **
** BLOCKS WITH **
** 0,0,0,0,-1,-1,-1,-1 **
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
/256. WORD BLOCKS \NO
/ WRITTEN WITH \
/ 0,0,0,0,-1,-1,-1,-1 \
YES
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
$ERROR(63)
** ERROR: 3 XOR 9 **
** PATTERN FAILURE **

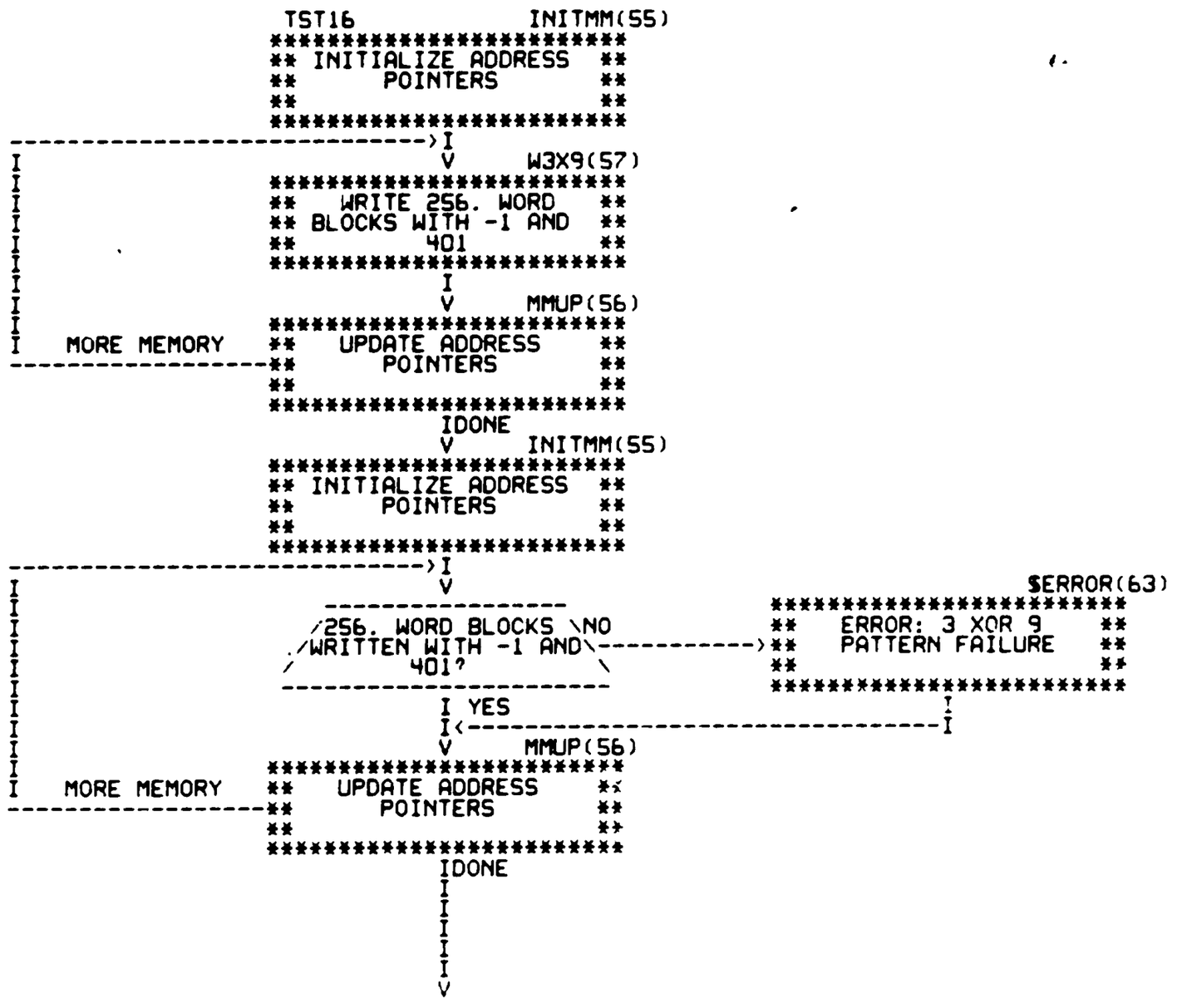

INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
DATA OK?
NO
YES
$ERROR(63)
** ERROR: 3 XOR 9 **
** FAILURE **
COMPLEMENT DATA
DATA OK?
NO
YES
$ERROR(63)
ERROR: COMPLEMENTED 3
** XOR 9 FAILURE **
COMPLEMENT DATA
DATA OK?
NO
YES
$ERROR(63)
** ERROR: TWICE **
**COMPLEMENTED 3 XOR 9 **
** FAILURE **
MMUP(56)
MORE MEMORY
** UPDATE ADDRESS **
** POINTERS **
DONE

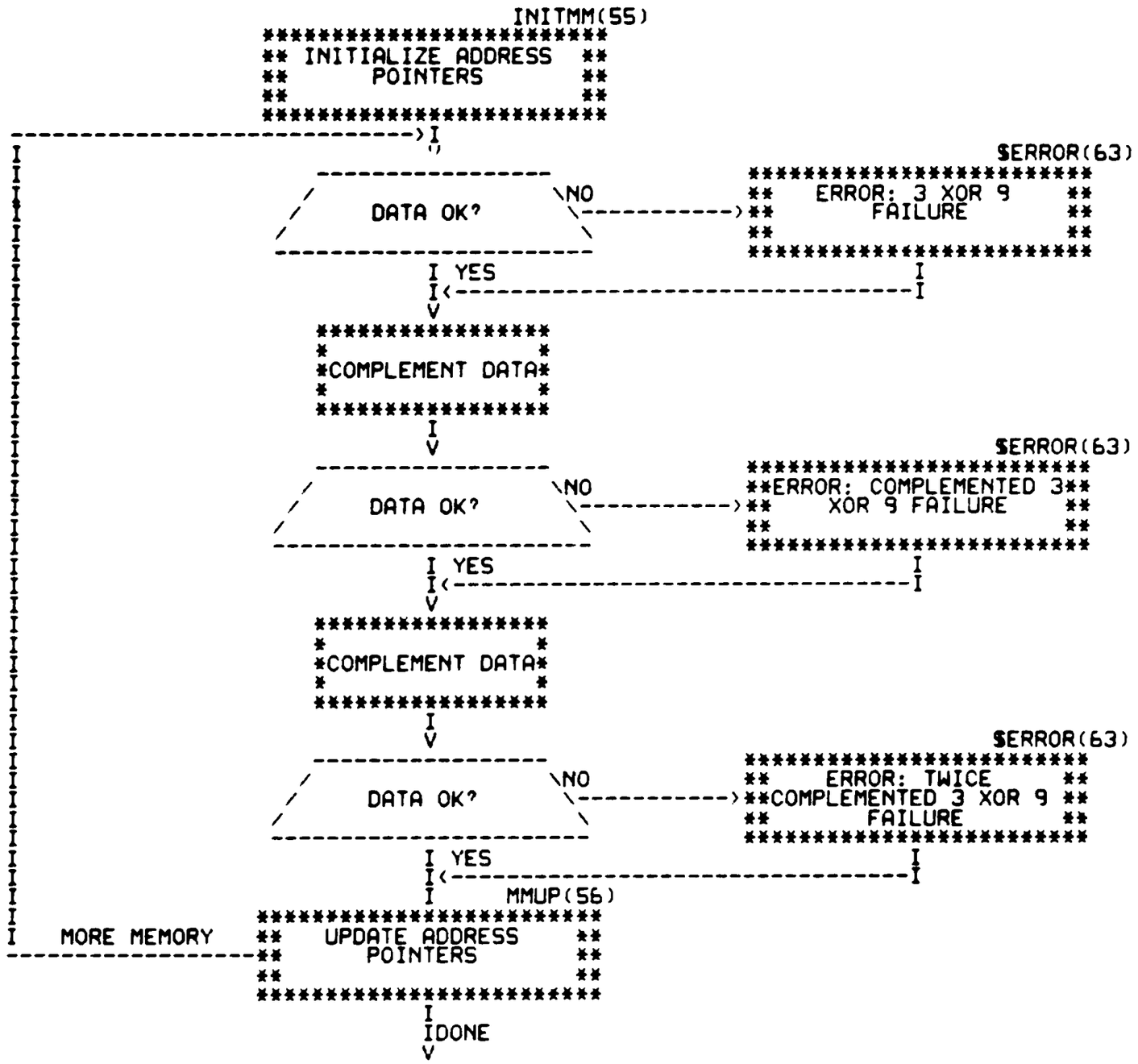

TST14
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
W3X9(57)
** WRITE 256. WORD **
** BLOCKS WITH **
** -1,-1,-1,-1,0,0,0,0 **
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
256. WORD BLOCKS WRITTEN WITH -1,-1,-1,-1,0,0,0,0
NO
YES
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
$ERROR(63)
** ERROR: 3 XOR 9 **
** PATTERN FAILURE **

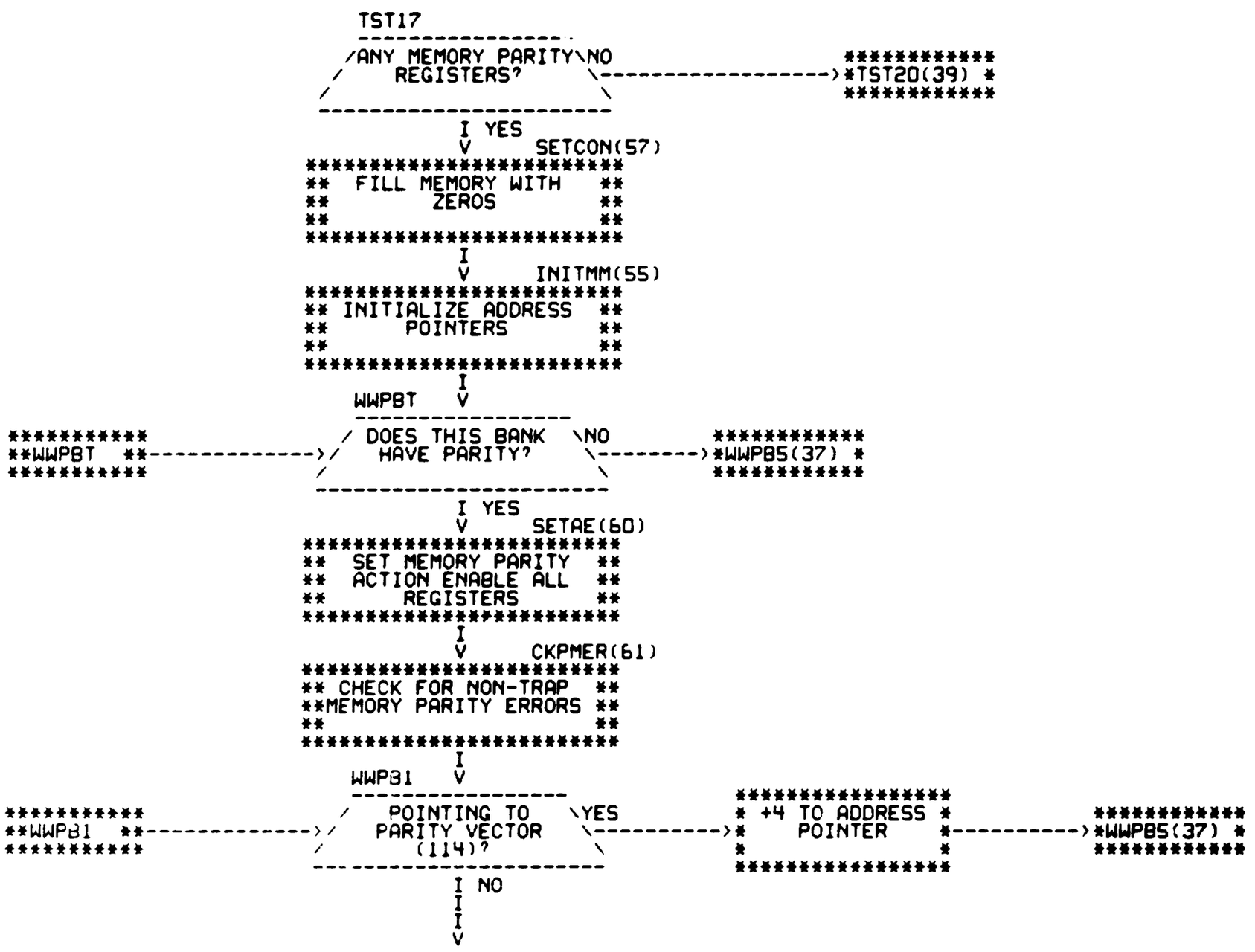

INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
DATA OK?
NO
$ERROR(63)
** ERROR: 3 XOR 9 **
** FAILURE **
YES
COMPLEMENT DATA
DATA OK?
NO
$ERROR(63)
ERROR: COMPLEMENTED 3
** XOR 9 FAILURE **
YES
COMPLEMENT DATA
DATA OK?
NO
$ERROR(63)
** ERROR: TWICE **
**COMPLEMENTED 3 XOR 9 **
** FAILURE **
YES
MMUP(56)
MORE MEMORY
** UPDATE ADDRESS **
** POINTERS **
DONE

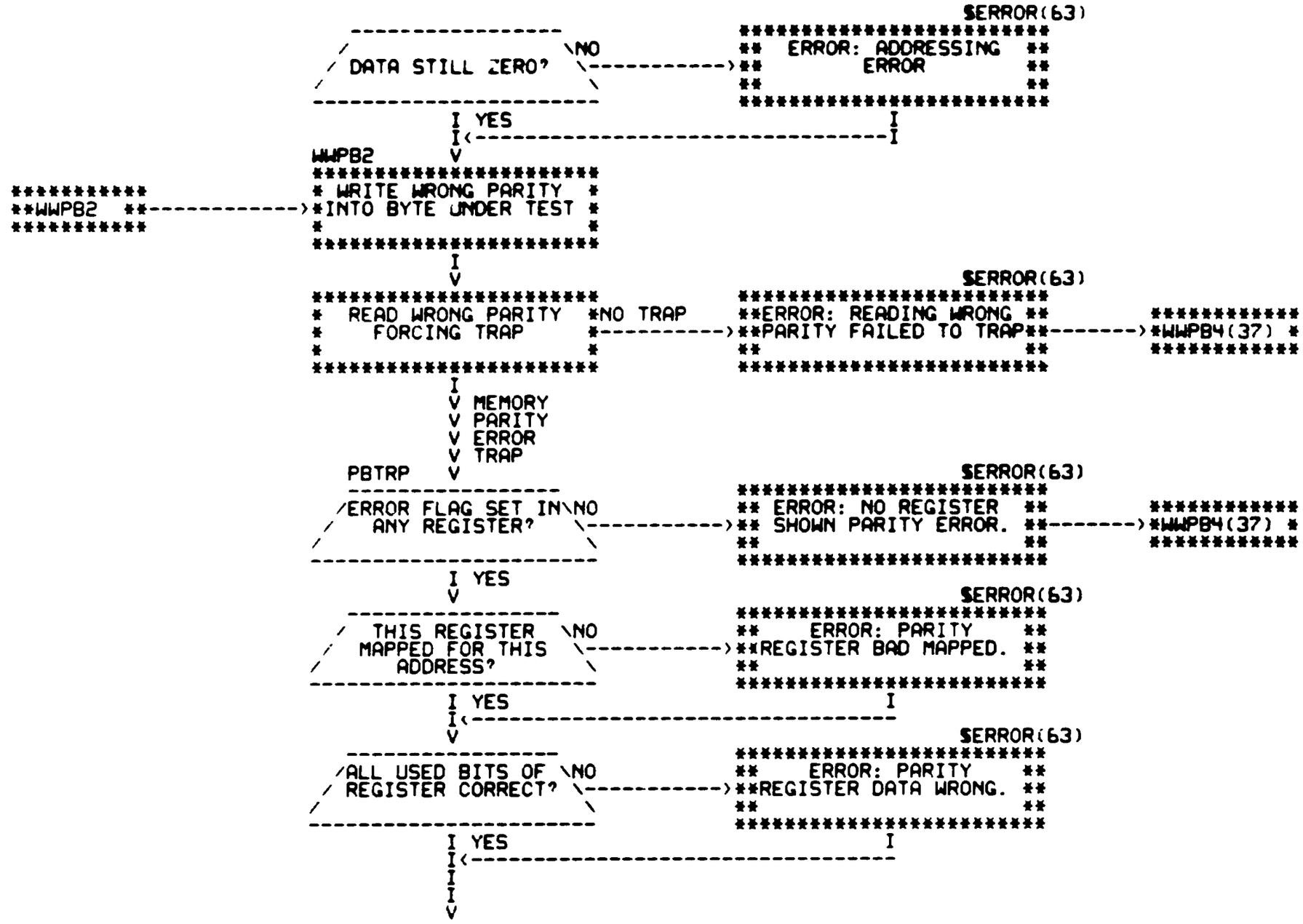

TST15
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
W3X9(57)
** WRITE 256. WORD **
** BLOCKS WITH 401 AND **
** -1 **
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
256. WORD BLOCKS WRITTEN WITH 401 AND -1?
NO
YES
$ERROR(63)
** ERROR: 3 XOR 9 **
** PATTERN FAILURE **
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE

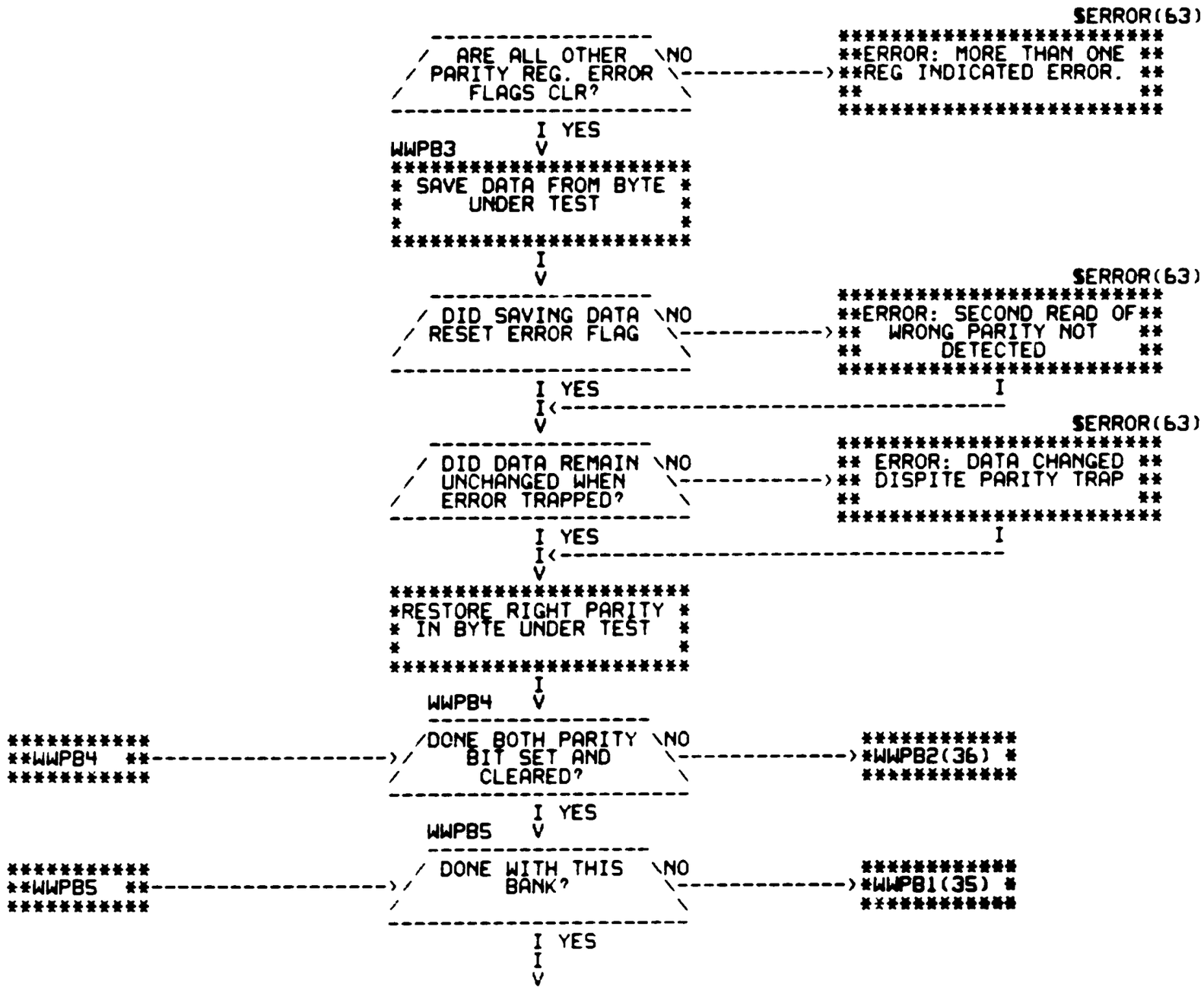

INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
DATA OK?
NO
$ERROR(63)
** ERROR: 3 XOR 9 **
** FAILURE **
YES
COMPLEMENT DATA
$ERROR(63)
ERROR: COMPLEMENTED 3
** XOR 9 FAILURE **
DATA OK?
NO
YES
COMPLEMENT DATA
$ERROR(63)
** ERROR: TWICE **
**COMPLEMENTED 3 XOR 9 **
** FAILURE **
DATA OK?
NO
YES
MMUP(56)
MORE MEMORY
** UPDATE ADDRESS **
** POINTERS **
DONE

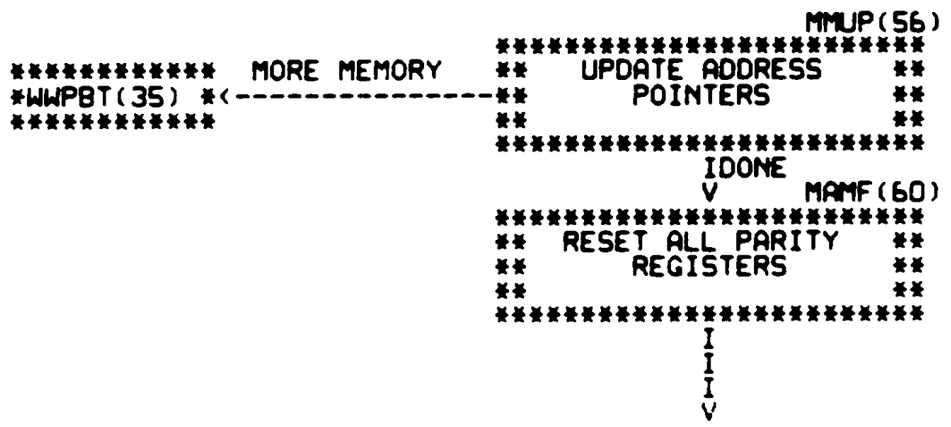

TST16
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
W3X9(57)
** WRITE 256. WORD **
** BLOCKS WITH -1 AND **
** 401 **
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
256. WORD BLOCKS WRITTEN WITH -1 AND 401?
NO
YES
MMUP(56)
** UPDATE ADDRESS **
** POINTERS **
MORE MEMORY
IDONE
$ERROR(63)
** ERROR: 3 XOR 9 **
** PATTERN FAILURE **


INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
DATA OK?
NO
YES
$ERROR(63)
ERROR: 3 XOR 9 FAILURE
COMPLEMENT DATA
DATA OK?
NO
YES
$ERROR(63)
ERROR: COMPLEMENTED 3 XOR 9 FAILURE
COMPLEMENT DATA
DATA OK?
NO
YES
$ERROR(63)
ERROR: TWICE COMPLEMENTED 3 XOR 9 FAILURE
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
DONE

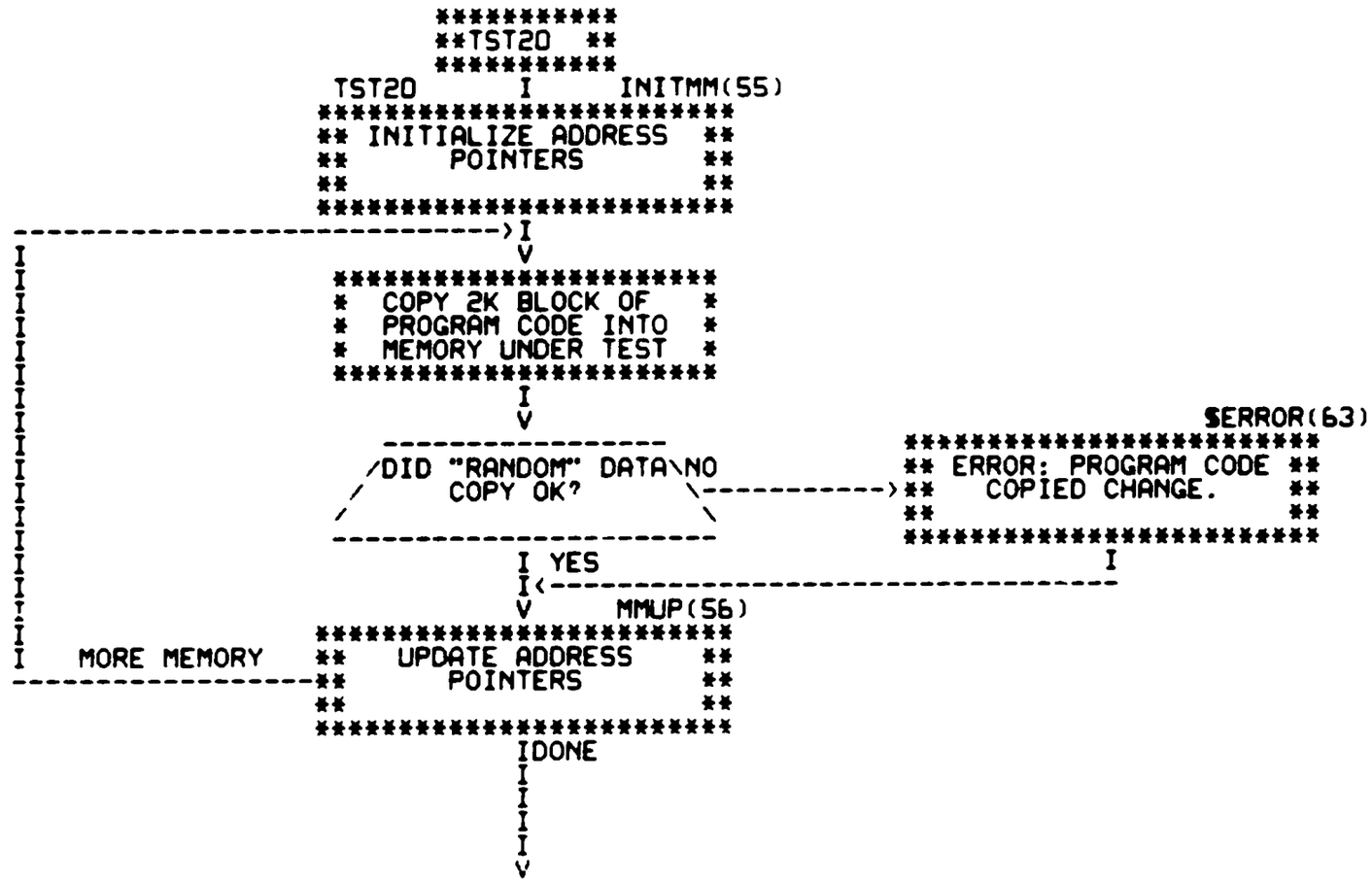

TST17
ANY MEMORY PARITY REGISTERS?
NO
*TST20(39) *
I YES
SETCON(57)
FILL MEMORY WITH ZEROS
INITMM(55)
INITIALIZE ADDRESS POINTERS
WWPBT
**WWPBT **
DOES THIS BANK HAVE PARITY?
NO
*WWPB5(37) *
I YES
SETAE(60)
SET MEMORY PARITY ACTION ENABLE ALL REGISTERS
CKPMER(61)
CHECK FOR NON-TRAP MEMORY PARITY ERRORS
WWPB1
**WWPB1 **
POINTING TO PARITY VECTOR (114)?
YES
+4 TO ADDRESS POINTER
*WWPB5(37) *
I NO

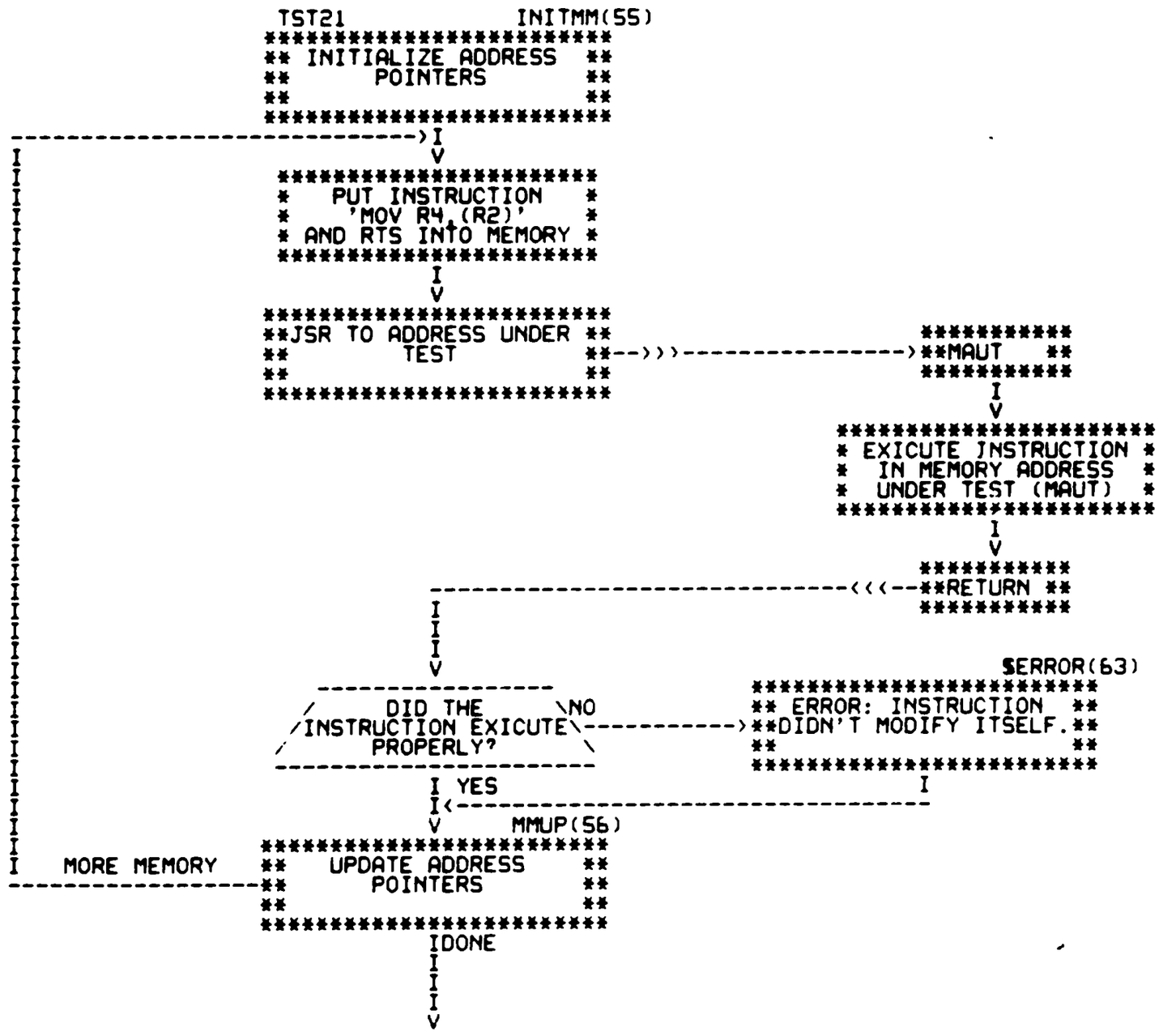

$ERROR(63)
DATA STILL ZERO?
NO
** ERROR: ADDRESSING **
** ERROR **
YES
WWPB2
****
**WWPB2 **
****
WRITE WRONG PARITY
INTO BYTE UNDER TEST
READ WRONG PARITY
FORCING TRAP
NO TRAP
**ERROR: READING WRONG **
PARITY FAILED TO TRAP
*WWPB4(37) *
MEMORY
PARITY
ERROR
TRAP
PBTRP
ERROR FLAG SET IN ANY REGISTER?
NO
** ERROR: NO REGISTER **
** SHOWN PARITY ERROR. **
YES
THIS REGISTER MAPPED FOR THIS ADDRESS?
NO
** ERROR: PARITY **
**REGISTER BAD MAPPED. **
YES
ALL USED BITS OF REGISTER CORRECT?
NO
** ERROR: PARITY **
**REGISTER DATA WRONG. **
YES

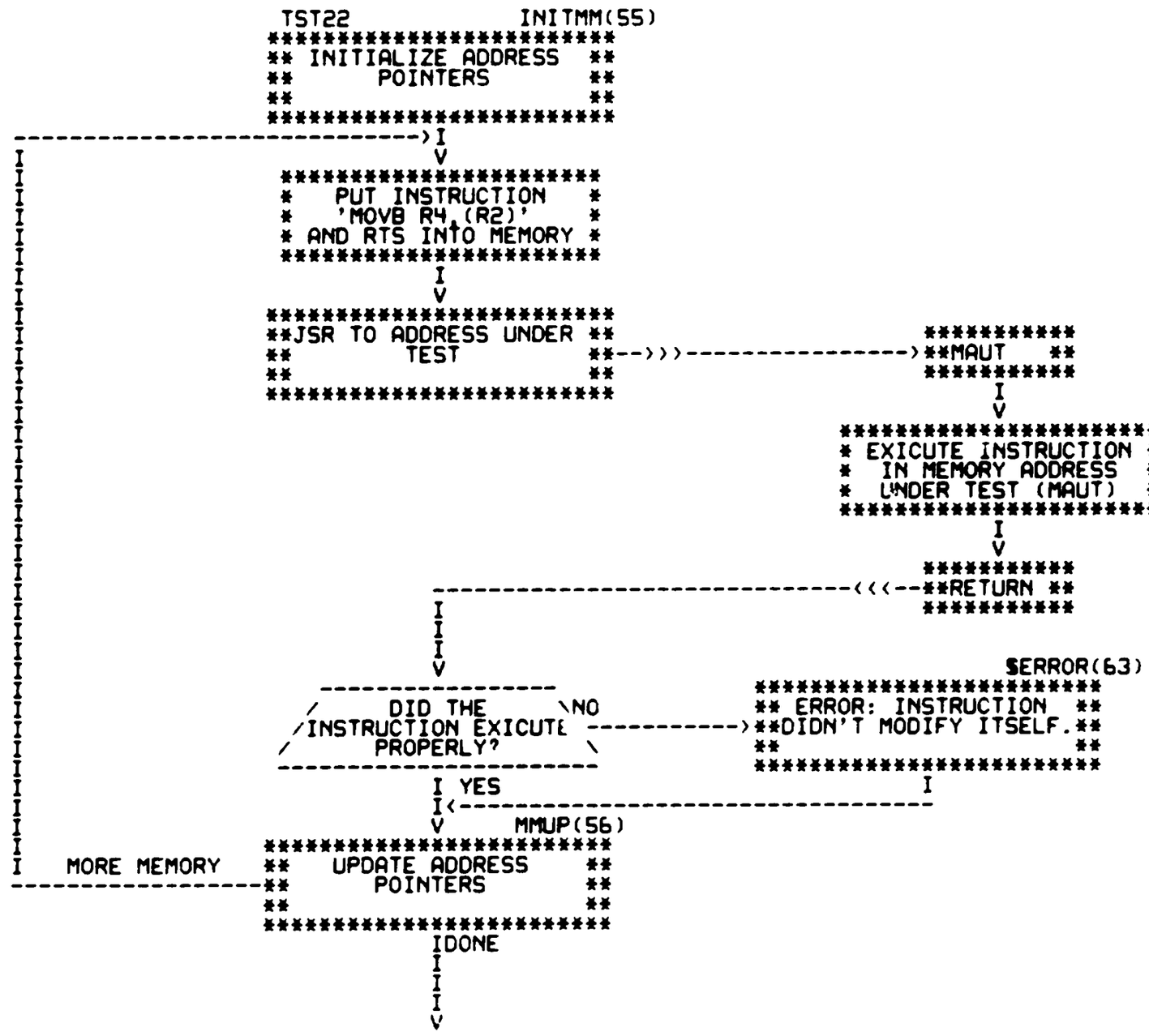

$ERROR(63)
ARE ALL OTHER PARITY REG. ERROR FLAGS CLR?
NO
**ERROR: MORE THAN ONE REG INDICATED ERROR.
YES
WWPB3
SAVE DATA FROM BYTE UNDER TEST
$ERROR(63)
DID SAVING DATA RESET ERROR FLAG
NO
**ERROR: SECOND READ OF WRONG PARITY NOT DETECTED
YES
$ERROR(63)
DID DATA REMAIN UNCHANGED WHEN ERROR TRAPPED?
NO
** ERROR: DATA CHANGED DISPITE PARITY TRAP
YES
RESTORE RIGHT PARITY IN BYTE UNDER TEST
WWPB4
**WWPB4
DONE BOTH PARITY BIT SET AND CLEARED?
NO
*WWPB2(36)
YES
WWPB5
**WWPB5
DONE WITH THIS BANK?
NO
*WWPB1(35)
YES

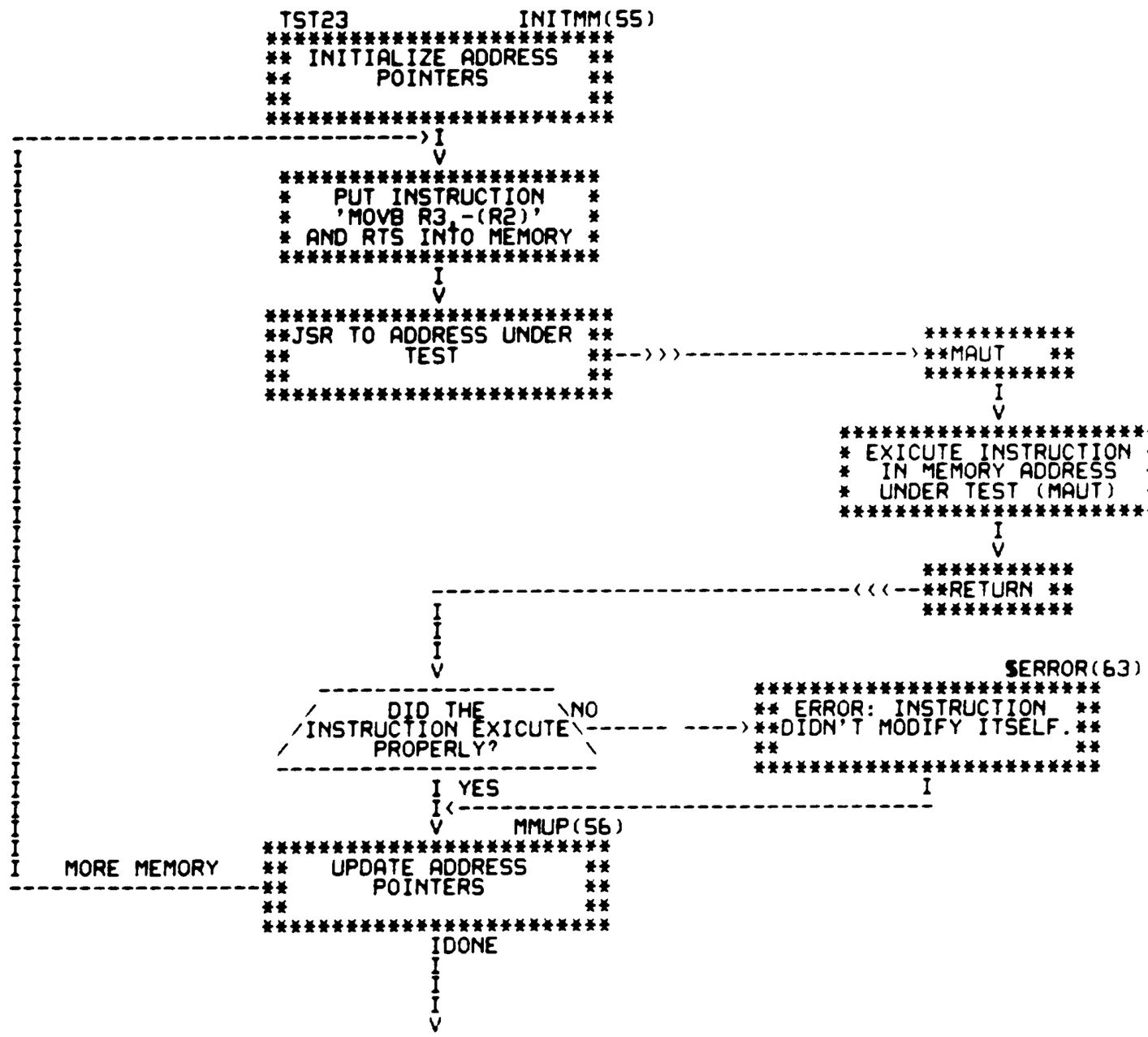

MMUP(56)
MORE MEMORY
WWPBT(35)
UPDATE ADDRESS POINTERS
IDONE
MAMF(60)
RESET ALL PARITY REGISTERS

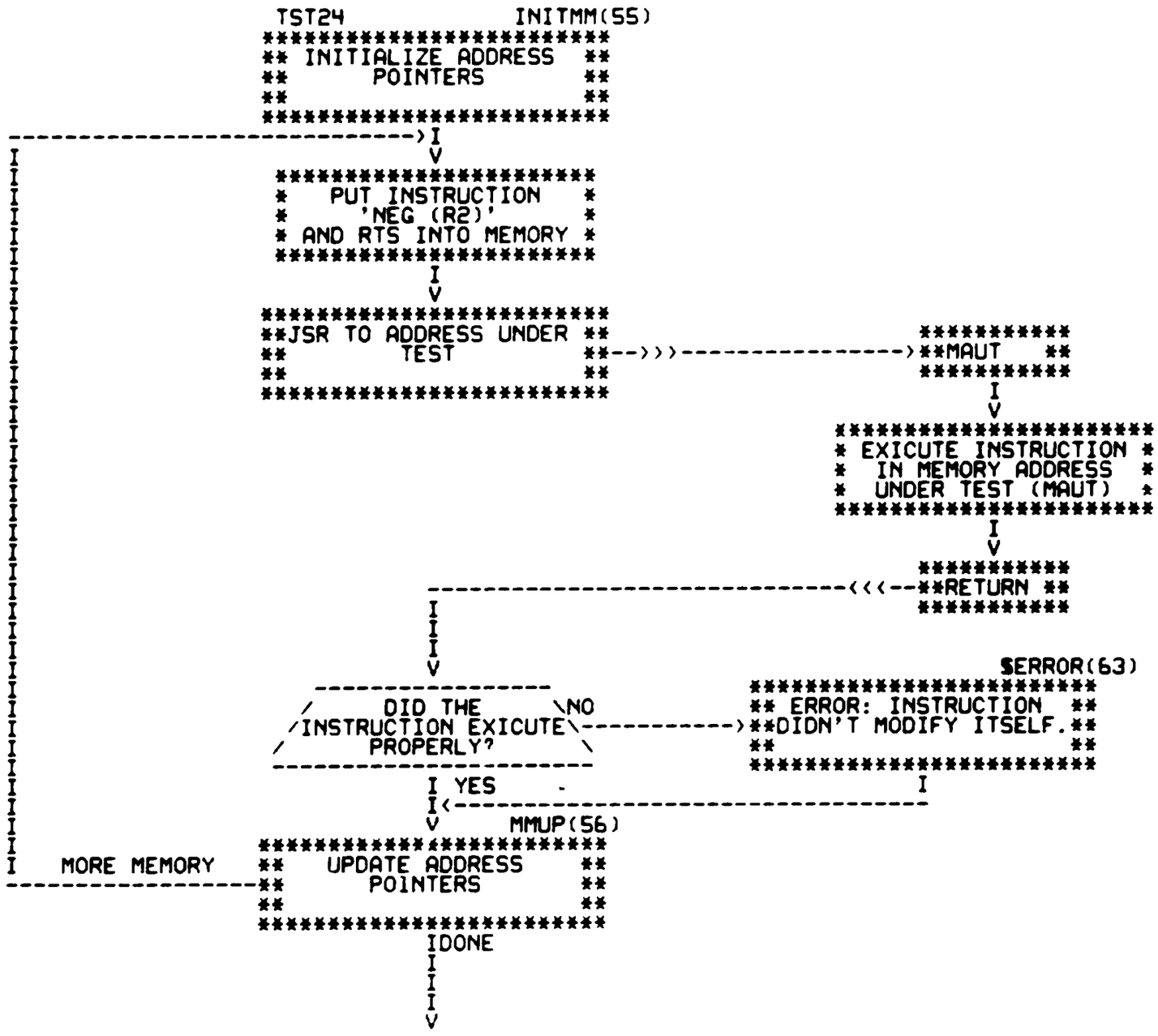
E05

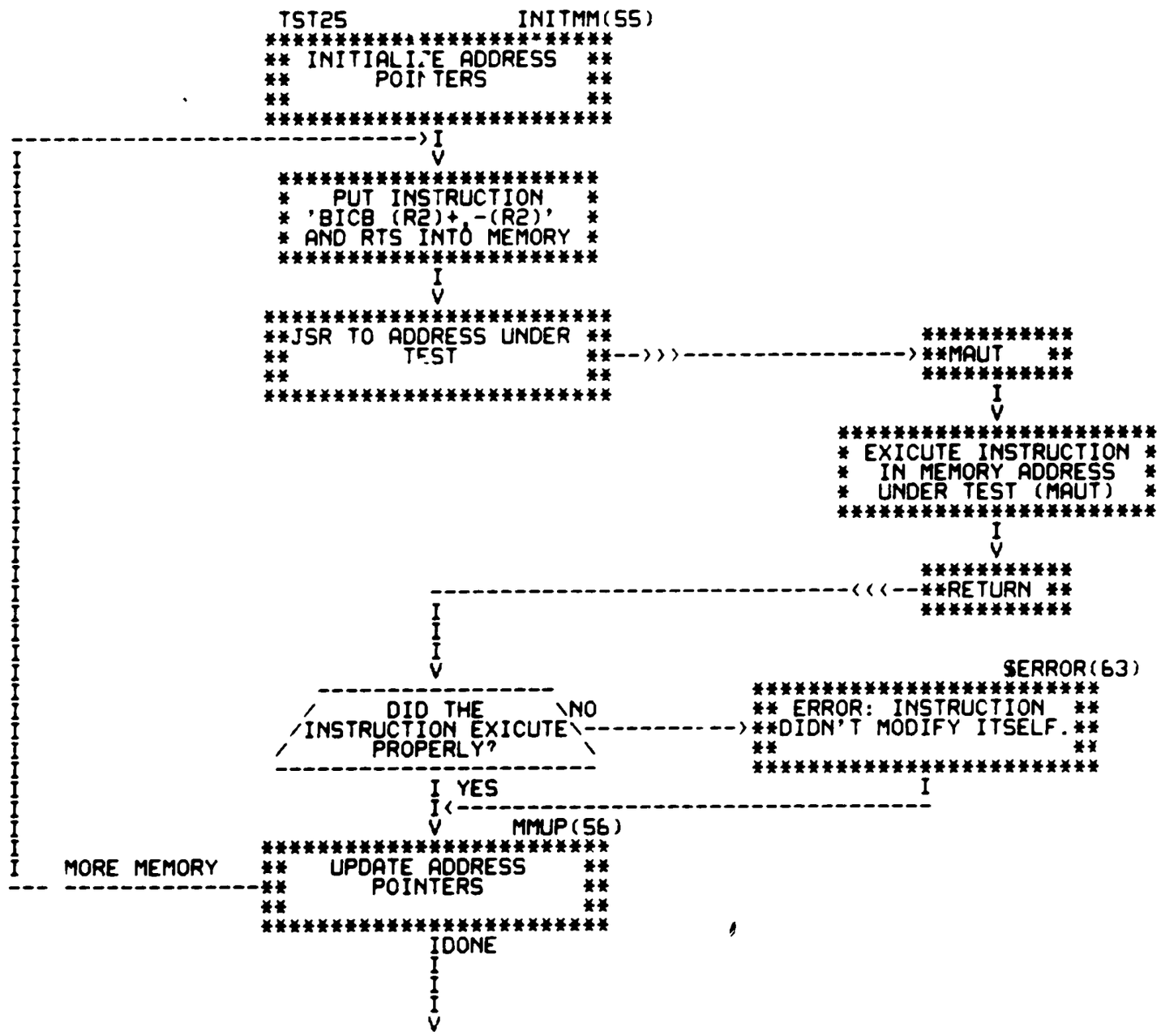

**TST20 **
TST20
I
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
COPY 2K BLOCK OF
PROGRAM CODE INTO
MEMORY UNDER TEST
DID "RANDOM" DATA COPY OK?
NO
$ERROR(63)
** ERROR: PROGRAM CODE **
** COPIED CHANGE. **
YES
MMUP(56)
MORE MEMORY
** UPDATE ADDRESS **
** POINTERS **
IDONE

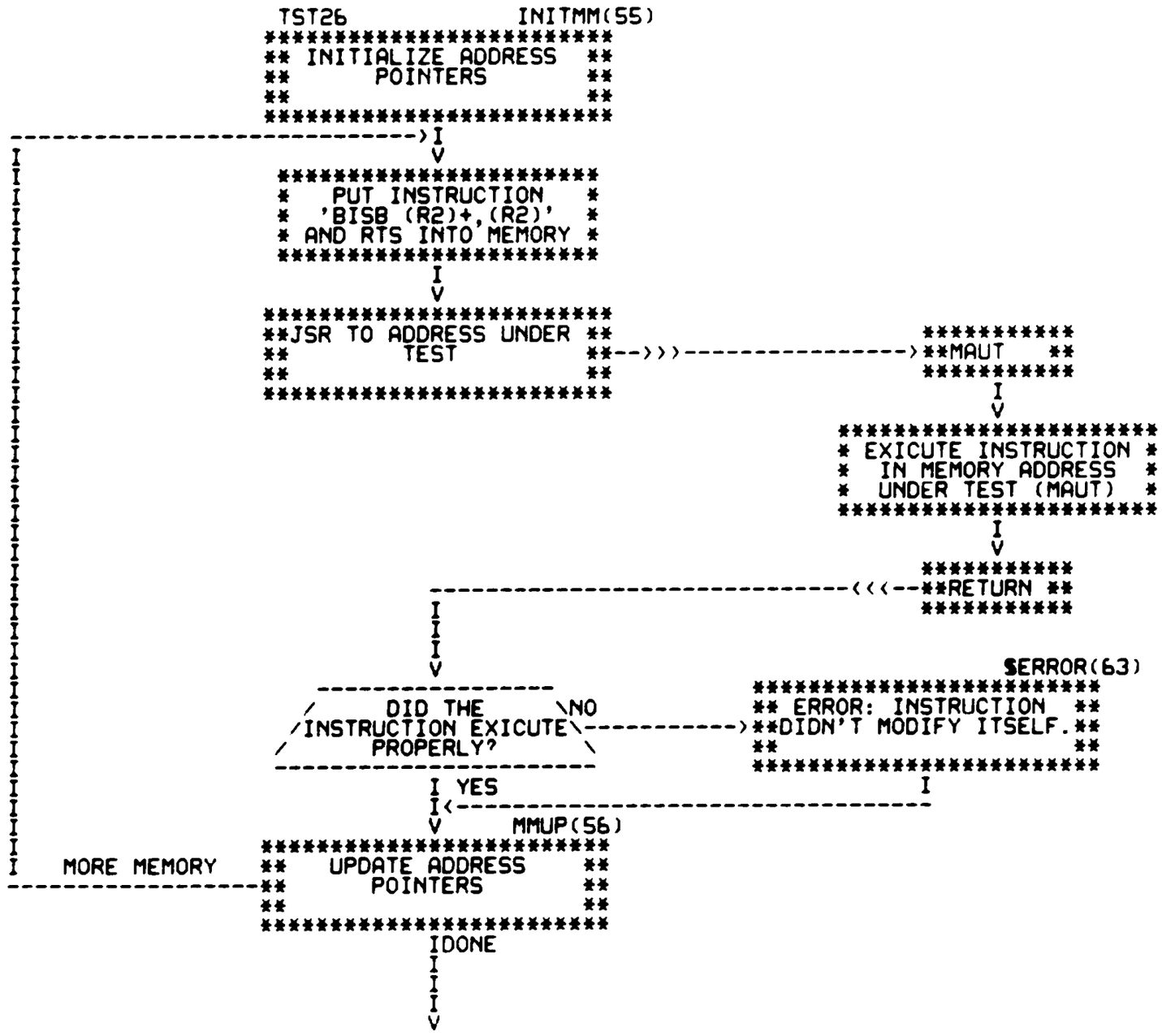

TST21
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
JSR TO ADDRESS UNDER TEST
MAUT
EXICUTE INSTRUCTION IN MEMORY ADDRESS UNDER TEST (MAUT)
RETURN
DID THE INSTRUCTION EXICUTE PROPERLY?
NO
$ERROR(63)
** ERROR: INSTRUCTION DIDN'T MODIFY ITSELF.**
YES
MMUP(56)
** UPDATE ADDRESS POINTERS **
MORE MEMORY
IDONE

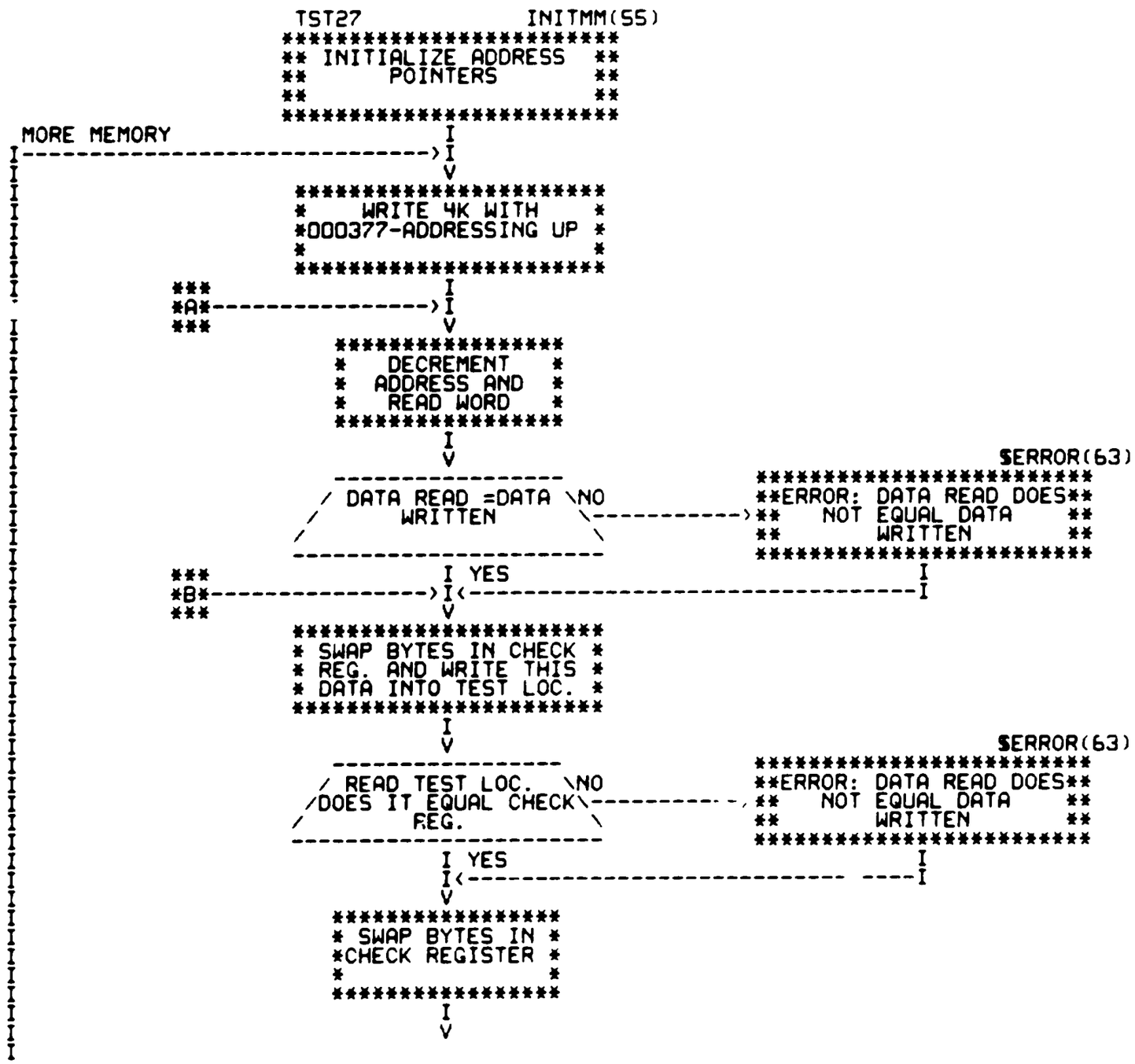

TST22
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
PUT INSTRUCTION
'MOVB R4,(R2)'
AND RTS INTO MEMORY
JSR TO ADDRESS UNDER
TEST
MAUT
EXICUTE INSTRUCTION
IN MEMORY ADDRESS
UNDER TEST (MAUT)
RETURN
DID THE INSTRUCTION EXICUTE PROPERLY?
NO
YES
$ERROR(63)
ERROR: INSTRUCTION
DIDN'T MODIFY ITSELF.
MMUP(56)
UPDATE ADDRESS POINTERS
MORE MEMORY
IDONE

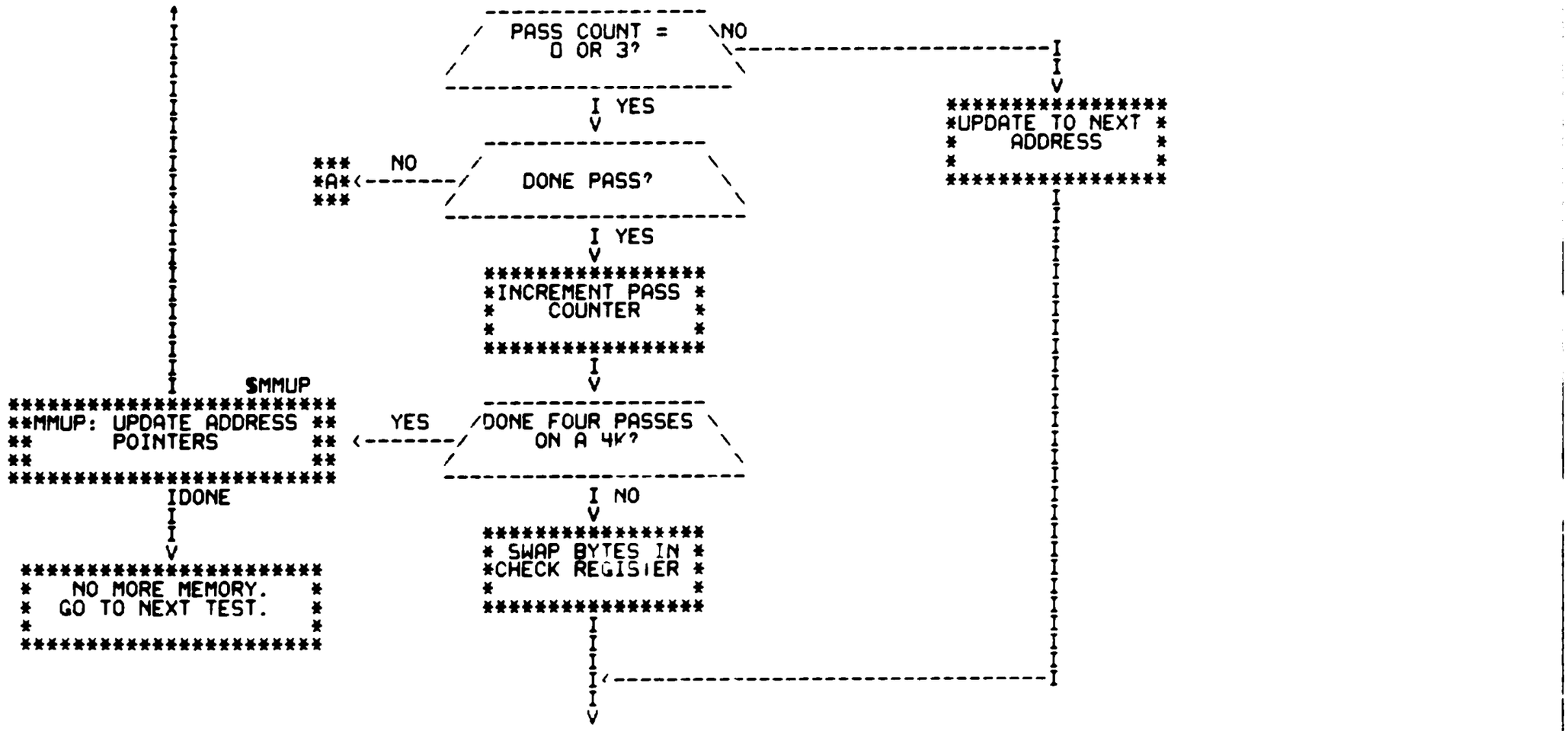

TST23
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
PUT INSTRUCTION 'MOVB R3,-(R2)' AND RTS INTO MEMORY
JSR TO ADDRESS UNDER TEST
MAUT
EXICUTE INSTRUCTION IN MEMORY ADDRESS UNDER TEST (MAUT)
RETURN
DID THE INSTRUCTION EXICUTE PROPERLY?
NO
YES
$ERROR(63)
** ERROR: INSTRUCTION DIDN'T MODIFY ITSELF. **
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
IDONE

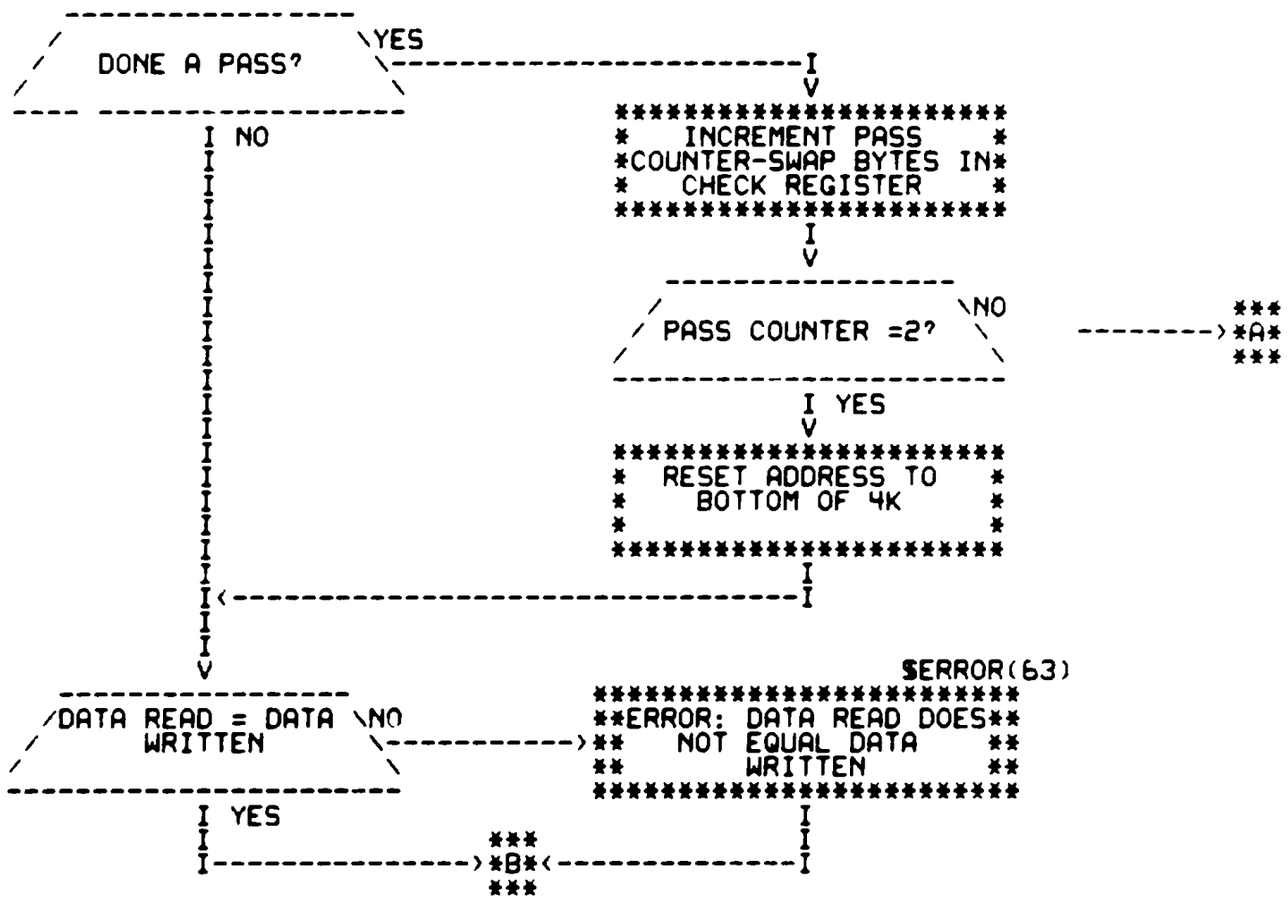

TST24
INITMM(55)
INITIALIZE ADDRESS POINTERS
PUT INSTRUCTION 'NEG (R2)' AND RTS INTO MEMORY
JSR TO ADDRESS UNDER TEST
MAUT
EXICUTE INSTRUCTION IN MEMORY ADDRESS UNDER TEST (MAUT)
RETURN
$ERROR(63)
ERROR: INSTRUCTION DIDN'T MODIFY ITSELF.
DID THE INSTRUCTION EXICUTE PROPERLY?
NO
YES
MMUP(56)
UPDATE ADDRESS POINTERS
MORE MEMORY
IDONE

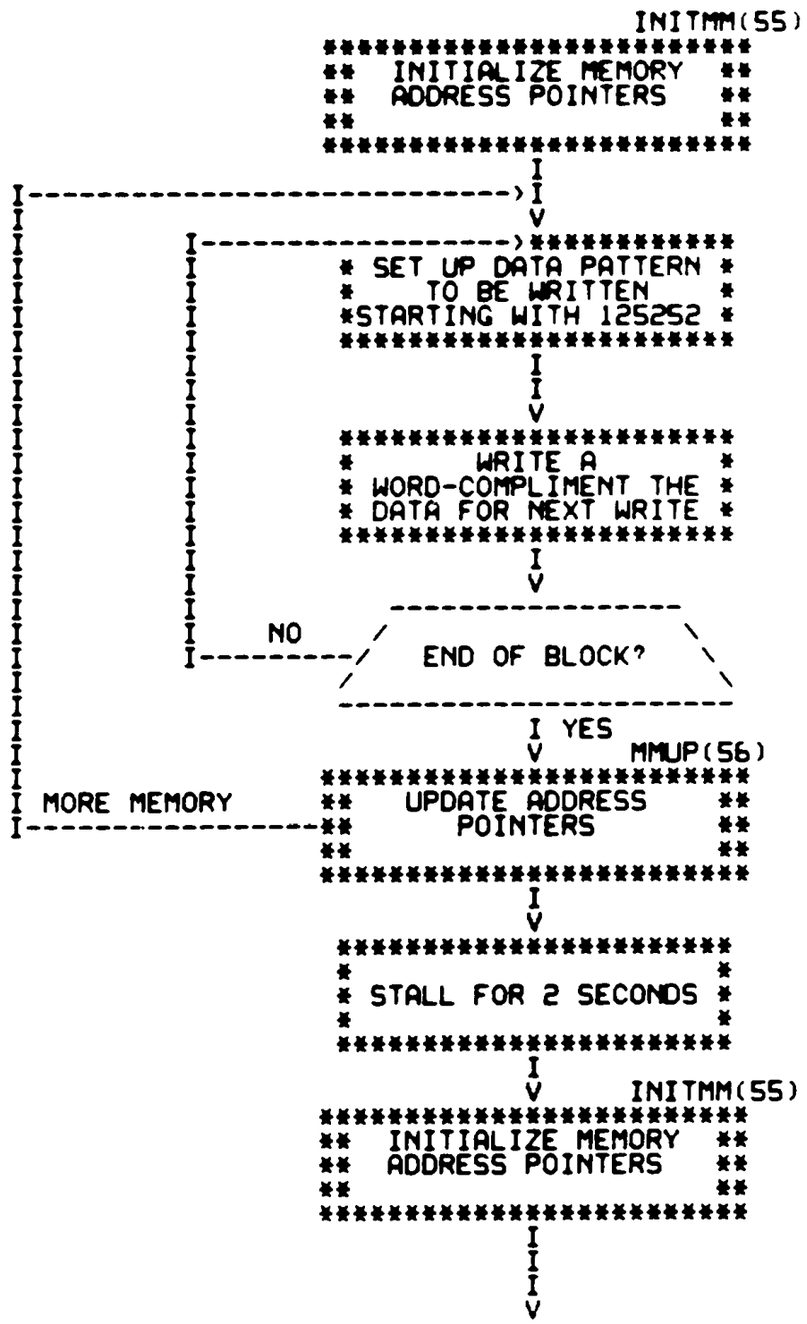

TST25
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
JSR TO ADDRESS UNDER TEST
MAUT
PUT INSTRUCTION 'BICB (R2)+,-(R2)' AND RTS INTO MEMORY
EXICUTE INSTRUCTION IN MEMORY ADDRESS UNDER TEST (MAUT)
RETURN
DID THE INSTRUCTION EXICUTE PROPERLY?
NO
$ERROR(63)
** ERROR: INSTRUCTION DIDN'T MODIFY ITSELF.**
YES
MMUP(56)
** UPDATE ADDRESS POINTERS **
MORE MEMORY
IDONE

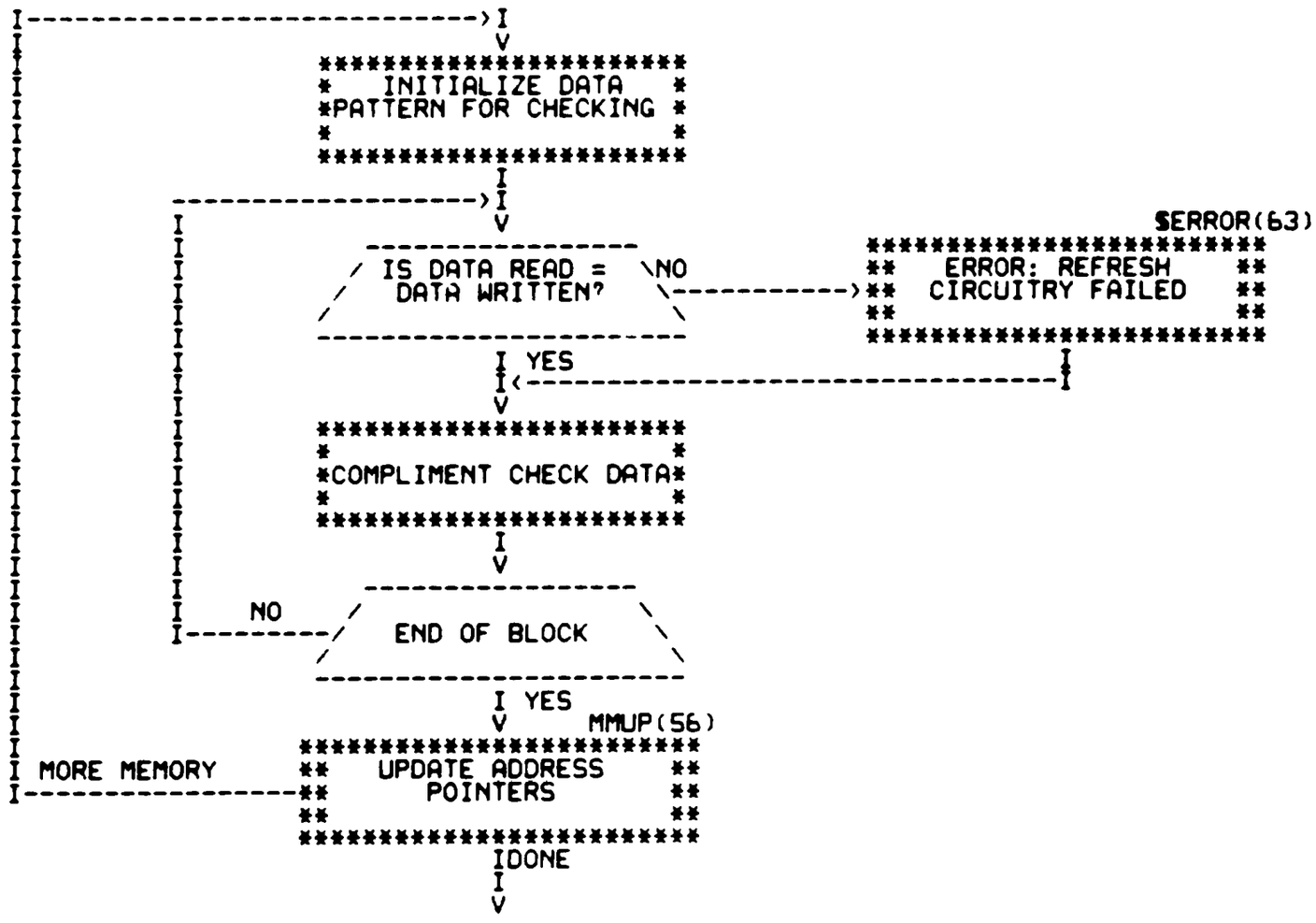

TST26
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
PUT INSTRUCTION
'BISB (R2)+,(R2)'
AND RTS INTO MEMORY
**JSR TO ADDRESS UNDER **
** TEST **
**MAUT **
EXICUTE INSTRUCTION
IN MEMORY ADDRESS
UNDER TEST (MAUT)
**RETURN **
DID THE INSTRUCTION EXICUTE PROPERLY?
NO
YES
$ERROR(63)
** ERROR: INSTRUCTION **
DIDN'T MODIFY ITSELF.
MMUP(56)
UPDATE ADDRESS POINTERS
MORE MEMORY
DONE

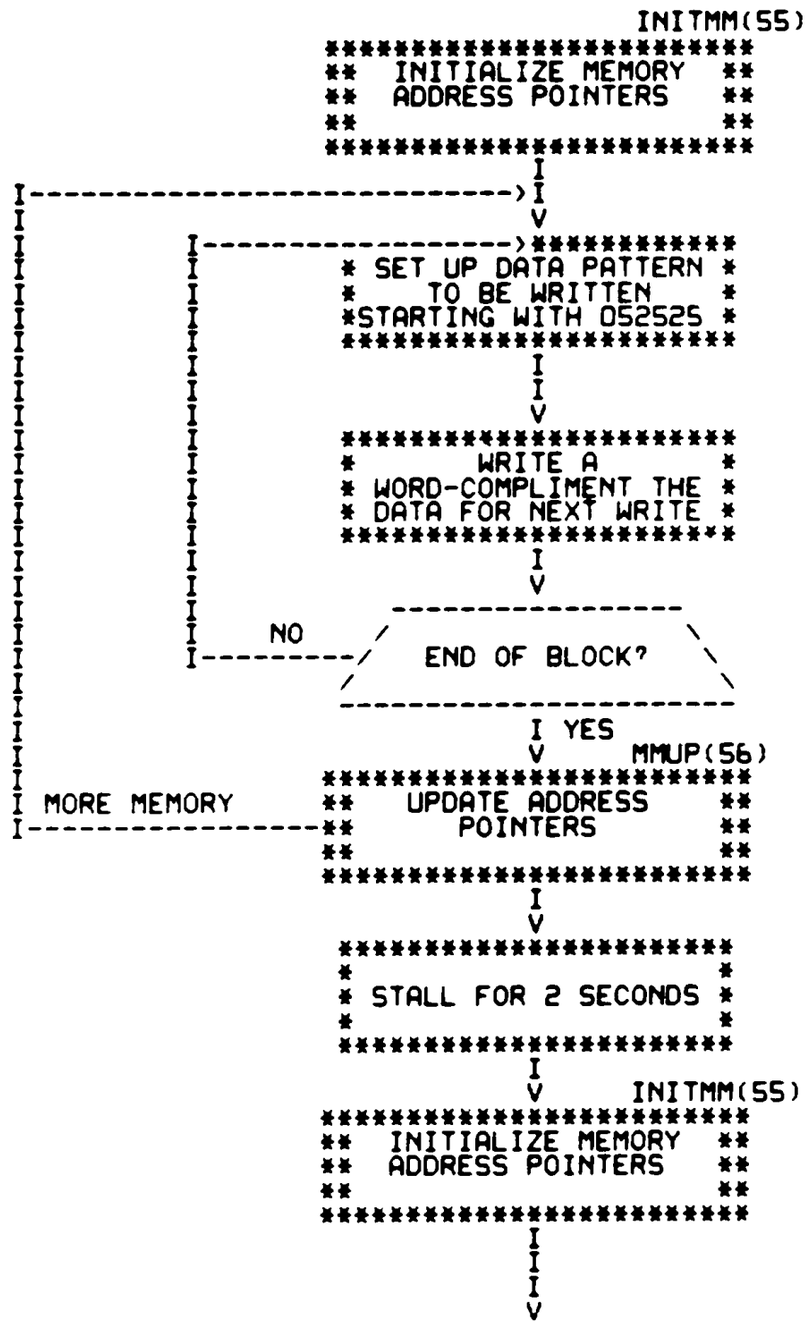

TST27
INITMM(55)
** INITIALIZE ADDRESS **
** POINTERS **
MORE MEMORY
WRITE 4K WITH
*000377-ADDRESSING UP *
A
DECREMENT
ADDRESS AND
READ WORD
DATA READ =DATA WRITTEN
NO
$ERROR(63)
ERROR: DATA READ DOES
** NOT EQUAL DATA **
** WRITTEN **
YES
B
SWAP BYTES IN CHECK
REG. AND WRITE THIS
DATA INTO TEST LOC.
READ TEST LOC. DOES IT EQUAL CHECK REG.
NO
$ERROR(63)
ERROR: DATA READ DOES
** NOT EQUAL DATA **
** WRITTEN **
YES
SWAP BYTES IN
*CHECK REGISTER *

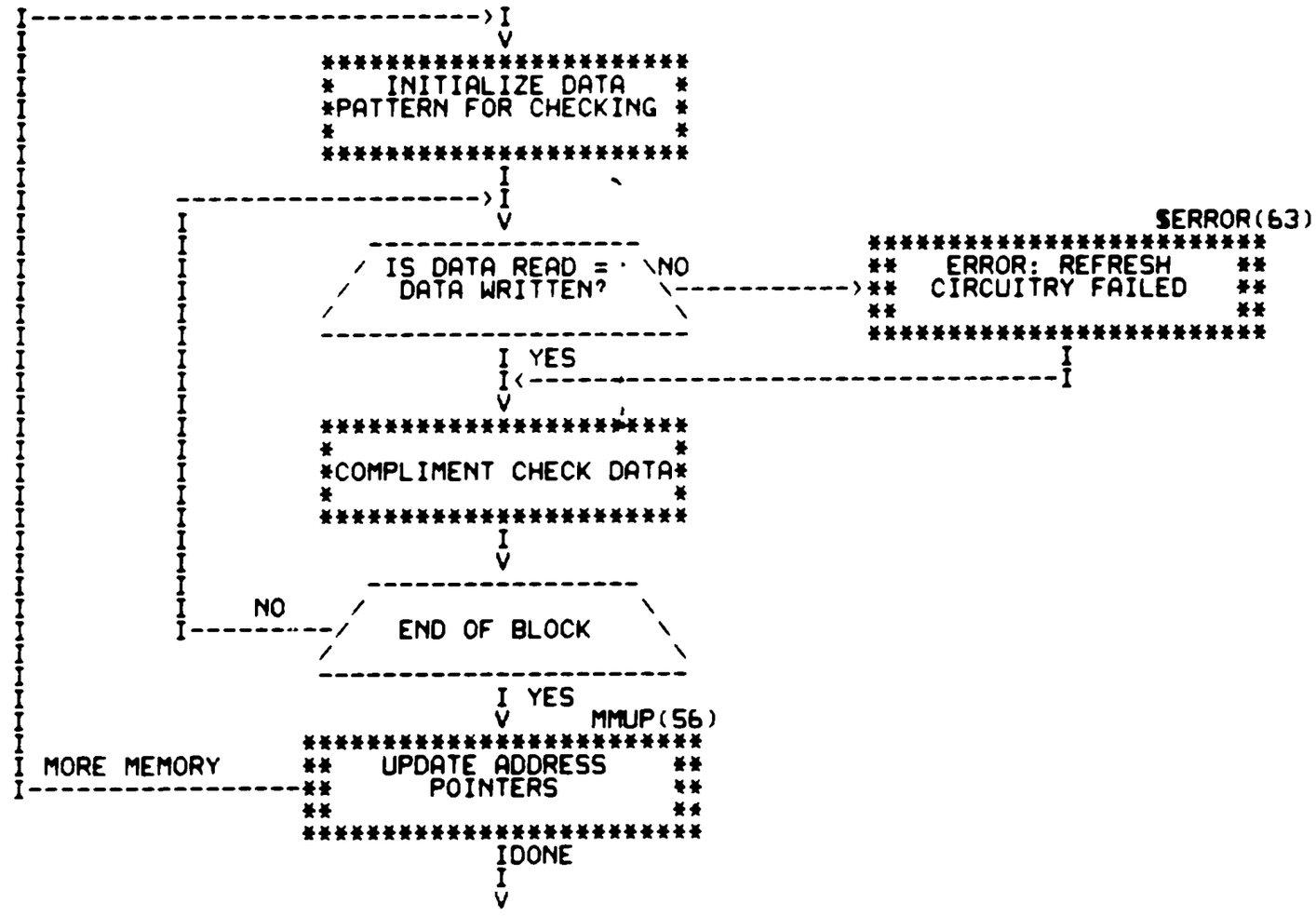

PASS COUNT = 0 OR 3?
NO
YES
DONE PASS?
NO
YES
DONE FOUR PASSES ON A 4K?
YES
NO
UPDATE TO NEXT ADDRESS
INCREMENT PASS COUNTER
SWAP BYTES IN CHECK REGISTER
$MMUP
MMUP: UPDATE ADDRESS POINTERS
IDONE
NO MORE MEMORY. GO TO NEXT TEST.

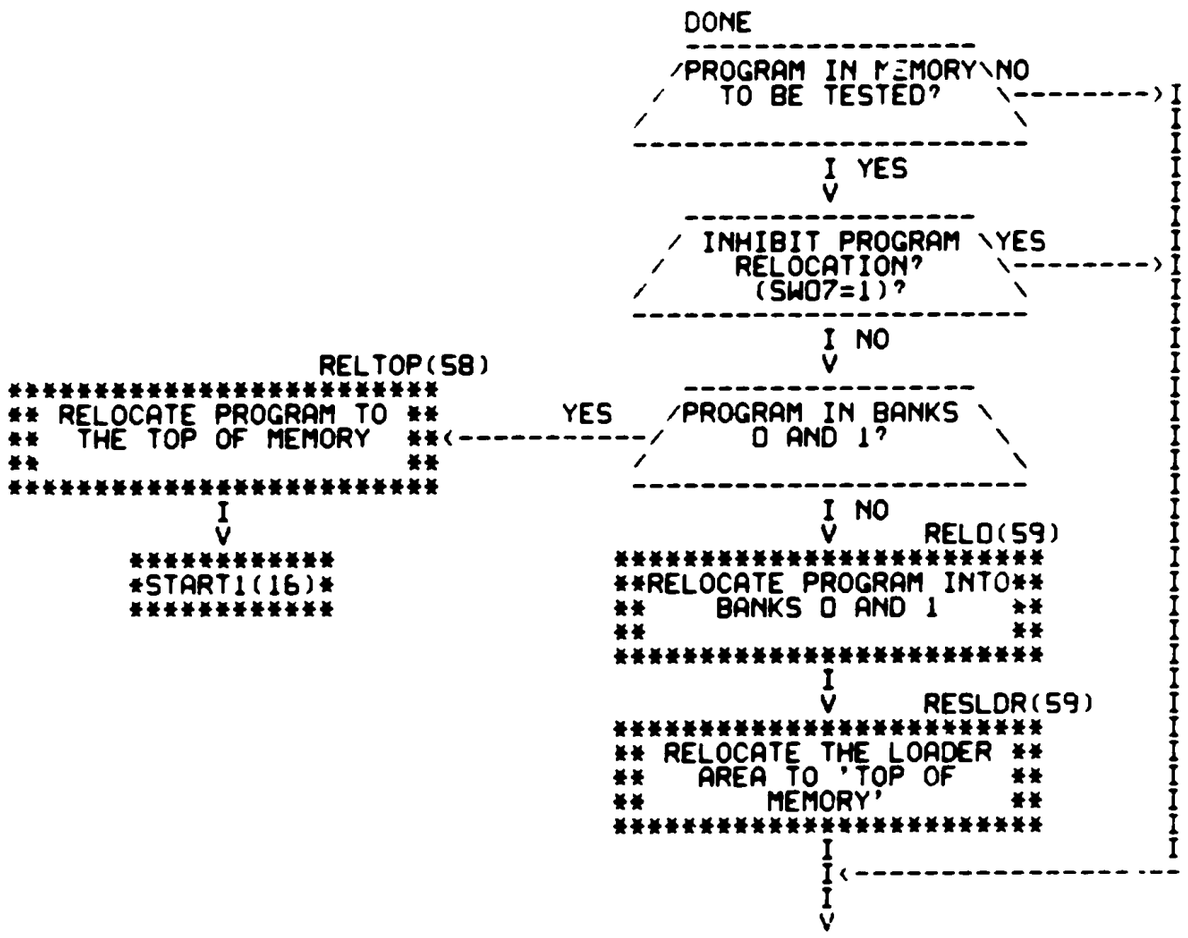

DONE A PASS?
YES
NO
INCREMENT PASS
COUNTER-SWAP BYTES IN
CHECK REGISTER
PASS COUNTER =2?
NO
YES
A
RESET ADDRESS TO
BOTTOM OF 4K
B
DATA READ = DATA
WRITTEN
NO
YES
SERROR(63)
**ERROR: DATA READ DOES
NOT EQUAL DATA
WRITTEN

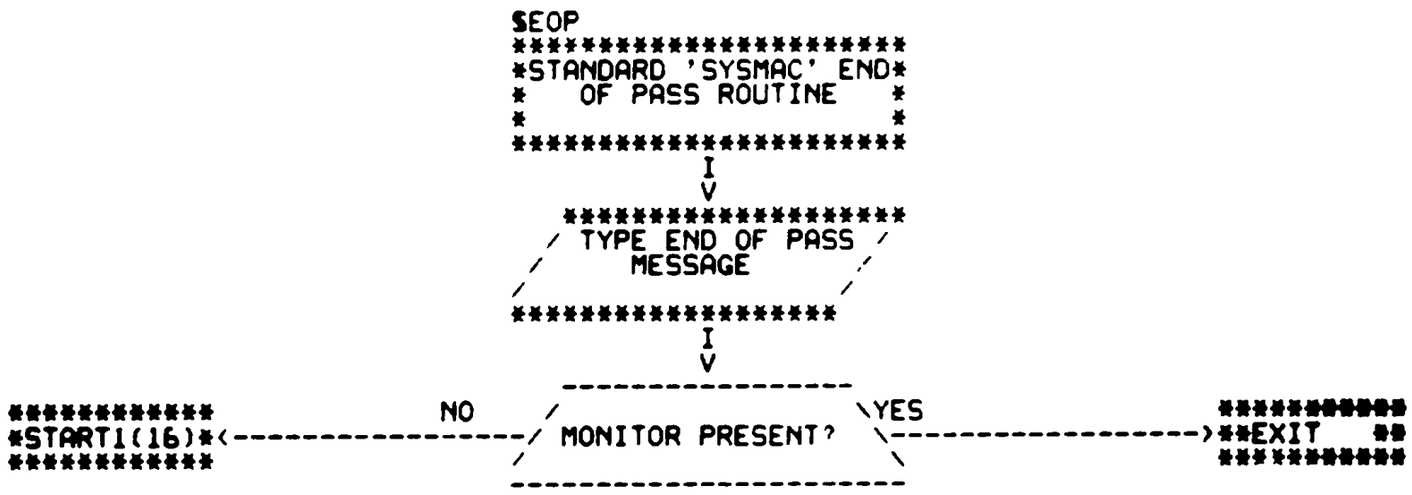

INITMM(55)
INITIALIZE MEMORY ADDRESS POINTERS
SET UP DATA PATTERN TO BE WRITTEN STARTING WITH 125252
WRITE A WORD-COMPLIMENT THE DATA FOR NEXT WRITE
NO
END OF BLOCK?
I YES
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
STALL FOR 2 SECONDS
INITMM(55)
INITIALIZE MEMORY ADDRESS POINTERS

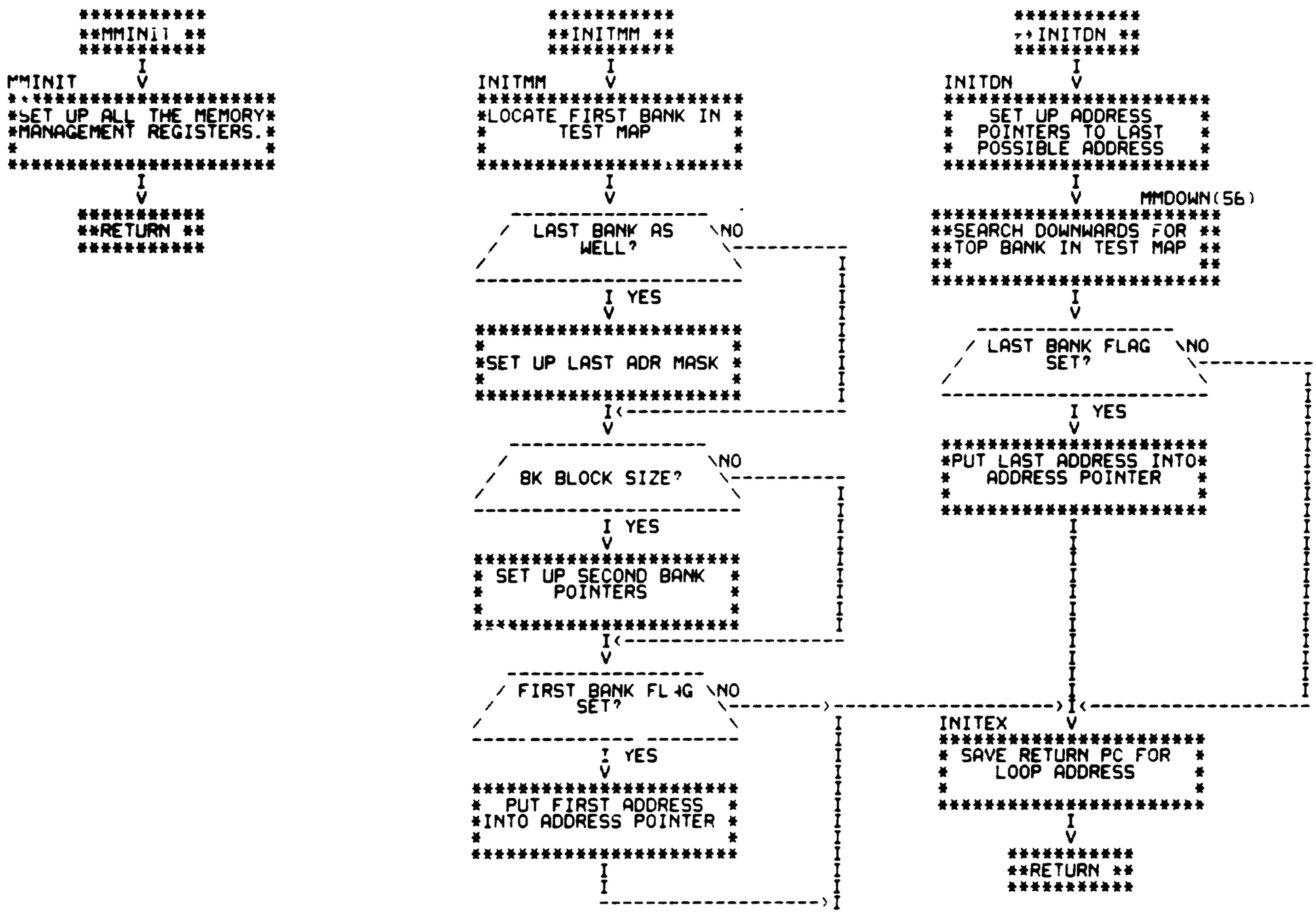

INITIALIZE DATA PATTERN FOR CHECKING
IS DATA READ = DATA WRITTEN?
NO
$ERROR(63)
ERROR: REFRESH CIRCUITRY FAILED
YES
COMPLIMENT CHECK DATA
END OF BLOCK
NO
YES
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
IDONE

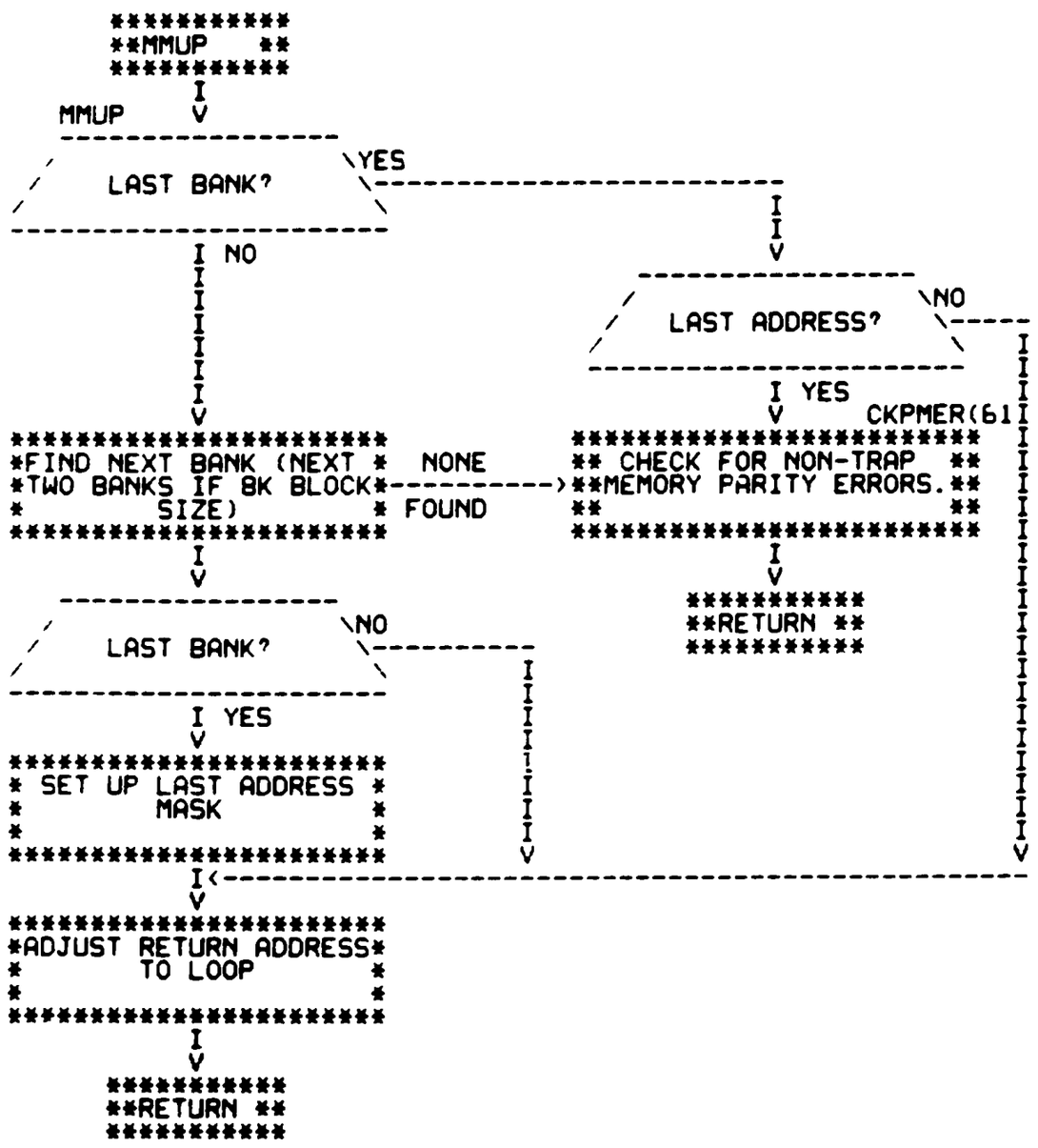

INITMM(55)
INITIALIZE MEMORY ADDRESS POINTERS
SET UP DATA PATTERN TO BE WRITTEN STARTING WITH 052525
WRITE A WORD-COMPLIMENT THE DATA FOR NEXT WRITE
NO
END OF BLOCK?
YES
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
STALL FOR 2 SECONDS
INITMM(55)
INITIALIZE MEMORY ADDRESS POINTERS

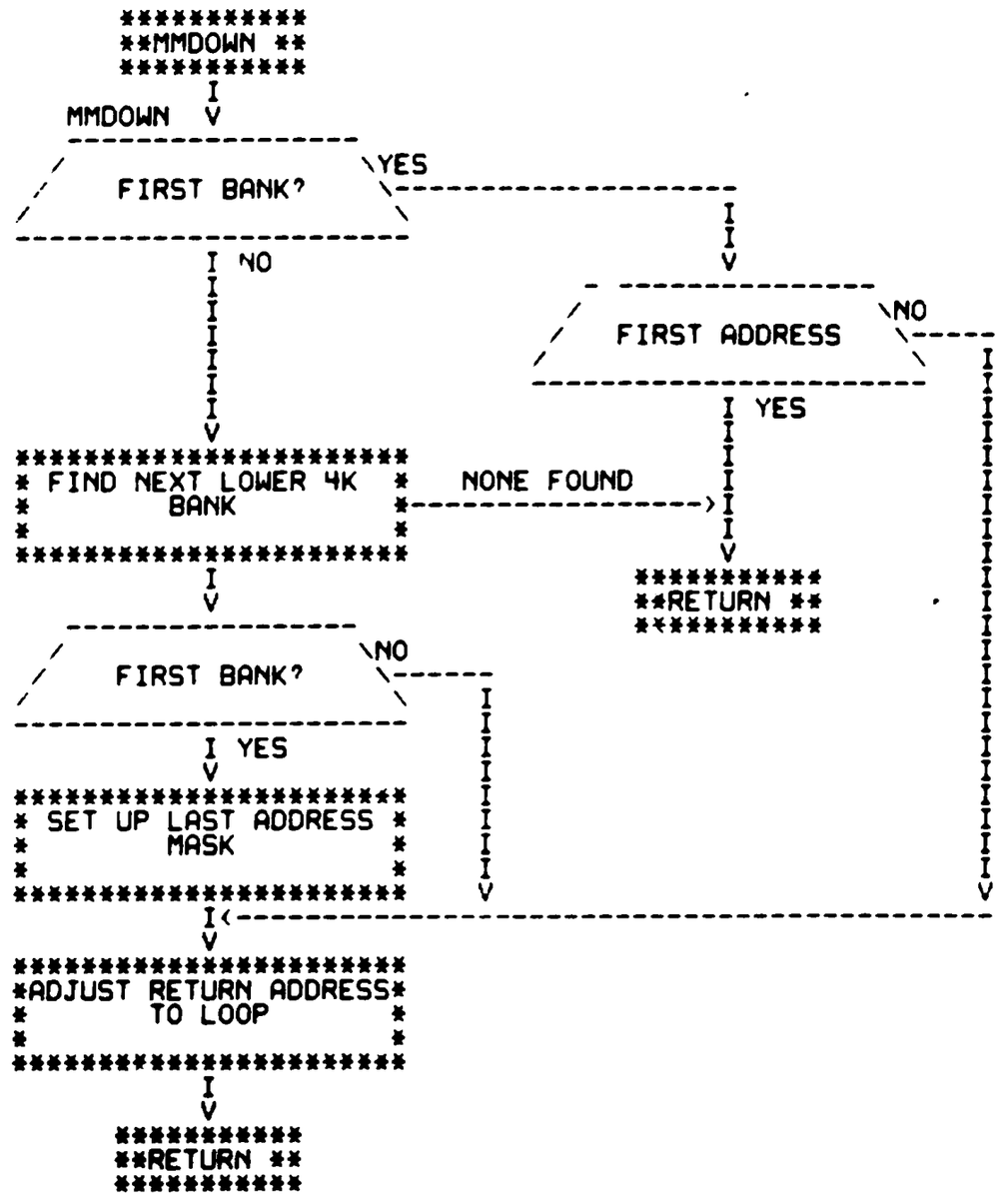

INITIALIZE DATA PATTERN FOR CHECKING
IS DATA READ = DATA WRITTEN?
NO
$ERROR(63)
ERROR: REFRESH CIRCUITRY FAILED
YES
COMPLIMENT CHECK DATA
END OF BLOCK
NO
YES
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
DONE

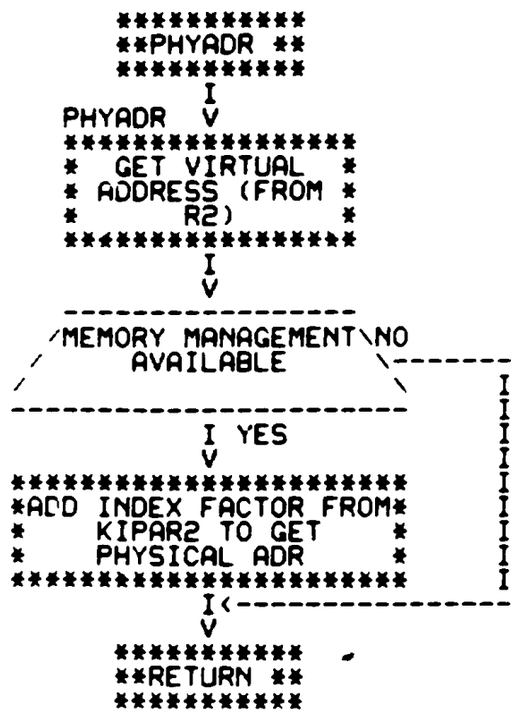

DONE
PROGRAM IN MEMORY TO BE TESTED?
NO
YES
INHIBIT PROGRAM RELOCATION? (SW07=1)?
YES
NO
PROGRAM IN BANKS 0 AND 1?
YES
NO
RELTOP(58)
** RELOCATE PROGRAM TO THE TOP OF MEMORY **
START1(16)
RELO(59)
RELOCATE PROGRAM INTO BANKS 0 AND 1
RESLDR(59)
** RELOCATE THE LOADER AREA TO 'TOP OF MEMORY' **

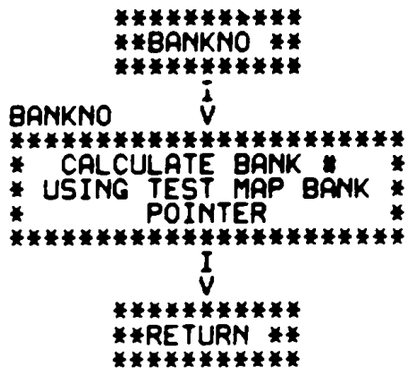

$EOP
STANDARD 'SYSMAC' END
* OF PASS ROUTINE *
TYPE END OF PASS MESSAGE
MONITOR PRESENT?
NO
YES
START1(16)
**EXIT **

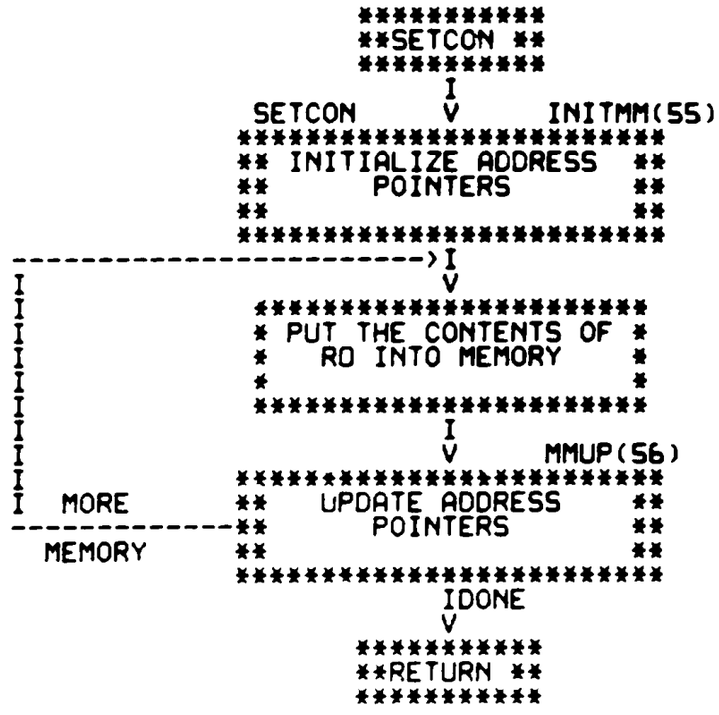

MMINIT
SET UP ALL THE MEMORY MANAGEMENT REGISTERS.
RETURN
INITMM
LOCATE FIRST BANK IN TEST MAP
LAST BANK AS WELL?
NO
YES
SET UP LAST ADR MASK
8K BLOCK SIZE?
NO
YES
SET UP SECOND BANK POINTERS
FIRST BANK FLAG SET?
NO
YES
PUT FIRST ADDRESS INTO ADDRESS POINTER
INITDN
SET UP ADDRESS POINTERS TO LAST POSSIBLE ADDRESS
MMDOWN(56)
SEARCH DOWNWARDS FOR TOP BANK IN TEST MAP
LAST BANK FLAG SET?
NO
YES
PUT LAST ADDRESS INTO ADDRESS POINTER
INITEX
SAVE RETURN PC FOR LOOP ADDRESS
RETURN

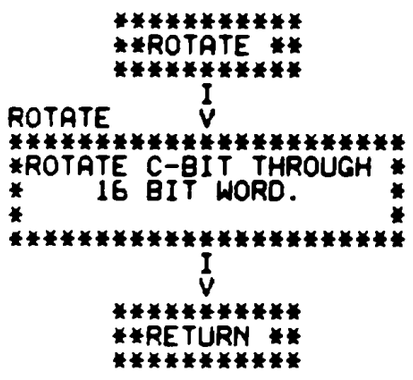

**MMUP **
MMUP
LAST BANK?
YES
NO
LAST ADDRESS?
YES
NO
CKPMER(61
*FIND NEXT BANK (NEXT *TWO BANKS IF 8K BLOCK* SIZE)
NONE FOUND
** CHECK FOR NON-TRAP **MEMORY PARITY ERRORS.**
**RETURN **
LAST BANK?
YES
NO
* SET UP LAST ADDRESS * MASK
ADJUST RETURN ADDRESS TO LOOP
**RETURN **

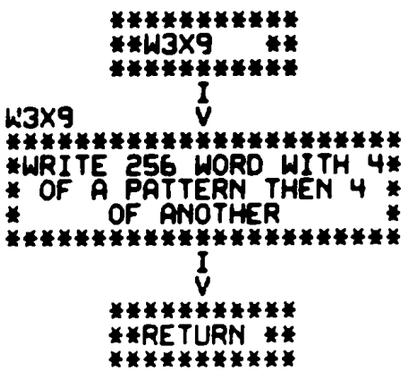

**MMDOWN **
MMDOWN
FIRST BANK?
YES
NO
FIRST ADDRESS
YES
NO
* FIND NEXT LOWER 4K BANK
NONE FOUND
**RETURN **
FIRST BANK?
YES
NO
* SET UP LAST ADDRESS * MASK
ADJUST RETURN ADDRESS TO LOOP
**RETURN **

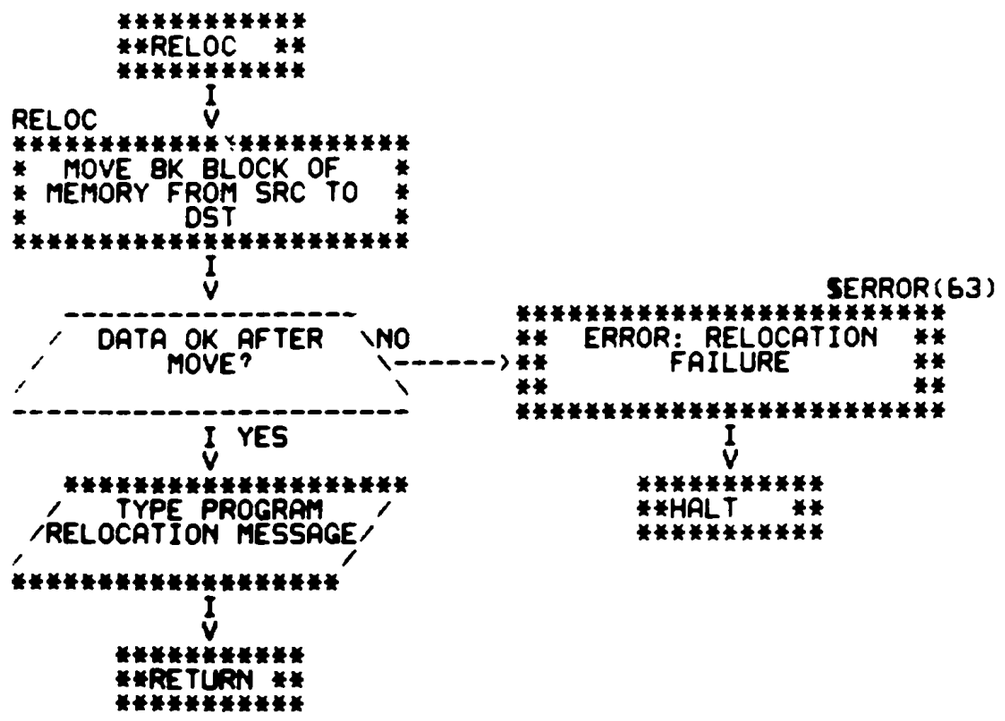

**PHYADR **
PHYADR
GET VIRTUAL ADDRESS (FROM R2)
MEMORY MANAGEMENT AVAILABLE
NO
YES
ADD INDEX FACTOR FROM KIPAR2 TO GET PHYSICAL ADR
**RETURN **

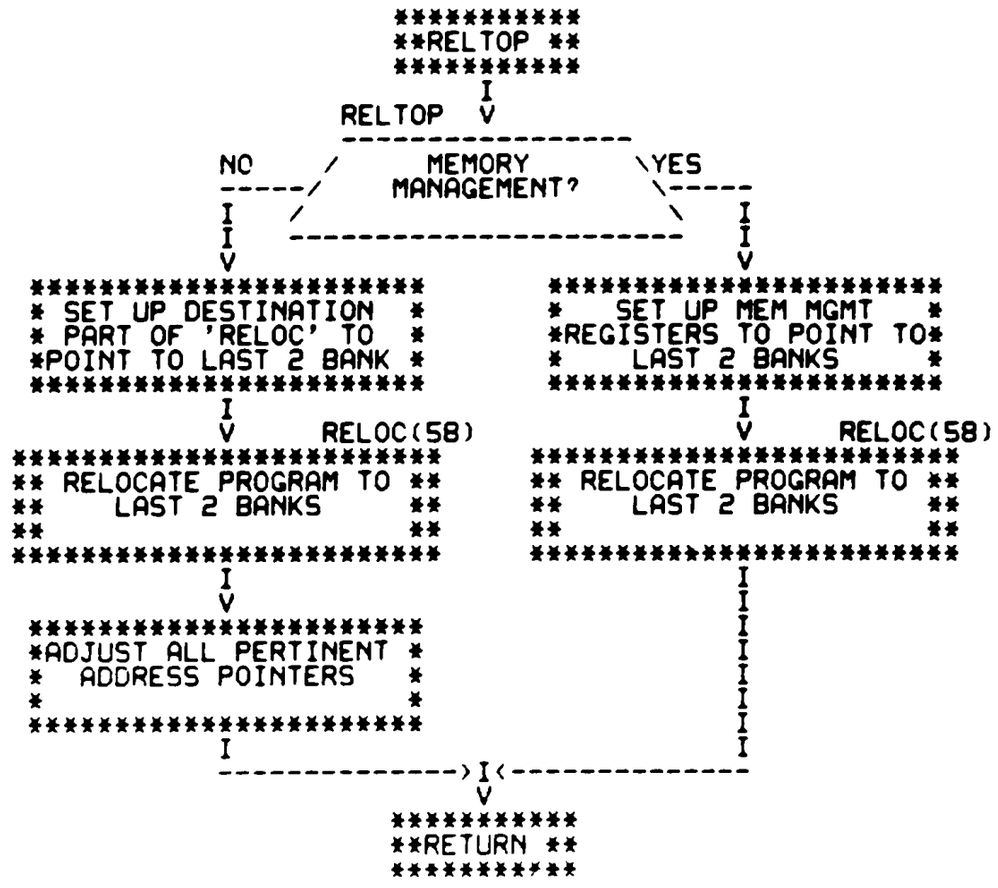

**BANKNO **
BANKNO
CALCULATE BANK # USING TEST MAP BANK POINTER
**RETURN **

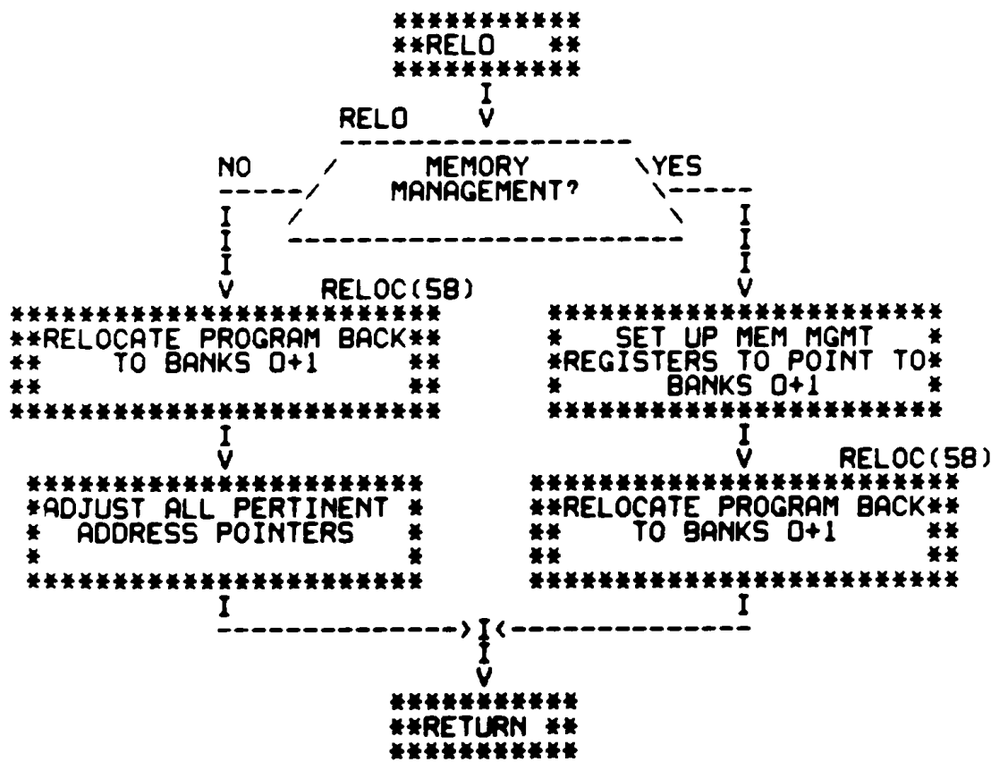

**SETCON **
SETCON
INITMM(55)
INITIALIZE ADDRESS POINTERS
PUT THE CONTENTS OF R0 INTO MEMORY
MMUP(56)
MORE MEMORY
UPDATE ADDRESS POINTERS
IDONE
**RETURN **

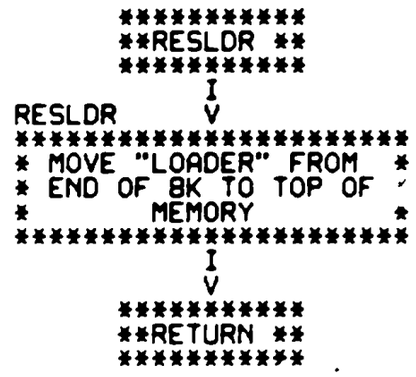

**ROTATE **
ROTATE
ROTATE C-BIT THROUGH 16 BIT WORD.
**RETURN **

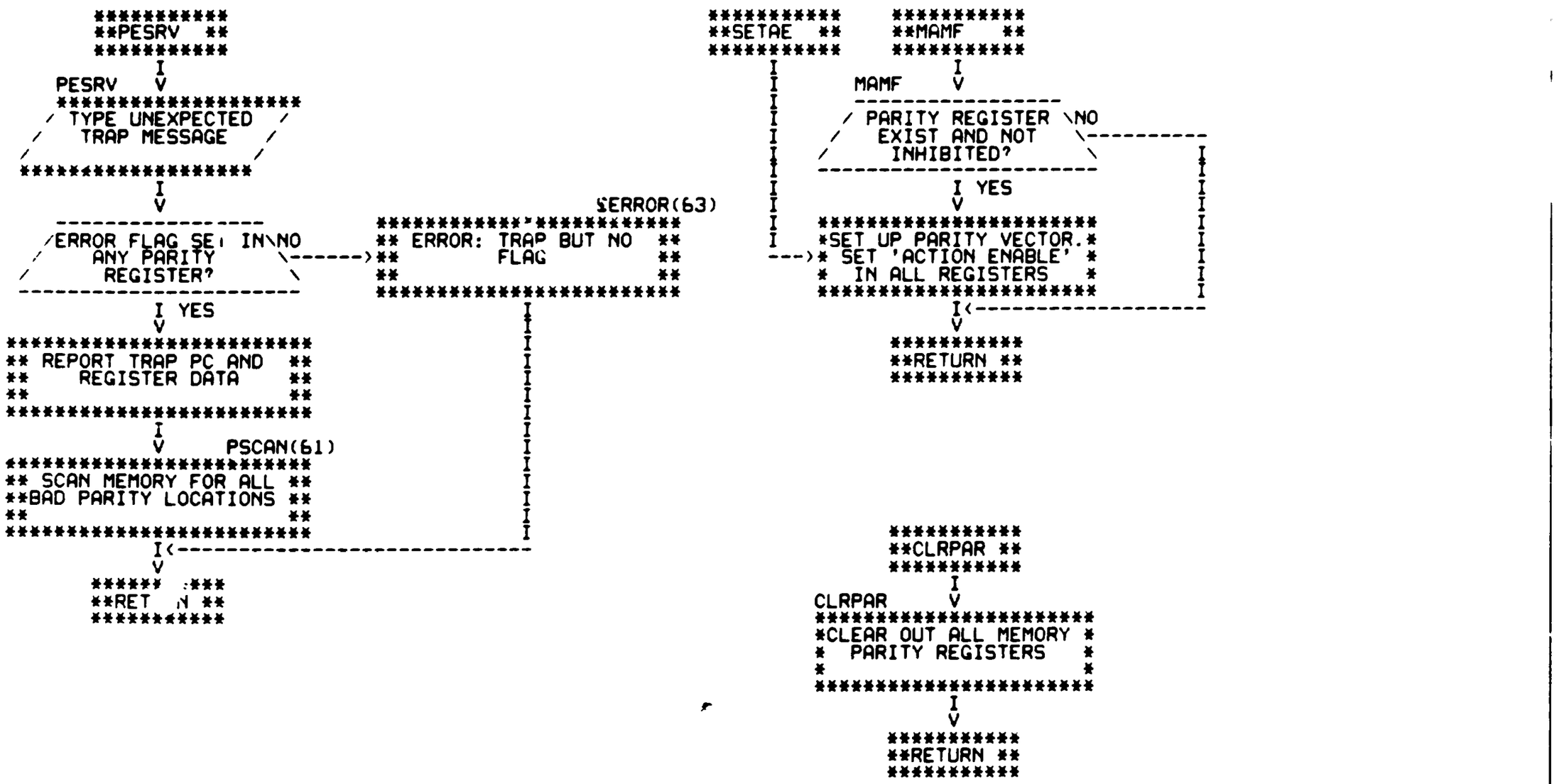

**W3X9 **
W3X9
WRITE 256 WORD WITH 4 OF A PATTERN THEN 4 OF ANOTHER
**RETURN **

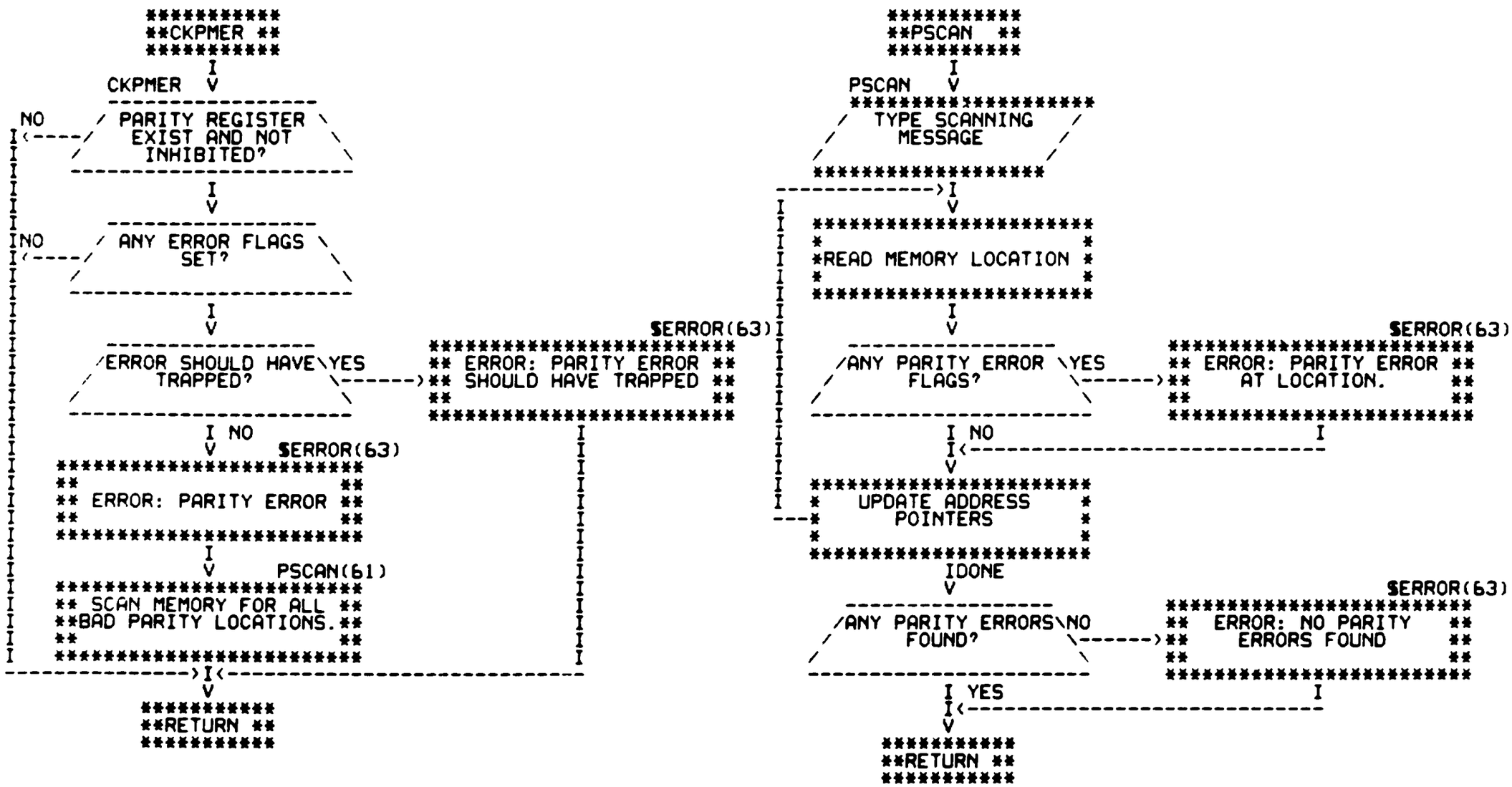

**RELOC **
RELOC
MOVE BK BLOCK OF MEMORY FROM SRC TO DST
DATA OK AFTER MOVE?
NO
$ERROR(63)
** ERROR: RELOCATION FAILURE **
**HALT **
YES
TYPE PROGRAM RELOCATION MESSAGE
**RETURN **

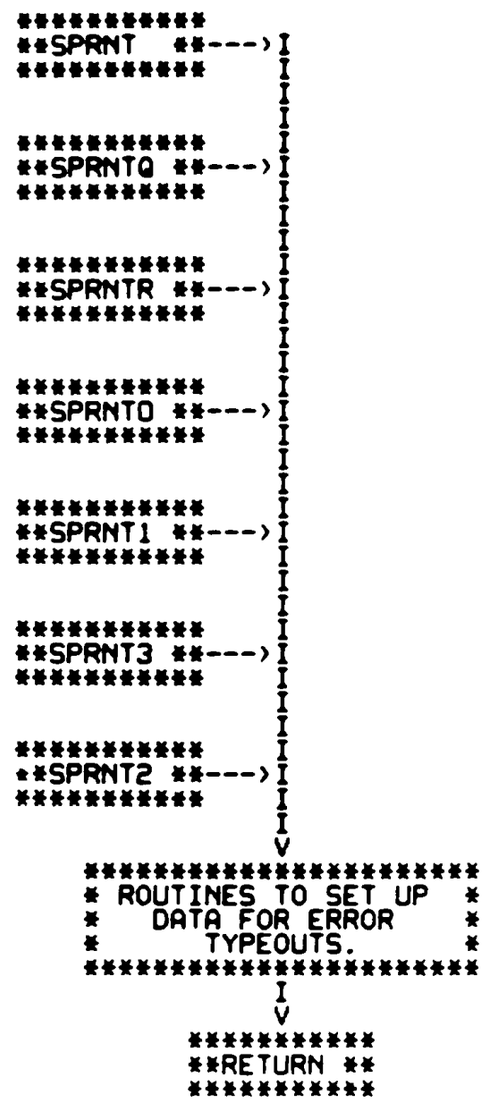

**RELTOP **
RELTOP
MEMORY MANAGEMENT?
NO
YES
SET UP DESTINATION PART OF 'RELOC' TO POINT TO LAST 2 BANK
SET UP MEM MGMT REGISTERS TO POINT TO LAST 2 BANKS
RELOC(58)
RELOCATE PROGRAM TO LAST 2 BANKS
RELOC(58)
RELOCATE PROGRAM TO LAST 2 BANKS
ADJUST ALL PERTINENT ADDRESS POINTERS
**RETURN **

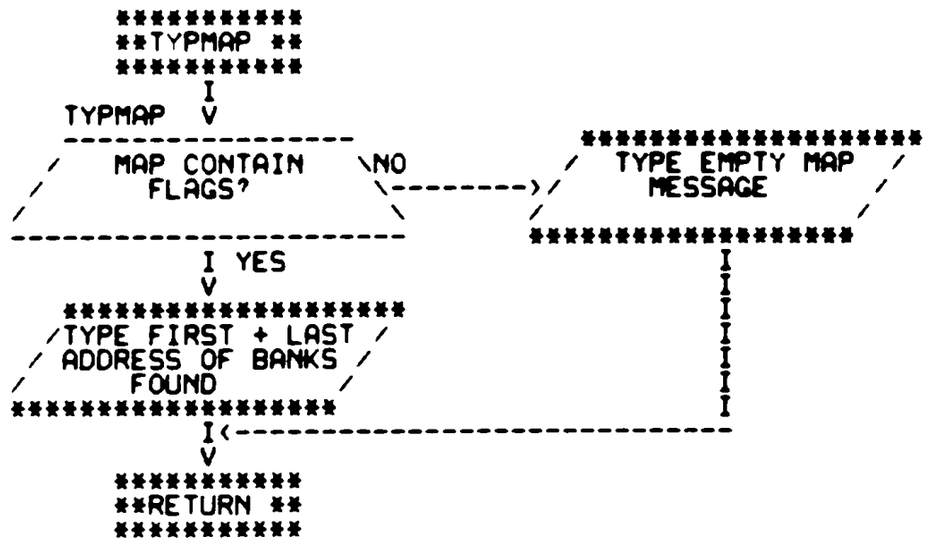

**RELO **
RELO
MEMORY MANAGEMENT?
NO
YES
RELOC(58)
RELOCATE PROGRAM BACK
** TO BANKS 0+1 **
*ADJUST ALL PERTINENT *
* ADDRESS POINTERS *
* SET UP MEM MGMT *
REGISTERS TO POINT TO
* BANKS 0+1 *
RELOC(58)
RELOCATE PROGRAM BACK
** TO BANKS 0+1 **
**RETURN **

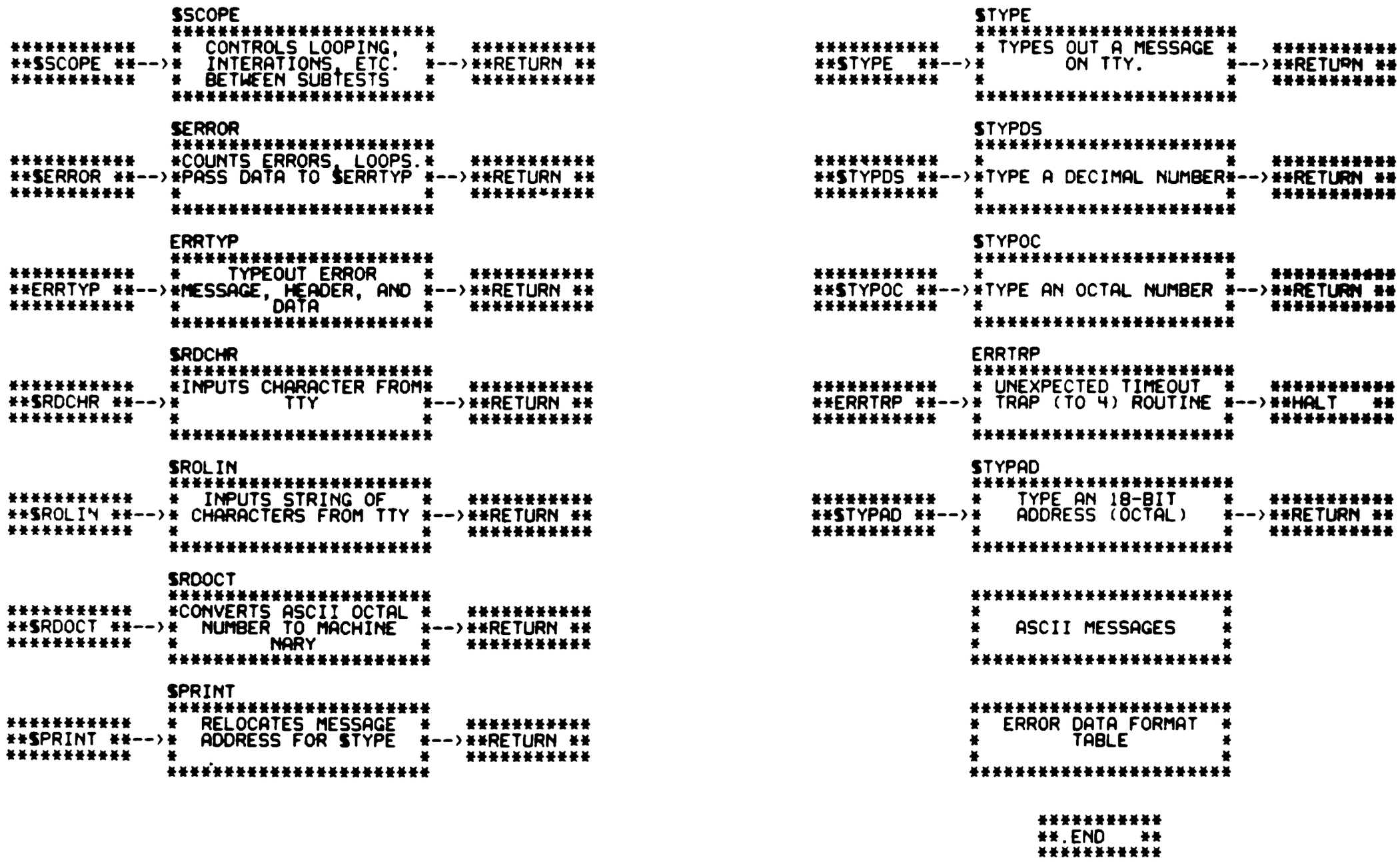

**RESLDR **
RESLDR
* MOVE "LOADER" FROM *
* END OF 8K TO TOP OF *
* MEMORY *
**RETURN **


**PESRV **
PESRV
TYPE UNEXPECTED TRAP MESSAGE
ERROR FLAG SET IN ANY PARITY REGISTER?
NO
YES
** REPORT TRAP PC AND REGISTER DATA **
PSCAN(61)
** SCAN MEMORY FOR ALL **BAD PARITY LOCATIONS **
**RET N **
$ERROR(63)
** ERROR: TRAP BUT NO FLAG **
**SETAE **
**MAMF **
MAMF
PARITY REGISTER EXIST AND NOT INHIBITED?
NO
YES
*SET UP PARITY VECTOR. SET 'ACTION ENABLE' IN ALL REGISTERS *
**RETURN **
**CLRPAR **
CLRPAR
*CLEAR OUT ALL MEMORY PARITY REGISTERS *
**RETURN **


**CKPMER **
CKPMER
NO
PARITY REGISTER EXIST AND NOT INHIBITED?
NO
ANY ERROR FLAGS SET?
ERROR SHOULD HAVE TRAPPED?
YES
$ERROR(63)
** ERROR: PARITY ERROR **
** SHOULD HAVE TRAPPED **
I NO
$ERROR(63)
** ERROR: PARITY ERROR **
PSCAN(61)
** SCAN MEMORY FOR ALL **
BAD PARITY LOCATIONS.
**RETURN **
**PSCAN **
PSCAN
TYPE SCANNING MESSAGE
*READ MEMORY LOCATION *
ANY PARITY ERROR FLAGS?
YES
$ERROR(63)
** ERROR: PARITY ERROR **
** AT LOCATION. **
I NO
UPDATE ADDRESS POINTERS
IDONE
ANY PARITY ERRORS FOUND?
NO
$ERROR(63)
** ERROR: NO PARITY **
** ERRORS FOUND **
I YES
**RETURN **


**SPRNT **
**SPRNTQ **
**SPRNTR **
**SPRNTO **
**SPRNT1 **
**SPRNT3 **
**SPRNT2 **
* ROUTINES TO SET UP *
* DATA FOR ERROR *
* TYPEOUTS. *
**RETURN **


**TYPMAP **
TYPMAP
MAP CONTAIN FLAGS?
NO
YES
TYPE EMPTY MAP MESSAGE
TYPE FIRST + LAST ADDRESS OF BANKS FOUND
**RETURN **


$SCOPE
CONTROLS LOOPING, INTERATIONS, ETC. BETWEEN SUBTESTS
**$SCOPE **
**RETURN **
$ERROR
COUNTS ERRORS, LOOPS.
*PASS DATA TO $ERRTYP *
**$ERROR **
**RETURN **
ERRTYP
TYPEOUT ERROR MESSAGE, HEADER, AND DATA
**ERRTYP **
**RETURN **
$RDCHR
INPUTS CHARACTER FROM TTY
**$RDCHR **
**RETURN **
$ROLIN
INPUTS STRING OF CHARACTERS FROM TTY
**$ROLIN **
**RETURN **
$RDOCT
*CONVERTS ASCII OCTAL * NUMBER TO MACHINE NARY
**$RDOCT **
**RETURN **
$PRINT
RELOCATES MESSAGE ADDRESS FOR $TYPE
**$PRINT **
**RETURN **
$TYPE
TYPES OUT A MESSAGE ON TTY.
**$TYPE **
**RETURN **
$TYPDS
**$TYPDS **
*TYPE A DECIMAL NUMBER
**RETURN **
$TYPOC
**$TYPOC **
*TYPE AN OCTAL NUMBER
**RETURN **
ERRTRP
UNEXPECTED TIMEOUT TRAP (TO 4) ROUTINE
**ERRTRP **
**HALT **
$TYPAD
TYPE AN 18-BIT ADDRESS (OCTAL)
**$TYPAD **
**RETURN **
ASCII MESSAGES
ERROR DATA FORMAT TABLE
**.END **

SPRNT2	62#																
SPRNT3	62#																
SPRNTQ	62#																
SPRNTR	62#																
START	06#																
START1	03	16#	16	53	54												
STARTA	02	06															
TIMOUT	09#																
TMAP	13																
TST1	17																
TST11	25																
TST12	26																
TST13	27																
TST14	29																
TST15	31																
TST16	33																
TST17	35																
TST2	18																
TST20	35	39#	39														
TST21	40																
TST22	41																
TST23	42																
TST24	43																
TST25	44																
TST26	45																
TST27	46																
TST3	19																
TST4	20																
TST5	21																
TST6	22																
TST7	23																
TYPMAP	13	62#	62														
W3X9	27	29	31	33	57#	57											
WWPB1	35	35#	37														
WWPB2	36	36#	37														
WWPB3	37																
WWPB4	36	36	37	37#													
WWPB5	35	35	37	37#													
WWPBT	35	35#	38														
$EOP	54																
$ERROR	14	14	14	17	18	19	20	21	23	24	25	26	27	28	28	28	29	30
	30	30	31	32	32	32	33	34	34	34	36	36	36	36	36	37	37	37
	39	40	41	42	43	44	45	46	46	48	50	52	58	60	61	61	61	61
	63	63#																
$ILLUP	04#																	
$MMUP	47																	
$PRINT	04	09	10	10	15	63	63#											
$PWRDN	04#																	
$PWRUP	04#																	
$RDCHR	63	63#																
$RDOCT	15	15	63	63#														
$ROLIN	63																	

	63#			
$SCOPE	63	63#		
$TYPAD	10	10	63	63#
$TYPDS	63	63#		
$TYPE	63	63#		
$TYPOC	63	63#		
.END	63			

```
                        .TITLE  CZQMCE0  0-124K MEMORY EXERCISER, 16K VER
                        ;*COPYRIGHT (C) 1975,1977
                        ;*DIGITAL EQUIPMENT CORP.
                        ;*MAYNARD, MASS. 01754
                        ;*
                        ;*PROGRAM BY BRUCE BURGESS/KEN CHAPMAN
                        ;*
                        ;*THIS PROGRAM WAS ASSEMBLED USING THE PDP-11 MAINDEC SYSMAC
                        ;*PACKAGE (MAINDEC-11-DZQAC-C3), JAN 19, 1977.
                        ;*

                                .SBTTL  OPERATIONAL SWITCH SETTINGS
                                ;*
                                ;*      SWITCH                  USE
                                ;*      ------          --------------------
                                ;*        15            HALT ON ERROR
                                ;*        14            LOOP ON TEST
                                ;*        13            INHIBIT ERROR TYPEOUTS
                                ;*        12            INHIBIT KT11 (AT START TIME ONLY)
                                ;*        11            INHIBIT ITERATIONS
                                ;*        10            BELL ON ERROR
                                ;*         9            LOOP ON ERROR
                                ;*         8            LOOP ON TEST IN SWR<4:0>
                                ;*         7            INHIBIT PROGRAM RELOCATION
                                ;*         6            INHIBIT PARITY ERROR DETECTION
                                ;*         5            INHIBIT EXRERCISING VECTOR AREA.
                                .SBTTL  BASIC DEFINITIONS

                                ;*INITIAL ADDRESS OF THE STACK POINTER *** 1100 ***
001100                          STACK=  1100
                                .EQUIV  EMT,ERROR       ;;BASIC DEFINITION OF ERROR CALL
                                .EQUIV  IOT,SCOPE       ;;BASIC DEFINITION OF SCOPE CALL

                                ;*MISCELLANEOUS DEFINITIONS
000011                          HT=     11              ;;CODE FOR HORIZONTAL TAB
000012                          LF=     12              ;;CODE FOR LINE FEED
000015                          CR=     15              ;;CODE FOR CARRIAGE RETURN
000200                          CRLF=   200             ;;CODE FOR CARRIAGE RETURN-LINE FEED
177776                          PS=     177776          ;;PROCESSOR STATUS WORD
                                .EQUIV  PS,PSW
177774                          STKLMT= 177774          ;;STACK LIMIT REGISTER
177772                          PIRQ=   177772          ;;PROGRAM INTERRUPT REQUEST REGISTER
177570                          DSWR=   177570          ;;HARDWARE SWITCH REGISTER
177570                          DDISP=  177570          ;;HARDWARE DISPLAY REGISTER

                                ;*GENERAL PURPOSE REGISTER DEFINITIONS
000000                          R0=     %0              ;;GENERAL REGISTER
000001                          R1=     %1              ;;GENERAL REGISTER
000002                          R2=     %2              ;;GENERAL REGISTER
000003                          R3=     %3              ;;GENERAL REGISTER
000004                          R4=     %4              ;;GENERAL REGISTER
000005                          R5=     %5              ;;GENERAL REGISTER
000006                          R6=     %6              ;;GENERAL REGISTER
000007                          R7=     %7              ;;GENERAL REGISTER
000006                          SP=     %6              ;;STACK POINTER
```

```
                        PC=     %7              ;;PROGRAM COUNTER

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

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

                        ;*DATA BIT DEFINITIONS (BIT00 TO BIT15)
100000                  BIT15=  100000
040000                  BIT14=  40000
020000                  BIT13=  20000
010000                  BIT12=  10000
004000                  BIT11=  4000
002000                  BIT10=  2000
001000                  BIT09=  1000
000400                  BIT08=  400
000200                  BIT07=  200
000100                  BIT06=  100
000040                  BIT05=  40
000020                  BIT04=  20
000010                  BIT03=  10
000004                  BIT02=  4
000002                  BIT01=  2
```

```
                        .000001                 BIT00=  1
                                                .EQUIV  BIT09,BIT9
                                                .EQUIV  BIT08,BIT8
                                                .EQUIV  BIT07,BIT7
                                                .EQUIV  BIT06,BIT6
                                                .EQUIV  BIT05,BIT5
                                                .EQUIV  BIT04,BIT4
                                                .EQUIV  BIT03,BIT3
                                                .EQUIV  BIT02,BIT2
                                                .EQUIV  BIT01,BIT1
                                                .EQUIV  BIT00,BIT0

                                                ;*BASIC "CPU" TRAP VECTOR ADDRESSES
                        000004                  ERRVEC= 4               ;;TIME OUT AND OTHER ERRORS
                        000010                  RESVEC= 10              ;;RESERVED AND ILLEGAL INSTRUCTIONS
                        000014                  TBITVEC=14              ;;"T" BIT
                        000014                  TRTVEC= 14              ;;TRACE TRAP
                        000014                  BPTVEC= 14              ;;BREAKPOINT TRAP (BPT)
                        000020                  IOTVEC= 20              ;;INPUT/OUTPUT TRAP (IOT) **SCOPE**
                        000024                  PWRVEC= 24              ;;POWER FAIL
                        000030                  EMTVEC= 30              ;;EMULATOR TRAP (EMT) **ERROR**
                        000034                  TRAPVEC=34              ;;"TRAP" TRAP
                        000060                  TKVEC=  60              ;;TTY KEYBOARD VECTOR
                        000064                  TPVEC=  64              ;;TTY PRINTER VECTOR
                        000240                  PIRQVEC=240             ;;PROGRAM INTERRUPT REQUEST VECTOR


                                                .SBTTL  MEMORY MANAGEMENT DEFINITIONS

                                                ;*KT11 VECTOR ADDRESS

                        000250                  MMVEC=  250

                                                ;*KT11 STATUS REGISTER ADDRESSES

                        177572                  SR0=    177572
                        177574                  SR1=    177574
                        177576                  SR2=    177576
                        172516                  SR3=    172516

                                                ;*KERNEL "I" PAGE DESCRIPTOR REGISTERS

                        172300                  KIPDR0= 172300
                        172302                  KIPDR1= 172302
                        172304                  KIPDR2= 172304
                        172306                  KIPDR3= 172306
                        172310                  KIPDR4= 172310
                        172312                  KIPDR5= 172312
                        172314                  KIPDR6= 172314
                        172316                  KIPDR7= 172316

                                                ;*KERNEL "I" PAGE ADDRESS REGISTERS

                        172340                  KIPAR0= 172340
                        172342                  KIPAR1= 172342
                        172344                  KIPAR2= 172344
```

```
                    172346                  KIPAR3= 172346
                    172350                  KIPAR4= 172350
                    172352                  KIPAR5= 172352
                    172354                  KIPAR6= 172354
                    172356                  KIPAR7= 172356

                    000000                  UP = 0                  ;CODE FOR UPWARDS MAP IN MEM MGMT PDR'S
                    000006                  RW = 6                  ;CODE FOR READ/WRITE IN MEM MGMT PDR'S

                                            ;*  PARITY MEMORY DEFINITIONS.
                    000001                  AE=1                            ;PARITY ACTION ENABLE
                    000114                  PARVEC=114                      ;PARITY TRAP VECTOR

                                            ;*  MISCELLANEOUS ASSIGNMENTS
                    017777                  MASK4K= 17777                   ;MASK FOR 4K ADDRESS BANK BOUNDRY.

                                            ;* CACHE REGISTER DEFINITIONS.
                    177746                  IMPCHE= 177746

                                            .SBTTL  TRAP CATCHER

                    000000                          .=0
                                            ;*ALL UNUSED LOCATIONS FROM 4 - 776 CONTAIN A ".+2,HALT"
                                            ;*SEQUENCE TO CATCH ILLEGAL TRAPS AND INTERRUPTS
                                            ;*LOCATION 0 CONTAINS 0 TO CATCH IMPROPERLY LOADED VECTORS
                    000174                          .=174
000174  000000                             DISPREG: .WORD  0               ;;SOFTWARE DISPLAY REGISTER
000176  000000                             SWREG:   .WORD  0               ;;SOFTWARE SWITCH REGISTER
                                            .SBTTL  STARTING ADDRESS(ES)
000200  000137  002640                             JMP     @#START ;;JUMP TO STARTING ADDRESS OF PROGRAM
000204  000167  002436                             JMP     SELECT          ;STARTING ADDRESS TO ALLOW THE OPERATOR TO
                                                                            ;SELECT VARIOUS PARAMETERS.
000210  000167  000064                             JMP     RESTAR          ;RESTART ADDRESS, USING PREVIOUS PARAMETERS.
000214  000167  000064                             JMP     RESTOR          ;RESTORE LOADERS TO END OF MEMORY AND HALT.
000220  000167  003352                             JMP     TIMOUT          ;TYPE OUT MEMORY MAP, BYTE BY BYTE.

                    000004                          .=ERRVEC
000004  025060                                     .WORD   ERRTRP
000006  000000                                     .WORD   0

                                            .SBTTL  ACT11 HOOKS

                                            ;;*****************************************************************
                                            ;HOOKS REQUIRED BY ACT11
                    000010                          $SVPC=.                 ;SAVE PC
                    000046                          .=46
000046  014174                                     $ENDAD                  ;;1)SET LOC.46 TO ADDRESS OF $ENDAD IN .$EOP
                    000052                          .=52
000052  040000                                     .WORD   BIT14           ;;2)SET LOC.52 TO BIT14
                    000010                          .=$SVPC                 ;; RESTORE PC
```

```
                        .=300
                        ;;*****************************************************************
                        ;*  THE FOLLOWING ROUTINES ARE LOCATED IN THE VECTOR AREA (0-1000) SO THAT
                        ;*   THEY CAN BE PROTECTED BY SELECTING SW05 (SEE DOCUMENT FOR USE OF SW05).
                        ;*   THE CODE CAN ALSO BE RUN FROM ANY BANK OF MEMORY, ASSUMING MEMORY
                        ;*   MANAGEMENT IS DISABLED BY "CONSOLE START".
                        ;;*****************************************************************
000300  005005          RESTAR: CLR     R5              ;CLEAR FLAG TO INDICATE RESTART.
000302  000401                  BR      REST1           ;GO RESTORE PROGRAM BEFORE RESTARTING.
000304  010705          RESTOR: MOV     PC,     R5      ;PUT DATA INTO FLAG FOR RESTORE.
000306  012706  001100  REST1:  MOV     #STACK, SP      ;SET UP THE STACK POINTER.
000312  005767  001206          TST     MEMMAP          ;CHECK IF THE MEMORY HAS BEEN MAPPED.
000316  001002                  BNE     REST2           ;BR IF MEMORY MAPPED.
000320  000167  002330          JMP     START           ;GO START
000324  005767  000256  REST2:  TST     MMAVA           ;CHECK IF MEM MGMT AVAILABLE.
000330  001470                  BEQ     10$             ;BR IF NO MEM MGMT.
000332  032737  000001  177572  BIT     #BIT0,  @#SR0   ;CHECK IF MEM MGMT ACTIVE.
000340  001034                  BNE     2$              ;BR IF MEM MGMT ALREADY SET UP.
000342  012700  172300          MOV     #KIPDR0,R0      ;POINT TO FIRST MEM MGMT DDATA REG.
000346  012701  000010          MOV     #8.,    R1      ;SET UP COUNTER.
000352  012720  077406  1$:     MOV     #077406,(R0)+   ;MAP FIRST 28K 1-FOR-1.
000356  005301                  DEC     R1              ;COUNT REGESTERS.
000360  001374                  BNE     1$              ;BR IF MORE REG.
000362  012700  172340          MOV     #KIPAR0,R0      ;POINT TO FIRST MEM MGMT ADDRESS REG.
000366  005020                  CLR     (R0)+           ;PAR0 MAPPED INTO BANK0.
000370  012720  000200          MOV     #200,   (R0)+   ;PAR1 MAPPED INTO BANK1.
000374  012720  000400          MOV     #400,   (R0)+   ;PAR2 MAPPED INTO BANK2.
000400  012720  000600          MOV     #600,   (R0)+   ;PAR3 MAPPED INTO BANK3.
000404  012720  001000          MOV     #1000,  (R0)+   ;PAR4 MAPPED INTO BANK4.
000410  012720  001200          MOV     #1200,  (R0)+   ;PAR5 MAPPED INTO BANK5.
000414  012720  001400          MOV     #1400,  (R0)+   ;PAR6 MAPPED INTO BANK6.
000420  012720  007600          MOV     #7600,  (R0)+   ;PAR7 MAPPED INTO BANK37.
000424  012737  000001  177572  MOV     #BIT0,  @#SR0   ;ENABLE MEM MGMT.
000432  005000          2$:     CLR     R0              ;INIT TEMP PAR REG.
000434  016701  000142          MOV     PRGMAP, R1      ;GET THE PROGRAM MAP...LO 64K.
000440  016702  000140          MOV     PRGMAP+2,R2     ;...HI 64K.
000444  006202          3$:     ASR     R2              ;SHIFT THE MAP POINTER...HI
000446  006001                  ROR     R1              ;...LO.
000450  103404                  BCS     4$              ;BR WHEN FIRST BANK FOUND.
000452  062700  000200          ADD     #200,   R0      ;UPDATE TMP PAR TO NEXT BANK.
000456  100372                  BPL     3$              ;BR IF MORE.
000460  000000                  HALT                    ;FATAL ERROR!!!  MAP EMPTY?
000462  010037  172340  4$:     MOV     R0,     @#KIPAR0 ;PUT TEMP PAR INTO FIRST PAR.
000466  000137  000472          JMP     @#5$            ;JUMP INTO PROGRAM IF NOT THERE ALREADY.
000472  062700  000200  5$:     ADD     #200,   R0      ;KEEP UPDATING TEMP PAR REG.
000476  006202                  ASR     R2              ;SHIFT POINTER...HI
000500  006001                  ROR     R1              ;...LO
000502  103373                  BCC     5$              ;BR IF TOP BANK NOT YET FOUND.
000504  010037  172342          MOV     R0,     @#KIPAR1 ;SET UP SECOND PROGRAM ANK POINTER.
000510  000410                  BR      20$             ;BR TO RELOCATE SECTION.
000512  016700  000062  10$:     MOV     RELOCF, R0      ;GET RELOCATION FACTOR.
000516  062700  001100          ADD     #STACK, R0      ;SET UP STACK POINTER.
000522  010006                  MOV     R0,     SP      ;SET STACK TO RELOCATE PROGRAM.
000524  062700  177432          ADD     #20$-STACK,R0   ;ADJUST R0 TO RELOCATED "20$" ADDRESS.
000530  000110                  JMP     (R0)            ;GO TO "20$" (RELOCATED).
000532  022767  000003  000042  20$:    CMP     #3,     PRGMAP  ;CHECK IF PROGRAM IS IN BANKS 0 AND 1.
```

```
  275  000540  001402                    BEQ     21$             ;BR IF IN BANKS 0 AND 1.
  276  000542  004767  016260            JSR     PC,     RELO    ;RELOCATE THE PROGRAM BACK TO BANKS 0 AND 1.
  277  000546  005705              21$:  TST     R5              ;CHECK RESTART/RESTORE FLAG.
  278  000550  001006                    BNE     22$             ;BR IF RESTORE.
  279  000552  005067  000412            CLR     $TIMES          ;CLEAN UP BEFORE STARTING.
  280  000556  105067  000320            CLRB    $TSTNM
  281  000562  000167  005272            JMP     START1          ;RESTART WITH PREVIOUSLY SELECTED PARAMETERS.
  282  000566  004767  016442      22$:  JSR     PC,     RESLDR  ;RESTORE THE LOADERS TO THE "TOP" OF MEMORY.
  283  000572  000000                    HALT                    ;HALT AFTER RESTORING THE LOADERS.
  284  000574  000167  002054            JMP     STARTA          ;CONTINUE WILL RESTART THE PROGRAM.
  285                              ;* THE FOLLOWING LOCATIONS ARE USED BY THE ABOVE ROUTINE AND MUST BE LOCATED
  286                              ;*  BELOW 1000 TO INSURE CORRECT OPERATION UNDER THE WIDEST VARIETY OF
  287                              ;*  CIRCUMSTANCES.
  288  000600  000000              RELOCF: .WORD   0               ;CONTAINS RELOCATION FACTOR (NO MEM MGMT)
  289  000602  000000  000000      PRGMAP: .WORD   0,0             ;PROGRAM MAP - WHERE THE PROGRAM IS LOCATED
  290  000606  000000              MMAVA:  .WORD   0               ;MEMORY MANAGEMENT AVAILABLE FLAG.
```

```
                                .SBTTL  POWER DOWN AND UP ROUTINES
                                ;;*****************************************************************
                                ;POWER DOWN ROUTINE
000610  012737  000756  000024  $PWRDN: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST UP
000616  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;PRIO:7
000624  010046                        MOV     R0,-(SP)        ;;PUSH R0 ON STACK
000626  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
000630  010246                        MOV     R2,-(SP)        ;;PUSH R2 ON STACK
000632  010346                        MOV     R3,-(SP)        ;;PUSH R3 ON STACK
000634  010446                        MOV     R4,-(SP)        ;;PUSH R4 ON STACK
000636  010546                        MOV     R5,-(SP)        ;;PUSH R5 ON STACK
000640  017746  000274                MOV     @$WR,-(SP)      ;;PUSH @$WR ON STACK
000644  010667  000112                MOV     SP,$SAVR6       ;;SAVE SP
000650  012737  000662  000024        MOV     #$PWRUP,@#PWRVEC ;;SET UP VECTOR
000656  000000                        HALT
000660  000776                        BR      .-2             ;;HANG UP
                                ;;*****************************************************************
                                ;POWER UP ROUTINE
000662  012737  000756  000024  $PWRUP: MOV     #$ILLUP,@#PWRVEC ;;SET FOR FAST DOWN
000670  016706  000066                MOV     $SAVR6,SP       ;;GET SP
000674  005067  000062                CLR     $SAVR6          ;;WAIT LOOP FOR THE TTY
000700  005267  000056          1$:   INC     $SAVR6          ;;WAIT FOR THE INC
000704  001375                        BNE     1$              ;;OF  WORD
000706  012677  000226                MOV     (SP)+,@$WR      ;;POP STACK INTO @$WR
000712  012605                        MOV     (SP)+,R5        ;;POP STACK INTO R5
000714  012604                        MOV     (SP)+,R4        ;;POP STACK INTO R4
000716  012603                        MOV     (SP)+,R3        ;;POP STACK INTO R3
000720  012602                        MOV     (SP)+,R2        ;;POP STACK INTO R2
000722  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
000724  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
000726  012737  000610  000024        MOV     #$PWRDN,@#PWRVEC ;;SET UP THE POWER DOWN VECTOR
000734  012737  000340  000026        MOV     #340,@#PWRVEC+2 ;;PRIO:7
000742  004567  022510                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
000746  025605          $PWRMG: .WORD   PWRMSG          ;;POWER FAIL MESSAGE POINTER
000750  012716                        MOV     (PC)+,(SP)      ;;RESTART AT RESTART
000752  000300          $PWRAD: .WORD   RESTART         ;;RESTART ADDRESS
000754  000002                        RTI
000756  000000          $ILLUP: HALT                    ;;THE POWER UP SEQUENCE WAS STARTED
000760  000776                        BR      .-2             ;; BEFORE THE POWER DOWN WAS COMPLETE
000762  000000          $SAVR6: 0                       ;;PUT THE SP HERE
```

```
                                .SBTTL  COMMON TAGS

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

                        001100          .=1100
001100                  $CMTAG:                         ;;START OF COMMON TAGS
001100  000000                  .WORD   0
001102  000                     $TSTNM: .BYTE   0       ;;CONTAINS THE TEST NUMBER
001103  000                     $ERFLG: .BYTE   0       ;;CONTAINS ERROR FLAG
001104  000000                  $ICNT:  .WORD   0       ;;CONTAINS SUBTEST ITERATION COUNT
001106  000000                  $LPADR: .WORD   0       ;;CONTAINS SCOPE LOOP ADDRESS
001110  000000                  $LPERR: .WORD   0       ;;CONTAINS SCOPE RETURN FOR ERRORS
001112  000000                  $ERTTL: .WORD   0       ;;CONTAINS TOTAL ERRORS DETECTED
001114  000                     $ITEMB: .BYTE   0       ;;CONTAINS ITEM CONTROL BYTE
001115  001                     $ERMAX: .BYTE   1       ;;CONTAINS MAX. ERRORS PER TEST
001116  000000                  $ERRPC: .WORD   0       ;;CONTAINS PC OF LAST ERROR INSTRUCTION
001120  000000                  $GDADR: .WORD   0       ;;CONTAINS ADDRESS OF 'GOOD' DATA
001122  000000                  $BDADR: .WORD   0       ;;CONTAINS ADDRESS OF 'BAD' DATA
001124  000000                  $GDDAT: .WORD   0       ;;CONTAINS 'GOOD' DATA
001126  000000                  $BDDAT: .WORD   0       ;;CONTAINS 'BAD' DATA
001130  000000                          .WORD   0       ;;RESERVED--NOT TO BE USED
001132  000000                          .WORD   0
001134  000                     $AUTOB: .BYTE   0       ;;AUTOMATIC MODE INDICATOR
001135  000                     $INTAG: .BYTE   0       ;;INTERRUPT MODE INDICATOR
001136  000000                          .WORD   0
001140  177570                  SWR:    .WORD   DSWR    ;;ADDRESS OF SWITCH REGISTER
001142  177570                  DISPLAY: .WORD  DDISP   ;;ADDRESS OF DISPLAY REGISTER
001144  177560                  $TKS:   177560          ;;TTY KBD STATUS
001146  177562                  $TKB:   177562          ;;TTY KBD BUFFER
001150  177564                  $TPS:   177564          ;;TTY PRINTER STATUS REG. ADDRESS
001152  177566                  $TPB:   177566          ;;TTY PRINTER BUFFER REG. ADDRESS
001154  000                     $NULL:  .BYTE   0       ;;CONTAINS NULL CHARACTER FOR FILLS
001155  002                     $FILLS: .BYTE   2       ;;CONTAINS # OF FILLER CHARACTERS REQUIRED
001156  012                     $FILLC: .BYTE   12      ;;INSERT FILL CHARS. AFTER A "LINE FEED"
001157  000                     $TPFLG: .BYTE   0       ;;"TERMINAL AVAILABLE" FLAG (BIT<07>=0=YES)
001160  000000                  $TMP0:  .WORD   0       ;;USER DEFINED
001162  000000                  $TMP1:  .WORD   0       ;;USER DEFINED
001164  000000                  $TMP2:  .WORD   0       ;;USER DEFINED
001166  000000                  $TMP3:  .WORD   0       ;;USER DEFINED
001170  000000                  $TIMES: 0               ;;MAX. NUMBER OF ITERATIONS
001172  000000                  $ESCAPE:0               ;;ESCAPE ON ERROR ADDRESS
001174  177607  000377          $BELL:  .ASCIZ  <207><377><377> ;;CODE FOR BELL
001200  077                     $QUES:  .ASCII  /?/     ;;QUESTION MARK
001201  015                     $CRLF:  .ASCII  <15>    ;;CARRIAGE RETURN
001202  000012                  $LF:    .ASCIZ  <12>    ;;LINE FEED
                                ;;*****************************************************************
                                .SBTTL  APT MAILBOX-ETABLE

                                ;;*****************************************************************
                                .EVEN
001204                          $MAIL:                  ;;APT MAILBOX
001204  000000                  $MSGTY: .WORD   AMSGTY   ;;MESSAGE TYPE CODE
001206  000000                  $FATAL: .WORD   AFATAL   ;;FATAL ERROR NUMBER
001210  000000                  $TESTN: .WORD   ATESTN   ;;TEST NUMBER
```

```
                        $PASS:  .WORD   APASS   ;;PASS COUNT
                        $DEVCT: .WORD   ADEVCT  ;;DEVICE COUNT
                        $UNIT:  .WORD   AUNIT   ;;I/O UNIT NUMBER
                        $MSGAD: .WORD   AMSGAD  ;;MESSAGE ADDRESS
                        $MSGLG: .WORD   AMSGLG  ;;MESSAGE LENGTH
                        $ETABLE:                ;;APT ENVIRONMENT TABLE
                        $ENV:   .BYTE   AENV    ;;ENVIRONMENT BYTE
                        $ENVM:  .BYTE   AENVM   ;;ENVIRONMENT MODE BITS
                        $SWREG: .WORD   ASWREG  ;;APT SWITCH REGISTER
                        $USWR:  .WORD   AUSWR   ;;USER SWITCHES
                        $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
                        $MAMS1: .BYTE   AMAMS1  ;;HIGH ADDRESS,M.S. BYTE
                        $MTYP1: .BYTE   AMTYP1  ;;MEM. TYPE,BLK#1
                        ;*                      MEM.TYPE BYTE   --  (HIGH BYTE)
                        ;*                              900 NSEC CORE=001
                        ;*                              300 NSEC BIPOLAR=002
                        ;*                              500 NSEC MOS=003
                        $MADR1: .WORD   AMADR1  ;;HIGH ADDRESS,BLK#1
                        ;*                        MEM.LAST ADDR.=3 BYTES,THIS WORD AND LOW OF "TYPE" ABOVE
                        $MAMS2:  BYTE   AMAMS2  ;;HIGH ADDRESS,M.S. BYTE
                        $MTYP2: .BYTE   AMTYP2  ;;MEM.TYPE,BLK#2
                        $MADR2: .WORD   AMADR2  ;;MEM.LAST ADDRESS,BLK#2
                        $MAMS3: .BYTE   AMAMS3  ;;HIGH ADDRESS,M.S.BYTE
                        $MTYP3: .BYTE   AMTYP3  ;;MEM.TYPE,BLK#3
                        $MADR3: .WORD   AMADR3  ;;MEM.LAST ADDRESS,BLK#3
                        $MAMS4: .BYTE   AMAMS4  ;;HIGH ADDRESS,M.S.BYTE
                        $MTYP4: .BYTE   AMTYP4  ;;MEM.TYPE,BLK#4
                        $MADR4: .WORD   AMADR4  ;;MEM.LAST ADDRESS,BLK#4
                        $VECT1: .WORD   AVECT1  ;;INTERRUPT VECTOR#1,BUS PRIORITY#1
                        $VECT2: .WORD   AVECT2  ;;INTERRUPT VECTOR#2BUS PRIORITY#2
                        $BASE:  .WORD   ABASE   ;;BASE ADDRESS OF EQUIPMENT UNDER TEST
                        $DEVM:  .WORD   ADEVM   ;;DEVICE MAP
                        $CDW1:  .WORD   ACDW1   ;;CONTROLLER DESCRIPTION WORD#1
                        $CDW2:  .WORD   ACDW2   ;;CONTROLLER DESCRIPTION WORD#2
                        $DDW0:  .WORD   ADDW0   ;;DEVICE DESCRIPTOR WORD#0
                        $DDW1:  .WORD   ADDW1   ;;DEVICE DESCRIPTOR WORD#1
                        $DDW2:  .WORD   ADDW2   ;;DEVICE DESCRIPTOR WORD#2
                        $DDW3:  .WORD   ADDW3   ;;DEVICE DESCRIPTOR WORD#3
                        $DDW4:  .WORD   ADDW4   ;;DEVICE DESCRIPTOR WORD#4
                        $DDW5:  .WORD   ADDW5   ;;DEVICE DESCRIPTOR WORD#5
                        $DDW6:  .WORD   ADDW6   ;;DEVICE DESCRIPTOR WORD#6
                        $DDW7:  .WORD   ADDW7   ;;DEVICE DESCRIPTOR WORD#7
                        $DDW8:  .WORD   ADDW8   ;;DEVICE DESCRIPTOR WORD#8
                        $DDW9:  .WORD   ADDW9   ;;DEVICE DESCRIPTOR WORD#9
                        $DDW10: .WORD   ADDW10  ;;DEVICE DESCRIPTOR WORD#10
                        $DDW11: .WORD   ADDW11  ;;DEVICE DESCRIPTOR WORD#11
                        $DDW12: .WORD   ADDW12  ;;DEVICE DESCRIPTOR WORD#12
                        $DDW13: .WORD   ADDW13  ;;DEVICE DESCRIPTOR WORD#13
                        $DDW14: .WORD   ADDW14  ;;DEVICE DESCRIPTOR WORD#14
                        $DDW15: .WORD   ADDW15  ;;DEVICE DESCRIPTOR WORD#15
```

```
                                        $SETEND:
                                        .MEXIT
                                        .SBTTL  APT PARAMETER BLOCK

                                        ;;*****************************************************************
                                        ;SET LOCATIONS 24 AND 44 AS REQUIRED FOR APT
                                        ;;*****************************************************************
001330                                          .$X=.   ;;SAVE CURRENT LOCATION
000024                                          .=24    ;;SET POWER FAIL TO POINT TO START OF PROGRAM
000024  000200                                 200     ;;FOR APT START UP
000044                                          .=44    ;;POINT TO APT INDIRECT ADDRESS PNTR.
000044  001330                                 $APTHDR ;;POINT TO APT HEADER BLOCK
001330                                          .=.$X   ;;RESET LOCATION COUNTER
                                        ;;*****************************************************************
                                        ;SETUP APT PARAMETER BLOCK AS DEFINED IN THE APT-PDP11 DIAGNOSTIC
                                        ;INTERFACE SPEC.

001330                                  $APTHD:
001330  000000                          $HIBTS: .WORD   0       ;;TWO HIGH BITS OF 18 BIT MAILBOX ADDR.
001332  001204                          $MBXDR: .WORD   $MAIL   ;;ADDRESS OF APT MAILBOX (BITS 0-15)
001334  004540                          $TSTM:  .WORD   2400.   ;;RUN TIM OF LONGEST TEST
001336  000170                          $PASTM: .WORD   120.    ;;RUN TIME IN SECS. OF 1ST PASS ON 1 UNIT (QUICK VERIFY)
001340  000360                          $UNITM: .WORD   240.    ;;ADDITIONAL RUN TIME (SECS) OF A PASS FOR EACH ADDITIONAL UNIT
001342  000052                                  .WORD   $ETEND-$MAIL/2 ;;LENGTH MAILBOX-ETABLE(WORDS)
                                         SBTTL  APT STATISTICS TABLE

                                        ;;*****************************************************************
001344                                  $ASTAT:
001344  177777  000000                          .WORD   -1,0
001350  177777  000000                          .WORD   -1,0
001354  177777  000000                          .WORD   -1,0
001360  177777  000000                          .WORD   -1,0
001364  177777  000000                          .WORD   -1,0
001370  177777  000000                          .WORD   -1,0
001374  177777  000000                          .WORD   -1,0
001400  177777  000000                          .WORD   -1,0
001404  177777  000000                          .WORD   -1,0
001410  177777  000000                          .WORD   -1,0
001414  177777  000000                          .WORD   -1,0
001420  177777  000000                          .WORD   -1,0
001424  177777  000000                          .WORD   -1,0
001430  177777  000000                          .WORD   -1,0
001434  177777  000000                          .WORD   -1,0
001440  177777  000000                          .WORD   -1,0
001444  177777  000000                          .WORD   -1,0
001450  177777  000000                          .WORD   -1,0
001454  177777  000000                          .WORD   -1,0
001460  177777  000000                          .WORD   -1,0
001464  177777  000000                          .WORD   -1,0
001470  177777  000000                          .WORD   -1,0
001474  177777  000000                          .WORD   -1,0
001500  177777  000000                          .WORD   -1,0
001504  177777  000000                          .WORD   -1,0
001510  177777                          $ASTEND:        -1
001512  001344                          $APTR:  $ASTAT
```

```
                                ;;*****************************************************************
                                ;*THE FOLLOWING TAGS ARE USER DEFINED
                                ;;*****************************************************************
001514  000000                  $VERPC: .WORD   0       ;VIRTUAL PC LOCATION FOR ERROR TYPEOUT ROUTINE ($ERTYP).
001516  070032                  RESRVD: .WORD   070032  ;CORE PARITY REG BITS RESERVED FOR FUTURE USE.
                                                        ;NOTE:  FOR MS11 MEMORY WITH PARITY, CHANGE TO 077772.
001520  000000                  LMAD:   .WORD   0       ;LAST CONTIGUOUS MEMORY ADDRESS (+2)
001522  000000                  LDDISP: .WORD   0       ;CONTAINS DISPLAY REGISTER IMAGE
001524                          MEMMAP:                 ;MEMORY MAP - EACH BIT CORRESPONDS TO 4K
001524  000000                          .WORD   0       ;FIRST WORD CONTAINS LOW (0-64K) MAP
001526  000000                          .WORD   0       ;SECOND WORD CONTAINS HIGH (64-128K) MAP
001530                          TSTMAP:                 ;TEST MAP - WHICH BANKS ARE SELECTED FOR TEST.
001530  000000                          .WORD   0       ;FIRST WORD CONTAINS LOW (0-64K) MAP
001532  000000                          .WORD   0       ;SECOND WORD CONTAINS HIGH (64-128K) MAP
001534                          SAVTST:                 ;SAVED TEST MAP - USED DURING FIRST PASS TO ONLY
                                                        ; TEST EACH BANK ONCE.
001534  000000                          .WORD   0       ;FIRST WORD CONTAINS LOW (0-64K) MAP
001536  000000                          .WORD   0       ;SECOND WORD CONTAINS HIGH (64-128K) MAP
001540                          PMEMAP:                 ;PARITY MAP - WHICH BANKS HAVE MEMORY PARITY
001540  000000                          .WORD   0       ;FIRST WORD CONTAINS LOW (0-64K) MAP
001542  000000                          .WORD   0       ;SECOND WORD CONTAINS HIGH (64-128K) MAP
001544                          BITPT:                  ;POINTER TO CURRENT 4K BANK OF MEMORY
001544  000000                          .WORD   0       ;FIRST WORD CONTAINS LOW (0-64K) MAP
001546  000000                          .WORD   0       ;SECOND WORD CONTAINS HIGH (64-128K) MAP
001550                          TMPPT:                  ;TEMPORARY POINTER FOR 2ND 4K BANK OF MEMORY
001550  000000                          .WORD   0       ;FIRST WORD CONTAINS LOW (0-64K) MAP
001552  000000                          .WORD   0       ;SECOND WORD CONTAINS HIGH (64-128K) MAP
001554  000000                  MMORE:  .WORD   0       ;LOOP ADDRESS FOR MULTIPLE BLOCK TESTING.
                                                        ;SET UP BY "INITMM" AND "INITDN" ROUTINEES.
                                                        ;USED BY "MMUP" AND "MMDOWN" ROUTINES.
001556  000                     SELFLG: .BYTE   0       ;OPERATOR SELECTED PARAMETERS FLAG.  (SA=204)
001557  000                     FLAG8K: .BYTE   0       ;8K BLOCK INDICATOR.  USED IN "INITMM" AND "MMUP".
001560  000                     OEFLG:  .BYTE   0       ;ODD/EVEN FLAG USED IN PARITY MEMORY BYTE TEST.
        001562                          .EVEN
001562  000000                  FSTADR: .WORD   0       ;FIRST VIRTUAL ADDRESS TO BE TESTED.
                                                        ;FIRST ADDRESS IS USER SELECTABLE.
001564  000000                  TMPFAD: .WORD   0       ;ADJUSTED FIRST ADDRESS.
001566  000000                  FADMSK: .WORD   0       ;BIT MASK TO ALLOW DOWNWARD ADDRESSING TESTS
                                                        ; TO BREAK TO "MMDOWN" TO FIND FIRST ADDRESS.
001570  000000  000000          FADMAP: .WORD   0,0     ;MAP OF BANK IN WHICH FIRST ADDRESS IS LOCATED.
001574  000000                  LSTADR: .WORD   0       ;LAST VIRTUAL ADDRESS (+2) TO BE TESTED.
                                                        ;LAST ADDRESS IS USER SELECTABLE.
001576  000000                  TMPLAD: .WORD   0       ;ADJUSTED LAST ADDRESS.
001600  000000                  LADMSK: .WORD   0       ;BIT MASK TO ALLOW UPWARD ADDRESSING TESTS
                                                        ; TO BREAK TO "MMUP" TO FIND LAST ADDRESS.
001602  000000  000000          LADMAP: .WORD   0,0     ;MAP OF BANK IN WHICH LAST ADDRESS IS LOCATED.
001606  000000                  BLKMSK: .WORD   0       ;BLOCK MASK, DETERMINES THE BLOCK SIZE.
001610  000000                  .CONST: .WORD   0       ;USER SELECTABLE CONSTANT DATA.
001612  000004                  WWP:    .WORD   4       ;WRITE WRONG PARITY COMMAND
001614  000000                  TEMP:   .WORD   0       ;TEMPORARY STORAGE
001616  000000                  CASFLG: .WORD   0       ;CACHE PRESENT FLAG
001620  177746                  CASREG: .WORD   177746  ;CACHE CONTROL REGISTER

                                ;;*****************************************************************
                                ;*  RELATIVE ADDRESSING TABLE.
                                ;*  THE FOLLOWING LOCATIONS ARE MODIFIED AT RELOCATION TIME TO ALLOW
```

```
                                        ;*  RELATIVE ADDRESSING TO GET THE RELOCATED VALUE OF THE ARGUEMEMT TAGS.
                                        ;;*****************************************************************
001622                                  RADTAB:
001622  001100                          .STACK: STACK           ;STACK POINTER INITIAL ADDRESS.
001624  001516                          .RESRV: RESRVD          ;PARITY REGISTER RESERVED BIT MASK ADDRESS.
001626  002076                          .MPRO:  MPRO            ;MEMORY PARITY REGISTER TABLE ADDRESS.
001630  002276                          .MPRX:  MPRX            ;MEMORY PARITY REGISTER EXIST TABLE ADDRESS.
001632  012026                          .PBTRP: PBTRP           ;PARITY BYTE TEST TRAP ROUTINE ADDRESS.
001634  002050                          .MPPAT: MPPATS          ;MEMORY PARITY PATTERN TABLE ADDRESS.
001636  017374                          .PESRV: PESRV           ;MEMORY PARITY ERROR TRAP ROUTINE ADDRESS.
001640  002340                          .ERRTB: $ERRTB          ;ERROR TYPEOUT TABLE PONTER.
001642  000010                          .EIGHT: 8.              ;DECIMAL TYPE ROUTINE COUNT DESIGNATOR.
001644  013760                          .TST32: TST32           ;SCOPE ABORT ADR FOR WHEN NO MEM AVA FOR TEST.
                                        ;;*****************************************************************
                                        ;*  DATA CONTAINERS FOR ERROR PRINTOUT.
                                        ;;*****************************************************************
001646  001116  001120  001124  DT1:    $ERRPC,$GDADR,$GDDAT,$BDDAT,0
001654  001126  000000
001660  001514  001116  0C1120  DT2:    $VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT,0
001666  001124  001126  000000
001674  001514  001116  001120  DT12:   $VERPC,$ERRPC,$GDADR,$GDDAT,0
001702  001124  000000
001706  001514  001116  001160  DT14:   $VERPC,$ERRPC,$TMP0,$GDADR,0
001714  001120  000000
001720  001514  001116  001120  DT15:   $VERPC,$ERRPC,$GDADR,$TMP0,$GDDAT,$BDDAT,0
001726  001160  001124  001126
001734  000000
001736  001514  001116  001160  DT21:   $VERPC,$ERRPC,$TMP0,$GDADR,$GDDAT,$BDDAT,0
001744  001120  001124  001126
001752  000000
001754  001514  001116  001120  DT23:   $VERPC,$ERRPC,$GDADR,$BDADR,$GDDAT,$BDDAT,0
001762  001122  001124  001126
001770  000000
001772  001514  001116  001122  DT24:   $VERPC,$ERRPC,$BDADR,0
002000  000000
002002  001514  001116  001122  DT25:   $VERPC,$ERRPC,$BDADR,$TMP0,$TMP1,0
002010  001160  001162  000000
002016  001514  001116  001160  DT26:   $VERPC,$ERRPC,$TMP0,$TMP1,0
002024  001162  000000
002030  001160  001162  001120  DT30:   $TMP0,$TMP1,$GDADR,$BDDAT,0
002036  001126  000000
002042  001166  000000          DT31:   $TMP3,0
002046  177777                          .WORD   -1      ;TABLE TERMINATOR.

                                        .SBTTL  MEMORY PARITY PATTERNS TABLE
                                        ;;*****************************************************************
                                        ;THE FOLLOWING ARE THE PARITY PATTERNS EXERCISED THRUOUT MEMORY
                                        ;;*****************************************************************

002050  125325                  MPPATS: 125325                  ;EVEN,ODD
002052  152652                          152652                  ;ODD,EVEN
002054  052452                          052452                  ;EVEN,ODD
002056  025125                          025125                  ;ODD,EVEN
002060  102070                          102070                  ;EVEN,EVEN
002062  072527                          072527                  ;ODD,ODD
002064  177777                          177777                  ;EVEN,EVEN
```

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                        107030                  ;ODD,ODD
                        152525                  ;ODD,EVEN
                        0                       ;EXTRA PATTERN HOLDER FOR
                                                ;FUTURE USE
MPEND:                  0                       ;TABLE TERMINATOR


                .SBTTL  MEMORY PARITY REGISTER ADDRESS TABLE
                ;////////////////////////////////////////////////////////////////////////
                ;*  THE FOLLOWING REPRESENTS THE MEMORY PARITY REGISTER ADDRESS TABLE
                ;*  FROM WHICH PARITY MEMORY IS ADDRESSED & CONTROLLED:
                ;*
                ;*  THE LEAST SIGNIFICANT BIT IN THE DEVICE ADDRESS IS SET TO A ONE (1)
                ;*  IF THE CONTROL IS FOUND NOT TO BE PRESENT.  THE MEMORY PRESENT UNDER
                ;*  THE CONTROL OF EACH CONTROLLER IS REPRESENTED BY TWO (2) WORDS FOLLOWING
                ;*  THE DEVICE ADDRESS,  EACH BIT REPRESENTING A 4K BLOCK.  I.E.
                ;*  FIRST WORD BIT0 = 0 - 4K,  BIT1 = 4 - 8K,...  BIT15 = 60 - 64K
                ;*  SECOND WORD BIT0 = 64 - 68K,... BIT14 = 120 - 124K.
                ;////////////////////////////////////////////////////////////////////////
MPR0:           172100 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR1:           172102 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR2:           172104 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR3:           172106 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR4:           172110 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR5:           172112 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR6:           172114 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR7:           172116 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR8:           172120 +1                       ;PARITY STATUS REGISTER
                0                               ;CONTROL MAP (LOW 64K)
                0                               ;CONTROL MAP (HIGH 64K)
                0                               ;MASK FOR MOS,CORE,MS11-K
MPR9:           172122 +1                       ;PARITY STATUS REGISTER
```

```
002210  000000                  0                       ;CONTROL MAP (LOW 64K)
002212  000000                  0                       ;CONTROL MAP (HIGH 64K)
002214  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
002216  172125         MPR10:   172124 +1               ;PARITY STATUS REGISTER
002220  000000                  0                       ;CONTROL MAP (LOW 64K)
002222  000000                  0                       ;CONTROL MAP (HIGH 64K)
002224  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
002226  172127         MPR11:   172126 +1               ;PARITY STATUS REGISTER
002230  000000                  0                       ;CONTROL MAP (LOW 64K)
002232  000000                  0                       ;CONTROL MAP (HIGH 64K)
002234  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
002236  172131         MPR12:   172130 +1               ;PARITY STATUS REGISTER
002240  000000                  0                       ;CONTROL MAP (LOW 64K)
002242  000000                  0                       ;CONTROL MAP (HIGH 64K)
002244  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
002246  172133         MPR13:   172132 +1               ;PARITY STATUS REGISTER
002250  000000                  0                       ;CONTROL MAP (LOW 64K)
002252  000000                  0                       ;CONTROL MAP (HIGH 64K)
002254  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
002256  172135         MPR14:   172134 +1               ;PARITY STATUS REGISTER
002260  000000                  0                       ;CONTROL MAP (LOW 64K)
002262  000000                  0                       ;CONTROL MAP (HIGH 64K)
002264  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
002266  172137         MPR15:   172136 +1               ;PARITY STATUS REGISTER
002270  000000                  0                       ;CONTROL MAP (LOW 64K)
002272  000000                  0                       ;CONTROL MAP (HIGH 64K)
002274  000000                  0                       ;MASK FOR MOS,CORE,MS11-K
                       ;THIS IS THE END OF THE TABLE !
002276  000021         MPRX:    .BLKW   17.     ;TABLE TO HOLD JUST PARITY STATUS REGISTERS THAT EXIST.
                                                ; (THE EXTRA WORD IS FOR A TERMINATOR.)
```

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                                .SBTTL  ERROR POINTER TABLE

                                ;*THIS TABLE CONTAINS THE INFORMATION FOR EACH ERROR THAT CAN OCCUR.
                                ;*THE INFORMATION IS OBTAINED BY USING THE INDEX NUMBER FOUND IN
                                ;*LOCATION $ITEMB. THIS NUMBER INDICATES WHICH ITEM IN THE TABLE IS PERTINENT.
                                ;*NOTE1:        IF $ITEMB IS 0 THE ONLY PERTINENT DATA IS ($ERRPC).
                                ;*NOTE2:        EACH ITEM IN THE TABLE CONTAINS 4 POINTERS EXPLAINED AS FOLLOWS:

                                ;*      EM              ;;POINTS TO THE ERROR MESSAGE
                                ;*      DH              ;;POINTS TO THE DATA HEADER
                                ;*      DT              ;;POINTS TO THE DATA
                                ;*      DF              ;;POINTS TO THE DATA FORMAT


002340                          $ERRTB:
                                ;*  ITEM 1
002340  026754                      DM1             ;PARITY REGISTER DATA ERROR.
002342  030333                      DH1             ;PC,REG,S/B,WAS
002344  001646                      DT1             ;$ERRPC,$GDADR,$GDDAT,$BDDAT
002346  030700                      DF1             ;16,18,16,16
                                ;*  ITEM 2
002350  027010                      DM2             ;ADDRESS TEST ERROR(TST1-5).
002352  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002354  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002356  030704                      DF2             ;16,18,18,16,16
                                ;*  ITEM 3
002360  027010                      DM2             ;ADDRESS TEST ERROR(TST1-5).
002362  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002364  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002366  030711                      DF3             ;16,18,18,8,8
                                ;*  ITEM 4
002370  027044                      DM4             ;CONSTANT DATA ERROR(TST6-10).
002372  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002374  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002376  030704                      DF2             ;16,18,18,16,16
                                ;*  ITEM 5
002400  027102                      DM5             ;ROTATING BIT ERROR(TST11-12).
002402  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002404  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002406  030704                      DF2             ;16,18,18,16,16
                                ;*  ITEM 6
002410  027140                      DM6             ;MOS REFRESH TEST ERROR (TST30-31).
002412  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002414  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002416  030704                      DF2             ;16,18,18,16,16
                                ;*  ITEM 7
002420  027204                      DM7             ;3 XOR 9 PATTERN ERROR(TST13-16).
002422  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002424  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002426  030704                      DF2             ;16,18,18,16,16
                                ;*  ITEM 10
002430  027245                      DM10            ;MARCHING 1'S AND 0'S ERROR(TST27).
002432  030352                      DH2             ;V/PC,P/PC,MA,S/B,WAS
002434  001660                      DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002436  030704                      DF2             ;16,18,18,16,16
                                ;*  ITEM 11
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002440  027311                  DM11            ;PARITY MEMORY ADDRESS ERROR(TST17).
002442  030352                  DH2             ;V/PC,P/PC,MA,S/B,WAS
002444  001660                  DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002446  030711                  DF3             ;16,18,18,8,8
                        ;*  ITEM 12
002450  027355                  DM12            ;DATIP WITH WRONG PARITY DIDN'T TRAP(TST17).
002452  030377                  DH12            ;V/PC,P/PC,MA,S/B
002454  001674                  DT12            ;$VERPC,$ERRPC,$GDADR,$GDDAT
002456  030711                  DF3             ;16,18,18,8
                        ;*  ITEM 13
002460  027431                  DM13            ;WRONG PARITY TRAPED, BUT NO REGISTER SHOWS ERROR FLAG.
002462  030377                  DH12            ;V/PC,P/PC,MA,S/B
002464  001674                  DT12            ;$VERPC,$ERRPC,$GDADR,$GDDAT
002466  030711                  DF3             ;16,18,18,8
                        ;*  ITEM 14
002470  027521                  DM14            ;PARITY REGISTER NOT MAPPED AS CONTROLLING THIS ADDRESS(TST17).
002472  030420                  DH14            ;V/PC,P/PC,REG,MA
002474  001706                  DT14            ;$VERPC,$ERRPC,$TMPO,$GDADR
002476  030716                  DF14            ;16,18,18,18
                        ;*  ITEM 15
002500  026754                  DM1             ;PARITY REGISTER DATA ERROR.
002502  030441                  DH15            ;V/PC,P/PC,MAUT,REG,S/B,WAS
002504  001720                  DT15            ;$VERPC,$ERRPC,$GDADR,$TMPO,$GDDAT,$BDDAT
002506  030716                  DF14            ;16,18,18,18,16,16
                        ;*  ITEM 16
002510  027620                  DM16            ;MORE THAN ONE REGISTER INDICATED PARITY ERROR.
002512  030420                  DH14            ;V/PC,P/PC,REG,MA
002514  001706                  DT14            ;$VERPC,$ERRPC,$TMPO,$GDADR
002516  030716                  DF14            ;16,18,18,18
                        ;*  ITEM 17
002520  027677                  DM17            ;DATA SHOULDN'T HAVE CHANGED WHEN PARITY ERROR
                                                ;  TRAPPED(TST21).
002522  030352                  DH2             ;V/PC,P/PC,MA,S/B,WAS
002524  001660                  DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002526  030711                  DF3             ;16,18,18,8,8
                        ;*  ITEM 20
002530  027775                  DM20            ;RANDOM DATA ERROR(TST20).
002532  030352                  DH2             ;V/PC,P/PC,MA,S/B,WAS
002534  001660                  DT2             ;$VERPC,$ERRPC,$GDADR,$GDDAT,$BDDAT
002536  030704                  DF2             ;16,18,18,16,16
                        ;*  ITEM 21
002540  030027                  DM21            ;INSTRUCTION EXICUTION ERROR(TST21-26).
002542  030474                  DH21            ;V/PC,P/PC,IUT,MA,S B,WAS
002544  001736                  DT21            ;$VERPC,$ERRPC,$TMPO,$GDADR,$GDDAT,$BDDAT
002546  030724                  DF21            ;16,18,16,18,16,16
                        ;*  ITEM 22             ;NOT USED
                        ;*  ITEM 23
002550  030076                  DM23            ;PROGRAM CODE CHANGED WHEN RELOCATED.
002552  030525                  DH23            ;V/PC,P/PC,SRC MA,DST MA,S/B,WAS
002554  001754                  DT23            ;$VERPC,$ERRPC,$GDADR,$BDADR,$GDDAT,$BDDAT
002556  030716                  DF14            ;16,18,18,18,16,16
                        ;*  ITEM 24
002560  030143                  DM24            ;TRAPPED, BUT NO REGISTER HAD ERROR BIT SET.
002562  030565                  DH24            ;V/PC,P/PC,TRP/PC
002564  001772                  DT24            ;$VERPC,$ERRPC,$BDADR
002566  030716                  DF14            ;16,18,18
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                                ;*  ITEM 25
002570  030217                      DM25            ;TRAPPED TO 114.
002572  030606                      DH25            ;V/PC,P/PC,TRP/PC,REG,WAS
002574  002002                      DT25            ;$VERPC,$ERRPC,$BDADR,$TMP0,$TMP1
002576  030716                      DF14            ;16,18,18,18,16
                                ;*  ITEM 26
002600  030237                      DM26            ;FAILED TO TRAP.
002602  030637                      DH26            ;V/PC,P/PC,REG,WAS
002604  002016                      DT26            ;$VERPC,$ERRPC,$TMP0,$TMP1
002606  030704                      DF2             ;16,18,18,16
                                ;*  ITEM 27
002610  030257                      DM27            ;(ACTION ENABLE WASN'T SET).
002612  030637                      DH26            ;V/PC,P/PC,REG,WAS
002614  002016                      DT26            ;$VERPC,$ERRPC,$TMP0,$BDDAT
002616  030704                      DF2             ;16,18,18,16
                                ;*  ITEM 30
002620  000000                      0               ;NO MESSAGE.
002622  030661                      DH30            ;REG,WAS,MA,WAS
002624  002030                      DT30            ;$TMP0,$TMP1,$GDADR,$BDDAT
002626  030732                      DF30            ;18,16,18,8
                                ;*  ITEM 31
002630  030313                      DM31            ;TRAPPED TO 4
002632  000000                      0               ;NO HEADER
002634  002042                      DT31            ;$TMP3
002636  030732                      DF30            ;18
```

```
837                                     .SBTTL START:   SETUP AND MAP MEMORY

                        ;/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:
                        ;*      THIS IS THE NORMAL (SA = 200) BEGINNING OF THE PROGRAM.
                        ;*      NOTE:   THIS CODE IS NOT POSITION INDEPENDENT.
                        ;/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*

844  002640  105067  176712          START:  CLRB    SELFLG          ;CLEAR SELECT PARAMETER FLAG.
845  002644  000403                  BR      STARTA          ;GO DO SETUP AND MEMORY MAP.
846  002646  112767  177777  176702  SELECT: MOVB    #-1,    SELFLG  ;SET THE SELECT PARAMETERS FLAG.
847  002654                          STARTA:
848                                  .SBTTL  INITIALIZE THE COMMON TAGS
849                                  ;;CLEAR THE COMMON TAGS ($CMTAG) AREA
850  002654  012706  001100                  MOV     #$CMTAG,R6      ;;FIRST LOCATION TO BE CLEARED
851  002660  005026                          CLR     (R6)+           ;;CLEAR MEMORY LOCATION
852  002662  022706  001140                  CMP     #SWR,R6 ;;DONE?
853  002666  001374                          BNE     .-6             ;;LOOP BACK IF NO
854  002670  012706  001100                  MOV     #STACK,SP       ;;SETUP THE STACK POINTER
855                                  ;;INITIALIZE A FEW VECTORS
856  002674  012737  000610  000024          MOV     #$PWRDN,@#PWRVEC ;;POWER FAILURE VECTOR
857  002702  012737  000340  000026          MOV     #340,@#PWRVEC+2 ;;LEVEL 7
858  002710  016767  011214  011204          MOV     $ENDCT,$EOPCT   ;;SETUP END-OF-PROGRAM COUNTER
859                                  ;;SIZE FOR A HARDWARE SWITCH REGISTER. IF NOT FOUND OR IT IS
860                                  ;;EQUAL TO A "-1", SETUP FOR A SOFTWARE SWITCH REGISTER.
861  002716  013746  000004                  MOV     @#ERRVEC,-(SP)  ;;SAVE ERROR VECTOR
862  002722  012737  002756  000004          MOV     #64$,@#ERRVEC   ;;SET UP ERROR VECTOR
863  002730  012767  177570  176202          MOV     #DSWR,SWR       ;;SETUP FOR A HARDWARE SWICH REGISTER
864  002736  012767  177570  176176          MOV     #DDISP,DISPLAY  ;;AND A HARDWARE DISPLAY REGISTER
865  002744  022777  177777  176166          CMP     #-1,@SWR        ;;TRY TO REFERENCE HARDWARE SWR
866  002752  001012                          BNE     66$             ;;BRANCH IF NO TIMEOUT TRAP OCCURRED
867                                                                  ;;AND  THE HARDWARE SWR IS NOT = -1
868  002754  000403                          BR      65$             ;;BRANCH IF NO TIMEOUT
869  002756  012716  002764          64$:    MOV     #65$,(SP)       ;;SET UP FOR TRAP RETURN
870  002762  000002                          RTI
871  002764  012767  000176  176146  65$:    MOV     #SWREG,SWR      ;;POINT TO SOFTWARE SWR
872  002772  012767  000174  176142          MOV     #DISPREG,DISPLAY
873  003000  012637  000004          66$:    MOV     (SP)+,@#ERRVEC  ;;RESTORE ERROR VECTOR
874
875  003004  005067  176202                  CLR     $PASS           ;;CLEAR PASS COUNT
876  003010  132767  000200  176207          BITB    #APTSIZE,$ENVM  ;;TEST USER SIZE UNDER APT
877  003016  001403                          BEQ     67$             ;;YES,USE NON-APT SWITCH
878  003020  012767  001226  176112          MOV     #$SWREG,SWR     ;;NO,USE APT SWITCH REGISTER
879  003026                          67$:
880  003026  005067  176470                  CLR     LDDISP          ;CLEAR DISPLAY REGISTER STORAGE LOCN
881  003032  005077  176104                  CLR     @DISPLAY        ;CLEAR DISPLAY REGISTER
882                                  .SBTTL  TYPE PROGRAM NAME
883                                  ;;TYPE THE NAME OF THE PROGRAM IF FIRST PASS
884  003036  005227  177777                  INC     #-1             ;;FIRST TIME?
885  003042  001040                          BNE     68$             ;;BRANCH IF NO
886  003044  022737  014174  000042          CMP     #$ENDAD,@#42    ;;ACT-11?
887  003052  001434                          BEQ     68$             ;;BRANCH IF YES
888  003054  004567  020376                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
889  003060  003132                          .WORD   69$             ;ADDRESS OF MESSAGE TO BE TYPED
890                                  .SBTTL  GET VALUE FOR SOFTWARE SWITCH REGISTER
891  003062  005737  000042                  TST     @#42            ;;ARE WE RUNNING UNDER XXDP/ACT?
892  003066  001015                          BNE     70$             ;;BRANCH IF YES
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003070  126727  176130  000001          CMPB    $ENV,#1         ;;ARE WE RUNNING UNDER APT?
003076  001411                          BEQ     70$             ;;BRANCH IF YES
003100  026727  176034  000176          CMP     SWR,#SWREG      ;;SOFTWARE SWITCH REG SELECTED?
003106  001010                          BNE     71$             ;;BRANCH IF NO
                                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $GTSWR ROUTINE
                                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
003110  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
003114  004767  017262                  JSR     PC,     $GTSWR  ;GO TO THE SUBROUTINE
003120  000403                          BR      71$
003122  112767  000001  176004  70$:    MOVB    #1,$AUTOB       ;;SET AUTO-MODE INDICATOR
003130                          71$:
003130  000405                          BR      68$             ;;GET OVER THE ASCIZ
                                ;;69$:  .ASCIZ  <CRLF>'CZQMCE0'<CRLF>
003144                          68$:
003144  010700                          MOV     PC,     R0      ;GET CURRENT PROGRAM COUNTER.
003146  022700  003146                  CMP     #.,     R0      ;CHECK IF THE PROGRAM IS RELOCATED.
003152  001402                          BEQ     10$             ;BR IF PROGRAM NOT RELOCATED.
003154  000167  175120                  JMP     RESTAR          ;GO TRY TO RELOCTED BEFORE CONTINUING.
003160  012767  000003  175414  10$:    MOV     #3,     PRGMAP  ;INITIALIZE PROGRAM MAP....LO 64K.
003166  005067  175412                  CLR     PRGMAP+2        ;...HI 64K.
003172  005067  175402                  CLR     RELOCF          ;INIT THE RELOCATION FACTOR.
003176  004767  014112                  JSR     PC,SAVLDR       ;GO SAVE LOADERS

                                ;*  CHECK IF MEMORY MANAGEMENT IS AVAILABLE, AND SET IT UP IF IT IS.
003202  005067  175400                  CLR     MMAVA           ;CLEAR MEM MGMT AVAILABLE FLAG
003206  032777  010000  175724          BIT     #SW12,  @SWR    ;CHECK FOR INHIBIT KT11 SWITCH
003214  001014                          BNE     IMPCK           ;BRANCH IF SET
003216  012737  003246  000004          MOV     #IMPCK,@#ERRVEC ;SET UP TIMEOUT TRAP VECTOR
003224  005037  177572                  CLR     @#SR0           ;CLEAR MEM MGMT STATUS REG
003230  004767  011010                  JSR     PC,     MMINIT  ;MEM MGMT INITIALIZATION ROUTINE.
003234  005267  175346                  INC     MMAVA           ;SET MEM MGMT AVAILABLE FLAG
003240  004567  020212                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
003244  025320                          .WORD   MMAMES          ;ADDRESS OF MESSAGE TO BE TYPED
                                                                ;"KT11 AVAILABLE"

                                ;*      CHECK IF CACHE PRESENT, IF SO TURN IT OFF!!!
003246  012706  001100          IMPCK:  MOV     #STACK, SP
003252  005067  176340                  CLR     CASFLG          ;CLEAR CACHE PRESENT FLAG
003256  012737  003300  000004          MOV     #MAPMEM,@#ERRVEC
003264  052767  000014  174454          BIS     #14,    IMPCHE
003272  012767  000001  176316          MOV     #1,     CASFLG  ;SET CACHE PRESENT FLAG

                                ;;*****************************************************************
                                ;*  ROUTINE TO MAP ALL OF MEMORY.
                                ;*  ONLY FULL 4K BANKS WILL BE RECOGNIZED.
                                ;*      R0 = MEMMAP POINTER...LO 64K.
                                ;*      R1 = MEMMAP POINTER...HI 64K.
                                ;*      R2 = ADDRESS POINTER
                                ;*      R3 = BANK POINTER...LO 64K.
                                ;*      R4 = BANK POINTER...HI 64K.
                                ;*      R5 = SCRATCH REGISTER.
                                ;;*****************************************************************
003300  012706  001100          MAPMEM: MOV     #STACK, SP      ;RESET THE STACK
003304  012700  001524                  MOV     #MEMMAP,R0      ;SET UP MEMORY MAP POINTER...LO 64K.
003310  012701  001526                  MOV     #MEMMAP+2,R1    ;...HI 64K.
003314  005010                          CLR     (R0)            ;CLR MEMORY MAP...LO 64K.
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 949  003316  005011                          CLR     (R1)              ;...HI 64K.
 950  003320  005002                          CLR     R2                ;SET ADDRESS POINTER TO 0
 951  003322  012703  000001                  MOV     #1,     R3        ;SETUP 4K BANK POINTER...LO 64K.
 952  003326  005004                          CLR     R4                ;...HI 64K.
 953  003330  005067  175632                  CLR     $TMP3             ;INIT TEMPORARY HIGH ADDRESS BITS.
 954  003334  004567  020116                  JSR     R5,     $PRINT    ;GO PRINT OUT THE FOLLOWING MESSAGE.
 955  003340  025365                          .WORD   MEMMES            ;ADDRESS OF MESSAGE TO BE TYPED
 956                                                                    ;"MEMORY MAP:"
 957  003342  012737  003456  000004          MOV     #2$, @#ERRVEC     ;SET UP TIMEOUT VECTOR
 958  003350  011222                  1$:     MOV     (R2),   (R2)+     ;READ+WRITE ALL MEMORY
 959  003352  032702  017777                  BIT     #MASK4K,R2        ;CHECK FOR 4K BOUNDRY
 960  003356  001374                          BNE     1$                ;BRANCH IF MORE IN BANK
 961  003360  050310                          BIS     R3,     (R0)      ;SET FLAG FOR BANK...LO 64K.
 962  003362  050411                          BIS     R4,     (R1)      ;...HI 64K.
 963  003364  010267  175574                  MOV     R2,     $TMP2     ;SAVE ADDRESS POINTER.
 964  003370  005367  175570                  DEC     $TMP2             ;ADJUST TO LAST ADR, LAST BANK.
 965  003374  005767  175206                  TST     MMAVA             ;CHECK FOR MEM MGMT.
 966  003400  001432                          BEQ     3$                ;BR IF NO MEM MGMT.
 967  003402  042767  160000  175554          BIC     #160000,$TMP2     ;CLEAR BANK BITS ON RELATIVE ADDRESS.
 968  003410  013705  172344                  MOV     @#KIPAR2,R5       ;SAVE KIPAR2.
 969  003414  005067  175546                  CLR     $TMP3             ;MAKE SURE HI BITS ARE INIT.
 970  003420  006305                          ASL     R5                ;SHIFT IT 6 PLACES.
 971  003422  006305                          ASL     R5
 972  003424  006305                          ASL     R5
 973  003426  006305                          ASL     R5
 974  003430  006305                          ASL     R5
 975  003432  006167  175530                  ROL     $TMP3
 976  003436  006305                          ASL     R5
 977  003440  006167  175522                  ROL     $TMP3
 978  003444  060567  175514                  ADD     R5,     $TMP2     ;MAKE LAST ADR PHYSICAL.
 979  003450  005567  175512                  ADC     $TMP3
 980  003454  000404                          BR      3$                ;GO TO UPDATE POINTERS.
 981
 982                                  ;*  TIMEOUT TRAPS TO HERE
 983  003456  022626                  2$:     CMP     (SP)+,  (SP)+     ;RESTORE THE STACK POINTER
 984  003460  052702  017777                  BIS     #MASK4K,R2        ;LAST ADDRESS OF 4K BANK
 985  003464  005202                          INC     R2                ;FIRST ADDRESS OF NEXT BANK.
 986  003466  005767  175114          3$:     TST     MMAVA             ;CHECK FOR MEM MGMT
 987  003472  001411                          BEQ     4$                ;BRANCH IF NO MEM MGMT
 988  003474  062737  000200  172344          ADD     #200, @#KIPAR2    ;UPDATE THIRD PAR
 989  003502  012702  040000                  MOV     #40000, R2        ;POINT TO START OF THIRD PAR
 990  003506  006303                          ASL     R3                ;UPDATE LO BANK POINTER.
 991  003510  006104                          ROL     R4                ;UPDATE HI BANK POINTER
 992  003512  100316                          BPL     1$                ;BRANCH IF MORE MEMORY TO MAP.
 993  003514  000402                          BR      5$                ;EXIT WHEN DONE.
 994
 995  003516  106303                  4$:     ASLB    R3                ;UPDATE MAP POINTER
 996  003520  100313                          BPL     1$                ;BRANCH IF NOT YET DONE
 997  003522  012737  025060  000004  5$:     MOV     #ERRTRP, @#ERRVEC ;RESET TIMEOUT VECTOR
 998  003530  004767  014622                  JSR     PC,     TYPMAP    ;GO TYPE THE MAP.
 999  003534  004567  017716                  JSR     R5,     $PRINT    ;GO PRINT OUT THE FOLLOWING MESSAGE.
1000  003540  001201                          .WORD   $CRLF             ;ADDRESS OF MESSAGE TO BE TYPED
1001  003542  011067  175766                  MOV     (R0),   SAVTST    ;SET UP TEST MAP...LO 64K.
1002  003546  011167  175764                  MOV     (R1),   SAVTST+2  ;...HI 64K.
1003  003552  011000                          MOV     (R0),   R0        ;GET LOW MEM MAP
1004  003554  042700  177760                  BIC     #177760, R0       ;MASK ALL BUT BOTTOM 4 BANKS
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1005  003560  020027  000017            CMP     R0,     #17     ;CHECK THAT BOTTOM 16K IS ALL THERE!
1006  003564  001530                    BEQ     GMPR            ;BRANCH IF BOTTOM 16K EXISTS
1007  003566  004567  017664            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1008  003572  025470                    .WORD   INSUFF          ;ADDRESS OF MESSAGE TO BE TYPED
1009                                                            ;"FIRST 16K OF MEMORY NOT ALL THERE!"
1010  003574  000000            6$:     HALT                    ;FATAL ERROR HALT...
1011                                                            ;MEMORY IS NOT CONFIGURED TO RUN THIS PROGRAM.
1012                              ;;*****************************************************************
1013                              ;*  SPECIAL ROUTINE TO TYPE OUT ALL UNIBUS ADDRESSES WHICH RESPOND TO
1014                              ;*    DATI, DATIP, DATO, AND DATOB.
1015                              ;*****************************************************************
1016  003576  012706  001100    TIMOUT: MOV     #STACK, SP      ;SET UP THE STACK POINTER.
1017  003602  005067  175000            CLR     MMAVA           ;CLEAR MEM MGMT AVAILABLE FLAG.
1018  003606  032777  010000  175324    BIT     #SW12,  @SWR    ;CHECK IF MEM MGMT TO BE INHIBITED.
1019  003614  001011                    BNE     1$              ;BR IF NO MEM MGMT.
1020  003616  012737  003640  000004    MOV     #1$,    @#ERRVEC ;SET TIMEOUT FOR MEM MGMT CHECK.
1021  003624  005037  177572            CLR     @#SR0           ;CHECK FOR MEM MGMT...TIMES OUT IF NONE.
1022  003630  004767  010410            JSR     PC,     MMINIT  ;INIT ALL MEM MGMT REGISTERS.
1023  003634  005267  174746            INC     MMAVA           ;SET MEM MGMT AVAILABLE FLAG.
1024  003640                    1$:
1025  003640  004567  017612            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1026  003644  025403                    .WORD   BYTMES          ;ADDRESS OF MESSAGE TO BE TYPED
1027                                                            ;"BYTE MEMORY MAP:"
1028  003646  005000                    CLR     R0              ;SET UP TYPE OUT FLAG.
1029  003650  005002                    CLR     R2              ;SET ADDRESS POINTER TO ZERO.
1030  003652  012737  003716  000004    MOV     #20$,   @#ERRVEC ;SET TIME OUT VEC TO SERVICE NON-EX MEM.
1031  003660  105712            10$:    TSTB    (R2)            ;DO DATI ONLY.
1032  003662  032702  000001            BIT     #BIT0,  R2      ;CHECK FOR WORD ADDRESS.
1033  003666  001001                    BNE     11$             ;BR IF ODD BYTE ADDRESS.
1034  003670  011212                    MOV     (R2),   (R2)    ;DO DATI, DATO...NOP FOR READ ONLY MAP.
1035  003672  151212            11$:    BISB    (R2),   (R2)    ;DO DATI, DATIP, DATOB... NOP FOR READ ONLY MAP.
1036  003674  005700                    TST     R0              ;CHECK FOR PREVIOUS TYPOUT.
1037  003676  001023                    BNE     30$             ;BR IF ALREADY TYPED "FROM".
1038  003700  004567  017552            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1039  003704  025453                    .WORD   FROM            ;ADDRESS OF MESSAGE TO BE TYPED
1040                                                            ;"FROM"
1041  003706  010246                    MOV     R2,     -(SP)   ;PUT THE DATA ON THE STACK.
1042  003710  004767  021202            JSR     PC,     $TYPAD  ;DETERMINE THE PHYSICAL ADDRESS AND TYPE IT.
1043  003714  000413                    BR      29$             ;GO TO ADDRESS POINTER UPDATE.
1044                              ;*  TIME OUTS COME HERE.
1045  003716  022626            20$:    CMP     (SP)+,  (SP)+   ;POP TWO OFF STACK.
1046  003720  005700                    TST     R0              ;CHECK FOR PREVIOUS TYPOUT.
1047  003722  001411                    BEQ     30$             ;BR IF ALREADY TYPED "TO".
1048  003724  004567  017526            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1049  003730  025463                    .WORD   TO              ;ADDRESS OF MESSAGE TO BE TYPED
1050                                                            ;"TO"
1051  003732  005302                    DEC     R2              ;BACK UP ONE BYTE.
1052  003734  010246                    MOV     R2,     -(SP)   ;PUT THE DATA ON THE STACK.
1053  003736  004767  021154            JSR     PC,     $TYPAD  ;DETERMINE THE PHYSICAL ADDRESS AND TYPE IT.
1054  003742  005202                    INC     R2              ;RESET ADDRESS POINTER.
1055  003744  005100            29$:    COM     R0              ;RESET PREVIOUS TYPOUT FLAG.
1056  003746  005202            30$:    INC     R2              ;UPDATE ADDRESS POINTER TO NEXT BYTE.
1057  003750  001423                    BEQ     31$             ;EXIT IF ZERO REACHED.
1058  003752  032702  017777            BIT     #MASK4K,R2      ;CHECK FOR 4K BANK BOUNDRY.
1059  003756  001340                    BNE     10$             ;BR IF MORE THIS 4K BANK.
1060  003760  005767  174622            TST     MMAVA           ;CHECK IF MEM MGMT IS AVAILABLE.
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1061  003764  001735                        BEQ     10$             ;BR IF NO MEM MGMT.
1062  003766  022737  007600  172346        CMP     #7600, @#KIPAR3 ;CHECK FOR END OF LAST 4K BANK.
1063  003774  001411                        BEQ     31$             ;EXIT WHEN ALL DONE.
1064  003776  012702  060000                MOV     #60000, R2      ;RESET VIRTUAL ADDRESS POINTER.
1065  004002  013737  172346  172344        MOV     @#KIPAR3,@#KIPAR2 ;SAVE MEM MGMT REG FOR TYPEOUT.
1066  004010  062737  000200  172346        ADD     #200,   @#KIPAR3 ;UPDATE MEM MGMT REG 2 TO NEXT 4K BANK.
1067  004016  000720                        BR      10$             ;BR BACK TO DO NEXT BANK.
1068  004020  005700                31$:    TST     R0              ;CHECK PREVIOUS TYPE FLAG BEFORE EXIT.
1069  004022  001407                        BEQ     32$             ;BR TO EXIT IF TYPING ALL DONE.
1070  004024  004567  017426                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1071  004030  025463                        .WORD   TO              ;ADDRESS OF MESSAGE TO BE TYPED
1072                                                                ;"TO"
1073  004032  005302                        DEC     R2              ;BACK ADDRESS POINTER UP ONE BYTE.
1074  004034  010246                        MOV     R2,     -(SP)   ;PUT THE DATA ON THE STACK.
1075  004036  004767  021054                JSR     PC,     $TYPAD  ;DETERMINE THE PHYSICAL ADDRESS AND TYPE IT.
1076  004042  000000                32$:    HALT                    ;* THIS ROUTINE IS FOR DEBUG USE ONLY.
1077                                                                ;*  TO RUN THE MAIN PROGRAM RESTART AT 200 OR 204.
1078  004044  000654                        BR      TIMOUT          ;LOOP BACK AND DO AGAIN UPON CONTINUE.
1079
1080                                .SBTTL  MAP PARITY REGISTERS
1081                                ;;**************************************************************
1082                                ;*  SEARCH FOR PARITY REGISTERS PRESENT AND TYPE ADDRESSES OF THOSE FOUND
1083                                ;*  THAT ARE FUNCTIONAL AND HAVE CORRESPONDING PARITY MEMORY
1084                                ;;**************************************************************
1085
1086  004046  012704  002276        GMPR:   MOV     #MPRX,  R4      ;SET UP POINTER TO PARITY REG EXIST TABLE.
1087  004052  032777  000100  175060        BIT     #SW06,  @SWR    ;CHECK FOR INHIBIT PARITY SWITCH.
1088  004060  001036                        BNE     GMPRD           ;BR IF INHIBIT PARITY.
1089  004062  012703  002076                MOV     #MPRO,  R3      ;SET UP TABLE POINTER
1090  004066  012737  004110  000004        MOV     #GMPRB, @#ERRVEC ;SET UP TIMEOUT TRAP SERVICE
1091  004074  042713  000001        GMPRA:  BIC     #1,     (R3)    ;CLEAR FLAG BIT IN TABLE
1092  004100  005773  000000                TST     @(R3)           ;DOES THIS MEMORY PARITY REGISTER EXIST.
1093                                ;*  IF IT DOESN'T EXIST, A TIMEOUT TRAP WILL GO TO "GMPRB".
1094  004104  012324                        MOV     (R3)+,  (R4)+   ;SAVE IT IN THE PARITY REG EXIST TABLE.
1095  004106  000403                        BR      GMPRC           ;SKIP TIMEOUT SERVICE CODE
1096                                ;*  TIMEOUT COMES HERE
1097  004110  022626                GMPRB:  CMP     (SP)+,  (SP)+   ;RESTORE STACK POINTER
1098  004112  052723  000001                BIS     #1,     (R3)+   ;SET FLAG TO INDICATE REGISTER NOT PRESENT
1099  004116  005023                GMPRC:  CLR     (R3)+           ;CLEAR THE MAP...LO 64K.
1100  004120  005023                        CLR     (R3)+           ;...HI 64K.
1101  004122  005023                        CLR     (R3)+           ;...AND THE MASK.
1102  004124  020327  002276                CMP     R3,     #MPRX   ;HAVE WE CHECKED ALL REGISTERS?
1103  004130  103761                        BLO     GMPRA           ;NO - GO BACK TO CHECK NEXT ONE
1104  004132  005014                        CLR     (R4)            ;SET TERMINATOR IN PARITY REG EXIST TABLE.
1105  004134  012737  025060  000004        MOV     #ERRTRP,@#ERRVEC ; RESTORE TRAPCATCHER
1106  004142  005767  176130                TST     MPRX                    ;ANY PARITY REGISTERS PRESENT?
1107  004146  001006                        BNE     MPAMEM                  ;YES - GO TEST CONTROLS PRESENT
1108  004150  004567  017302                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1109  004154  025551                        .WORD   MTR             ;ADDRESS OF MESSAGE TO BE TYPED
1110                                                                ;"NO MEMORY PARITY REGISTERS FOUND"
1111  004156  005014                GMPRD:  CLR     (R4)            ;MAKE SURE TABLE IS CLEAR.
1112  004160  000167  001156                JMP     MANUAL                  ;AND SKIP ALL CONTROLS TESTING
1113
```

```
                                .SBTTL  MAP PARITY MEMORY
                                ;;*****************************************************************
                                ;MAP CORRESPONDENCE BETWEEN PARITY REGISTERS AND MEMORY, AND TYPE RESULTS
                                ;NOTE THAT IF PARITY MEMORY IS NOT LOCATED CORRECTLY THAT IT IS IN ALL
                                ;PROBABILITY DUE TO ONE OF THE FOLLOWING FAILURES:
                                ;       - SETTING WRITE WRONG PARITY DIDN'T CAUSE BAD PARITY TO BE WRITTEN
                                ;       - PARITY GENERATE OR DETECT LOGIC FAILED
                                ;       - PARITY ERROR BIT FAILED TO SET
                                ;       - PARITY BITS IN MEMORY LOCATION FAILED
                                ;       - I.E. BIT STUCK AT GOOD PARITY VALUE
                                ;;*****************************************************************

004164  004767  014044          MPAMEM: JSR     PC,     CLRPAR  ;INITIALIZE ALL PARITY REGISTERS
004170  012767  000001  175346          MOV     #1,     BITPT   ;INITIALIZE 4K POINTER
004176  005067  175344                  CLR     BITPT+2         ;CLEAR HI 64K POINTER
004202  012702  014000                  MOV     #14000, R2      ;SET ADR POINTER TO 14000.
004206  005767  174374                  TST     MMAVA           ;CHECK FOR MEM MGMT
004212  001404                          BEQ     MAPRB           ;BRANCH IF NO MEM MGMT
004214  012702  054000                  MOV     #54000, R2      ;SET ADR POINTER TO PAR2
004220  004767  010020                  JSR     PC,     MMINIT  ;SET UP ALL MEMORY MGMT REGISTERS.

                                ;;*****************************************************************
                                ;SET WRITE WRONG PARITY IN ALL REGISTERS PRESENT
                                ;*  THEN WRITE TEST LOCATION VIA DATO & READ TEST LOCATION VIA DATI
                                ;*  THEN CLEAR WRITE WRONG PARITY IN ALL REGISTERS.
                                ;;*****************************************************************

004224  005067  175310          MAPRB:  CLR     PMEMAP          ;CLEAR THE PARITY MEMORY MAP
004230  005067  175306                  CLR     PMEMAP+2
004234  012703  002076          1$:     MOV     #MPRO,  R3      ;INITIALIZE TABLE ADDRESS
004240  032713  000001          2$:     BIT     #1,     (R3)    ;IS THIS REGISTER PRESENT?
004244  001052                          BNE     3$              ;NO - GET THE NEXT ONE
004246  013773  001612  000000          MOV     @#WWP,  @(R3)   ;YES - SET WRITE WRONG PARITY
                                                                ;AND CLEAR REST OF REGISTER
004254  011212                          MOV     (R2),   (R2)    ;WRITE WRONG PARITY
004256  005712                          TST     (R2)            ;READ WRONG PARITY
004260  043773  001612  000000          BIC     @#WWP,  @(R3)   ;CLEAR WRITE WRONG PARITY
004266  005773  000000                  TST     @(R3)           ;OTHERWISE, CHECK TO SEE IF THIS
                                                                ;CONTROL REGISTER GOT A PARITY
                                                                ;ERROR
004272  100014                          BPL     6$              ;BRANCH IF IT DIDN'T AND CHECK
004274  032773  007740  000000          BIT     #7740,  @(R3)   ;IS IT A CORE PAR. REG.
004302  001404                          BEQ     5$              ;BRANCH IF NOT.
004304  012763  070032  000006          MOV     #70032, 6(R3)   ;IF IT IS SET UP MASK
004312  000413                          BR      7$              ;AND BRANCH TO SET BITS.
004314  012763  077772  000006  5$:     MOV     #77772, 6(R3)   ;IF MOS SET UP MASK
004322  000407                          BR      7$              ;AND BRANCH TO SET BIT.
004324  032773  007740  000000  6$:     BIT     #7740,  @(R3)   ;IF ANY BITS ARE SET
004332  001417                          BEQ     3$              ;THEN CSR IS MS11-K.
004334  012763  070000  000006          MOV     #70000, 6(R3)   ;IF MS11-K SET MASK.
004342  056763  175176  000002  7$:     BIS     BITPT,  2(R3)   ;SET FLAG IN MAP FOR THIS PARITY REGISTER
004350  056763  175172  000004          BIS     BITPT+2,4(R3)
004356  056767  175162  175154          BIS     BITPT,  PMEMAP  ;SET FLAG IN PARITY MAP
004364  056767  175156  175150          BIS     BITPT+2,PMEMAP+2
004372  062703  000010          3$:     ADD     #10,    R3      ;STEP UP TO NEXT REGISTER
004376  020327  002276                  CMP     R3,     #MPRX   ;ARE WE DONE WITH TABLE?
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1170  004402  103716                          BLO     2$              ;GO BACK TO CHECK FOR ANY MORE!
1171  004404  011212                          MOV     (R2),   (R2)    ;CLEAR BAD PARITY
1172  004406  005767  174174                  TST     MMAVA           ;CHECK FOR MEM MGMT
1173  004412  001444                          BEQ     10$             ;BR IF NO MEM MGMT
1174  004414  062737  000200  172344  4$:     ADD     #200,   @#KIPAR2 ;UPDATE PAR TO NEXT 4K BANK.
1175  004422  006367  175116                  ASL     BITPT           ;UPDATE BANK POINTER...LO 64K.
1176  004426  006167  175114                  ROL     BITPT+2         ;...HI 64K.
1177  004432  100441                          BMI     TMAP            ;BR IF ALL DONE.
1178  004434  023727  172344  001000          CMP     @#KIPAR2,#1000  ;THIS CODE TESTS IF MS11-K IS
1179  004442  001013                          BNE     12$             ;PRESENT AND IF IT IS I SET
1180  004444  032737  000003  002260          BIT     #3,@#MPR14+2    ;THE BIT TO DISABLE ECC IN
1181  004452  001004                          BNE     13$             ;THE LOCATION WWP THAT IS
1182  004454  032737  000003  002270          BIT     #3,@#MPR15+2    ;USED AS THE COMMAND TO
1183  004462  001400                          BEQ     13$             ;WRITE WRONG PARITY.
1184  004464  012737  020004  001612  13$:     MOV     #20004,@#WWP
1185  004472  036767  175046  175024  12$:     BIT     BITPT,  MEMMAP  ;CHECK IF BANK EXISTS...LO 64K.
1186  004500  001255                          BNE     1$              ;BR IF BANK EXISTS.
1187  004502  036767  175040  175016          BIT     BITPT+2,MEMMAP+2 ;...HI 64K.
1188  004510  001251                          BNE     1$              ;BR IF BANK EXISTS.
1189  004512  000740                          BR      4$              ;BR IF  ANK DOESN'T EXIST.
1190  004514  036767  175024  175002  11$:     BIT     BITPT,  MEMMAP  ;CHECK  F BANK EXISTS.
1191  004522  001244                          BNE     1$              ;BR IF BANK EXISTS.
1192  004524  062702  020000          10$:     ADD     #20000, R2      ;UPDATE ADDRESS POINTER TO NEXT BANK.
1193  004530  106367  175010                  ASLB    BITPT           ;MOVE POINTER TO NEXT BANK.
1194  004534  100367                          BPL     11$             ;BR IF MORE TO LOOK FOR.
1195
1196                                  ;;*****************************************************************
1197                                  ;*  ROUTINE TO TYPE MAP OF WHERE PARITY MEMORY IS PRESENT
1198                                  ;*  AND WHICH CONTROL REGISTERS CONTROL WHICH MEMORY
1199                                  ;;*****************************************************************
1200
1201  004536  004767  013472          TMAP:   JSR     PC,     CLRPAR  ;INITIALIZE ALL PARITY REGISTERS PRESENT
1202  004542  004567  016710                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1203  004546  025426                          .WORD   MTMAP           ;ADDRESS OF MESSAGE TO BE TYPED
1204                                                                  ;"PARITY MEMORY MAP:"
1205  004550  012703  002076                  MOV     #MPR0,  R3      ;INITIALIZE TABLE POINTER
1206  004554  032713  000001          1$:     BIT     #BIT0,  (R3)    ;CHECK IF THIS REGISTER IS PRESENT.
1207  004560  001046                          BNE     2$              ;BR IF NOT PRESENT.
1208  004562  022763  070032  000006          CMP     #70032, 6(R3)
1209  004570  001004                          BNE     3$
1210  004572  004567  016660                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1211  004576  026067                          .WORD   MX3             ;ADDRESS OF MESSAGE TO BE TYPED
1212                                                                  ;"CORE PARITY"
1213  004600  000417                          BR      5$
1214  004602  022763  077772  000006  3$:     CMP     #77772, 6(R3)
1215  004610  001004                          BNE     4$
1216  004612  004567  016640                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1217  004616  026106                          .WORD   MX4             ;ADDRESS OF MESSAGE TO BE TYPED
1218                                                                  ;"MOS PARITY"
1219  004620  000407                          BR      5$
1220  004622  022763  070000  000006  4$:     CMP     #70000, 6(R3)
1221  004630  001003                          BNE     5$
1222  004632  004567  016620                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1223  004636  026124                          .WORD   MX5             ;ADDRESS OF MESSAGE TO BE TYPED
1224                                                                  ;"MS11-K CSR"
1225  004640                          5$:
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1226  004640  004567  016612            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1227  004644  026035                    .WORD   MX1             ;ADDRESS OF MESSAGE TO BE TYPED
1228                                                            ;"REGISTER AT"
1229  004646  011346                    MOV     (R3),-(SP)      ;;SAVE (R3) FOR TYPEOUT
1230                            ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOC ROUTINE
1231                            ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
1232  004650  013746  177776            MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
1233  004654  004767  017774            JSR     PC,     $TYPOC  ;GO TO THE SUBROUTINE
1234  004660  004567  016572            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1235  004664  026054                    .WORD   MX2             ;ADDRESS OF MESSAGE TO BE TYPED
1236                                                            ;"CONTROLS"
1237  004666  010300                    MOV     R3,     R0      ;SET UP R0 FOR TYPMAP ROUTINE.
1238  004670  005720                    TST     (R0)+           ;UPDATE POINTER TO MAP.
1239  004672  004767  013460            JSR     PC,     TYPMAP  ;GO TYPE THE MEMORY COVERED BY THIS REGISTER.
1240  004676  062703  000010    2$:     ADD     #10,    R3      ;UPDATE TO NEXT REGISTER IN TABLE.
1241  004702  020327  002276            CMP     R3,     #MPRX   ;ARE WE ALL DONE WITH TABLE?
1242  004706  103722                    BLO     1$              ;BRANCH IF MORE REGISTERS
1243  004710  004567  016542            JSR     R5,     $PRINT  ;THE REASON I'M OUTPUTTING THIS CRLF
1244  004714  001201                    $CRLF                   ;IS TO GIVE THE PRINTER ENOUGH TIME TO
1245                                                            ;FINISH PRINTING THE MEMORY MAP BEFORE THE RESET OCCURS.
1246  004716  022737  070000  002264    CMP     #70000,@#MPR14+6 ;DO WE HAVE MS11-K AT THIS ADDRESS
1247  004724  001006                    BNE     7$              ;IF NO BRANCH
1248  004726  043727  002260  001540    BIC     @#MPR14+2,#PMEMAP ;IF YES THEN CLEAR THE BITS IN
1249  004734  043737  002262  001540    BIC     @#MPR14+4,@#PMEMAP ;THE PARITY MEMORY MAP.
1250  004742  022737  070000  002274  7$:CMP     #70000, @#MPR15+6       ;DO WE HAVE A MS11-K
1251  004750  001031                    BNE     9$              ;IF NO GO TO TESTS NOW.
1252  004752  043737  002270  001540    BIC     @#MPR15+2,@#PMEMAP      ;IF YES I AM GOING TO
1253  004760  043737  002272  001542    BIC     @#MPR15+4,@#PMEMAP+2    ;CLEAR THE PARITY INDICATORS
1254  004766  012705  007276            MOV     #MPRX,  R5      ;FOR THAT PORTION OF MEMORY.
1255  004772  021537  002256    6$:     CMP     (R5),@#MPR14    ;SEARCH FOR THIS MS11-K  CSR IN
1256  004776  001004                    BNE     8$              ;AND IF ITS THERE DELETE IT
1257  005000  005015                    CLR     (R5)
1258  005002  052737  000001  002256    BIS     #1,@#MPR14
1259  005010  022537  002266    8$:     CMP     (R5)+,  @#MPR15 ;SEARCH FOR MS11-K CSR IN
1260  005014  001366                    BNE     6$              ;THE AVAILABILITY TABLE,
1261  005016  005045                    CLR     -(R5)           ;AND CLEAR ITS ADDRESS FROM THE TABLE
1262  005020  052737  000001  002266    BIS     #1,     @#MPR15 ;SET BIT0 IN ADDRESS IN CSR TABLE
1263  005026  004567  016424            JSR     R5,     $PRINT  ;OUTPUT MESSAGE TO RUN MS11-K TEST.
1264  005032  026142                    .WORD   MX6
1265  005034  005737  002276    9$:     TST     @#MPRX          ;ARE THERE ANY PARITY REGISTERS TO TEST?
1266  005040  001002                    BNE     CTRLS           ;IF SO TEST THE BITS IN THE REGISTERS,
1267  005042  000167  000274            JMP     MANUAL          ;IF NO JUMP OVER REGISTER TESTS.
1268
1269                                    .SBTTL  TEST PARITY REGISTERS
1270                                    ;;**************************************************************
1271                                    ;* SHOW THAT BITS 0, 2, 5 - 11, AND 15 OF EACH PARITY REGISTER PRESENT
1272                                    ;*  CAN BE SET AND CLEARED.
1273                                    ;*  THIS IS A ONCE ONLY TEST.
1274                                    ;;**************************************************************
1275
1276  005046  012703  002076    CTRLS:  MOV     #MPR0,  R3      ;LOAD INITIAL TABLE ADDRESS FOR A POINTER
1277  005052  011302            1$:     MOV     (R3),   R2      ;LOAD R2 WITH ADDRESS OF THIS PARITY REGISTER
1278  005054  062703  000010            ADD     #10,    R3      ;UPDATE POINTER TO NEXT PAR. REG. ADD.
1279  005060  032702  000001            BIT     #1,     R2      ;IS THIS REGISTER BEING USED?
1280  005064  001372                    BNE     1$              ;GO TO NEXT IF NOT
1281  005066  020327  002276            CMP     R3,     #MPRX   ;ARE WE AT END OF TABLE
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1282  005072  003055                        BGT     RESCHK          ;GO TO NEXT TEST IF YES
1283  005074  005763  177776                TST     -2(R3)          ;TEST MASK FOR PARITY REGISTER
1284  005100  001764                        BEQ     1$              ;IF = 0,THEN DO NOT TEST
1285  005102  016367  177776  174406        MOV     -2(R3), RESRVD  ;GET MASK FOR REGISTER WE ARE WORKING ON
1286  005110  012700  000001                MOV     #1,     R0      ;LOAD R0 WITH VALUE OF 1ST BIT TESTED
1287  005114  005012                        CLR     (R2)            ;INITIALIZE THE PARITY REGISTER
1288  005116  011201                        MOV     (R2),   R1      ;READ THE CONTENTS OF THE PARITY REGISTER
1289  005120  046701  174372                BIC     RESRVD, R1      ;CLEAR BITS WHICH ARE RESERVED
1290  005124  001405                        BEQ     2$              ;CHECK OTHER BITS - BRANCH IF OK
1291  005126  004767  013124        64$:    JSR     PC,     SPRNT   ;SET UP VALUES FOR ERROR PRINTING.
1292  005132  004767  014446                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1293  005136  000001                        .WORD   1               ;ERROR TYPE CODE.
1294  005140  030067  174352        2$:     BIT     R0,     RESRVD  ;IS THIS BIT RESERVED?
1295  005144  001025                        BNE     3$              ;YES - DON'T TEST IT
1296  005146  010012                        MOV     R0,     (R2)    ;NO - SET THIS BIT IN THE PARITY REGISTER
1297  005150  011201                        MOV     (R2),   R1      ;READ & SAVE CONTENTS OF THE  PARITY REGISTER
1298  005152  005012                        CLR     (R2)            ;CLEAR THE PARITY REGISTER
1299  005154  046701  174336                BIC     RESRVD, R1      ;CLEAR BIT LOCATIONS THAT ARE RESERVED
1300  005160  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WC D WITH THE DATA READ.
1301  005162  001405                        BEQ     66$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1302  005164  004767  013116        65$:    JSR     PC,     SPRNTO  ;SET UP VALUES FOR ERROR PRINTING.
1303  005170  004767  014410                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1304  005174  000001                        .WORD   1               ;ERROR TYPE CODE.
1305  005176                        66$:
1306  005176  011201                        MOV     (R2),   R1      ;READ THE CONTENTS OF THE PARITY REGISTER
1307  005200  046701  174312                BIC     RESRVD, R1      ;CLEAR BITS WHICH ARE RESERVED
1308  005204  001405                        BEQ     3$              ;CHECK OTHER BITS - BRANCH IF OK
1309  005206  004767  013044        67$:    JSR     PC,     SPRNT   ;SET UP VALUES FOR ERROR PRINTING.
1310  005212  004767  014366                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1311  005216  000001                        .WORD   1               ;ERROR TYPE CODE.
1312  005220  006300                3$:     ASL     R0              ;ROTATE TO GET NEXT BIT TO BE TESTED
1313  005222  103346                        BCC     2$              ;BRANCH IF NOT DONE WITH ALL BITS
1314  005224  000712                        BR      1$              ;AFTER TESTING FOR BIT 15 GO GET NEXT REGISTER.
1315
1316                                ;;*****************************************************************
1317                                ;* SHOW THAT RESET CLEARS BITS 0,2, AND 15 OF EACH PARITY REGISTER PRESENT.
1318                                ;*  THIS IS A ONCE ONLY TEST.
1319                                ;;*****************************************************************
1320
1321  005226  012704  002076        RESCHK: MOV     #MPR0,  R4      ;LOAD INITIAL TABLE ADDRESS FOR A POINTER
1322  005232  010403                1$:     MOV     R4,     R3
1323  005234  062704  000010                ADD     #10,    R4
1324  005240  032713  000001        BIT     #1,     (R3)    ;IS THIS REGISTER BEING USED
1325  005244  001372                        BNE     1$              ;BRANCH IF NO
1326  005246  012773  177777  000000        MOV     #-1,    @(R3)   ;SET ALL BITS TO A 1
1327  005254  022704  002276                CMP     #MPRX,R4        ;ARE WE AT THE END OF THE TABLE
1328  005260  002764                        BLT     1$              ;IF YES THEN WE ARE READY TO TEST
1329  005262  000005                        RESET                   ;RESET THE WORLD
1330  005264  012703  002076                MOV     #MPR0,  R3      ;LOAD INITIAL ADDRESS FOR POINTER
1331  005270  011302                2$:     MOV     (R3),   R2      ;STORE PARITY REGISTER ADDRESS
1332  005272  062703  000010                ADD     #10,    R3
1333  005276  032702  000001                BIT     #1,     R2
1334  005302  001372                        BNE     2$
1335  005304  022703  002276                CMP     #MPRX,  R3
1336  005310  002014                        BGE     MANUAL
1337  005312  011201                        MOV     (R2),   R1      ;GET CONTENTS OF REGISTER
```

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1338  005314  005012                    CLR     (R2)
1339  005316  042701  077772            BIC     #77772, R1      ;CLEAR BITS NOT EFFECTED  BY RESET
1340  005322  005701                    TST     R1              ;CHECK IF REST  WERE CLEARED BY  RESET
1341  005324  001405                    BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1342  005326  004767  012724            64$:    JSR     PC,     SPRNT   ;SET UP VALUES FOR ERROR PRINTING.
1343  005332  004767  014246                    JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1344  005336  000001                            .WORD   1               ;ERROR TYPE CODE.
1345  005340                            65$:
1346  005340  000753                    BR      2$              ;BRANCH BACK TO CHECK NEXT REGISTER
1347
1348
1349  005342  012700  000014            MANUAL: MOV     #12.,   R0      ;SET COUNTER TO CLEAR 12 WORDS.
1350  005346  012701  001562                    MOV     #FSTADR,R1      ;STARTING AT FSTADR.
1351  005352  005021                    1$:     CLR     (R1)+           ;CLEAR THE LOCATIONS.
1352  005354  005300                    DEC     R0              ;COUNT.
1353  005356  001375                    BNE     1$              ;BR IF MORE.
1354  005360  105767  174172            TSTB    SELFLG          ;CHECK FOR SELECT PARAMETERS STARTUP.
1355  005364  001005                    BNE     MANUL1          ;BR IF PARAMETERS TO BE SELECTED.
1356  005366  016767  173572  174200    MOV     $TMP2,  LSTADR  ;SET UP VIRTUAL LAS  ADDRESS.
1357  005374  000167  000402            JMP     MANUL2          ;SKIP PARAMETER SEL. CTION SECTION.
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                                .SBTTL  USER PARAMETER SELECTION SECTION
                                ;;*****************************************************************
                                ;* USER PARAMETER SELECTION SECTION IS ENTERED BY STARTING AT 204.
                                ;;*****************************************************************
005400  012700  000001          MANUL1: MOV     #BITO,  R0          ;SET UP BANK POINTER.
005404  005001                          CLR     R1                  ;...HI 64K.
005406  005002                          CLR     R2                  ;CLEAR ADDRESS POINTER.
005410  005003                          CLR     R3                  ;...HI ADDRESS BITS.
005412  004567  016040                  JSR     R5,     $PRINT      ;GO PRINT OUT THE FOLLOWING MESSAGE.
005416  026255                          .WORD   FADMES              ;ADDRESS OF MESSAGE TO BE TYPED
                                                                    ;"FIRST ADDRESS:"
                                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $RDOCT ROUTINE
                                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
005420  013746  177776                  MOV     @#PSW,  -(SP)       ;PUT THE PROCESSOR STATUS ON THE STACK
005424  004767  015654                  JSR     PC,     $RDOCT      ;GO TO THE SUBROUTINE
005430  042716  000001                  BIC     #BITO,  (SP)        ;MAKE SURE ADDRESS IS ON A WORD BOUNDRY.
005434  005067  174074                  CLR     SAVTST              ;INIT TEST MAP...LO 64K.
005440  005067  174072                  CLR     SAVTST+2            ;...HI 64K.
005444  062702  020000          1$:     ADD     #20000, R2          ;UPDATE ADDRESS POINTER TO NEXT BANK.
005450  005503                          ADC     R3
005452  020367  015776                  CMP     R3,     $HIOCT      ;CHECK HI ADDRESS BITS.
005456  103403                          BLO     2$                  ;BR IF NOT HI ENOUGH YET.
005460  101006                          BHI     3$                  ;BR IF PAST SELECTED ADDRESS.
005462  020216                          CMP     R2,     (SP)        ;CHECK THE LO ADDRESS BITS.
005464  101004                          BHI     3$                  ;BR IF PAST SELECTED ADDRESS.
005466  006300          2$:     ASL     R0                          ;UPDATE POINTER...LO 64K.
005470  006101                          ROL     R1                  ;...HI 64K.
005472  100364                          BPL     1$                  ;BR BACK TO CHECK NEXT BANK.
005474  000507                          BR      17$                 ;BR IF OVERFLOW.
005476  030067  174022          3$:     BIT     R0,     MEMMAP      ;CHECK IF BANK EXISTS.
005502  001003                          BNE     4$                  ;BR IF BANK EXISTS.
005504  030167  174016                  BIT     R1,     MEMMAP+2    ;CHECK HI 64K.
005510  001501                          BEQ     17$                 ;BR IF ADDRESS IN UN-MAPPED BANK.
005512  016704  015736          4$:     MOV     $HIOCT, R4          ;SAVE FIRST ADR HI BITS.
005516                          10$:
005516  004567  015734                  JSR     R5,     $PRINT      ;GO PRINT OUT THE FOLLOWING MESSAGE.
005522  026342                          .WORD   LADMES              ;ADDRESS OF MESSAGE TO BE TYPED
                                                                    ;"LAST ADDRESS:"
                                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $RDOCT ROUTINE
                                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
005524  013746  177776                  MOV     @#PSW,  -(SP)       ;PUT THE PROCESSOR STATUS ON THE STACK
005530  004767  015550                  JSR     PC,     $RDOCT      ;GO TO THE SUBROUTINE
005534  005716                          TST     (SP)                ;CHECK IF ADR 0 SELECTED (DEFAULT).
005536  001010                          BNE     11$                 ;BR IF NOT 0 (DEFAULT)
005540  005767  015710                  TST     $HIOCT              ;CHECK HI BITS.
005544  001005                          BNE     11$                 ;BR IF NOT 0 (DEFAULT).
005546  016716  173412                  MOV     $TMP2,  (SP)        ;SET UP DEFAULT LAST ADR.
005552  016767  173410  015674          MOV     $TMP3,  $HIOCT
005560  012667  174010          11$:    MOV     (SP)+,  LSTADR      ;GET THE DATA.
005564  020467  015664                  CMP     R4,     $HIOCT      ;CHECK FOR LAST ADR BELOW FIRST ADR.
005570  101352                          BHI     10$                 ;BB IF LAST BELOW FIRST.
005572  103403                          BLO     12$                 ;BR IF LAST ABOVE FIRST.
005574  021667  173774                  CMP     (SP),   LSTADR      ;CHECK FOR LAST BELOW FIRST.
005600  101346                          BHI     10$                 ;BR IF LAST BELOW FIRST.
005602  032716  017777          12$:    BIT     #MASK4K,(SP)        ;CHECK IF FIRST ADR ON BANK BOUNDRY.
005606  001404                          BEQ     13$                 ;BR IF ON BOUNDRY.
```

```
1414  005610  010067  173754          MOV     R0,     FADMAP  ;SET UP FIRST ADDRESS MAP.
1415  005614  010167  173752          MOV     R1,     FADMAP+2
1416  005620  050067  173710  13$:    BIS     R0,     SAVTST  ;SET FLAG IN TEST MAP...LO 64K.
1417  005624  050167  173706          BIS     R1,     SAVTST+2        ...HI 64K.
1418  005630  020367  015620  14$:    CMP     R3,     $HIOCT  ;CHECK FOR PAST LAST ADR.
1419  005634  103404                  BLO     15$             ;BR IF BELOW LAST ADR.
1420  005636  101020                  BHI     16$             ;BR IF GONE PAST LAST ADR.
1421  005640  020267  173730          CMP     R2,     LSTADR  ;CHECK FOR PAST LAST ADR.
1422  005644  101015                  BHI     16$             ;BR IF GONE PAST LAST ADR.
1423  005646  062702  020000  15$:    ADD     #20000, R2      ;UPDATE ADDRESS POINTER.
1424  005652  005503                  ADC     R3              ;...HI BITS.
1425  005654  006300                  ASL     R0              ;UPDATE BANK POINTER...LO 64K.
1426  005656  006101                  ROL     R1              ;...HI 64K.
1427  005660  100415                  BMI     17$             ;BR IF OVERFLOW.
1428  005662  030067  173636          BIT     R0,     MEMMAP  ;CHECK IF THIS BANK EXISTS.
1429  005666  001354                  BNE     13$             ;BR IF BANK EXISTS.
1430  005670  030167  173632          BIT     R1,     MEMMAP+2 ;CHECK IF THIS BANK EXISTS.
1431  005674  001351                  BNE     13$             ;BR IF BANK EXISTS.
1432  005676  000754                  BR      14$             ;BR IF BANK DOESN'T EXIST.
1433  005700  030067  173620  16$:    BIT     R0,     MEMMAP  ;CHECK IF THIS BANK EXISTS.
1434  005704  001010                  BNE     20$             ;BR IF IT EXISTS.
1435  005706  030167  173614          BIT     R1,     MEMMAP+2 ;CHECK IF THIS BANK EXISTS.
1436  005712  001005                  BNE     20$             ;BR IF IT EXISTS.
1437  005714  005726  017$:    TST     (SP)+           ;ADJUST THE STACK.
1438  005716  004567  015534          JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1439  005722  026365                  .WORD   BADADR          ;ADDRESS OF MESSAGE TO BE TYPED
1440                                                          ;"?ADDRESS IN UNMAPPED BANK?"
1441  005724  000606                  BR      MANUAL          ;LOOP BACK TO THE BEGINNING.
1442  005726  010067  173650  20$:    MOV     R0,     LADMAP  ;SET UP MAP FOR LAST ADDRESS.
1443  005732  010167  173646          MOV     R1,     LADMAP+2
1444  005736  005767  172644  21$:    TST     MMAVA           ;CHECK FOR MEMORY MANAGEMENT.
1445  005742  001404                  BEQ     22$             ;BR IF NO MEM MGMT.
1446  005744  042716  160000          BIC     #160000,(SP)    ;ADJUST FSTADR TO VITRUAL BANK 0.
1447  005750  062716  040000          ADD     #40C00, (SP)    ;...TO VIRTUAL BANK 2.
1448  005754  012667  173602  22$:    MOV     (SP)+,  FSTADR  ;SAVE FISRT ADDRESS OFF THE STACK.
1449  005760          30$:
1450  005760  004567  015472          JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
1451  005764  026422                  .WORD   CONST           ;ADDRESS OF MESSAGE TO BE TYPED
1452                                                          ;"SELECT CONSTANT: "
1453                                  ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $RDOCT ROUTINE
1454                                  ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
1455  005766  013746  177776          MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
1456  005772  004767  015306          JSR     PC,     $RDOCT  ;GO TO THE SUBROUTINE
1457  005776  012667  173606          MOV     (SP)+,  .CONST  ;SAVE THE CONSTANT
1458  006002  005767  172600  MANUL2: TST     MMAVA           ;CHECK IF MEM MGMT IS AVAILABLE.
1459  006006  001406                  BEQ     31$             ;BR IF NO MEM MGMT.
1460  006010  042767  160000  173556  BIC     #160000,LSTADR  ;ADJUST LSTADR TO VIRTUAL BANK 0.
1461  006016  062767  040000  173550  ADD     #40000, LSTADR  ;...VIRTUAL BANK 2.
1462  006024  062767  000002  173542  31$:    ADD     #2,     LSTADR  ;ADJUST LAST ADDRESS UP ONE WORD.
1463  006032  042767  000001  173534  BIC     #BIT0,  LSTADR  ;MAKE SURE IT IS A WORD ADDRESS.
1464  006040  032767  017777  173526  BIT     #MASK4K,LSTADR  ;CHECK IF LAST ADR IS ON BANK BOUNDRY.
1465  006046  001004                  BNE     START1          ;BR IF NOT ON BOUNDRY.
1466  006050  005067  173526          CLR     LADMAP          ;CLEAR OUT THE LAST ADDRESS MAP.
1467  006054  005067  173524          CLR     LADMAP+2
1468
```

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        ;/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:/*\:
        ;*  THE REST OF THE PROGRAM IS POSITION INDEPENDENT CODE, SO THAT IT CAN EXICUTE PROPERLY WHEN THE PROGRAM HAS BEEN RELO
        ;*  THIS IS DONE SO THAT THE FIRST TWO BANKS OF MEMORY CAN BE EXERCISED IN EXACTLY THE SAME MANNER AS THE REST OF MEMORY
        ;/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*/:\*

  1475  006060  016706  173536          START1: MOV     .STACK, SP      ;SET STACK POINTER
  1476  006064  005767  173526                  TST     CASFLG          ;CHECK CACHE PRESENT FLAG
  1477  006070  001403                          BEQ     1$              ;BRANCH IF NO CACHE
  1478  006072  052777  000014  173520          BIS     #14,    @CASREG ;TURN OFF CACHE
  1479  006100  012767  006060  173000  1$:     MOV     #START1,$LPADR  ;INIT LOOP ADDRESS.
  1480  006106  066767  172466  172772          ADD     RELOCF, $LPADR
  1481  006114  004767  011362                  JSR     PC,     MAMF    ;SET UP MEMORY PARITY ERROR VECTOR
  1482  006120  005767  172462                  TST     MMAVA           ;CHECK FOR MEMORY MANAGEMENT AVAILABLE.
  1483  006124  001406                          BEQ     TST1            ;BRANCH IF NO MEM MGMT.
  1484  006126  032737  000001  177572          BIT     #BIT0,  @#SR0   ;CHECK IF MEM MGMT ENABLED.
  1485  006134  001002                          BNE     TST1            ;BR IF MEM MGMT ENABLED.
  1486  006136  004767  006102                  JSR     PC,     MMINIT  ;SET UP MEM MGMT REGISTERS.
```

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                                .SBTTL SECTION 1:       MEMORY ADDRESS TESTS
                                ;;*****************************************************************
                                ;*TEST 1         WRITE VALUE OF MEMORY ADDRESS INTO MEMORY
                                ;*      R0 = DATA WRITTEN INTO MEMORY (SHOULD BE)
                                ;*      R1 = DATA READ FROM MEMORY (WAS)
                                ;*      R2 = VIRTUAL ADDRESS
                                ;*      R3 = NOT USED
                                ;*      R4 = NOT USED
                                ;*      R5 = BLOCK BOUNDRY BIT MASK.
                                ;;*****************************************************************
006142                          TST1:
006142  004567  012426                JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
006146  000001                       .WORD   1               ;MINIMUM BLOCK SIZE OF 1 WORDS
                                                               ; REQUIRED FOR THIS TEST.
006150  000167  005604                JMP     TST32           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                               ; AVAILABLE FOR TEST.
                                ;*  UPWARDS WORD ADDRESSING.
006154  004467  006212                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006160  004767  007634          1$:   JSR     PC,     PHYADR  ;GET PHYSICAL ADDRESS INTO R0
006164  010012                  2$:   MOV     R0,     (R2)    ;WRITE VALUE OF ADDRESS INTO ADDRESS
006166  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
006170  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
006172  001405                        BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
006174  004767  012132          64$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
006200  004767  013400                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
006204  000002                       .WORD   2               ;ERROR TYPE CODE.
006206                          65$:
006206  062700  000002                ADD     #2,     R0      ;ADD #2 TO PHYSICAL ADDRESS
006212  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006214  001363                        BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
006216  004767  006726                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;*  CHECK THAT VALUE OF MEMORY ADDRESS WAS WRITTEN CORRECTLY
                                ;*  DOWNWARDS WORD ADDRESSING.
006222  004467  006602                JSR     R4,     INITDN  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006226  004767  007566          3$:   JSR     PC,     PHYADR  ;GET PHYSICAL ADDRESS INTO R0
006232  162700  000002          4$:   SUB     #2,     R0      ;DEC DATA BY 2
006236  014201                        MOV     -(R2),  R1      ;GET THE DATA FROM MEMORY
006240  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
006242  001405                        BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
006244  004767  012036          66$:  JSR     PC,     SPRNT0  ;SET UP VALUES FOR ERROR PRINTING.
006250  004767  013330                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
006254  000002                       .WORD   2               ;ERROR TYPE CODE.
006256                          67$:
006256  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006260  001364                        BNE     4$              ;BRANCH IF MORE IN CURRENT BLOCK.
006262  004767  007352                JSR     PC,     MMDOWN  ;FIND NEXT BLOCK AND LOOP TO $TAG1.
```

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                                ;;*****************************************************************
                                ;*TEST 2        WRITE VALUE OF MEMORY ADDRESS INTO MEMORY
                                ;*      R0 = DATA WRITTEN INTO MEMORY (SHOULD BE)
                                ;*      R1 = DATA READ FROM MEMORY (WAS)
                                ;*      R2 = VIRTUAL ADDRESS
                                ;*      R3 = NOT USED
                                ;*      R4 = NOT USED
                                ;*      R5 = BLOCK BOUNDRY BIT MASK.
                                ;;*****************************************************************
006266                          TST2:
006266  004567  012302                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
006272  000000                          .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
                                ;*  UPWARDS BYTE ADDRESSING.
006274  004467  006072                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006300  004767  007514          1$:     JSR     PC,     PHYADR  ;GET PHYSICAL ADDRESS INTO R0
006304  110022          2$:     MOVB    R0,     (R2)+   ;WRITE VALUE OF ADDRESS INTO ADDRESS
006306  005200                  INC     R0              ;ADD ONE TO PHYSICAL ADDRESS
006310  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006312  001374                  BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
006314  004767  006630                  JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;*  CHECK THAT VALUE OF MEMORY ADDRESS WAS WRITTEN CORRECTLY
                                ;*  DOWNWARDS BYTE ADDRESSING.
006320  004467  006504                  JSR     R4,     INITDN  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006324  004767  007470          3$:     JSR     PC,     PHYADR  ;GET PHYSICAL ADDRESS INTO R0
006330  005300          4$:     DEC     R0              ;DEC DATA BY 1
006332  114201                  MOVB    -(R2),  R1      ;GET THE DATA FROM MEMORY
006334  120001                  CMPB    R0,     R1      ;CHECK THE DATA...LO BYTE ONLY VALID.
006336  001405                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
006340  004767  011742  64$:    JSR     PC,     SPRNTO  ;SET UP VALUES FOR ERROR PRINTING.
006344  004767  013234          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
006350  000003                  .WORD   3               ;ERROR TYPE CODE.
006352                  65$:
006354  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006356  001365                  BNE     4$              ;BRANCH IF MORE IN CURRENT BLOCK.
006360  004767  007256          JSR     PC,     MMDOWN  ;FIND NEXT BLOCK AND LOOP TO $TAG1.

                                ;;*****************************************************************
                                ;*TEST 3        WRITE 1'S COMPLEMENT VALUE OF ADDRESS INTO ADDRESS.
                                ;*      R0 = DATA WRITTEN INTO MEMORY (SHOULD BE)
                                ;*      R1 = DATA READ FROM MEMORY (WAS)
                                ;*      R2 = VIRTUAL ADDRESS
                                ;*      R3 = NOT USED
                                ;*      R4 = NOT USED
                                ;*      R5 = BLOCK BOUNDRY BIT MASK.
                                ;;*****************************************************************
006362                          TST3:
006362  004567  012206                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
006366  000000                          .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
                                ;*  DOWNWARDS WORD ADDRESSING.
006370  004467  006434                  JSR     R4,     INITDN  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006374  004767  007420          1$:     JSR     PC,     PHYADR  ;GET PHYSICAL ADDRESS INTO R0
006400  005100                  COM     R0              ;COMPLEMENT THE ADR
006402  062700  000002          2$:     ADD     #2,     R0      ;+2 TO DATA--ADR GOES DOWN SO COM GOES UP
006406  010042                  MOV     R0,     -(R2)   ;PUT DATA INTO MEMORY
006410  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
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                                        BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
                                        JSR     PC,     MMDOWN  ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;*  CHECK COMPLEMENT DATA WRITTEN DOWN
                                ;*  UPWARDS WORD ADDRESSING.
                                        JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
                                3$:     JSR     PC,     PHYADR  ;GET PHYSICAL ADDRESS INTO R0
                                        COM     R0              ;COMPLEMENT IT
                                4$:
                                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
                                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
                                        BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
                                64$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
                                        JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
                                        .WORD   2               ;ERROR TYPE CODE.
                                65$:
                                        SUB     #2,     R0      ;COUNT DOWN WITH ADDRESS
                                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
                                        BNE     4$              ;BRANCH IF MORE IN CURRENT BLOCK.
                                        JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 3$.

                                ;;*****************************************************************
                                ;*TEST 4         WRITE BANK # INTO ALL ADDRESSES IN A 4K BANK
                                ;*      R0 = DATA WRITTEN INTO MEMORY (SHOULD BE)
                                ;*      R1 = DATA READ FROM MEMORY (WAS)
                                ;*      R2 = VIRTUAL ADDRESS
                                ;*      R3 = NOT USED
                                ;*      R4 = NOT USED
                                ;*      R5 = BLOCK BOUNDRY BIT MASK.
                                ;;*****************************************************************
                                TST4:
                                        JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
                                        .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
                                ;*  UPWARDS BYTE ADDRESSING.
                                        JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
                                1$:     JSR     PC,     BANKNO  ;GET THE BANK NUMBER INTO R0
                                2$:     MOVB    R0,     (R2)+   ;WRITE BANK # INTO ALL ADDRESSES
                                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
                                        BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
                                        JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;*  CHECK THAT DATA WRITTEN ABOVE CAN BE READ
                                ;*  UPWARDS BYTE ADDRESSING.
                                        JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
                                3$:     JSR     PC,     BANKNO  ;GET THE BANK NUMBER INTO R0
                                4$:     MOVB    (R2)+,  R1      ;READ THE DATA OUT OF MEMORY
                                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
                                        BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
                                64$:    JSR     PC,     SPRNT1  ;SET UP VALUES FOR ERROR PRINTING.
                                        JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
                                        .WORD   3               ;ERROR TYPE CODE.
                                65$:
                                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
                                        BNE     4$              ;BRANCH IF MORE IN CURRENT BLOCK.
                                        JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 3$.
```

```
                                ;;*****************************************************************
                                ;*TEST 5        WRITE 1'S COMPLEMENT OF BANK #.
                                ;*      R0 = DATA WRITTEN INTO MEMORY (SHOULD BE)
                                ;*      R1 = DATA READ FROM MEMORY (WAS)
                                ;*      R2 = VIRTUAL ADDRESS
                                ;*      R3 = NOT USED
                                ;*      R4 = NOT USED
                                ;*      R5 = BLOCK BOUNDRY BIT MASK.
                                ;;*****************************************************************
006556                          T5T5:
006556  004567  012012                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
006562  000000                          .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
                                ;*  DOWNWARDS BYTE ADDRESSING.
006564  004467  006240                  JSR     R4,     INITDN  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006570  004767  007300          1$:     JSR     PC,     BANKNO  ;GET THE BANK NUMBER INTO R0
006574  005100                          COM     R0              ;1'S COMPLEMENT OF BANK #
006576  110042                  2$:     MOVB    R0,     -(R2)   ;PUT 1'S COM OF BANK # INTO MEMORY
006600  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006602  001375                          BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
006604  004767  007030                  JSR     PC,     MMDOWN  ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;*  CHECK THAT DATA WRITTEN CAN BE READ.
                                ;*  DOWNWARDS BYTE ADDRESSING.
006610  004467  006214                  JSR     R4,     INITDN  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006614  004767  007254          3$:     JSR     PC,     BANKNO  ;GET THE BANK # INTO R0
006620  005100                          COM     R0              ;SET 1'S COMPLEMENT OF BANK #
006622  114201                  4$:     MOVB    -(R2),  R1      ;READ DATA OUT OF MEMORY
006624  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
006626  001405                          BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
006630  004767  011452          64$:    JSR     PC,     SPRNTO  ;SET UP VALUES FOR ERROR PRINTING.
006634  004767  012744                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
006640  000003                          .WORD   3               ;ERROR TYPE CODE.
006642                          65$:
006642  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006644  001366                          BNE     4$              ;BRANCH IF MORE IN CURRENT BLOCK.
006646  004767  006766                  JSR     PC,     MMDOWN  ;FIND NEXT BLOCK AND LOOP TO $TAG1.
```

```
                                .SBTTL SECTION 2:       WORST CASE NOISE TESTS
                                ;;*****************************************************************
                                ;*  THESE TESTS WRITE MEMORY WORST CASE NOISE TEST PATTERNS THROUGHOUT
                                ;*  MEMORY AND CHECK THAT THEY CAN BE WRITTEN AND READ.
                                ;;*****************************************************************
                                ;;*****************************************************************
                                ;*TEST 6         WRITE A CONSTANT INTO MEMORY.
                                ;*      .*  THE CONSTANT IS USER SELECTABLE (DEFAULT = 0).
                                ;*      R0 = DATA WRITTEN INTO MEMORY (SHOULD BE)
                                ;*      R1 = DATA READ FROM MEMORY (WAS)
                                ;*      R2 = VIRTUAL ADDRESS
                                ;*      R3 = NOT USED
                                ;*      R4 = NOT USED
                                ;*      R5 = BLOCK BOUNDRY BIT MASK.
                                ;;*****************************************************************
006652                          TST6:
006652  004567  011716                JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
006656  000000                        .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
006660  016700  172724        TST6A:  MOV     .CONST, R0      ;GET USER CONSTANT
006664  004467  005502                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006670  010022        1$:     MOV     R0,     (R2)+   ;WRITE CONSTANT INTO MEMORY.
006672  030502                BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006674  001375                BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
006676  004767  006246        JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;;*****************************************************************
                                ;*TEST 7         READ MEMORY AND COMPARE TO CONSTANT.
                                ;*  IMPORTANT:  THIS TEST SHOULD NOT BE RUN WITHOUT FIRST RUNNING TEST $TN.
                                ;;*****************************************************************
006702                          TST7:
006702  004567  011666                JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
006706  000000                        .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
006710  016700  172674                MOV     .CONST, R0      ;GET USER CONSTANT
006714  004467  005452                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
006720                          1$:
006720  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
006722  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
006724  001405                        BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
006726  004767  011400        64$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
006732  004767  012646                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
006736  000004                        .WORD   4               ;ERROR TYPE CODE.
006740                          65$:
006740  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
006742  001366                        BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
006744  004767  006200                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
                                ;*  SPECIAL CHECK TO SEE IF TEST 6 IS SELECTED THRU THE SWR.
                                ;*  ALLOWS THE OPERATOR TO SWITCH BACK AND FORTH BETWEEN TESTS 6 AND 7
                                ;*  BY SIMPLY "TOGGLING" SW00 WHEN SW01, SW02, AND SW08 ARE SET.
006750  032777  000400  172162        BIT     #SW08,  @SWR    ;CHECK THAT LOOP ON TEST BIT SET
006756  001416                        BEQ     TST10           ;BRANCH IF NOT LOOP ON TEST
006760  017746  172154                MOV     @SWR,   -(SP)   ;GET SWITCH REGISTER DATA.
006764  042716  177740                BIC     #177740,(SP)    ;CLEAR NON-TEST-NUMBER SWITCHS.
006770  022726  000006                CMP     #6,     (SP)+   ;CHECK IF TEST 6 IN SWITCHES.
006774  001007                        BNE     TST10           ;BRANCH IF NOT TEST 6
006776  162767  000001  172076        SUB     #1,     $TSTNM  ;RESET TEST NUM
007004  162767  000030  172074        SUB     #TST7-TST6,$LPADR ;RESET LOOP ADR
```

```
1738  007012  000722                        BR      TST6A           ;GO TO TEST 6
1739
1740                                  ;;*****************************************************************
1741                                  ;*TEST 10       WORSE CASE NOISE (PARITY) WORD TESTING
1742                                  ;*  CHECK MEMORY WITH A SERIES OF PATTERNS
1743                                  ;;*****************************************************************
1744  007014                          TST10:
1745  007014  004567  011554                JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
1746  007020  000000                        .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
1747  007022  016704  172606                MOV     .MPPAT, R4      ;INITIALIZE PATTERN TABLE POINTER
1748  007026  004767  010550        1$:     JSR     PC,     CKPMER  ;CHECK FOR NON-TRAP PARITY MEMORY ERRORS.
1749  007032  012400                        MOV     (R4)+,  R0      ;GET THE DATA PATTERN.
1750  007034  001420                        BEQ     TST11           ;BR IF END OF TABLE.
1751  007036  004467  005330                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1752  007042  010012                2$:     MOV     R0,     (R2)    ;PUT DATA PATTERN INTO MEMORY.
1753  007044  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1754  007046  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1755  007050  001405                        BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1756  007052  004767  011254        64$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1757  007056  004767  012522                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1758  007062  000004                        .WORD   4               ;ERROR TYPE CODE.
1759  007064                          65$:
1760  007064  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1761  007066  001365                        BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
1762  007070  004767  006054                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 2$.
1763  007074  000754                        BR      1$              ;BR BACK TO DO NEXT PATTERN
```

```
1764                                    ;;*****************************************************************
1765                                    ;*TEST 11       ROTATE A "0" BIT THROUGH A FIELD OF ONES.
1766                                    ;;*****************************************************************
1767   007076                           T$T11:
1768   007076  004567  011472                 JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
1769   007102  000000                          .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
1770   007104  012700  177777                 MOV     #-1,    R0      ;SET CHECK WORD
1771   007110  004767  007020                 JSR     PC,     SETCON  ;PUT THE CONTENTS OF R0 IN ALL MEMORY.
1772   007114  004467  005252                 JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1773   007120  000241                  1$:     CLC                     ;CLEAR CARRY BIT IN PSW
1774   007122  004767  007026                 JSR     PC,     ROTATE
1775   007126  016201  177776                 MOV     -2(R2), R1      ;GET RESULT
1776   007132  103402                          BCS     63$             ;BRANCH IF 'C' BIT WAS SET
1777   007134  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1778   007136  001405                          BEQ     64$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1779   007140  004767  011166          63$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1780   007144  004767  012434                 JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1781   007150  000005                          .WORD   5               ;ERROR TYPE CODE.
1782   007152                          64$:
1783   007152  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1784   007154  001361                          BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
1785   007156  004767  005766                 JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
1786
1787                                    ;;*****************************************************************
1788                                    ;*TEST 12       ROTATE A "1" BIT THROUGH A FIELD OF ZEROS
1789                                    ;;*****************************************************************
1790   007162                           T$T12:
1791   007162  004567  011406                 JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
1792   007166  000000                          .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
1793   007170  005000                          CLR     R0              ;SET CHECK WORD
1794   007172  004767  006736                 JSR     PC,     SETCON  ;PUT THE CONTENTS OF R0 IN ALL MEMORY
1795   007176  004467  005170                 JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1796   007202  000261                  1$:     SEC                     ;SET 'C' BIT IN PSW
1797   007204  004767  006744                 JSR     PC,     ROTATE  ;GO ROTATE '1' BIT
1798   007210  016201  177776                 MOV     -2(R2), R1      ;GET RESULT
1799   007214  103002                          BCC     63$             ;BRANCH IF 'C' IS CLEAR
1800   007216  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1801   007220  001405                          BEQ     64$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1802   007222  004767  011104          63$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1803   007226  004767  012352                 JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1804   007232  000005                          .WORD   5               ;ERROR TYPE CODE.
1805   007234                          64$:
1806   007234  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1807   007236  001361                          BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
1808   007240  004767  005704                 JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
1809                                    ;;*****************************************************************
1810                                    ;*TEST 13       3 XOR 9 TEST PATTERN.
1811                                    ;;*****************************************************************
1812  007244                            TST13:
1813  007244  004567  011324                   JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
1814  007250  000777                           .WORD   777             ;MINIMUM BLOCK SIZE OF 256. WORDS
1815                                                                    ; REQUIRED FOR THIS TEST.
1816  007252  000167  000312                   JMP     TST14           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
1817                                                                    ; AVAILABLE FOR TEST.
1818  007256  005000                    .3X9:  CLR     R0              ;SET UP TEST DATA
1819  007260  012703  177777                   MOV     #-1,    R3      ;SET COM DATA REG
1820  007264  004467  005102                   JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1821  007270  004767  006726            1$:    JSR     PC,     W3X9    ;WRITE 256. WORD BLOCK WITH 3 XOR 9 PAT.
1822  007274  030502                           BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1823  007276  001374                           BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
1824  007300  004767  005644                   JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
1825
1826                                    ;;*****************************************************************
1827                                    ;*  CHECK 3 XOR 9 TEST PATTERN WRITTEN ABOVE
1828                                    ;;*****************************************************************
1829  007304  005000                           CLR     R0              ;SET CHECK WORD
1830  007306  004467  005060                   JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1831  007312  012704  000100            11$:   MOV     #64.,   R4      ;SET 256. WORD COUNTER
1832  007316                             12$:
1833  007316  012201                           MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1834  007320  020001                           CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1835  007322  001405                           BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1836  007324  004767  011002            64$:   JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1837  007330  004767  012250                   JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1838  007334  000007                           .WORD   7               ;ERROR TYPE CODE.
1839  007336                             65$:
1840  007336  012201                           MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1841  007340  020001                           CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1842  007342  001405                           BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1843  007344  004767  010762            66$:   JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1844  007350  004767  012230                   JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1845  007354  000007                           .WORD   7               ;ERROR TYPE CODE.
1846  007356                             67$:
1847  007356  012201                           MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1848  007360  020001                           CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1849  007362  001405                           BEQ     69$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1850  007364  004767  010742            68$:   JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1851  007370  004767  012210                   JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1852  007374  000007                           .WORD   7               ;ERROR TYPE CODE.
1853  007376                             69$:
1854  007376  012201                           MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1855  007400  020001                           CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1856  007402  001405                           BEQ     71$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1857  007404  004767  010722            70$:   JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1858  007410  004767  012170                   JSR     PC,     $ERROR  ;*** FRROR *** (GO TYPE A MESSAGE)
1859  007414  000007                           .WORD   7               ;ERROR TYPE CODE.
1860  007416                             71$:
1861  007416  005100                           COM     R0              ;COMPLEMENT CHECK WORD
1862  007420  005304                           DEC     R4              ;DECREMENT 256. WORD COUNTER
1863  007422  001335                           BNE     12$
1864  007424  005100                           COM     R0              ;COMPLEMENT CHECK WORD
```

```
1865  007426  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1866  007430  001330                        BNE     11$             ;BRANCH IF MORE IN CURRENT BLOCK.
1867  007432  004767  005512                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 11$.
1868
1869                                ;;*****************************************************************
1870                                ;*  CHECK, COM, CHECK, COM, CHECK 3 XOR 9 PATTERN WRITTEN ABOVE.
1871                                ;;*****************************************************************
1872  007436  005000                        CLR     R0
1873  007440  004467  004726                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1874  007444  012704  000100        21$:    MOV     #64.,   R4      ;SET 256. WORD COUNTER
1875  007450  012703  000004        22$:    MOV     #4,     R3      ;SET 4 WORD COUNTER
1876  007454                        23$:
1877  007454  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1878  007456  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1879  007460  001405                        BEQ     73$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1880  007462  004767  010644        72$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1881  007466  004767  012112                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1882  007472  000007                        .WORD   7               ;ERROR TYPE CODE.
1883  007474                        73$:
1884  007474  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1885  007476  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
1886  007500  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1887  007502  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1888  007504  001405                        BEQ     75$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1889  007506  004767  010620        74$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1890  007512  004767  012066                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1891  007516  000007                        .WORD   7               ;ERROR TYPE CODE.
1892  007520                        75$:
1893  007520  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1894  007522  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
1895  007524  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1896  007526  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1897  007530  001405                        BEQ     77$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1898  007532  004767  010574        76$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1899  007536  004767  012042                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1900  007542  000007                        .WORD   7               ;ERROR TYPE CODE.
1901  007544                        77$:
1902  007544  005303                        DEC     R3              ;DECREMENT 4 WORD COUNTER
1903  007546  001342                        BNE     23$             ;BR IF NOT DONE.
1904  007550  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1905  007552  005304                        DEC     R4              ;DECREMENT 256. WORD COUNTER
1906  007554  001335                        BNE     22$             ;BR IF NOT DONE.
1907  007556  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1908  007560  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1909  007562  001330                        BNE     21$             ;BRANCH IF MORE IN CURRENT BLOCK.
1910  007564  004767  005360                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 21$.
```

```
                                        ;;*****************************************************************
                                        ;*TEST 14       COMPLEMENT 3 XOR 9 TEST PATTERN
                                        ;;*****************************************************************
007570                                  TST14:
007570  004567  011000                          JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
007574  000777                                  .WORD   777             ;MINIMUM BLOCK SIZE OF 256. WORDS
                                                                        ; REQUIRED FOR THIS TEST.
007576  000167  000316                          JMP     TST15           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                                        ; AVAILABLE FOR TEST.
007602  012700  177777                          MOV     #-1,    R0      ;SET UP TEST DATA
007606  005003                                  CLR     R3              ;SET COM DATA REG
007610  004467  004556                          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
007614  004767  006402          1$:             JSR     PC,     W3X9    ;WRITE 256. WORD BLOCK WITH 3 XOR 9 PAT.
007620  030502                                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
007622  001374                                  BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
007624  004767  005320                          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.


                                        ;;*****************************************************************
                                        ;*  CHECK COMPLEMENTED 3 XOR 9 TEST PATTERN WRITTEN ABOVE.
                                        ;;*****************************************************************
007630  012700  177777                          MOV     #-1,    R0      ;SET CHECK WORD
007634  004467  004532                          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
007640  012704  000100          11$:            MOV     #64.,   R4      ;SET 256. WORD COUNTER
007644                          12$:
007644  012201                                  MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
007646  020001                                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
007650  001405                                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
007652  004767  010454          64$:            JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
007656  004767  011722                          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
007662  000007                                  .WORD   7               ;ERROR TYPE CODE.
007664                          65$:
007664  012201                                  MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
007666  020001                                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
007670  001405                                  BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
007672  004767  010434          66$:            JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
007676  004767  011702                          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
007702  000007                                  .WORD   7               ;ERROR TYPE CODE.
007704                          67$:
007704  012201                                  MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
007706  020001                                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
007710  001405                                  BEQ     69$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
007712  004767  010414          68$:            JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
007716  004767  011662                          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
007722  000007                                  .WORD   7               ;ERROR TYPE CODE.
007724                          69$:
007724  012201                                  MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
007726  020001                                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
007730  001405                                  BEQ     71$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
007732  004767  010374          70$:            JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
007736  004767  011642                          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
007742  000007                                  .WORD   7               ;ERROR TYPE CODE.
007744                          71$:
007744  005100                                  COM     R0              ;COMPLEMENT CHECK WORD
007746  005304                                  DEC     R4              ;DECREMENT 256. WORD COUNTER
007750  001335                                  BNE     12$
```

```
1967  007752  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1968  007754  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
1969  007756  001330                        BNE     11$             ;BRANCH IF MORE IN CURRENT BLOCK.
1970  007760  004767  005164                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 11$.
1971
1972                                  ;;*****************************************************************
1973                                  ;*  CHECK, COM, CHECK, COM, CHECK COMPLEMENTED 3 XOR 9 PATTERN.
1974                                  ;;*****************************************************************
1975  007764  012700  177777                MOV     #-1,    R0      ;SET UP CHECK WORD.
1976  007770  004467  004376                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
1977  007774  012704  000100          21$:  MOV     #64.,   R4      ;SET 256. WORD COUNTER
1978  010000  012703  000004          22$:  MOV     #4,     R3      ;SET 4 WORD COUNTER
1979  010004                           23$:
1980  010004  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1981  010006  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1982  010010  001405                        BEQ     73$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1983  010012  004767  010314          72$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1984  010016  004767  011562                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1985  010022  000007                        .WORD   7               ;ERROR TYPE CODE.
1986  010024                           73$:
1987  010024  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1988  010026  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
1989  010030  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1990  010032  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
1991  010034  001405                        BEQ     75$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
1992  010036  004767  010270          74$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
1993  010042  004767  011536                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
1994  010046  000007                        .WORD   7               ;ERROR TYPE CODE.
1995  010050                           75$:
1996  010050  005100                        COM     R0              ;COMPLEMENT CHECK WORD
1997  010052  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
1998  010054  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
1999  010056  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2000  010060  001405                        BEQ     77$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2001  010062  004767  010244          76$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2002  010066  004767  011512                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2003  010072  000007                        .WORD   7               ;ERROR TYPE CODE.
2004  010074                           77$:
2005  010074  005303                        DEC     R3              ;DECREMENT 4 WORD COUNTER
2006  010076  001342                        BNE     23$             ;BR IF NOT DONE.
2007  010100  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2008  010102  005304                        DEC     R4              ;DECREMENT 256. WORD COUNTER
2009  010104  001335                        BNE     22$             ;BR IF NOT DONE.
2010  010106  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2011  010110  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2012  010112  001330                        BNE     21$             ;BRANCH IF MORE IN CURRENT BLOCK.
2013  010114  004767  005030                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 21$.
```

```
                                ;;*****************************************************************
                                ;*TEST 15       MODIFIED 3 XOR 9 PATTERN FOR PARITY MEMORY
                                ;;*****************************************************************
010120                          TST15:
010120  004567  010450                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
010124  000777                          .WORD   777             ;MINIMUM BLOCK SIZE OF 256. WORDS
                                                                ; REQUIRED FOR THIS TEST.
010126  000167  000610                  JMP     TST16           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                                ; AVAILABLE FOR TEST.
010132  012700  000401                  MOV     #401,   R0      ;SET UP PARITY "ALL ZEROS" PATTERN
010136  012703  177777                  MOV     #-1,    R3      ;SET COM DATA REG
010142  004467  004224                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
010146  004767  006050          1$:     JSR     PC,     W3X9    ;WRITE 256. WORD BLOCK WITH 3 XOR 9 PAT.
010152  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
010154  001374                          BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
010156  004767  004766                  JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.

                                ;;*****************************************************************
                                ;*  CHECK PARITY 3 XOR 9 PATTERN WRITTEN ABOVE.
                                ;;*****************************************************************
010162  012700  000401                  MOV     #401,   R0      ;RESET PARITY "ALL ZEROS" PATTERN.
010166  012703  177777                  MOV     #-1,    R3      ;RESET PARITY ALL ONES PATTERN.
010172  004467  004174                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
010176  012704  000100          11$:    MOV     #64.,   R4      ;SET 256. WORD COUNTER
010202                          12$:
010202  012201                          MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
010204  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
010206  001405                          BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
010210  004767  010116          64$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
010214  004767  011364                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
010220  000007                          .WORD   7               ;ERROR TYPE CODE.
010222                          65$:
010222  012201                          MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
010224  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
010226  001405                          BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
010230  004767  010076          66$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
010234  004767  011344                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
010240  000007                          .WORD   7               ;ERROR TYPE CODE.
010242                          67$:
010242  012201                          MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
010244  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
010246  001405                          BEQ     69$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
010250  004767  010056          68$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
010254  004767  011324                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
010260  000007                          .WORD   7               ;ERROR TYPE CODE.
010262                          69$:
010262  012201                          MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
010264  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
010266  001405                          BEQ     71$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
010270  004767  010036          70$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
010274  004767  011304                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
010300  000007                          .WORD   7               ;ERROR TYPE CODE.
010302                          71$:
010302  010046                          MOV     R0,     -(SP)   ;SAVE R0
010304  010300                          MOV     R3,     R0      ;PUT R3 INTO R0
010306  012603                          MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
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2070  010310  005304                        DEC     R4              ;COUNT 256. WORDS
2071  010312  001333                        BNE     12$             ;BRANCH IF MORE
2072  010314  010046                        MOV     R0,     -(SP)   ;SAVE R0
2073  010316  010300                        MOV     R3,     R0      ;PUT R3 INTO R0
2074  010320  012603                        MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2075  010322  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2076  010324  001324                        BNE     11$             ;BRANCH IF MORE IN CURRENT BLOCK.
2077  010326  004767  004616                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 11$.
2078
2079                                  ;;*****************************************************************
2080                                  ;*  CHECK, COM, CHECK, COM, CHECK PARITY 3 XOR 9 PATTERN.
2081                                  ;;*****************************************************************
2082  010332  012700  000401                MOV     #401,   R0      ;SET UP PARITY "ALL ZEROS" PATTERN.
2083  010336  012703  177777                MOV     #-1,    R3      ;SET UP ALL ONES PATTERN.
2084  010342  004467  004024                JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2085  010346  012704  000100        21$:    MOV     #64.,R4         ;SET 256. WORD COUNTER
2086  010352                        22$:
2087  010352  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2088  010354  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2089  010356  001405                        BEQ     73$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2090  010360  004767  007746        72$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2091  010364  004767  011214                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2092  010370  000007                        .WORD   7               ;ERROR TYPE CODE.
2093  010372                        73$:
2094  010372  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2095  010374  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
2096  010376  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2097  010400  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2098  010402  001405                        BEQ     75$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2099  010404  004767  007722        74$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2100  010410  004767  011170                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2101  010414  000007                        .WORD   7               ;ERROR TYPE CODE.
2102  010416                        75$:
2103  010416  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2104  010420  005142                        COM     -(R2)           ;RESTORE DATA
2105  010422  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2106  010424  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2107  010426  001405                        BEQ     77$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2108  010430  004767  007676        76$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2109  010434  004767  011144                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2110  010440  000007                        .WORD   7               ;ERROR TYPE CODE.
2111  010442                        77$:
2112  010442  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2113  010444  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2114  010446  001405                        BEQ     79$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2115  010450  004767  007656        78$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2116  010454  004767  011124                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2117  010460  000007                        .WORD   7               ;ERROR TYPE CODE.
2118  010462                        79$:
2119  010462  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2120  010464  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
2121  010466  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2122  010470  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2123  010472  001405                        BEQ     81$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2124  010474  004767  007632        80$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2125  010500  004767  011100                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
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2126  010504  000007                    .WORD   7               ;ERROR TYPE CODE.
2127  010506                    81$:
2128  010506  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2129  010510  005142                    COM     -(R2)           ;RESTORE DATA
2130  010512  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2131  010514  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2132  010516  001405                    BEQ     83$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2133  010520  004767  007606    82$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2134  010524  004767  011054            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2135  010530  000007                    .WORD   7               ;ERROR TYPE CODE.
2136  010532                    83$:
2137  010532  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2138  010534  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2139  010536  001405                    BEQ     85$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2140  010540  004767  007566    84$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2141  010544  004767  011034            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2142  010550  000007                    .WORD   7               ;ERROR TYPE CODE.
2143  010552                    85$:
2144  010552  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2145  010554  005142                    COM     -(R2)           ;COMPLEMENT TEST DATA
2146  010556  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2147  010560  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2148  010562  001405                    BEQ     87$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2149  010564  004767  007542    86$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2150  010570  004767  011010            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2151  010574  000007                    .WORD   7               ;ERROR TYPE CODE.
2152  010576                    87$:
2153  010576  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2154  010600  005142                    COM     -(R2)           ;RESTORE DATA
2155  010602  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2156  010604  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2157  010606  001405                    BEQ     89$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2158  010610  004767  007516    88$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2159  010614  004767  010764            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2160  010620  000007                    .WORD   7               ;ERROR TYPE CODE.
2161  010622                    89$:
2162  010622  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2163  010624  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2164  010626  001405                    BEQ     91$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2165  010630  004767  007476    90$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2166  010634  004767  010744            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2167  010640  000007                    .WORD   7               ;ERROR TYPE CODE.
2168  010642                    91$:
2169  010642  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2170  010644  005142                    COM     -(R2)           ;COMPLEMENT TEST DATA
2171  010646  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2172  010650  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2173  010652  001405                    BEQ     93$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2174  010654  004767  007452    92$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2175  010660  004767  010720            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2176  010664  000007                    .WORD   7               ;ERROR TYPE CODE.
2177  010666                    93$:
2178  010666  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2179  010670  005142                    COM     -(R2)           ;RESTORE DATA
2180  010672  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2181  010674  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
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2182  010676  001405                    BEQ     95$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2183  010700  004767  007426    94$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2184  010704  004767  010674            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2185  010710  000007                    .WORD   7               ;ERROR TYPE CODE.
2186  010712                    95$:
2187  010712  010046                    MOV     R0,     -(SP)   ;SAVE R0
2188  010714  010300                    MOV     R3,     R0      ;PUT R3 INTO R0
2189  010716  012603                    MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2190  010720  005304                    DEC     R4              ;DECREMENT 256. WORD COUNTER
2191  010722  001213                    BNE     22$             ;BRANCH IF MORE.
2192  010724  010046                    MOV     R0,     -(SP)   ;SAVE R0
2193  010726  010300                    MOV     R3,     R0      ;PUT R3 INTO R0
2194  010730  012603                    MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2195  010732  030502                    BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2196  010734  001204                    BNE     21$             ;BRANCH IF MORE IN CURRENT BLOCK.
2197  010736  004767  004206            JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 21$.
2198
2199                                    ;;*****************************************************************
2200                                    ;*TEST 16       COMPLEMENT PARITY 3 XOR 9 TEST PATTERN.
2201                                    ;;*****************************************************************
2202  010742                    TST16:
2203  010742  004567  007626            JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
2204  010746  000777                    .WORD   777             ;MINIMUM BLOCK SIZE OF 256. WORDS
2205                                                            ; REQUIRED FOR THIS TEST.
2206  010750  000167  000610            JMP     TST17           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
2207                                                            ; AVAILABLE FOR TEST.
2208  010754  012700  177777            MOV     #-1,    R0      ;SET UP ALL ONES PATTERN
2209  010760  012703  000401            MOV     #401,   R3      ;SET UP PARITY "ALL ZEROS" PATTERN
2210  010764  004467  003402            JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2211  010770  004767  005226    1$:     JSR     PC,     W3X9    ;WRITE 256. WORD BLOCK WITH 3 XOR 9 PAT.
2212  010774  030502                    BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2213  010776  001374                    BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
2214  011000  004767  004144            JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
2215
2216                                    ;;*****************************************************************
2217                                    ;*  CHECK COMPLEMENT PARITY 3 XOR 9 PATTERN WRITTEN ABOVE.
2218                                    ;;*****************************************************************
2219  011004  012700  177777            MOV     #-1,    R0      ;SET UP ALL ONES PATTERN
2220  011010  012703  000401            MOV     #401,   R3      ;SET UP PARITY "ALL ZEROS" PATTERN
2221  011014  004467  003352            JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2222  011020  012704  000100    11$:    MOV     #64 ,   R4      ;SET 256. WORD COUNTER
2223  011024                    12$:
2224  011024  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2225  011026  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2226  011030  001405                    BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2227  011032  004767  007274    64$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2228  011036  004767  010542            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2229  011042  000007                    .WORD   7               ;ERROR TYPE CODE.
2230  011044                    65$:
2231  011044  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2232  011046  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2233  011050  001405                    BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2234  011052  004767  007254    66$:    JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2235  011056  004767  010522            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2236  011062  000007                    .WORD   7               ;ERROR TYPE CODE.
2237  011064                    67$:
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2238  011064  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2239  011066  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2240  011070  001405                    BEQ     69$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2241  011072  004767  007234  68$:      JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2242  011076  004767  010502            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2243  011102  000007                    .WORD   7               ;ERROR TYPE CODE.
2244  011104                  69$:
2245  011104  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2246  011106  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2247  011110  001405                    BEQ     71$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2248  011112  004767  007214  70$:      JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2249  011116  004767  010462            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2250  011122  000007                    .WORD   7               ;ERROR TYPE CODE.
2251  011124                  71$:
2252  011124  010046                    MOV     R0,     -(SP)   ;SAVE R0
2253  011126  010300                    MOV     R3,     R0      ;PUT R3 INTO R0
2254  011130  012603                    MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2255  011132  005304                    DEC     R4              ;COUNT 256. WORDS
2256  011134  001333                    BNE     12$             ;BRANCH IF MORE
2257  011136  010046                    MOV     R0,     -(SP)   ;SAVE R0
2258  011140  010300                    MOV     R3,     R0      ;PUT R3 INTO R0
2259  011142  012603                    MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2260  011144  030502                    BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2261  011146  001324                    BNE     11$             ;BRANCH IF MORE IN CURRENT BLOCK.
2262  011150  004767  003774            JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 11$.
2263
2264                          ;;**************************************************
2265                          ;*  CHECK, COM, CHECK, COM  CHECK COMPLEMENTED PARITY 3 XOR 9 PATTERN.
2266                          ;;**************************************************
2267  011154  012700  177777            MOV     #-1,    R0      ;SET UP ALL ONES PATTERN
2268  011160  012703  000401            MOV     #401,   R3      ;SET UP PARITY "ALL ZEROS" PATTERN
2269  011164  004467  003202            JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2270  011170  012704  000100  21$:      MOV     #64.,R4         ;SET 256. WORD COUNTER
2271  011174                  22$:
2272  011174  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2273  011176  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2274  011200  001405                    BEQ     73$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2275  011202  004767  007124  72$:      JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2276  011206  004767  010372            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2277  011212  000007                    .WORD   7               ;ERROR TYPE CODE.
2278  011214                  73$:
2279  011214  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2280  011216  005142                    COM     -(R2)           ;COMPLEMENT TEST DATA
2281  011220  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2282  011222  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2283  011224  001405                    BEQ     75$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2284  011226  004767  007100  74$:      JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2285  011232  004767  010346            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2286  011236  000007                    .WORD   7               ;ERROR TYPE CODE.
2287  011240                  75$:
2288  011240  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2289  011242  005142                    COM     -(R2)           ;RESTORE DATA
2290  011244  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2291  011246  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2292  011250  001405                    BEQ     77$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2293  011252  004767  007054  76$:      JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
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2294  011256  004767  010322            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2295  011262  000007                    .WORD   7               ;ERROR TYPE CODE.
2296  011264                    77$:
2297  011264  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2298  011266  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2299  011270  001405                    BEQ     79$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2300  011272  004767  007034    78$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2301  011276  004767  010302            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2302  011302  000007                    .WORD   7               ;ERROR TYPE CODE.
2303  011304                    79$:
2304  011304  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2305  011306  005142                    COM     -(R2)           ;COMPLEMENT TEST DATA
2306  011310  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2307  011312  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2308  011314  001405                    BEQ     81$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2309  011316  004767  007010    80$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2310  011322  004767  010256            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2311  011326  000007                    .WORD   7               ;ERROR TYPE CODE.
2312  011330                    81$:
2313  011330  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2314  011332  005142                    COM     -(R2)           ;RESTORE DATA
2315  011334  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2316  011336  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2317  011340  001405                    BEQ     83$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2318  011342  004767  006764    82$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2319  011346  004767  010232            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2320  011352  000007                    .WORD   7               ;ERROR TYPE CODE.
2321  011354                    83$:
2322  011354  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2323  011356  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2324  011360  001405                    BEQ     85$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2325  011362  004767  006744    84$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2326  011366  004767  010212            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2327  011372  000007                    .WORD   7               ;ERROR TYPE CODE.
2328  011374                    85$:
2329  011374  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2330  011376  005142                    COM     -(R2)           ;COMPLEMENT TEST DATA
2331  011400  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2332  011402  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2333  011404  001405                    BEQ     87$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2334  011406  004767  006720    86$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2335  011412  004767  010166            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2336  011416  000007                    .WORD   7               ;ERROR TYPE CODE.
2337  011420                    87$:
2338  011420  005100                    COM     R0              ;COMPLEMENT CHECK WORD
2339  011422  005142                    COM     -(R2)           ;RESTORE DATA
2340  011424  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2341  011426  020001                    CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2342  011430  001405                    BEQ     89$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2343  011432  004767  006674    88$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2344  011436  004767  010142            JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2345  011442  000007                    .WORD   7               ;ERROR TYPE CODE.
2346  011444                    89$:
2347  011444  012201                    MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2348  011446  020001                    CMP     R0,     R1      ;COMPARE THE CHEC. WORD WITH THE DATA READ.
2349  011450  001405                    BEQ     91$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
```

```
2350  011452  004767  006654          90$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2351  011456  004767  010122                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2352  011462  000007                        .WORD   7               ;ERROR TYPE CODE.
2353  011464                          91$:
2354  011464  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2355  011466  005142                        COM     -(R2)           ;COMPLEMENT TEST DATA
2356  011470  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2357  011472  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2358  011474  001405                        BEQ     93$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2359  011476  004767  006630          92$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2360  011502  004767  010076                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2361  011506  000007                        .WORD   7               ;ERROR TYPE CODE.
2362  011510                          93$:
2363  011510  005100                        COM     R0              ;COMPLEMENT CHECK WORD
2364  011512  005142                        COM     -(R2)           ;RESTORE DATA
2365  011514  012201                        MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2366  011516  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2367  011520  001405                        BEQ     95$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2368  011522  004767  006604          94$:  JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2369  011526  004767  010052                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2370  011532  000007                        .WORD   7               ;ERROR TYPE CODE.
2371  011534                          95$:
2372  011534  010046                        MOV     R0,     -(SP)   ;SAVE R0
2373  011536  010300                        MOV     R3,     R0      ;PUT R3 INTO R0
2374  011540  012603                        MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2375  011542  005304                        DEC     R4              ;DECREMENT 256. WORD COUNTER
2376  011544  001213                        BNE     22$             ;BRANCH IF MORE.
2377  011546  010046                        MOV     R0,     -(SP)   ;SAVE R0
2378  011550  010300                        MOV     R3,     R0      ;PUT R3 INTO R0
2379  011552  012603                        MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
2380  011554  030502                        BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2381  011556  001204                        BNE     21$             ;BRANCH IF MORE IN CURRENT BLOCK.
2382  011560  004767  003364                JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 21$.
```

```
2383                                    ;;*****************************************************************
2384                                    ;*TEST 17       WORSE CASE NOISE PARITY BYTE TESTING
2385                                    ;*  CHECK PARITY MEMORY WITH A SERIES OF BYTE PATTERNS
2386                                    ;*      1) FORCE WRONG PARITY IN EACH BYTE OF PARITY MEMORY
2387                                    ;*      2) READ IT BACK WITH ACTION ENABLE SET, MAKING SURE THAT A TRAP OCCURS
2388                                    ;*      3) WRITE GOOD PARITY AND MAKE SURE NO TRAP OCCURS WHEN IT IS READ
2389                                    ;*      4) MAKE SURE THE ERROR ADDRESS BITS (CSR BITS <11-5>) ARE CORRECT
2390                                    ;;*****************************************************************
2391  011564                            TST17:
2392  011564  004567  007004                   JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
2393  011570  000000                           .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
2394  011572  005767  170500           WWPB0:  TST     MPRX            ;CHECK FOR ANY PARITY MEMORY.
2395  011576  001404                           BEQ     1$              ;BR IF NO PARITY MEMORY.
2396  011600  032777  000100  167332           BIT     #SW06,  @SWR    ;CHECK FORINHIBIT PARITY SWITCH.
2397  011606  001402                           BEQ     2$              ;BR IF NOT SET.
2398  011610  000167  000622           1$:     JMP     TST20           ;SKIP THIS TEST IF NO PARITY MEMORY PRESENT.
2399  011614  005000                   2$:     CLR     R0              ;ZERO TO BE PUT IN ALL MEMORY.
2400  011616  004767  004312                   JSR     PC,     SETCON  ;ROUTINE TO LOAD ALL MEMORY.
2401  011622  004467  002544                   JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2402  011626  036767  167712  167704   WWPBYT: BIT     BITPT,  PMEMAP  ;CHECK IF CURRENT BANK HAS PARITY MEMORY.
2403  011634  001010                           BNE     2$              ;BR IF PARITY MEM.
2404  011636  036767  167704  167676           BIT     BITPT+2,PMEMAP+2 ;...HI 64K.
2405  011644  001004                           BNE     2$              ;BR IF PARITY MEM.
2406  011646  050502                           BIS     R5,     R2      ;POINT TO END OF BLOCK.
2407  011650  005202                           INC     R2              ;FIRST ADR OF NEXT BLOCK.
2408  011652  000167  000540                   JMP     WWPB5           ;GO TO FIND NEXT BLOCK.
2409  011656  004767  005664           2$:     JSR     PC,     SETAE   ;SET ACTION ENABLE (EVEN IF BANK0.)
2410  011662  004767  005714                   JSR     PC,     CKPMER  ;CHECK FOR ANY NON TRAP PARITY ERRORS.
2411  011666  020227  000114           WWPB1:  CMP     R2,     #114    ;CKECK IF POINTING TO PARITY ERROR VECTOR.
2412  011672  001004                           BNE     3$              ;BR IF NOT AT VECTOR.
2413  011674  062702  000004                   ADD     #4,     R2      ;SKIP PARITY VECTOR.
2414  011700  000167  000512                   JMP     WWPB5           ;CHECK FOR BLOCK END.
2415  011704  111201                   3$:     MOVB    (R2),   R1      ;CHECK IF BYTE STILL CLEARED.
2416  011706  001405                           BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2417  011710  004767  006342           64$:    JSR     PC,     SPRNT   ;SET UP VALUES FOR ERROR PRINTING.
2418  011714  004767  007664                   JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2419  011720  000011                           .WORD   11              ;ERROR TYPE CODE.
2420  011722                           65$:
2421  011722  105067  167632                   CLRB    OEFLG           ;CLEAR ODD/EVEN FLAG.
2422  011726  112700  000252                   MOVB    #252,   R0      ;SET UP DATA...EVEN, SETS PARITY BIT.
2423  011732  110012           WWPB2.  MOVB    R0,     (R2)            ;MOV DATA INTO TEST LOCATION.
2424  011734  016703  167670                   MOV     .MPRX,  R3      ;GET PARITY REGISTER TABLE POINTER.
2425  011740  056773  167646  000000   10$:    BIS     WWP,@(R3)       ;SET WRITE WRONG PARITY.
2426  011746  052733  000001                   BIS     #AE,@(R3)+
2427  011752  005713                           TST     (R3)            ;CHECK FOR TABLE TERMINATOR.
2428  011754  001371                           BNE     10$             ;BR IF MORE REGS IN TABLE.
2429                                   ;*  SET WRONG PARITY IN LOCATION UNDER TEST.
2430  011756  110012                           MOVB    R0,     (R2)    ;WRITE SAME DATA (EXCEPT PARITY) VIA DATOB.
2431  011760  016703  167644                   MOV     .MPRX,  R3      ;GET PARITY REG TABLE POINTER.
2432  011764  046733  167622           11$:    BIC     WWP,    @(R3)+  ;CLEAR WRITE WRONG PARITY.
2433  011770  005713                           TST     (R3)            ;CHECK FOR TABLE TERMINATOR.
2434  011772  001374                           BNE     11$             ;BR IF MORE PARITY REGISTERS.
2435  011774  016737  167632  000114           MOV     .PBTRP, @#PARVEC ;SET UP VECTOR FOR EXPECTED TRAP.
2436                                   ;*  DETECT WRONG PARITY VIA DATIP; DATOB SHOULDN'T EXECUTE.
2437  012002  105412                           NEGB    (R2)            ;DATIP (DATOB AND COM PARITY BIT.)
2438                                   ;*  SHOULD HAVE TRAPPED TO PBTRP.
```

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2439  012004  016737  167626  000114          MOV     .PESRV, @#PARVEC ;RESET VECTOR FOR UNEXPECTED TRAPS.
2440  012012  004767  006270          64$:     JSR     PC,     SPRNTQ   ;SET UP VALUES FOR ERROR PRINTING.
2441  012016  004767  007562                   JSR     PC,     $ERROR   ;*** ERROR *** (GO TYPE A MESSAGE)
2442  012022  000012                           .WORD   12               ;ERROR TYPE CODE.
2443  012024  000562                           BR      WWPB4            ;SKIP TRAP SERVICE.
2444
2445                                  ;*  EXPECTED PARITY MEMORY TRAPS COME HERE.
2446  012026  016737  167604  000114  PBTRP:  MOV     .PESRV, @#PARVEC ;RESET PARITY VECTOR FOR UNEXPECTED TRAPS.
2447  012034  022626                           CMP     (SP)+,  (SP)+    ;RESET THE STACK POINTER AFTER TRAP.
2448  012036  016703  167564                   MOV     .MPR0,  R3       ;GET PARITY REG AND MAP TABLE POINTER.
2449  012042  032713  000001          21$:     BIT     #BIT0,  (R3)     ;CHECK IF THIS REGISTER EXISTS.
2450  012046  001003                           BNE     22$              ;BR IF IT DOESN'T EXIST.
2451  012050  017301  000000                   MOV     @(R3),  R1       ;GET THE CONTENTS.
2452  012054  100413                           BMI     23$              ;BR IF ERROR FLAG SET.
2453  012056  062703  000010          22$:     ADD     #10,    R3       ;MOVE POINTER TO NEXT REG.
2454  012062  020367  167542                   CMP     R3,     .MPRX    ;CHECK FOR END OF TABLE.
2455  012066  103765                           BLO     21$              ;BR IF MORE REGISTERS.
2456  012070  004767  006212          64$:     JSR     PC,     SPRNT0   ;SET UP VALUES FOR ERROR PRINTING.
2457  012074  004767  007504                   JSR     PC,     $ERROR   ;*** ERROR *** (GO TYPE A MESSAGE)
2458  012100  000013                           .WORD   13               ;ERROR TYPE CODE.
2459  012102  000533                           BR      WWPB4            ;EXIT AFTER ERROR.
2460  012104  036763  167434  000002  23$:     BIT     BITPT,  2(R3)    ;CHECK THE MAP FOR THIS REGISTER.
2461  012112  001011                           BNE     24$              ;BR IF THIS REGISTER CONTROLS THIS BANK.
2462  012114  036763  167426  000004          BIT     BITPT+2,4(R3)    ;CHECK THE HI 64K.
2463  012122  001005                           BNE     24$              ;BR IF THIS REGISTER CONTROLS THIS BANK.
2464  012124  004767  006152          65$:     JSR     PC,     SPRNTP   ;SET UP VALUES FOR ERROR PRINTING.
2465  012130  004767  007450                   JSR     PC,     $ERROR   ;*** ERROR *** (GO TYPE A MESSAGE)
2466  012134  000014                           .WORD   14               ;ERROR TYPE CODE.
2467  012136                          24$:
2468  012136  010046                           MOV     R0,-(SP)         ;;PUSH R0 ON STACK
2469  012140  010200                           MOV     R2,     R0       ;GET THE ADDRESS POINTER.
2470  012142  042700  003777                   BIC     #3777,  R0       ;CLEAR LOW ADDRESS BITS.
2471  012146  000300                           SWAB    R0               ;SHIFT 6 PLACES RIGHT.
2472  012150  006300                           ASL     R0
2473  012152  006300                           ASL     R0
2474  012154  005767  166426                   TST     MMAVA            ;CHECK FOR MEM MGMT.
2475  012160  001404                           BEQ     25$              ;BR IF NO MEM MGMT.
2476  012162  042700  177600                   BIC     #177600,R0       ;CLEAR BANK BITS
2477  012166  063700  172344                   ADD     @#KIPAR2,R0      ;ADD MEM MGMT OFFSET.
2478  012172  052700  100001          25$:     BIS     #BIT15+BIT0,R0   ;SET ERROR AND AE BIT IN CHECK WORD.
2479  012176  016367  000006  167312          MOV     6(R3),  RESRVD   ;GET APPROPIATE MASK.
2480  012204  046700  167306                   BIC     RESRVD, R0       ;CLEAR PARITY REG BITS RESERVED FOR FUTURE.
2481  012210  046701  167302                   BIC     RESRVD, R1       ;CLEAR PARITY REG BITS RESERVED FOR FUTURE.
2482                                  ;NOTE: THE ABOVE INSTRUCTION (2 WORDS) CAN BE NOP'ED FOR UNMIXED MEMORY TYPES.
2483  012214  020001                           CMP     R0,     R1       ;COMPARE THE CHECK WORD WITH THE DATA READ.
2484  012216  001405                           BEQ     67$              ;BRANCH OVER ERROR CALL IF GOOD DATA.
2485  012220  004767  006056          66$:     JSR     PC,     SPRNTP   ;SET UP VALUES FOR ERROR PRINTING.
2486  012224  004767  007354                   JSR     PC,     $ERROR   ;*** ERROR *** (GO TYPE A MESSAGE)
2487  012230  000015                           .WORD   15               ;ERROR TYPE CODE.
2488  012232                          67$:
2489  012232  005073  000000                   CLR     @(R3)            ;CLEAR REG INCLUDING ACTION ENABLE.
2490  012236  010346                           MOV     R3,-(SP)         ;;PUSH R3 ON STACK
2491  012240  062703  000010          26$:     ADD     #10,    R3       ;UPDATE POINTER TO NEXT PARITY REG + MAP.
2492  012244  020367  167360                   CMP     R3,     .MPRX    ;CHECK FOR END OF TABLE.
2493  012250  101014                           BHI     WWPB3            ;BR IF END OF TABLE REACHED.
2494  012252  032713  000001                   BIT     #BIT0,  (R3)     ;CHECK IF NEXT REG EXISTS.
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2495  012256  001370                        BNE     26$             ;BR IF THIS PARITY REG DOESN'T EXIST.
2496  012260  017301  000000                MOV     @(R3), R1       ;SAVE AND CHECK FOR ERROR FLAG.
2497  012264  100365                        BPL     26$             ;BR IF NO ERROR FLAG.
2498  012266  004767  006010        68$:    JSR     PC,     SPRNTP  ;SET UP VALUES FOR ERROR PRINTING.
2499  012272  004767  007306                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2500  012276  000016                        .WORD   16              ;ERROR TYPE CODE.
2501  012300  000757                        BR      26$             ;BR AFTER ERROR.
2502  012302  111204        WWPB3:  MOVB    (R2),   R4              ;GET THE DATA FOR CHECKING.
2503                        ;* READING THE DATA VIA DATI TO CHECK IT SHOULD CAUSE PARITY ERROR, BUT
2504                        ;*  ACTION ENABLE IS NOT SET IN CONTROLING REG, SO NO TRAP SHOULD OCCURE.
2505  012304  111212                        MOVB    (R2),   (R2)    ;RESTORE RIGHT PARITY
2506                        ;NOTE:  THE ABOVE INSTRUCTION CAN BE NOP'ED FOR PROCESSORS
2507                        ;       WHICH DO ONLY DATOB TO DESTINATION OF MOVB INSTRUCTIONS.
2508  012306  012603                        MOV     (SP)+,R3        ;POP STACK INTO R3
2509  012310  017301  000000                MOV     @(R3),  R1      ;READ THE PARITY REGISTER TO CHECK IT AGAIN.
2510  012314  046701  167176                BIC     RESRVD, R1      ;CLEAR PARITY REG BITS RESERVED FOR FUTURE.
2511                        ;NOTE: THE ABOVE INSTRUCTION (2 WORDS) CAN BE NOP'ED FOR UNMIXED MEMORY TYPES.
2512  012320  042700  000001                BIC     #AE,    R0      ;CLEAR THE ACTION ENABLE BIT IN TEST DATA.
2513  012324  020001                        CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2514  012326  001405                        BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2515  012330  004767  005746        64$:    JSR     PC,     SPRNTP  ;SET UP VALUES FOR ERROR PRINTING.
2516  012334  004767  007244                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2517  012340  000015                        .WORD   15              ;ERROR TYPE CODE.
2518  012342                        65$:
2519  012342  012773  000001  000000        MOV     #1,     @(R3)   ;CLEAR ALL BUT ACTION ENABLE.
2520  012350  010401                        MOV     R4,     R1      ;GET DATA READ FROM MEMORY FOR TESTING.
2521  012352  012600                        MOV     (SP)+,R0        ;POP STACK INTO R0
2522  012354  120001                        CMPB    R0,     R1      ;CHECK THE DATA.
2523  012356  001405                        BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2524  012360  004767  005722        66$:    JSR     PC,     SPRNTO  ;SET UP VALUES FOR ERROR PRINTING.
2525  012364  004767  007214                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2526  012370  000017                        .WORD   17              ;ERROR TYPE CODE.
2527  012372                        67$:
2528  012372  110012        WWPB4:  MOVB    R0,     (R2)            ;RESTORE DATA.
2529  012374  105712                        TSTB    (R2)            ;DO A DATI TO BE SURE RIGHT PARITY.
2530  012376  012700  000253                MOV     #253,   R0      ;SET ODD PARITY DATA.
2531  012402  105167  167152                COMB    OEFLG           ;CHECK IF DONE BOTH ODD AND EVEN PARITY.
2532  012406  100002                        BPL     27$             ;BR IF DONE BOTH EVEN AND ODD.
2533  012410  000167  177316                JMP     WWPB2           ;LOOP BACK AND DO ODD(PARITY BIT CLR).
2534  012414  005202                27$:    INC     R2              ;MOVE POINTER TO NEXT MEMORY BYTE.
2535  012416  030502        WWPB5:  BIT     R5,     R2              ;CHECK FOR END OF BLOCK.
2536  012420  001402                        BEQ     30$             ;BR IF END OF BLOCK FOUND.
2537  012422  000167  177240                JMP     WWPB1           ;LOOP BACK TO TEST NEXT BYTE.
2538  012426  004767  002516        30$:    JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO WWPBYT
2539  012432  004767  005044                JSR     PC,     MAMF    ;GO RESET PARITY REGISTERS.
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2540                                    ;;*****************************************************************
2541                                    ;*TEST 20       RANDOM DATA  TESTING THRU PROGRAM CODE RELOCATION.
2542                                    ;;*****************************************************************
2543  012436                            TST20:
2544  012436  004567  006132                   JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
2545  012442  000000                            .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
2546  012444  010703                    RANTST: MOV     PC,     R3      ;GET CURRENT PROGRAM COUNTER.
2547  012446  042703  007777                   BIC     #7777,  R3      ;POINT TO BEGINNING OF CURRENT 2K BLOCK.
2548  012452  004467  001714                   JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2549  012456  010246                    1$:     MOV     R2,     -(SP)   ;SAVE MEMORY POINTER.
2550  012460  010346                            MOV     R3,     -(SP)   ;SAVE "DATA" POINTER.
2551  012462  012322                    2$:     MOV     (R3)+,  (R2)+   ;MOV CODE INTO TEST MEMORY.
2552  012464  032703  007777                   BIT     #7777,  R3      ;CHECK FOR END OF "DATA TABLE"
2553  012470  001002                            BNE     3$              ;BRANCH IF MORE
2554  012472  162703  010000                   SUB     #10000, R3      ;RESET POINTER TO START OF "RANDOM DATA"
2555  012476  030502                    3$:     BIT     R5,     R2      ;CHECK FOR END OF BLOCK
2556  012500  001370                            BNE     2$              ;BRANCH IF MORE.
2557  012502  012603                            MOV     (SP)+,  R3      ;RESET "DATA" POINTER.
2558  012504  012602                            MOV     (SP)+,  R2      ;RESET MEMORY POINTER.
2559  012506  012300                    4$:     MOV     (R3)+,  R0      ;GET S/B DATA.
2560  012510  012201                            MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2561  012512  020001                            CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
2562  012514  001405                            BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2563  012516  004767  005610          64$:     JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2564  012522  004767  007056                   JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2565  012526  000020                            .WORD   20              ;ERROR TYPE CODE.
2566  012530                            65$:
2567  012530  032703  007777                   BIT     #7777,  R3      ;CHECK FOR END OF "DATA TABLE"
2568  012534  001002                            BNE     5$              ;BR IF MORE.
2569  012536  162703  010000                   SUB     #10000, R3      ;RESET POINTER TO TOP OF "DATA TABLE".
2570  012542                            5$:
2571  012542  030502                            BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2572  012544  001360                            BNE     4$              ;BRANCH IF MORE IN CURRENT BLOCK.
2573  012546  004767  002376                   JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

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                        .SBTTL SECTION 3:       INSTRUCTION EXECUTION TESTS.
                        ;*****************************************************************
                        ;*TEST 21       EXECUTE DATI, DATO THRU MEMORY.
                        ;*  EXECUTE THE INSTRUCTION 'MOV R4,(R2)' THROUGHOUT MEMORY.
                        ;*  AN 'RTS R5' (CODE 205) IS PLACED AFTER THE 'MOV' INSTRUCTION TO RETURN
                        ;*  CONTROL TO THE MAIN PROGRAM FOR INSTRUCTION EXECUTION CHECKOUT.
                        ;*  THIS IS AN EXAMPLE OF WHAT THIS TEST DOES IN RELATION TO MEMORY:
                        ;*
                        ;*                  MEMORY        INSTRUCTION     CONTENTS OF MEMORY LOCATION
                        ;*                 LOCATION       PLACED THERE    AFTER INSTRUCTION EXECUTION
                        ;*
                        ;*   1ST PASS /   40000            010412          000205
                        ;*  THRU TEST /   40002            000205          000205
                        ;*
                        ;*   2ND PASS /   40002            010412          000205
                        ;*  THRU TEST /   40004            000205          000205
                        ;*
                        ;*      ETC., ETC., ETC.
                        ;*
                        ;*  R0 = DATA WRITTEN ON TOP OF IUT BY THE IUT (SHOULD BE).
                        ;*  R1 = DATA READ FROM MEMORY (WAS).
                        ;*  R2 = ADDRESS OF IUT/DATA.
                        ;*  R3 = INSTRUCTION UNDER TEST (IUT).
                        ;*  R4 = RTS R5 (CODE 205).
                        ;*  R5 = BLOCK BOUNDRY BIT MASK.
                        ;*****************************************************************
012552                  TST21:
012552  004567  006016          JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
012556  000003                  .WORD   3               ;MINIMUM BLOCK SIZE OF 2 WORDS
                                                        ; REQUIRED FOR THIS TEST.
012560  000167  000056          JMP     TST22           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                        ; AVAILABLE FOR TEST.
012564  012703  010412  DIDO:   MOV     #010412,R3      ;GET 'MOV R4,(R2)' INSTRUCTION (IUT).
012570  012704  000205          MOV     #205,   R4      ;GET 'RTS R5'
012574  010400                  MOV     R4,     R0      ;SET UP S/B DATA AFTER EXECUTION.
012576  004467  001570          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
012602  010322  1$:     MOV     R3,     (R2)+   ;PUT IUT INTO FIRST LOC OF BLOCK.
012604  010412  2$:     MOV     R4,     (R2)    ;PUT 'RTS R5' FOLLOWING IUT.
012606  004542          JSR     R5,     -(R2)   ;GO EXECUTE THE IUT.
012610  012201          MOV     (R2)+,  R1      ;GET THE DATA FROM THE MEM ADR UNDER TEST.
012612  020001          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
012614  001405          BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
012616  004767  005504  64$:    JSR     PC,     SPRNT3  ;SET UP VALUES FOR ERROR PRINTING.
012622  004767  006756          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
012626  000021                  .WORD   21              ;ERROR TYPE CODE.
012630                  65$:
012630  010322          MOV     R3,     (R2)+   ;PUT THE IUT INTO THE NEXT LOCATION.
012632  030502          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
012634  001363          BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
012636  004767  002306          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
                        ;;*****************************************************************
                        ;*TEST 22       EXECUTE DATI, DATOB (LOW BYTE) THRU MEMORY.
                        ;*  EXECUTES THE INSTRUCTION 'MOVB R4,(R2)' THROUGHOUT MEMORY.
                        ;*  AN 'RTS R5' (CODE 205) IS PLACED AFTER THE 'MOVB' INSTRUCTION TO RETURN
                        ;*  CONTROL TO THE MAIN PROGRAM FOR INSTRUCTION EXECUTION CHECKOUT.
                        ;*  THIS IS AN EXAMPLE OF WHAT THIS TEST DOES IN RELATION TO MEMORY:
                        ;*
                        ;*                MEMORY        INSTRUCTION     CONTENTS OF MEMORY LOCATION
                        ;*               LOCATION       PLACED THERE    AFTER INSTRUCTION EXECUTION
                        ;*
                        ;*   1ST PASS /  40000           110412          110605
                        ;*  THRU TEST /  40002           000205          000205
                        ;*
                        ;*   2ND PASS /  40002           110412          110605
                        ;*  THRU TEST /  40004           000205          000205
                        ;*
                        ;*      ETC., ETC., ETC.
                        ;*
                        ;*  R0 = DATA WRITTEN ON TOP OF IUT BY THE IUT (SHOULD BE).
                        ;*  R1 = DATA READ FROM MEMORY (WAS).
                        ;*  R2 = ADDRESS OF IUT/DATA.
                        ;*  R3 = INSTRUCTION UNDER TEST (IUT).
                        ;*  R4 = RTS R5 (CODE 205).
                        ;*  R5 = BLOCK BOUNDRY BIT MASK.
                        ;*****************************************************************
012642                  TST22:
012642  004567  005726          JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
012646  000003          .WORD   3                       ;MINIMUM BLOCK SIZE OF 2 WORDS
                                                        ; REQUIRED FOR THIS TEST.
012650  000167  000060          JMP     TST23           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                        ; AVAILABLE FOR TEST.
012654  012703  110412  DIDBL:   MOV     #110412,R3      ;GET 'MOVB R4,(R2)' INSTRUCTION (IUT).
012660  012704  000205          MOV     #205,   R4      ;GET 'RTS R5'
012664  012700  110605          MOV     #110605,R0      ;SET UP S/B DATA AFTER EXECUTION.
012670  004467  001476          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
012674  010322  1$:     MOV     R3,     (R2)+   ;PUT IUT INTO FIRST LOC OF BLOCK.
012676  010412  2$:     MOV     R4,     (R2)    ;PUT 'RTS R5' FOLLOWING IUT.
012700  004542          JSR     R5,     -(R2)   ;GO EXECUTE THE IUT.
012702  012201          MOV     (R2)+,  R1      ;GET THE DATA FROM THE MEM ADR UNDER TEST.
012704  020001          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
012706  001405          BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
012710  004767  005412  64$:    JSR     PC,     SPRNT3  ;SET UP VALUES FOR ERROR PRINTING.
012714  004767  006664          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
012720  000021          .WORD   21              ;ERROR TYPE CODE.
012722                  65$:
012722  010322          MOV     R3,     (R2)+   ;PUT THE IUT INTO THE NEXT LOCATION.
012724  030502          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
012726  001363          BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
012730  004767  002214          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
                        ;*****************************************************************
                        ;*TEST 23       EXECUTE DATI, DATOB (HIGH BYTE) THRU MEMORY.
                        ;*   EXECUTES THE INSTRUCTION 'MOVB R3,-(R2)' THROUGHOUT MEMORY.
                        ;*   AN 'RTS R5' (CODE 205) IS PLACED AFTER THE 'MOVB' INSTRUCTION TO RETURN
                        ;*   CONTROL TO THE MAIN PROGRAM FOR INSTRUCTION EXECUTION CHECKOUT.
                        ;*   THIS IS AN EXAMPLE OF WHAT THIS TEST DOES IN RELATION TO MEMORY:
                        ;*
                        ;*                  MEMORY        INSTRUCTION     CONTENTS OF MEMORY LOCATION
                        ;*                 LOCATION       PLACED THERE    AFTER INSTRUCTION EXECUTION
                        ;*
                        ;*    1ST PASS /   40000            110342          161342
                        ;*  THRU TEST /    40002            000205          000205
                        ;*
                        ;*    2ND PASS /   40002            110342          161342
                        ;*  THRU TEST /    40004            000205          000205
                        ;*
                        ;*       ETC., ETC., ETC.
                        ;*
                        ;*   R0 = DATA WRITTEN ON TOP OF IUT BY THE IUT (SHOULD BE).
                        ;*   R1 = DATA READ FROM MEMORY (WAS).
                        ;*   R2 = ADDRESS OF IUT/DATA.
                        ;*   R3 = INSTRUCTION UNDER TEST (IUT).
                        ;*   R4 = RTS R5 (CODE 205).
                        ;*   R5 = BLOCK BOUNDRY BIT MASK.
                        ;*****************************************************************
012734                  TST23:
012734  004567  005634          JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
012740  000003                  .WORD   3               ;MINIMUM BLOCK SIZE OF 2 WORDS
                                                        ; REQUIRED FOR THIS TEST.
012742  000167  000064          JMP     TST24           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                        ; AVAILABLE FOR TEST.
012746  012703  110342  DIDBH:  MOV     #110342,R3      ;GET 'MOVB R3,-(R2)' INSTRUCTION (IUT).
012752  012704  000205          MOV     #205,   R4      ;GET 'RTS R5'
012756  012700  161342          MOV     #161342,R0      ;SET UP S/B DATA AFTER EXECUTION.
012762  004467  001404          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
012766  010322          1$:     MOV     R3,     (R2)+   ;PUT IUT INTO FIRST LOC OF BLOCK.
012770  010412          2$:     MOV     R4,     (R2)    ;PUT 'RTS R5' FOLLOWING IUT.
012772  004562  177776          JSR     R5,     -2(R2)  ;GO EXECUTE THE IUT.
012776  005302                  DEC     R2              ;ADJUST R2 TO POINT TO MAUT.
013000  012201                  MOV     (R2)+,  R1      ;GET THE DATA FROM THE MEM ADR UNDER TEST.
013002  020001                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
013004  001405                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
013006  004767  005314  64$:    JSR     PC,     SPRNT3  ;SET UP VALUES FOR ERROR PRINTING.
013012  004767  006566          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
013016  000021                  .WORD   21              ;ERROR TYPE CODE.
013020                  65$:
013020  010322                  MOV     R3,     (R2)+   ;PUT THE IUT INTO THE NEXT LOCATION.
013022  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
013024  001361                  BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
013026  004767  002116          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
                                ;;*****************************************************************
                                ;*TEST 24       EXECUTE DATI, DATIP, DATO THRU MEMORY.
                                ;*  EXECUTES THE INSTRUCTION 'NEG (R2)' THROUGHOUT MEMORY.
                                ;*  AN 'RTS R5' (CODE 205) IS PLACED AFTER THE 'NEG' INSTRUCTION TO RETURN
                                ;*  CONTROL TO THE MAIN PROGRAM FOR INSTRUCTION EXECUTION CHECKOUT.
                                ;*  THIS IS AN EXAMPLE OF WHAT THIS TEST DOES IN RELATION TO MEMORY:
                                ;*
                                ;*                MEMORY        INSTRUCTION     CONTENTS OF MEMORY LOCATION
                                ;*               LOCATION       PLACED THERE    AFTER INSTRUCTION EXECUTION
                                ;*
                                ;*   1ST PASS /  40000          005412          172366
                                ;*  THRU TEST /  40002          000205          000205
                                ;*
                                ;*   2ND PASS /  40002          005412          172366
                                ;*  THRU TEST /  40004          000205          000205
                                ;*
                                ;*      ETC., ETC., ETC.
                                ;*
                                ;*  R0 = DATA WRITTEN ON TOP OF IUT BY THE IUT (SHOULD BE).
                                ;*  R1 = DATA READ FROM MEMORY (WAS).
                                ;*  R2 = ADDRESS OF IUT/DATA.
                                ;*  R3 = INSTRUCTION UNDER TEST (IUT).
                                ;*  R4 = RTS R5 (CODE 205).
                                ;*  R5 = BLOCK BOUNDRY BIT MASK.
                                ;*****************************************************************
013032                          TST24:
013032  004567  005536                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
013036  000003                          .WORD   3               ;MINIMUM BLOCK SIZE OF 2 WORDS
                                                                ; REQUIRED FOR THIS TEST.
013040  000167  000060                  JMP     TST25           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                                ; AVAILABLE FOR TEST.
013044  012703  005412          DIPDO:  MOV     #005412,R3      ;GET 'NEG (R2)' INSTRUCTION (IUT).
013050  012704  000205                  MOV     #205,   R4      ;GET 'RTS R5'
013054  012700  172366                  MOV     #172366,R0      ;SET UP S/B DATA AFTER EXECUTION.
013060  004467  001306                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
013064  010322                  1$:     MOV     R3,     (R2)+   ;PUT IUT INTO FIRST LOC OF BLOCK.
013066  010412                  2$:     MOV     R4,     (R2)    ;PUT 'RTS R5' FOLLOWING IUT.
013070  004542                          JSR     R5,     -(R2)   ;GO EXECUTE THE IUT.
013072  012201                          MOV     (R2)+,  R1      ;GET THE DATA FROM THE MEM ADR UNDER TEST.
013074  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
013076  001405                          BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
013100  004767  005222          64$:    JSR     PC,     SPRNT3  ;SET UP VALUES FOR ERROR PRINTING.
013104  004767  006474                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
013110  000021                          .WORD   21              ;ERROR TYPE CODE.
013112                          65$:
013112  010322                          MOV     R3,     (R2)+   ;PUT THE IUT INTO THE NEXT LOCATION.
013114  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
013116  001363                          BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
013120  004767  002024                  JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
                        ;*****************************************************************
                        ;*TEST 25       EXECUTE DATI, DATI, DATIP, DATOB (LOW BYTE) THRU MEMORY.
                        ;*  EXECUTES THE INSTRUCTION 'BICB (R2)+,-(R2)' THROUGHOUT MEMORY.
                        ;*  AN 'RTS R5' (CODE 205) IS PLACED AFTER THE BICB' INSTRUCTION TO RETURN
                        ;*  CONTROL TO THE MAIN PROGRAM FOR INSTRUCTION EXECUTION CHECKOUT.
                        ;*  THIS IS AN EXAMPLE OF WHAT THIS TEST DOES IN RELATION TO MEMORY:
                        ;*
                        ;*                MEMORY        INSTRUCTION     CONTENTS OF MEMORY LOCATION
                        ;*               LOCATION       PLACED THERE    AFTER INSTRUCTION EXECUTION
                        ;*
                        ;*   1ST PASS /  40000           142242          142000
                        ;*  THRU TEST /  40002           000205          000205
                        ;*
                        ;*   2ND PASS /  40002           142242          142000
                        ;*  THRU TEST /  40004           000205          000205
                        ;*
                        ;*      ETC., ETC., ETC.
                        ;*
                        ;*  R0 = DATA WRITTEN ON TOP OF IUT BY THE IUT (SHOULD BE).
                        ;*  R1 = DATA READ FROM MEMORY (WAS).
                        ;*  R2 = ADDRESS OF IUT/DATA.
                        ;*  R3 = INSTRUCTION UNDER TEST (IUT).
                        ;*  R4 = RTS R5 (CODE 205).
                        ;*  R5 = BLOCK BOUNDRY BIT MASK.
                        ;*****************************************************************
013124                  TST25:
013124  004567  005444          JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
013130  000003                  .WORD   3               ;MINIMUM BLOCK SIZE OF 2 WORDS
                                                        ; REQUIRED FOR THIS TEST.
013132  000167  000060          JMP     TST26           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                        ; AVAILABLE FOR TEST.
013136  012703  142242  DPDBL:  MOV     #142242,R3      ;GET BICB (R2)+,-(R2)' INSTRUCTION (IUT).
013142  012704  000205          MOV     #205,   R4      ;GET 'RTS R5'
013146  012700  142000          MOV     #142000,R0      ;SET UP S/B DATA AFTER EXECUTION.
013152  004467  001214          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
013156  010322          1$:     MOV     R3,     (R2)+   ;PUT IUT INTO FIRST LOC OF BLOCK.
013160  010412          2$:     MOV     R4,     (R2)    ;PUT 'RTS R5' FOLLOWING IUT.
013162  004542                  JSR     R5,     -(R2)   ;GO EXECUTE THE IUT.
013164  012201                  MOV     (R2)+,  R1      ;GET THE DATA FROM THE MEM ADR UNDER TEST.
013166  020001                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
013170  001405                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
013172  004767  005130  64$:    JSR     PC,     $PRNT3  ;SET UP VALUES FOR ERROR PRINTING.
013176  004767  006402          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
013202  000021                  .WORD   21              ;ERROR TYPE CODE.
013204                  65$:
013204  010322                  MOV     R3,     (R2)+   ;PUT THE IUT INTO THE NEXT LOCATION.
013206  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
013210  001363                  BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
013212  004767  001732          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
                                ;*****************************************************************
                                ;*TEST 26       EXECUTE DATI, DATI, DATIP, DATOB (HIGH BYTE) THRU MEMORY.
                                ;*  EXECUTES THE INSTRUCTION 'BISB (R2)+,(R2)' THROUGHOUT MEMORY.
                                ;*  AN 'RTS R5' (CODE 205) IS PLACED AFTER THE 'BISB' INSTRUCTION TO RETURN
                                ;*  CONTROL TO THE MAIN PROGRAM FOR INSTRUCTION EXECUTION CHECKOUT.
                                ;*  THIS IS AN EXAMPLE OF WHAT THIS TEST DOES IN RELATION TO MEMORY:
                                ;*
                                ;*                MEMORY        INSTRUCTION     CONTENTS OF MEMORY LOCATION
                                ;*               LOCATION       PLACED THERE    AFTER INSTRUCTION EXECUTION
                                ;*
                                ;*   1ST PASS /   40000           152212          157212
                                ;*  THRU TEST /   40002           000205          000205
                                ;*
                                ;*   2ND PASS /   40002           152212          157212
                                ;*  THRU TEST /   40004           000205          000205
                                ;*
                                ;*      ETC., ETC., ETC.
                                ;*
                                ;*  R0 = DATA WRITTEN ON TOP OF IUT BY THE IUT (SHOULD BE).
                                ;*  R1 = DATA READ FROM MEMORY (WAS).
                                ;*  R2 = ADDRESS OF IUT/DATA.
                                ;*  R3 = INSTRUCTION UNDER TEST (IUT).
                                ;*  R4 = RTS R5 (CODE 205).
                                ;*  R5 = BLOCK BOUNDRY BIT MASK.
                                ;*****************************************************************
013216                          TST26:
013216  004567  005352                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
013222  000003                          .WORD   3               ;MINIMUM BLOCK SIZE OF 2 WORDS
                                                                ; REQUIRED FOR THIS TEST.
013224  000167  000062                  JMP     TST27           ;SKIP TO NEXT TEST WHEN LESS THAN ONE BLOCK
                                                                ; AVAILABLE FOR TEST.
013230  012703  152212          DPDBH:  MOV     #152212,R3      ;GET 'BISB (R2)+,(R2)' INSTRUCTION (IUT).
013234  012704  000205                  MOV     #205,   R4      ;GET 'RTS R5'
013240  012700  157212                  MOV     #157212,R0      ;SET UP S/B DATA AFTER EXECUTION.
013244  004467  001122                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
013250  010322          1$:     MOV     R3,     (R2)+   ;PUT IUT INTO FIRST LOC OF BLOCK.
013252  010412          2$:     MOV     R4,     (R2)    ;PUT 'RTS R5' FOLLOWING IUT.
013254  004542                  JSR     R5,     -(R2)   ;GO EXECUTE THE IUT.
013256  005302                  DEC     R2              ;RESET R2 TO POINT TO IUT.
013260  012201                  MOV     (R2)+,  R1      ;GET THE DATA FROM THE MEM ADR UNDER TEST.
013262  020001                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
013264  001405                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
013266  004767  005034  64$:    JSR     PC,     SPRNT3  ;SET UP VALUES FOR ERROR PRINTING.
013272  004767  006306          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
013276  000021                  .WORD   21              ;ERROR TYPE CODE.
013300                  65$:
013300  010322                  MOV     R3,     (R2)+   ;PUT THE IUT INTO THE NEXT LOCATION.
013302  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
013304  001362                  BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
013306  004767  001636          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
                                .SBTTL SECTION 4:MOS TESTS
                                ;;*****************************************************************
                                ;*TEST 27       MARCHING 1'S AND 0'S.
                                ;* THIS TEST IS DESIGNED TO STRESS MOS MEMORIES.
                                ;* STARTING AT THE BOTTOM ADDRESS AND ADDRESSING UPWARDS A 4K BANK IS
                                ;* WRITTEN WITH 000377,THEN STARTING AT THE TOP ADDRESS OF THE BANK THE
                                ;* 000377 IS READ,THE BYTES ARE SWAPPED TO 177400 AND THE LOCATION
                                ;* REREAD TO CONFIRM THE WRITE.THIS IS REPEATED FOR EVERY LOCATION
                                ;* ADDRESSED DOWNWARD UNTIL THE BOTTOM IS REACHED. STARTING AT THE
                                ;* BOTTOM EACH LOCATION IS READ FOR 177400,THE BYTES ARE SWAPPED TO
                                ;* 000377 AND REREAD TO CONFIRM THE WRITE UNTIL THE TOP ADDRESS OF THE
                                ;* BANK IS REACHED. AGAIN STARTING AT THE BOTTOM EACH LOCATION IS READ
                                ;* FOR 000377,THE BYTES SWAPPED TO 177400 AND THE LOCATION REREAD TO
                                ;* CONFIRM THE WRITE. LASTLY STARTING FROM THE TOP AND ADDRESSING DOWN-
                                ;* WARD EACH LOCATION IS READ,THE BYTES SWAPPED TO 000377 AND THE
                                ;* LOCATION IS REREAD TO CONFIRM THE WRITE. THIS IS RELATED FOR EVERY
                                ;*4K BANK UNDER TEST.
                                ;*
                                ;*      R0=DATA WRITTEN INTO MEMORY(SHOULD BE)
                                ;*      R1=DATA READ FROM MEMORY(WAS)
                                ;*      R2=VIRTUAL ADDRESS
                                ;*      R3=TIMES THROUGH COUNTER
                                ;*      R4=NOT USED
                                ;*      R5=BLOCK BOUNDARY BIT MASK.
                                ;;*****************************************************************
013312                          TST27:
013312  004567  005256                  JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
013316  000000                          .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
013320  004467  001046                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
013324  010267  166264                  MOV     R2,TEMP         ;SAVE BANK STARTING ADDRESS
013330  005003                  1$:     CLR     R3              ;CLEAR PASS COUNTER
013332  012700  000377                  MOV     #000377,R0      ;SETUP TO WRITE PATTERN
013336  010022                  2$:     MOV     R0,(R2)+        ;WRITE PATTERN
013340  030502                          BIT     R5,R2           ;END OF 4K?
013342  001375                          BNE     2$              ;CONTINUE WRITING IF NO.
013344  014201                  3$:     MOV     -(R2),R1        ;GET DATA WRITEN
013346  020C01                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
013350  001405                          BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
013352  004767  004754          64$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
013356  004767  006222                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
013362  000010                          .WORD   10              ;ERROR TYPE CODE.
013364                          65$:
013364  000300                  4$:     SWAB    R0              ;SWAP BYTES OF DATA
013366  010012                          MOV     R0,(R2) ;WRITE SWAPPED WORD
013370  011201                          MOV     (R2),R1         ;GET DATA WRITEN
013372  020001                          CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
013374  001405                          BEQ     67$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
013376  004767  004730          66$:    JSR     PC,     $PRNT2  ;SET UP VALUES FOR ERROR PRINTING.
013402  004767  006176                  JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
013406  000010                          .WORD   10              ;ERROR TYPE CODE.
013410                          67$:
013410  000300                          SWAB    R0              ;PUT DATA BACK TO ORINGINAL
013412  005703                          TST     R3              ;IF ON PASS 0 OR PASS 3
013414  001403                          BEQ     5$              ;WE ARE ADDRESSING DOWN
013416  020327  000003                  CMP     R3,#3           ;IF ON PASS 1 OR 2 GO TO
013422  001010                          BNE     6$              ;UPWARD
```

```
2927  013424  030502                5$:   BIT   R5,R2          ;DONE A PASS?
2928  013426  001346                      BNE   3$             ;IF NO CONTINUE
2929  013430  005203                      INC   R3             ;IF YES INCREMENT PASS COUNTER
2930  013432  022703  000004              CMP   #4,R3          ;ARE WE DONE ALL PASSES FOR THIS 4K?
2931  013436  001427                      BEQ   9$             ;IF YES BRANCH
2932  013440  000300                      SWAB  R0             ;ELSE SET UP NEW READ WORD
2933  013442  000404                      BR    7$             ;GO TO START OF ADDRESS UP
2934  013444  062702  000002        6$:   ADD   #2,R2          ;UPDATE TO NEXT ADDRESS
2935  013450  030502                      BIT   R5,R2          ;DONE A PASS
2936  013452  001411                      BEQ   8$             ;IF YES BRANCH
2937  013454  011201                7$:   MOV   (R2),R1        ;GET DATA WRITTEN
2938  013456  020001                      CMP   R0,     R1     ;COMPARE THE CHECK WORD WITH THE DATA READ.
2939  013460  001405                      BEQ   69$            ;BRANCH OVER ERROR CALL IF GOOD DATA.
2940  013462  004767  004644        68$:  JSR   PC,     SPRNT2 ;SET UP VALUES FOR ERROR PRINTING.
2941  013466  004767  006112              JSR   PC,     $ERROR ;*** ERROR *** (GO TYPE A MESSAGE)
2942  013472  000010                      .WORD 10             ;ERROR TYPE CODE.
2943  013474                        69$:
2944  013474  000733                      BR    4$
2945  013476  005203                8$:   INC   R3             ;INCREMENT      PASS COUNTER
2946  013500  000300                      SWAB  R0             ;SET UP NEW READ WORD
2947  013502  020327  000002              CMP   R3,#2          ;ADDRESSING UP?
2948  013506  001316                      BNE   3$             ;IF NO GO TO DOWN SEQUENCE
2949  013510  016702  166100              MOV   TEMP,R2        ;IF YES RESET ADDRESS TO START
2950  013514  000757                      BR    7$             ;GO TO UP SEQUENCE
2951  013516  004467  000650        9$:   JSR   R4,INITMM      ;INITIALIZE MEMORY ADDRESS POINTERS
2952  013522  004767  001422              JSR   PC,MMUP        ;UPDATE TO NEW BANK IF EXISTS
2953
2954                                ;;*****************************************************************
2955                                ;*TEST 30       WRITE CHECKERBOARD STARTING WITH '125252' DATA.
2956                                ;* THESE TESTS WRITE A CHECKERBOARD THROUGHOUT MEMORY,STALL
2957                                ;* FOR 2 SECONDS THEN CHECK PATTERN TO VERIFY DATA DID NOT
2958                                ;* DETERIORATE BETWEEN REFRESH CYCLES.
2959                                ;*
2960                                ;*       R0=DATA WRITTEN INTO MEMORY(SHOULD BE)
2961                                ;*       R1=DATA READ FROM MEMORY(WAS)
2962                                ;*       R2=VIRTUAL ADDRESS
2963                                ;*       R3=SMALL LOOP COUNTER FOR STALL
2964                                ;*       R4=NUMBER OF TIMES SMALL LOOP DONE
2965                                ;*       R5=BLOCK BOUNDARY BIT MASK.
2966                                ;*****************************************************************
2967  013526                        TST30:
2968  013526  004567  005042              JSR   R5,     $SCOPE ;GO TO SCOPE ROUTINE.
2969  013532  000000                      .WORD 0              ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
2970  013534  004467  000632              JSR   R4,     INITMM ;INITIALIZE THE MEMORY ADDRESS POINTERS
2971  013540  012700  125252              MOV   #125252 ,R0    ;SETUP DATA PATTERN
2972  013544  010022                1$:   MOV   R0      ,(R2)+ ;WRITE A WORD
2973  013546  005100                      COM   R0             ;COMPLEMENT DATA
2974  013550  030502                      BIT   R5,     R2     ;CHECK FOR END OF A BLOCK.
2975  013552  001374                      BNE   1$             ;BRANCH IF MORE IN CURRENT BLOCK.
2976  013554  004767  C 1370              JSR   PC,     MMUP   ;FIND NEXT BLOCK AND LOOP TO 1$.
2977  013560  005003                      CLR   R3             ;SET UP COUNTER FOR STALL
2978  013562  012704  000046              MOV   #46,    R4     ;DO LOOP 46 TIMES OR 2 SEC. TOTAL.
2979  013566  005303                2$:   DEC   R3
2980  013570  001376                      BNE   2$
2981  013572  005304                      DEC   R4
2982  013574  001374                      BNE   2$
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2983  013576  004467  000570          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
2984  013602  012700  125252          MOV     #125252,R0      ;INIT DATA FOR CHECKING
2985  013606                      3$:
2986  013606  012201                  MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
2987  013610  020001                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ
2988  013612  001405                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
2989  013614  004767  004512      64$:JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
2990  013620  004767  005760          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
2991  013624  000006                  .WORD   6               ;ERROR TYPE CODE.
2992  013626                      65$:
2993  013626  005100                  COM     R0
2994  013630  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
2995  013632  001365                  BNE     3$              ;BRANCH IF MORE IN CURRENT BLOCK.
2996  013634  004767  001310          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
2997                              ;;*****************************************************************
2998                              ;*TEST 31        WRITE CHECKERBOARD STARTING WITH 052525 DATA
2999                              ;;*****************************************************************
3000  013640                      TST31:
3001  013640  004567  004730          JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
3002  013644  000000                  .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
3003  013646  004467  000520          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
3004  013652  012700  052525          MOV     #052525,R0      ;SETUP DATA PATTERN
3005  013656  010022              1$: MOV     R0,     (R2)+   ;WRITE A WORD
3006  013660  005100                  COM     R0
3007  013662  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
3008  013664  001374                  BNE     1$              ;BRANCH IF MORE IN CURRENT BLOCK.
3009  013666  004767  001256          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
3010  013672  005003                  CLR     R3              ;SET COUNTER FOR LOOP
3011  013674  012704  000046          MOV     #46.,   R4      ;DO LOOP 46 TIMES OR 2 SEC. TOTAL
3012  013700  005303              2$: DEC     R3
3013  013702  001376                  BNE     2$
3014  013704  005304                  DEC     R4
3015  013706  001374                  BNE     2$
3016  013710  004467  000456          JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
3017  013714  012700  052525          MOV     #052525,R0      ;INIT PATTERN FOR CHECKING
3018  013720                      3$:
3019  013720  012201                  MOV     (R2)+,  R1      ;GET THE DATA FROM MEMORY UNDER TEST.
3020  013722  020001                  CMP     R0,     R1      ;COMPARE THE CHECK WORD WITH THE DATA READ.
3021  013724  001405                  BEQ     65$             ;BRANCH OVER ERROR CALL IF GOOD DATA.
3022  013726  004767  004400      64$:JSR     PC,     SPRNT2  ;SET UP VALUES FOR ERROR PRINTING.
3023  013732  004767  005646          JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
3024  013736  000006                  .WORD   6               ;ERROR TYPE CODE.
3025  013740                      65$:
3026  013740  005100                  COM     R0
3027  013742  030502                  BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
3028  013744  001365                  BNE     3$              ;BRANCH IF MORE IN CURRENT BLOCK.
3029  013746  004767  001176          JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
```

```
3030                                        .SBTTL DONE:    RELOCATE PROGRAM AND REPEAT ALL TESTS.
3031   013752                               DONE:
3032   013752  004567  004616                      JSR     R5,     $SCOPE  ;GO TO SCOPE ROUTINE.
3033   013756  000000                              .WORD   0               ;NO MINIMUM BLOCK SIZE REQUIRED THIS TEST.
3034   013760  005067  165204               TST32: CLR     $TIMES          ;RESET ITERATION COUNTER FOR RESTARTING TEST.
3035   013764  105067  165112                      CLRB    $ISTNM          ;RESET TEST NUMBER.
3036   013770  036767  164606  165536       1$:    BIT     PRGMAP, SAVTST  ;CHECK IF PROGRAM IS IN TEST AREA.
3037   013776  001004                              BNE     2$              ;BR IF IT PROG IN MEM TO BE TESTED.
3038   014000  036767  164600  165530              BIT     PRGMAP+2,SAVTST+2 ;CHECK HI 64K
3039   014006  001434                              BEQ     $EOP            ;BR IF PROG NOT IN MEM TO BE TESTED.
3040   014010  032777  000200  165122  2$:    BIT     #SW07,  @SWR    ;CHECK FOR INHIBIT RELOCATION SWITCH.
3041   014016  001030                              BNE     $EOP            ;SKIP RELOCATION IF SWITCH SET.
3042   014020  022767  000003  164554              CMP     #3,     PRGMAP  ;CHECK IF PROGRAM IN FIRST 8K.
3043   014026  001012                              BNE     4$              ;BR IF NOT IN FIRST 8K.
3044   014030  005737  000042                      TST     @#42            ;CHECK FOR A ACT11.
3045   014034  001014                              BNE     5$              ;BR IF A ACT11.
3046   014036  105737  001224                      TSTB    @#$ENV          ;CHECK FOR APT
3047   014042  001011                              BNE     5$              ;IF APT DO NOT RELOCATE
3048   014044  004767  002354                      JSR     PC,     RELTOP  ;RELOCATE PROGRAM TO TOP OF MEMORY.
3049   014050  000167  172004               3$:    JMP     START1          ;LOOP BACK AND RUN ALL TESTS AGAIN.
3050
3051   014054  004767  002746               4$:    JSR     PC,     RELO    ;RELOCATE PROGRAM BACK TO FIRST 8K.
3052   014060  005737  000042                      TST     @#42            ;TEST FOR XXDP
3053   014064  001402                              BEQ     6$              ;IF NOT RUNNING UNDER MON. DONT
3054   014066  004767  003142               5$:    JSR     PC,     RESLDR  ;RESTORE LOADERS.
3055   014072                               6$:
3056   014072  004567  007360                      JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3057   014076  001201                              .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
```

```
                                ;;*****************************************************************
                                .SBTTL  END OF PASS ROUTINE
                                ;*INCREMENT THE PASS NUMBER ($PASS)
                                ;*TYPE "END PASS #XXXXX" (WHERE XXXXX IS A DECIMAL NUMBER)
                                ;*IF THERES A MONITOR GO TO IT
                                ;*IF THERE ISN'T JUMP TO START1
014100                          $EOP:
014100  000240                          NOP
014102  005067  165062                  CLR     $TIMES          ;;ZERO THE NUMBER OF ITERATIONS
014106  005267  165100                  INC     $PASS           ;;INCREMENT THE PASS NUMBER
014112  042767  100000  165072          BIC     #100000,$PASS   ;;DON'T ALLOW A NEG. NUMBER
014120  005327                          DEC     (PC)+           ;;LOOP?
014122  000001                  $EOPCT: .WORD   1
014124  003035                          BGT     $DOAGN          ;;YES
014126  012737                          MOV     (PC)+,@(PC)+    ;;RESTORE COUNTER
014130  000001                  $ENDCT: .WORD   1
014132  014122                          $EOPCT
014134  004567  007316                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
014140  014224                          .WORD   $ENDMG          ;ADDRESS OF MESSAGE TO BE TYPED
014142  016746  165044                  MOV     $PASS,-(SP)     ;;SAVE $PASS FOR TYPEOUT
                                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPDS ROUTINE
                                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
014146  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
014152  004767  010220                  JSR     PC,     $TYPDS  ;GO TO THE SUBROUTINE
014156  004567  007274                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
014162  014241                          .WORD   $ENULL          ;ADDRESS OF MESSAGE TO BE TYPED
014164                          $GET42:
014164  016700  163652                  MOV     42,     R0              ;;GET MONITOR ADDRESS
014170  001413                          BEQ     $DOAGN          ;;BRANCH IF NO MONITOR
014172  000005                          RESET                   ;;CLEAR THE WORLD
014174  004710                  $ENDAD: JSR     PC,(R0)         ;;GO TO MONITOR
014176  000240                          NOP                     ;;SAVE ROOM
014200  000240                          NOP                     ;;FOR
014202  000240                          NOP                     ;;ACT11
014204  023737  000042  000046          CMP     @#42,@#46       ;;ARE WE UNDER ACT11 OR XXDP
014212  001402                          BEQ     $DOAGN          ;;IF ACT11 THEN RESTART
014214  004767  003074                  JSR     PC,     SAVLDR  ;;IF XXDP FIRST SAVE MONITOR
014220                          $DOAGN:
014220  000167  171634                  JMP     START1          ;;RETURN*****
014224  005015  047105  020104  $ENDMG: .ASCIZ  <15><12>/END PASS #/
014232  040520  051523  021440
014240     000
014241     377     377     000  $ENULL: .BYTE   -1,-1,0          ;;NULL CHARACTER STRING
                                .SBTTL SUBROUTINE AND TRAP ROUTINE SECTION.
                                .SBTTL  MEMORY MANAGEMENT AND ADDRESSING SUBROUTINES.
                                ;;*****************************************************************
                                ;*  SET UP ALL THE MEM MGMT REGISTERS FOR NORMAL OPERATION.
                                ;*  THE PROGRAM IS POINTED TO BY PARS 0 AND 1.
                                ;*  THE MEMORY UNDER TEST IS POINTED TO BY PARS 2 AND 3.
                                ;*  THE DEVICE ADDRESS AREA IS POINTED TO BY PAR 7.
                                ;*  PARS 4, 5, AND 6 ARE UNUSED.
                                ;;*****************************************************************
```

```
3114  014244                                  MMINIT:
3115  014244  012737  077406  172300          MOV     #200-1*400+UP+RW,@#KIPDR0       ;SET KIPDR0 = RW UP 200 BLOCKS
3116  014252  012737  077406  172302          MOV     #200-1*400+UP+RW,@#KIPDR1       ;SET KIPDR1 = RW UP 200 BLOCKS
3117  014260  012737  077406  172304          MOV     #200-1*400+UP+RW,@#KIPDR2       ;SET KIPDR2 = RW UP 200 BLOCKS
3118  014266  012737  077406  172306          MOV     #200-1*400+UP+RW,@#KIPDR3       ;SET KIPDR3 = RW UP 200 BLOCKS
3119  014274  005037  172310                  CLR     @#KIPDR4
3120  014300  005037  172312                  CLR     @#KIºDR5
3121  014304  005037  172314                  CLR     @#KIPDR6
3122  014310  012737  077406  172316          MOV     #200-1*400+UP+RW,@#KIPDR7       ;SET KIPDR7 = RW UP 200 BLOCKS
3123  014316  005037  172340                  CLR     @#KIPAR0        ;MAP PAR0 INTO BANK0
3124  014322  012737  000200  172342          MOV     #200, @#KIPAR1  ;MAP PAR1 INTO BANK1
3125  014330  005037  172344                  CLR     @#KIPAR2        ;MAP PAR2 INTO BANK0
3126  014334  005037  172346                  CLR     @#KIPAR3
3127  014340  005037  172350                  CLR     @#KIPAR4
3128  014344  005037  172352                  CLR     @#KIPAR5
3129  014350  005037  172354                  CLR     @#KIPAR6
3130  014354  012737  007600  172356          MOV     #7600, @#KIPAR7 ;MAP PAR7 INTO I/O BANK
3131  014362  012737  000001  177572          MOV     #1,     @#SR0   ;ENABLE MEMORY MANAGEMENT
3132  014370  000207                          RTS     PC              ;RETURN
3133
3134
3135                                          ;;*****************************************************************
3136                                          ;*  MEMORY ADDRESS POINTER INITIALIZATION ROUTINES.
3137                                          ;;*****************************************************************
3138  014372  012767  000001  165144  INITMM: MOV     #BIT0,  BITPT   ;SET POINTER TO BANK0
3139  014400  005067  165142                  CLR     BITPT+2         ;CLEAR HI 64K BANK POINTERS
3140  014404  005002                          CLR     R2              ;SET ADDRESS POINTER TO 0
3141  014406  016705  165174                  MOV     BLKMSK, R5      ;RESET R5 TO BLOCK MASK.
3142  014412  005767  164170                  TST     MMAVA           ;CHECK FOR MEM MGMT AVAILABLE
3143  014416  001514                          BEQ     10$             ;BRANCH IF NO MEM MGMT
3144  014420  005037  172344                  CLR     @#KIPAR2        ;SET UP 3RD PAR TO BANK0
3145  014424  012702  040000                  MOV     #40000, R2      ;RESET VIRTUAL ADR POINTER
3146  014430  036767  165110  165072  1$:     BIT     BITPT,  TSTMAP  ;CHECK IF THIS BANK TO BE TESTED
3147  014436  0[1015                          BNE     2$              ;BRANCH IF MATCH
3148  014440  036767  165102  165064          BIT     BITPT+2,TSTMAP+2 ;CHECK IN HI MAP
3149  014446  001011                          BNE     2$              ;BRANCH IF MATCH
3150  014450  062737  000200  172344          ADD     #200,   @#KIPAR2 ;UPDATE MEM MGMT, THIRD PAR.
3151  014456  006367  165062                  ASL     BITPT           ;UPDATE LO POINTER TO NEXT BANK.
3152  014462  006167  165060                  ROL     BITPT+2         ;...HI POINTER.
3153  014466  100360                          BPL     1$              ;BR IF MORE.
3154  014470  000000                          HALT                    ;FATAL ERROR!!!  NO 4K BANK FOUND?
3155  014472  036767  165046  165102  2$:     BIT     BITPT,  LADMAP  ;CHECK IF LAST BANK.
3156  014500  001004                          BNE     3$              ;BR IF LAST BANK.
3157  014502  036767  165040  165074          BIT     BITPT+2,LADMAP+2 ;CHECK IF LAST BANK.
3158  014510  001405                          BEQ     4$              ;BR IF NOT LAST BANK.
3159  014512  016705  165062          3$:     MOV     LADMSK, R5      ;SET MASK TO FIND LAST ADR.
3160  014516  042767  020000  165052          BIC     #20000, TMPLAD  ;MAKE SURE VIRTUAL LAST ADR IN BANK 2.
3161  014524  013737  172344  172346  4$:     MOV     @#KIPAR2,@#KIPAR3 ;COPY CURRENT PAR INTO FORTH PAR.
3162  014532  016767  165006  165010          MOV     BITPT,  TMPPT   ;COPY BITPT...LO 64K.
3163  014540  016767  165002  165004          MOV     BITPT+2,TMPPT+2 ;...HI 64K.
3164  014546  032705  020000                  BIT     #BIT13, R5      ;CHECK FOR A BLOCK SIZE OF 8K.
3165  014552  001505                          BEQ     21$             ;BRANCH IF NOT 8K.
3166  014554  062737  000200  172346  5$:     ADD     #200,   @#KIPAR3 ;UP DATE FORTH PAR.
3167  014562  006367  164762                  ASL     TMPPT           ;UPDATE LO POINTER TO NEXT 4K BANK.
3168  014566  006167  164760                  ROL     TMPPT+2         ;...HI POINTER.
3169  014572  100473                          BMI     20$             ;BR IF NO MORE.
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3170  014574  036767  164750  164726          BIT     TMPPT,  TSTMAP  ;CHECK IF BANK TO BE TESTED.
3171  014602  001004                          BNE     6$              ;BRANCH IF A MATCH.
3172  014604  036767  164742  164720          BIT     TMPPT+2,TSTMAP+2 ;CHECK FOR HI 64K BANKS.
3173  014612  001760                          BEQ     5$              ;BRANCH IF NO MEMORY
3174  014614  036767  164730  164760  6$:     BIT     TMPPT,  LADMAP  ;CHECK IF LAST BANK.
3175  014622  001004                          BNE     7$              ;BRANCH IF A MATCH
3176  014624  036767  164722  164752          BIT     TMPFT+2,LADMAP+2 ;CHECK HI 64K
3177  014632  001455                          BEQ     21$             ;BR IF NOT LAST BANK.
3178  014634  016705  164740          7$:     MOV     LADMSK, R5      ;RESET MASK TO FIND LAST ADR.
3179  014640  052767  020000  164730          BIS     #20000, TMPLAD  ;MAKE SURE LAST ADDRESS IS IN BANK 3.
3180  014646  000447                          BR      21$             ;BR TO FINISH UP.
3181
3182  014650  036767  164670  164652  10$:    BIT     BITPT,  TSTMAP  ;CHECK IF THIS BANK TO BE TESTED.
3183  014656  001006                          BNE     11$             ;BR IF MATCH.
3184  014660  062702  020000                  ADD     #20000, R2      ;UPDATE PHYSICAL ADR PNTR TO NEXT BANK.
3185  014664  106367  164654                  ASLB    BITPT           ;UPDATE BANK POINTER TO NEXT BANK.
3186  014670  100367                          BPL     10$             ;BR IF MORE BANKS.
3187  014672  000000                          HALT                    ;FATAL ERROR!!!  NO 4K BANK FOUND?
3188  014674  016767  164644  164646  11$:    MOV     BITPT, TMPPT    ;COPY BANK POINTER.
3189  014702  036767  164636  164672          BIT     BITPT,  LADMAP  ;CHECK IF LAST BANK.
3190  014710  001021                          BNE     12$             ;BR IF LAST BANK.
3191  014712  032705  020000                  BIT     #BIT13, R5      ;CHECK FOR 8K BLOCK SIZE.
3192  014716  001423                          BEQ     21$             ;BRANCH IF SMALLER BLOCK SIZE.
3193  014720  106367  164624                  ASLB    TMPPT           ;POINT TO NEXT BANK.
3194  014724  100416                          BMI     20$             ;BRANCH IF OVERFLOW.
3195  014726  036767  164616  164574          BIT     TMPPT,  TSTMAP  ;CHECK IF BANK TO BE TESTED.
3196  014734  001412                          BEQ     20$             ;BRANCH IF NOT TO BE TESTED.
3197  014736  112767  000011  164613          MOVB    #11,    FLAG8K  ;SET 8K BLOCK SIZE FLAG.
3198  014744  036767  164600  164630          BIT     TMPPT,  LADMAP  ;CHECK FOR LAST BANK.
3199  014752  001403                          BEQ     20$             ;BR IF NOT LAST BANK.
3200  014754  016705  164620          12$:    MOV     LADMSK, R5      ;RESET MASK TO FIND LAST ADR.
3201  014760  000402                          BR      21$             ;SKIP MASK RESET.
3202  014762  012705  017777          20$:    MOV     #MASK4K,R5      ;RESET MASK TO 4K BLOCK SIZE.
3203  014766  056767  164552  164554  21$:    BIS     BITPT,  TMPPT   ;SET TMPPT FOR FLAGING LAST BANK.
3204  014774  056767  164546  164550          BIS     BITPT+2,TMPPT+2
3205  015002  036767  164536  164560          BIT     BITPT,  FADMAP  ;CHECK IF FIRST ADDRESS NEEDS TO BE SET.
3206  015010  001004                          BNE     22$             ;BR IF FIRST BANK.
3207  015012  036767  164530  164552          BIT     BITPT+2,FADMAP+2 ;CHECK HI 64K.
3208  015020  001450                          BEQ     INITEX          ;BR IF NOT FIRST BANK.
3209  015022  016702  164536          22$:    MOV     TMPFAD, R2      ;RESET ADDRESS POINTER TO FIRST ADR.
3210  015026  000445                          BR      INITEX
3211
3212  015030  016705  164552          INITDN: MOV     BLKMSK, R5      ;RESET R5 TO CURRENT BLOCK MASK.
3213  015034  005002                          CLR     R2              ;INIT ADDRESS POINTER.
3214  015036  005767  163544                  TST     MMAVA           ;CHECK FOR MEM MGMT
3215  015042  001411                          BEQ     31$             ;BRANCH IF NO MEM MGMT
3216  015044  012767  100000  164474          MOV     #BIT15, BITPT+2 ;SET POINTER TO TOP BIT
3217  015052  005067  164466                  CLR     BITPT
3218  015056  012737  007600  172344          MOV     #7600,  @#KIPAR2 ;SET PAR TO TOP OF MEM
3219  015064  000403                          BR      32$             ;BRANCH TO COMMON AREA
3220
3221  015066  012767  000400  164450  31$:    MOV     #BIT8,  BITPT   ;SET UP BANK POINTER
3222  015074  012767  015116  164452  32$:    MOV     #33$,   MMORE   ;SET "MMDOWN" EXIT ADDRESS.
3223  015102  066767  163472  164444          ADD     RELOCF, MMORE   ;ADD OFFSET
3224  015110  004767  000524                  JSR     PC,     MMDOWN  ;ROUTINE TO SEARCH DOWNWARD FOR TOP MEM BANK
3225  015114  000000                          HALT                    ;FATAL ERROR!!!  NO MEM INDICATED IN MEM MAP ABOVE 8K!
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 3226  015116  036767  164422  164456  33$:    BIT     BITPT,  LADMAP  ;CHECK FOR NON BOUNDRY LAST ADDR.
 3227  015124  001004                          BNE     34$             ;BR IF LAST BANK FLAG FOUND.
 3228  015126  036767  164414  164450          BIT     BITPT+2,LADMAP+2 ;CHECK FOR NON BOUNDRY LAST ADDR.
 3229  015134  001402                          BEQ     INITEX          ;BR IF NO LAD FLG FOUND.
 3230  015136  016702  164432          34$:    MOV     LSTADR, R2      ;SET UP R2.
 3231  015142  010467  164406          INITEX: MOV     R4,     MMORE   ;PUT RETURN PC INTO "MMORE"
 3232  015146  000204                          RTS     R4              ;RETURN
 3233
 3234                                          ;;*****************************************************************
 3235                                          ;*  COMMON UPWARDS ADDRESSING ROUTINE
 3236                                          ;*  FINDS NEXT EXISTING 4K BANK AND UPDATES POINTERS.
 3237                                          ;*  GOES TO ADDRESS IN "MMORE" IF MORE BANKS.
 3238                                          ;*  DOES STRAIGHT EXIT WHEN ALL MEMORY HAS BEEN DONE.
 3239                                          ;;*****************************************************************
 3240  015150  036767  164374  164424  MMUP:   BIT     TMPPT,  LADMAP  ;CHECK FOR LAST BANK FLAG.
 3241  015156  001122                          BNE     10$             ;BR IF LAST BANK.
 3242  015160  036767  164366  164416          BIT     TMPPT+2,LADMAP+2 ;CHECK FOR LAST BANK FLAG.
 3243  015166  001116                          BNE     10$             ;BR IF LAST BANK.
 3244  015170  016705  164412                  MOV     BLKMSK, R5      ;RESET R5 TO BLOCK MASK.
 3245  015174  005767  163406                  TST     MMAVA           ;CHECK FOR MEM MGMT AVAILABLE
 3246  015200  001515                          BEQ     20$             ;BRANCH IF NO MEM MGMT
 3247  015202  012702  040000                  MOV     #40000, R2      ;RESET VIRTUAL ADR POINTER
 3248  015206  062737  000200  172344  1$:     ADD     #200,   @#KIPAR2 ;UPDATE MEM MGMT, THIRD PAR.
 3249  015214  006367  164324                  ASL     BITPT           ;UPDATE LO POINTER TO NEXT BANK.
 3250  015220  006167  164322                  ROL     BITPT+2         ;...HI POINTER.
 3251  015224  100577                          BMI     32$             ;BR IF ALL DONE.
 3252  015226  036767  164312  164274          BIT     BITPT,  TSTMAP  ;CHECK IF THIS BANK EXISTS
 3253  015234  001004                          BNE     2$              ;BRANCH IF MATCH
 3254  015236  036767  164304  164266          BIT     BITPT+2,TSTMAP+2 ;CHECK IN HI MAP
 3255  015244  001760                          BEQ     1$              ;BRANCH IF NO MATCH
 3256  015246  036767  164272  164326  2$:     BIT     BITPT,  LADMAP  ;CHECK FOR LAST BANK FLAG.
 3257  015254  001004                          BNE     3$              ;BRANCH IF LAST BANK FLAG.
 3258  015256  036767  164264  164320          BIT     BITPT+2,LADMAP+2 ;CHECK IF LAST BANK FLAG.
 3259  015264  001405                          BEQ     4$              ;BR IF NOT LAST BANK.
 3260  015266  016705  164306          3$:     MOV     LADMSK, R5      ;RESET MASK.
 3261  015272  042767  020000  164276          BIC     #20000, TMPLAD  ;MAKE SURE VIRTUAL LAST ADR IN BANK 2
 3262  015300  016767  164240  164242  4$:     MOV     BITPT,  TMPPT   ;COPY BITPT...LO 64K.
 3263  015306  016767  164234  164236          MOV     BITPT+2,TMPPT+2 ;...HI 64K.
 3264  015314  032705  020000                  BIT     #BIT13, R5      ;CHECK FOR A BLOCK SIZE OF 8K.
 3265  015320  001530                          BEQ     31$             ;BRANCH IF NOT.
 3266  015322  013737  172344  172346          MOV     @#KIPAR2,@#KIPAR3 ;COPY CURRENT PAR INTO FORTH PAR.
 3267  015330  062737  000200  172346  5$:     ADD     #200,   @#KIPAR3 ;UP DATE FORTH PAR.
 3268  015336  006367  164206                  ASL     TMPPT           ;UPDATE LO POINTER TO NEXT 4K BANK.
 3269  015342  006167  164204                  ROL     TMPPT+2         ;...HI POINTER.
 3270  015346  100513                          BMI     30$             ;BR IF NO MORE.
 3271  015350  036767  164174  164152  6$:     BIT     TMPPT,  TSTMAP  ;CHECK IF BANK TO BE TESTED.
 3272  015356  001004                          BNE     7$              ;BRANCH IF A MATCH.
 3273  015360  036767  164166  164144          BIT     TMPPT+2,TSTMAP+2 ;CHECK FOR HI 64K BANKS.
 3274  015366  001760                          BEQ     5$              ;BRANCH IF NO MEMORY
 3275  015370  036767  164154  164204  7$:     BIT     TMPPT,LADMAP    ;CHECK FOR LAST BANK FLAG.
 3276  015376  001004                          BNE     8$              ;BRANCH IF A MATCH
 3277  015400  036767  164146  164176          BIT     TMPPT+2,LADMAP+2 ;CHECK HI 64K
 3278  015406  001475                          BEQ     31$             ;BR IF NO LAST BANK FLAG.
 3279  015410  016705  164164          8$:     MOV     LADMSK, R5      ;RESET MASK TO FIND LAST ADDRESS.
 3280  015414  052767  020000  164154          BIS     #20000, TMPLAD  ;SET VIRTUAL ADR TO BANK 3.
 3281  015422  000467                  BR      31$
```

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3282
3283  015424  026702  164146          10$:    CMP     TMPLAD, R2      ;CHECK IF LAST ADR REACHED.
3284  015430  001064                          BNE     31$             ;BR IF MORE.
3285  015432  000474                          BR      32$             ;BR IF ALL DONE.
3286
3287  015434  106267  164117          20$:    ASRB    FLAG8K          ;SHIFT 8K FLAG
3288  015440  001407                          BEQ     22$             ;BR IF NOT 8K BLOCK.
3289  015442  103455                          BCS     30$             ;BR IF ANOTHER 4K.
3290  015444  105067  164107                  CLRB    FLAG8K          ;CLEAR OUT ALL FLAGS.
3291  015450  162702  040000                  SUB     #40000, R2      ;BACK UP 8K.
3292  015454  062702  020000          21$:    ADD     #20000, R2      ;UPDATE PHYSICAL ADR PNTR TO NEXT BANK.
3293  015460  106367  164060          22$:    ASLB    BITPT           ;UPDATE POINTER.
3294  015464  100457                          BMI     32$             ;BRANCH WHEN END IS REACHED.
3295  015466  036767  164052  164034          BIT     BITPT,  TSTMAP  ;CHECK IF THIS BANK EXISTS.
3296  015474  001767                          BEQ     21$             ;BRANCH IF NO MATCH.
3297  015476  036767  164042  164076          BIT     BITPT,  LADMAP  ;CHECK FOR LAST BANK FLAG.
3298  015504  001402                          BEQ     23$             ;BR IF NO MATCH.
3299  015506  016705  164066                  MOV     LADMSK, R5      ;RESET MASK TO FIND LAST ADR.
3300  015512  016767  164026  164030  23$:    MOV     BITPT,  TMPPT   ;SET UP TMP POINTER.
3301  015520  032705  020000                  BIT     #BIT13, R5      ;CHECK FOR 8K BLOCK SIZE.
3302  015524  001426                          BEQ     31$             ;BRANCH IF SMALLER BLOCK SIZE.
3303  015526  106367  164016                  ASLB    TMPPT           ;POINT TO NEXT BANK.
3304  015532  100421                          BMI     30$             ;BRANCH IF OVERFLOW.
3305  015534  036767  164010  163766          BIT     TMPPT,  TSTMAP  ;CHECK IF BANK TO BE TESTED.
3306  015542  001415                          BEQ     30$             ;BRANCH IF NOT TO BE TESTED.
3307  015544  036767  163774  164030          BIT     BITPT,  LADMAP  ;CHECK FOR LAST BANK FLAG.
3308  015552  112767  000011  163777          MOVB    #11,    FLAG8K  ;SET 8K BLOCK FLAG.
3309  015560  036767  163760  164014          BIT     BITPT,  LADMAP  ;CHECK FOR LAST BANK FLAG.
3310  015566  001403                          BEQ     30$             ;BR IF NO FLAG.
3311  015570  016705  164004                  MOV     LADMSK, R5      ;RESET MASK TOFIND LAST ADR.
3312  015574  000402                          BR      31$
3313  015576  012705  017777          30$:    MOV     #MASK4K,R5      ;SET MASK TO 4K.
3314  015602  056767  163736  163740  31$:    BIS     BITPT,  TMPPT   ;SET TMPPT FOR FINDING LAST ADR.
3315  015610  056767  163732  163734          BIS     BITPT+2,TMPPT+2
3316  015616  016716  163732                  MOV     MMORE,  (SP)    ;FUDGE RETURN ADDRESS TO LOOP.
3317  015622  000207                          RTS     PC              ;RETURN
3318                                  ;*  BEFORE FINAL EXIT, CHECK FOR ANY NON-TRAP PARITY ERRORS.
3319  015624  005767  164446          32$:    TST     MPRX            ;CHECK FOR ANY PARITY REGISTERS PRESENT.
3320  015630  001402                          BEQ     33$             ;BR IF NONE.
3321  015632  004767  001744                  JSR     PC,     CKPMER  ;CHECK FOR PARITY MEMORY ERRORS.
3322  015636  000207                  33$:    RTS     PC              ;STRAIGHT RETURN.
3323
3324                                  ;;*****************************************************************
3325                                  ;*  MEMORY DOWNWARDS ADDRESSING SUBROUTINE.
3326                                  ;*  FINDS NEXT LOWER 4K BANK AND UPDATES POINTERS.
3327                                  ;*  GOES TO ADDRESS IN "MMORE" IF MORE BANKS.
3328                                  ;*  DOES STRAIGHT EXIT WHEN ALL MEMORY HAS BEEN DONE.
3329                                  ;;*****************************************************************
3330  015640  036767  163700  163722  MMDOWN: BIT     BITPT,  FADMAP  ;CHECK FOR FIRST ADR FLAG.
3331  015646  001004                          BNE     1$              ;BR IF FIRST ADR IN THIS BANK.
3332  015650  036767  163672  163714          BIT     BITPT+2,FADMAP+2 ;CHECK FOR FIRST ADR FLAG.
3333  015656  001404                          BEQ     2$              ;BR IF NO FLAG
3334  015660  026702  163700          1$:     CMP     TMPFAD, R2      ;CHECK IF FIRST ADDRESS REACHED.
3335  015664  001052                          BNE     9$              ;BR IF MORE.
3336  015666  000453                          BR      10$             ;BR IF ALL DONE.
3337  015670  005767  162712          2$:     TST     MMAVA           ;CHECK IF MEM MGMT IS AVAILABLE
```

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3338  015674  001425                        BEQ     6$                  ;BRANCH IF NOT
3339  015676  162737  000200  172344  3$:   SUB     #200, @#KIPAR2      ;LOWER MEM MGMT PAR BY 4K
3340  015704  006067  163636                ROR     BITPT+2             ;MOV POINTER TO NEXT LOWER BANK...HI MAP.
3341  015710  006067  163630                ROR     BITPT               ;...LO MAP.
3342  015714  103440                        BCS     10$                 ;BR IF NO MORE.
3343  015716  036767  163622  163604        BIT     BITPT,  TSTMAP      ;CHECK FOR BANK EXISTING
3344  015724  001004                        BNE     4$                  ;BR IF BANK TO BE TESTED.
3345  015726  036767  163614  163576        BIT     BITPT+2,TSTMAP+2    ;CHECK FOR BANK IN HI MAP.
3346  015734  001760                        BEQ     3$                  ;BR IF NOT THERE.
3347  015736  012702  060000          4$:   MOV     #60000, R2          ;SET ADR POINTER TO TOP OF BANK
3348  015742  000411                        BR      7$                  ;GO TO COMMON EXIT
3349  015744  162702  020000          5$:   SUB     #20000, R2          ;BACK POINTER DOWN ONE BANK
3350  015750  006267  163570          6$:   ASR     BITPT               ;MOVE POINTER TO NEXT LOWER BANK
3351  015754  103420                        BCS     10$                 ;BRANCH TO EXIT IF NO MORE  MEM
3352  015756  036767  163562  163544        BIT     BITPT,  TSTMAP      ;CHECK IF BANK EXISTS
3353  015764  001767                        BEQ     5$                  ;BRANCH IF BANK DOESN'T EXIST
3354  015766  036767  163552  163574  7$:   BIT     BITPT,  FADMAP      ;CHECK IF FIRST BANK FLAG.
3355  015774  001004                        BNE     8$                  ;BR IF FIRST BANK.
3356  015776  036767  163544  163566        BIT     BITPT+2,FADMAP+2    ;CHECK IF FIRST BANK FLAG.
3357  016004  001402                        BEQ     9$                  ;BR IF NO FLAG FOUND.
3358  016006  016705  163554          8$:   MOV     FADMSK, R5          ;SET UP R5 TO FIND FIRST ADDRESS.
3359  016012  016716  163536          9$:   MOV     MMORE,  (SP)        ;RESET RETURN ADDRESS
3360  016016  000207                10$:   RTS     PC                  ;RETURN
```

```
                                .SBTTL  SUBROUTINES FOR ADDRESS AND WORSE CASE NOISE TESTS.
                                ;;*****************************************************************
                                ;*  SUBROUTINE TO CALCULATE PHYSICAL ADDRESS AND PUT IT IN R0 (BOTTOM 16 BITS).
                                ;*  BITS 16 AND 17 ARE IN $TMP0.
                                ;;*****************************************************************
016020  010200                  PHYADR: MOV     R2,     R0      ;VITRUAL INTO R0
016022  005067  163132                  CLR     $TMP0           ;CLEAR TEMP SAVE OF HIGH BITS
016026  005767  162554                  TST     MMAVA           ;CHECK FOR MEM MGMT AVAILABLE
016032  001417                          BEQ     1$              ;BRANCH IF NO MEM MGMT
016034  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
016036  013701  172344                  MOV     @#KIPAR2, R1    ;GET PAR TO BE ADDED TO VIRTUAL
016042  006301                          ASL     R1              ;SHIFT IT 6 TIMES
016044  006301                          ASL     R1
016046  006301                          ASL     R1
016050  006301                          ASL     R1
016052  006301                          ASL     R1
016054  006167  163100                  ROL     $TMP0           ;SAVE EXTRA BITS
016060  006301                          ASL     R1
016062  006167  163072                  ROL     $TMP0
016066  060100                          ADD     R1,     R0      ;ADD SHIFTED PAR TO VIRTUAL
016070  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
016072  000207                  1$:     RTS     PC              ;RETURN

                                ;;*****************************************************************
                                ;*  SUBROUTINE TO PUT BANK NUMBER INTO R0.
                                ;;*****************************************************************
016074  005000                  BANKNO: CLR     R0              ;INIT R0
016076  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
016100  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
016102  016701  163436                  MOV     BITPT,  R1      ;GET BANK MAP POINTER...LO 64K.
016106  016702  163434                  MOV     BITPT+2,R2      ;...HI 64K.
016112  006202                  1$:     ASR     R2              ;SHIFT POINTER...HI
016114  006001                          ROR     R1              ;...LO
016116  103403                          BCS     2$              ;BR WHEN POINTER FOUND.
016120  105200                          INCB    R0              ;COUNT BANKS.
016122  100373                          BPL     1$              ;BR IF NOT OVERFLOW.
016124  000000                          HALT            ;FATAL ERROR!!!  NO POINTER FOUND.
016126                          2$:
016126  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
016130  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
016132  000207                          RTS     PC              ;RETURN

                                ;;*****************************************************************
                                ;*  SUBROUTINE TO WRITE THE CONSTANT IN R0 INTO ALL OF MEMORY.
                                ;;*****************************************************************
016134                          SETCON:
016134  004467  176232                  JSR     R4,     INITMM  ;INITIALIZE THE MEMORY ADDRESS POINTERS.
016140  010022                  2$:     MOV     R0,     (R2)+   ;MOV CONSTANT INTO MEMORY
016142  030502                          BIT     R5,     R2      ;CHECK FOR END OF A BLOCK.
016144  001375                          BNE     2$              ;BRANCH IF MORE IN CURRENT BLOCK.
016146  004767  176776                  JSR     PC,     MMUP    ;FIND NEXT BLOCK AND LOOP TO 1$.
016152  000207                          RTS     PC              ;RETURN
```

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3413
3414                    ;;*****************************************************************
3415                    ;* ROUTINE TO ROTATE 'C' BIT THROUGH A MEMORY LOCATION.
3416                    ;*****************************************************************
3416  016154  106112    ROTATE: ROLB    (R2)            ;(R2)=177776 OR 000001
3417  016156  106112            ROLB    (R2)            ;(R2)=177775 OR 000002
3418  016160  106112            ROLB    (R2)            ;(R2)=177773 OR 000004
3419  016162  106112            ROLB    (R2)            ;(R2)=177767 OR 000010
3420  016164  106112            ROLB    (R2)            ;(R2)=177757 OR 000020
3421  016166  106112            ROLB    (R2)            ;(R2)=177737 OR 000040
3422  016170  106112            ROLB    (R2)            ;(R2)=177677 OR 000100
3423  016172  106112            ROLB    (R2)            ;(R2)=177777 OR 000000
3424  016174  106122            ROLB    (R2)+           ;(R2)=177577 OR 000200
3425  016176  106112            ROLB    (R2)            ;(R2)=177377 OR 000400
3426  016200  106112            ROLB    (R2)            ;(R2)=176777 OR 001000
3427  016202  106112            ROLB    (R2)            ;(R2)=175777 OR 002000
3428  016204  106112            ROLB    (R2)            ;(R2)=173777 OR 004000
3429  016206  106112            ROLB    (R2)            ;(R2)=167777 OR 010000
3430  016210  106112            ROLB    (R2)            ;(R2)=157777 OR 020000
3431  016212  106112            ROLB    (R2)            ;(R2)=137777 OR 040000
3432  016214  106112            ROLB    (R2)            ;(R2)=077777 OR 100000
3433  016216  106122            ROLB    (R2)+           ;(R2)=177777 OR 000000
3434  016220  000207            RTS     PC              ;RETURN
3435
3436                    ;;*****************************************************************
3437                    ;*  SUBROUTINE TO WRITE 3 XOR 9 PATTERN INTO 256. WORD BLOCK.
3438                    ;*****************************************************************
3439  016222  012704  000020    W3X9:   MOV     #16.,R4         ;EACH LOOP WRITES 256. WORDS
3440
3441  016226  010022    2$:     MOV     R0,(R2)+
3442  016230  010022            MOV     R0,(R2)+
3443  016232  010022            MOV     R0,(R2)+
3444  016234  010022            MOV     R0,(R2)+
3445
3446  016236  010322            MOV     R3,(R2)+
3447  016240  010322            MOV     R3,(R2)+
3448  016242  010322            MOV     R3,(R2)+
3449  016244  010322            MOV     R3,(R2)+
3450
3451  016246  010022            MOV     R0,(R2)+
3452  016250  010022            MOV     R0,(R2)+
3453  016252  010022            MOV     R0,(R2)+
3454  016254  010022            MOV     R0,(R2)+
3455
3456  016256  010322            MOV     R3,(R2)+
3457  016260  010322            MOV     R3,(R2)+
3458  016262  010322            MOV     R3,(R2)+
3459  016264  010322            MOV     R3,(R2)+
3460
3461  016266  005304            DEC     R4
3462  016270  001356            BNE     2$
3463  016272  010046            MOV     R0,     -(SP)   ;SAVE R0
3464  016274  010300            MOV     R3,     R0      ;PUT R3 INTO R0
3465  016276  012603            MOV     (SP)+,  R3      ;PUT SAVED R0 INTO R3
3466  016300  000207            RTS     PC              ;RETURN
```

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                                        .SBTTL  RELOCATION SUBROUTINES.
                                        ;;*****************************************************************
                                        ;* ROUTINE TO RELOCATE PROGRAM CODE
                                        ;;*****************************************************************
016302                                  RELOC:
016302  010246                                MOV     R2,-(SP)        ;;PUSH R2 ON STACK
016304  010346                                MOV     R3,-(SP)        ;;PUSH R3 ON STACK
016306  010446                                MOV     R4,-(SP)        ;;PUSH R4 ON STACK
016310  012502                          4$:   MOV     (R5)+,  R2      ;GET FIRST LOCATION.
016312  012503                                MOV     (R5)+,  R3      ;GET FIRST LOCATION OF DESTINATION.
016314  012704  020000                       MOV     #20000, R4      ;SET UP 8K COUNTER.
016320  012223                          1$:   MOV     (R2)+,  (R3)+   ;MOV THE DATA.
016322  005304                                DEC     R4              ;COUNT THE WORDS.
016324  001375                                BNE     1$              ;BR IF MORE.
016326  012704  020000                       MOV     #20000, R4      ;RESET THE COUNTER.
016332  024243                          2$:   CMP     -(R2),  -(R3)   ;CHECK THE DATA JUST MOVED.
016334  001417                                BEQ     3$              ;BR IF DATA OK.
016336  011267  162562                       MOV     (R2),   $GDDAT  ;GET SOURCE DATA.
016342  011367  162560                       MOV     (R3),   $BDDAT  ;GET DESTINATION DATA.
016346  010267  162546                       MOV     R2,     $GDADR  ;GET SOURCE ADDRESS.
016352  010367  162544                       MOV     R3,     $BDADR  ;GET DESTINATION ADDRESS.
016356  004767  003222                       JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
016362  000023                               .WORD   23              ;ERROR TYPE CODE.
016364  000000                               HALT                    ;FATAL ERROR!!!  RELOCATION FAILED.
016366  162705  000004                       SUB     #4,     R5      ;ADJUST RETURN POINTER.
016372  000746                               BR      4$              ;GO BACK AND TRY AGAIN.
016374  005304                          3$:  DEC     R4              ;COUNT WORDS.
016376  001355                               BNE     2$              ;BR IF MORE.
016400  004567  005052                       JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
016404  026506                               .WORD   PRELOC          ;ADDRESS OF MESSAGE TO BE TYPED
                                                                     ;"PROGRAM RELOCATED TO "
016406  010346                               MOV     R3,     -(SP)   ;PUT THE DATA ON THE STACK.
016410  004767  006502                       JSR     PC,     $TYPAD  ;DETERMINE THE PHYSICAL ADDRESS AND TYPE IT.
016414  012604                               MOV     (SP)+,R4        ;;POP STACK INTO R4
016416  012603                               MOV     (SP)+,R3        ;;POP STACK INTO R3
016420  012602                               MOV     (SP)+,R2        ;;POP STACK INTO R2
016422  000205                               RTS     R5              ;RETURN
                                        ;;*****************************************************************
                                        ;*  SUBROUTINE TO MOVE PROGRAM FROM BOTTOM TO TOP OF MEMORY.
                                        ;;*****************************************************************
016424  022767  000003  162150      RELTOP: CMP     #3,     PRGMAP  ;CHECK THAT THE PROGRAM IS NOW IN BANKS 0 AND 1.
016432  001401                               BEQ     1$              ;BR IF OK
016434  000000                               HALT                    ;FATAL ERROR!!!  PROG SHOULD BE IN BANKS 0 AND 1
016436                                  1$:
016436  010046                               MOV     R0,-(SP)        ;;PUSH R0 ON STACK
016440  010146                               MOV     R1,-(SP)        ;;PUSH R1 ON STACK
016442  005767  162140                       TST     MMAVA
016446  001465                               BEQ     10$
016450  012737  007600  172346               MOV     #7600,  @#KIPAR3 ;SET PAR TO TOP OF MEM
016456  005000                               CLR     R0              ;INIT BANK POINTER...LO 64K
016460  012701  100000                       MOV     #BIT15, R1      ;...HI 64K.
016464  162737  000200  172346          2$:  SUB     #200,   @#KIPAR3        ;BACK DOWN ONE BANK.
016472  006001                               ROR     R1              ;MOVE POINTER...HI 64K.
016474  006000                               ROR     R0              ;..LO 64K.
016476  103500                               BCS     90$
016500  030167  163022                       BIT     R1,     MEMMAP+2 ;CHECK FOR BANK EXISTS.
```

```
3523  016504  001003                        BNE     3$              ;BR IF AVAILABLE
3524  016506  030067  163012                BIT     R0,     MEMMAP  ;CHECK FOR BANK EXISTS.
3525  016512  001764                        BEQ     2$              ;BR IF NO BANK FOUND.
3526  016514  013737  172346  172344  3$:   MOV     @#KIPAR3,@#KIPAR2 ;COPY PAR
3527  016522  010046                        MOV     R0,-(SP)        ;;PUSH R0 ON STACK
3528  016524  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
3529  016526  162737  000200  172344  4$:   SUB     #200,   @#KIPAR2 ;BACK DOWN WITH LOW PAR.
3530  016534  006001                        ROR     R1              ;SHIFT POINTER.
3531  016536  006000                        ROR     R0              ;...LO 64K.
3532  016540  103457                        BCS     90$             ;BR IF OVERFLOW.
3533  016542  030167  162760          5$:   BIT     R1,     MEMMAP+2 ;      CHECK IF BANK EXISTS...HI 64K.
3534  016546  001003                        BNE     6$              ;BR IF BANK EXISTS.
3535  016550  030067  162750                BIT     R0,     MEMMAP  ;CHECK IF BANK EXISTS...LO 64K.
3536  016554  001764                        BEQ     4$              ;BR IF BANK DOESN'T EXIST.
3537  016556  052601                  6$:   BIS     (SP)+,  R1      ;GE  SECOND BANK POINTER.
3538  016560  052600                        BIS     (SP)+,  R0      ;....  64K.
3539  016562  030067  162014                BIT     R0,     PRGMAP  ;CHECK FOR CONFLICT.
3540  016566  001044                        BNE     90$             ;ABORT IF DESTINATION OVERLAYS SOURCE.
3541  016570  004567  177506                JSR     R5,     RELOC   ;GO RELOCATE PROGRAM.
3542  016574  000000                        .WORD   0               ;SOURCE FIRST ADDRESS.
3543  016576  040000                        .WORD   40000           ;DESTINATION FIRST ADDRESS.
3544  016600  013737  172344  172340        MOV     @#KIPAR2,@#KIPAR0 ;RELOCATE LO BANK
3545  016606  013737  172346  172342        MOV     @#KIPAR3,@#KIPAR1 ;RELOCATE HI BANK.
3546                        ;*  PROGRAM SHOULD NOW BE EXICUTING OUT OF LAST TWO BANKS OF MEMORY.
3547  016614  010167  161764                MOV     R1,     PRGMAP+2 ;RESET PROGRAM MAP.
3548  016620  000473                        BR      30$             ;BR TO COMMON EXIT.
3549
3550  016622  012700  000400          10$:  MOV     #BIT8,  R0      ;SET BANK POINTER TO TOP OF MEM.
3551  016626  005001                        CLR     R1              ;SET ADDRESS POINTER TO TOP.
3552  016630  162701  020000          11$:  SUB     #20000, R1      ;BACK DOWN ONE BANK.
3553  016634  006200                        ASR     R0              ;MOVE POINTER DOWN ONE BANK.
3554  016636  103420                        BCS     90$             ;BR IF OVERFLOW.
3555  016640  030067  162660                BIT     R0,     MEMMAP  ;CHECK IF THIS BANK EXISTS.
3556  016644  001771                        BEQ     11$             ;BR IF NON-EXISTANT BANK.
3557  016646  162701  020000                SUB     #20000, R1      ;BACK DOWN TO NEXT BANK.
3558  016652  006200                        ASR     R0              ;MOV POINTER DOWN ONE BANK.
3559  016654  103411                        BCS     90$             ;BR IF OVERFLOW.
3560  016656  030067  162642                BIT     R0,     MEMMAP  ;CHECK IF THIS BANK EXISTS.
3561  016662  001762                        BEQ     11$             ;BR TO START OVER IF NO LOWER BANK.
3562  016664  010046                        MOV     R0,     -(SP)   ;SAVE THE POINTER.
3563  016666  006300                        ASL     R0              ;RESET POINTER TO HI BANK.
3564  016670  052600                        BIS     (SP)+,  R0      ;SET BIT FOR LO BANK.
3565  016672  030067  161704                BIT     R0,     PRGMAP  ;CHECK FOR A PROGRAM CONFLICT.
3566  016676  001401                        BEQ     12$             ;BR IF NO CONFLICT.
3567  016700                          90$:
3568  016700  000000                        HALT                    ;FATAL ERROR!!!  NOT ENOUGH MEMORY??
3569  016702  010167  000006          12$:  MOV     R1,     13$     ;SET DATA FOR RELOCATION SUBROUTINE.
3570  016706  004567  177370                JSR     R5,     RELOC   ;GO RELOCATE THE PROGRAM TO TOP OF MEM.
3571  016712  000000                        .WORD   0               ;SOURCE STARTING ADDRESS.
3572  016714  000000                  13$:  .WORD   0               ;DESTINATION STARTING ADDRESS.
3573  016716  010167  161656                MOV     R1,     RELOCF  ;SET RELOCATION FACTOR IN UNRELOCATED CODE.
3574  016722  060107                        ADD     R1,     PC      ;JUMP TO RELOCATED PROGRAM
3575                              ;*  PROGRAM NOW EXICUTING OUT OF TOP OF MEMORY.
3576  016724  060106                        ADD     R1,     SP      ;ADJUST THE STACK POINTER TO TOP OF MEMORY.
3577  016726  010167  161646                MOV     R1,     RELOCF  ;SET THE RELOCATION FACTOR.
3578  016732  060137  000004                ADD     R1,     @#ERRVEC ;ADJUST ERROR VECTOR.
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3579  016736  060137  000024                ADD     R1,     @#PWRVEC ;ADJUST POWER FAIL VECTOR.
3580  016742  060137  000114                ADD     R1,     @#PARVEC ;ADJUST PARITY ERROR VECTOR.
3581  016746  026727  162166  177570        CMP     SWR,    #177570  ;CHECK FOR HARDWARE SWITCH REGISTER.
3582  016754  001404                        BEQ     14$              ;BR IF HARDWARE SWITCH REGISTER.
3583  016756  060167  162156                ADD     R1,     SWR      ;ADJUST SOFTWARE SWITCH REGISTER.
3584  016762  060167  162154                ADD     R1,     DISPLAY  ;ADJUST SOFTWARE DISPLAY REGISTER.
3585  016766  062701  001622        14$:    ADD     #RADTAB,R1       ;POINT TO THE RELATIVE RELOCATION TABLE.
3586  016772  066721  161602        15$:    ADD     RELOCF, (R1)+    ;ADD RELOCATION FACTOR TO ADDRESSES IN TABLE.
3587  016776  005721                16$:    TST     (R1)+            ;CHECK FOR INTERUM TERMINATOR.
3588  017000  001776                        BEQ     16$              ;BR SO AS TO NOT MODIFY ZERO.
3589  017002  024127  177777                CMP     -(R1),  #-1      ;CHECK FOR END OF TABLE.
3590  017006  001371                        BNE     15$              ;BR IF MORE IN TABLE.
3591  017010  010067  161566        30$:    MOV     R0,     PRGMAP   ;SET NEW PROGRAM MAP...LO 64K.
3592  017014  012601                        MOV     (SP)+,R1         ;;POP STACK INTO R1
3593  017016  012600                        MOV     (SP)+,R0         ;;POP STACK INTO R0
3594  017020  066716  161554                ADD     RELOCF, (SP)     ;ADJUST RETURN ADDRESS.
3595  017024  000207                        RTS     PC               ;RETURN
3596
3597                                ;;*****************************************************************
3598                                ;*  SUBROUTINE TO RELOCATE PROGRAM BACK TO BANKS 0 AND 1.
3599                                ;;*****************************************************************
3600  017026  032767  000003  161546 RELO:    BIT     #3,     PRGMAP   ;CHECK FOR PROGRAM ALREADY IN BANKS 0 OR 1.
3601  017034  001401                        BEQ     1$               ;BR IF NO CONFLICT.
3602  017036  000000                        HALT                     ;FATAL ERROR!!!  PROGRAM ALREADY IN BANKS 0 OR 1!!!!
3603  017040  005767  161542        1$:     TST     MMAVA            ;CHECK FOR MEM MGMT.
3604  017044  001417                        BEQ     10$              ;BR IF NO MEMMGMT.
3605  017046  005037  172344                CLR     @#KIPAR2         ;SET PAR 2 TO BANK 0.
3606  017052  012737  000200  172346        MOV     #200,   @#KIPAR3 ;SET PAR 3 TO BANK 1.
3607  017060  004567  177216                JSR     R5,     RELOC    ;GO MOVE 8K INTO BANKS 0 AND 1.
3608  017064  000000                        .WORD   0                ;SOURCE STARTING ADDRESS.
3609  017066  040000                        .WORD   40000            ;DESTINATION STARTING ADDRESS.
3610  017070  005037  172340                CLR     @#KIPAR0         ;RESTORE PAR 0 TO BANK0.
3611  017074  012737  000200  172342        MOV     #200,   @#KIPAR1 ;RESTORE PAR 1 TO BANK 1.
3612                                ;*  PROGRAM IS NOW EXICUTING OUT OF BANKS 0 AND 1.
3613  017102  000444                        BR      30$              ;BR TO COMMON EXIT.
3614
3615  017104  016746  161470        10$:    MOV     RELOCF, -(SP)    ;PUT RELOCATION FACTOR ONTO THE STACK.
3616  017110  011667  000004                MOV     (SP),   20$      ;SET DATA FOR RELOC SUBROUTINE.
3617  017114  004567  177162                JSR     R5,     RELOC    ;GO MOVE THE PROGRAM BACK TO BANKS 0 AND 1.
3618  017120  000000        20$:    .WORD   0                ;SOURCE STARTING ADDRESS.
3619  017122  000000                .WORD   0                ;DESTINATION STARTING ADDRESS.
3620  017124  161607                SUB     (SP),   PC       ;JUMP TO RELOCATED PROGRAM.
3621                                ;*  THE PROGRAM IS NOW EXICUTING OUT OF BANKS 0 AND 1.
3622  017126  161606                SUB     (SP),   SP       ;RESET THE STACK POINTER.
3623  017130  010046                MOV     R0,-(SP)         ;;PUSH R0 ON STACK
3624  017132  012700  001622                MOV     #RADTAB,R0       ;SET UP POINTER TO RELATIVE ADDRESS TABLE.
3625  017136  166620  000002        21$:    SUB     2(SP),  (R0)+    ;RESET ADDRESSES TO UNRELOCATED VALUES.
3626  017142  005720                22$:    TST     (R0)+            ;CHECK FOR TERMINATORS.
3627  017144  001776                        BEQ     22$              ;BR OVER TERMINATORS.
3628  017146  024027  177777                CMP     -(R0),  #-1      ;CHECK FOR END OF TABLE INDICATOR.
3629  017152  001371                        BNE     21$              ;BR IF MORE ADDRESSES IN TABLE.
3630  017154  012600                        MOV     (SP)+,R0         ;;POP STACK INTO R0
3631  017156  161637  000004                SUB     (SP),   @#ERRVEC ;ADJUST ERROR VECTOR.
3632  017162  161637  000024                SUB     (SP),   @#PWRVEC ;ADJUST POWER FAIL VECTOR.
3633  017166  161637  000114                SUB     (SP),   @#PARVEC ;ADJUST PARITY ERROR VECTOR.
3634  017172  026727  161742  177570        CMP     SWR,    #177570  ;CHECK FOR HARDWARE SWITCH REGISTER.
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3635  017200  001404                        BEQ     23$             ;BR IF HARDWARE SWITCH REGISTER.
3636  017202  161667  161732                SUB     (SP), SWR       ;ADJUST SOFTWARE SWITCH REGISTER.
3637  017206  161667  161730                SUB     (SP), DISPLAY   ;ADJUST SOFTWARE DISPLAY REGISTER.
3638  017212  162616              23$:      SUB     (SP)+, -(SP)    ;ADJUST RETURN ADDRESS.
3639  017214  005067  161360      30$:      CLR     RELOCF          ;RESET RELOCATION FACTOR.
3640  017220  012767  000003  161354        MOV     #3, PRGMAP      ;SET PROGRAM MAP TO POINT TO BANKS 0 AND 1.
3641  017226  005067  161352                CLR     PRGMAP+2        ;...HI 64K.
3642  017232  000207                        RTS     PC              ;RETURN.
3643
3644                                        ;;*****************************************************************
3645                                        ;* THIS SUBROUTINE MOVES THE LOADER AREA BACK TO THE "TOP" OF MEMORY FROM
3646                                        ;*  WHENCE IT CAME.  THE LOADER AREA IS SAVED AT THE END OF THE 8K OF
3647                                        ;*  PROGRAM CODE WHEN THE PROGRAM IS INITIALLY RUN.
3648                                        ;;*****************************************************************
3649  017234  016700  162260      RESLDR:   MOV     LMAD, R0        ;CHECK IF THE LOADERS WERE SAVED.
3650  017240  001001                        BNE     1$              ;BR IF LOADER AREA WAS SAVED.
3651  017242  000000                        HALT                    ;FATAL ERROR!!!  CAN'T RESTORE LOADER AREA IF IT WASN'T SAVED.
3652  017244  005767  161336      1$:       TST     MMAVA           ;CHECK FOR MEM MGMT.
3653  017250  001402                        BEQ     2$              ;SKIP IF NO MEM MGMT.
3654  017252  005037  177572                CLR     @#SR0           ;DISABLE MEM MGMT.
3655  017256  012701  040000      2$:       MOV     #40000., R1     ;GET END OF 8K, ASSUME PROG NOT RELOCATED.
3656  017262  012702  002734                MOV     #1500., R2      ;GET COUNTER.
3657  017266  014140              3$:       MOV     -(R1), -(R0)    ;MOVE THE LOADER AREA.
3658  017270  005302                        DEC     R2              ;COUNT HOW LONG THE AREA IS.
3659  017272  001375                        BNE     3$              ;BR IF NOT MORE TO MOVE.
3660  017274  005067  162220                CLR     LMAD            ;CLEAR MONITOR SAVED FLAG
3661  017300  005767  161302                TST     MMAVA           ;CHECK FOR MEM MGMT.
3662  017304  001402                        BEQ     4$              ;BR IF NO MEM MGMT.
3663  017306  005237  177572                INC     @#SR0           ;ENABLE MEM MGMT.
3664  017312  000207              4$:       RTS     PC              ;RETURN.
3665
3666                                        ;*  ROUTINE TO SAVE THE LOADERS AT THE END OF 8K.
3667  017314  005767  162000      SAVLDR:   TST     LMAD            ;CHECK IF LOADERS HAVE BEEN SAVED ALREADY.
3668  017320  001024                        BNE     4$              ;BRANCH IF ALREADY SAVED
3669  017322  012700  040000                MOV     #40000, R0      ;GET END OF 8K
3670  017326  010001                        MOV     R0, R1          ;GET END OF 8K
3671  017330  012737  017342  000004        MOV     #2$, @#ERRVEC   ;SET UP TIMEOUT VECTOR
3672  017336  011020              1$:       MOV     (R0), (R0)+     ;SEARCH FOR END OF MEMORY
3673  017340  000776                        BR      1$              ;KEEP SEARCHING
3674  017342  022626              2$:       CMP     (SP)+, (SP)+    ;RESTORE STACK POINTER
3675  017344  012737  025060  000004        MOV     #ERRTRP,@#ERRVEC ;RESET TIMEOUT VECTOR.
3676  017352  010046                        MOV     R0, -(SP)       ;SAVE LAST MEMORY ADDRESS (CONTIGUOUS)
3677  017354  012702  002734                MOV     #1500., R2      ;SET UP WORD COUNTER
3678  017360  014041              3$:       MOV     -(R0), -(R1)    ;SAVE THE LOADERS
3679  017362  005302                        DEC     R2              ;COUNT THE WORDS
3680  017364  001375                        BNE     3$              ;BRANCH IF MORE WORDS
3681  017366  012667  162126                MOV     (SP)+, LMAD     ;SAVE LAST MEMORY ADDRESS
3682  017372  000207              4$:       RTS     PC              ;RETURN
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                                .SBTTL  PARITY MEMORY TRAP SERVICE AND SUBROUTINES.
                                ;;*********************************************************************
                                ;* PARITY MEMORY UNEXPECTED ERROR TRAP SERVICE ROUTINE.
                                ;*  FIND OUT WHICH REGISTER DETECTED THE ERROR,
                                ;*  THEN SCAN MEMORY TO SEE IF PARITY ERROR STILL SET AND REPORT LOCATION.
                                ;;*********************************************************************
017374  011667  161522        PESRV:  MOV     (SP),   $BDADR  ;GET PC OF INSTRUCTION WHICH CAUSED ERROR.
017400  004567  004052                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
017404  026445                        .WORD   UNEXPT          ;ADDRESS OF MESSAGE TO BE TYPED
                                                            ;"UNEXPECTED MEMORY PARITY TRAP."
017406  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
017410  010346                        MOV     R3,-(SP)        ;;PUSH R3 ON STACK
017412  016703  162212                MOV     .MPRX,  R3      ;GET POINTER TO PARITY REGISTERS.
017416  005733                1$:     TST     @(R3)+          ;CHECK THE PARITY REG FOR AN ERROR FLAG.
017420  100415                        BMI     3$              ;BR IF THIS REGISTER SHOWS THE ERROR.
017422  005713                        TST     (R3)            ;CHECK FOR TABLE TERMINATOR.
017424  001374                        BNE     1$              ;BR IF MORE REGISTERS.
017426  004767  002152                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
                                ;***ERROR***    NO REGISTER INDICATED ERROR
017432  000024                        .WORD   24              ;ERROR TYPE CODE.
017434  000417                        BR      4$              ;EXIT
017436  005713                2$:     TST     (R3)            ;CHECK FOR TABLE TERMINATOR.
017440  001415                        BEQ     4$              ;BR IF NO MORE PARITY REGISTERS.
017442  005733                        TST     @(R3)+          ;CHECK THE PARITY REG FOR AN ERROR FLAG.
017444  100374                        BPL     2$              ;BR IF NO ERROR FLAG.
017446  004567  004004                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
017452  026536                        .WORD   MTOE            ;ADDRESS OF MESSAGE TO BE TYPED
                                                            ;"MORE THAN ONE ERROR FOUND."
017454                          3$:
017454  004767  000610        64$:    JSR     PC,     SPRNTQ  ;SET UP VALUES FOR ERROR PRINTING.
017460  004767  002120                JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
017464  000025                        .WORD   25              ;ERROR TYPE CODE.
017466  004767  000216                JSR     PC,     PSCAN   ;GO SCAN MEMORY FOR BAD PARITY.
017472  000761                        BR      2$              ;GO LOOK FOR MORE ERRORS.
017474                          4$:
017474  012603                        MOV     (SP)+,R3        ;;POP STACK INTO R3
017476  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
017500  000002                        RTI                     ;RETURN.

                                ;;*********************************************************************
                                ;ROUTINE TO ENABLE PARITY ERROR ACTION ON MA/MF PARITY MEMORIES
                                ;THIS ROUTINE IS MEANT TO CATCH UNEXPECTEDS
                                ;;*********************************************************************
017502  005767  162570        MAMF:   TST     MPRX            ;CHECK IF ANY PARITY REGISTERS EXIST.
017506  001434                        BEQ     MAMF2           ;EXIT IF NO PARITY REGISTERS.
017510  032777  000100  161422        BIT     #SW6,   @SWR    ;CHECK FOR INHIBIT PARITY ERROR DETECTION.
017516  001030                        BNE     MAMF2           ;EXIT IF NO PARITY ERROR DETECTION.
017520  005767  161054                TST     RELOCF          ;CHECK IF PROGRAM RELOCATED OUT OF BANK 0.
017524  001410                        BEQ     SETAE           ;BR IF PROG IN BANK 0.
017526  032777  000040  161404        BIT     #SW5,   @SWR    ;CHECK IF VECTORS PROTECTED.
017534  001004                        BNE     SETAE           ;BR IF VECTOR AREA PROTECTED.
017536  026727  162020  001000        CMP     FSTADR, #1000   ;CHECK FOR STARTING ADDRESS ABOVE THE VECTORS.
017544  103415                        BLO     MAMF2           ;EXIT IF VECTORS EXPOSED TO TESTING.
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3736  017546  016737  162064  000114  SETAE:  MOV     .PESRV, @#PARVEC ;SET PARITY ERROR TRAP VECTOR
3737  017554  005037  000116          CLR     @#PARVEC+2       ;PRIORITY LEVEL 0 ON TRAP
3738  017560  010346                  MOV     R3,-(SP)         ;;PUSH R3 ON STACK
3739  017562  016703  162042          MOV     .MPRX,  R3       ;GET PARITY REGISTER TABLE POINTER.
3740  017566  052733  000001          MAMF1:  BIS     #AE,    @(R3)+   ;SET ACTION ENABLE BIT IN PARITY REG
3741  017572  005713                  TST     (R3)             ;CHECK FOR END OF TABLE.
3742  017574  001374                  BNE     MAMF1            ;BR IF MORE PARITY REGISTERS.
3743  017576  012603                  MOV     (SP)+,R3         ;;POP STACK INTO R3
3744  017600  000207          MAMF2:  RTS     PC               ;RETURN.
3745
3746                                  ;;*****************************************************************
3747                                  ;*  SUBROUTINE TO CHECK PARITY REGISTERS FOR ERRORS THAT DIDN'T TRAP.
3748                                  ;;*****************************************************************
3749  017602  005767  162470  CKPMER: TST     MPRX             ;CHECK IF ANY PARITY REGISTERS EXIST.
3750  017606  001437                  BEQ     4$               ;BR IF NO PARITY REGISTERS.
3751  017610  032777  000100  161322          BIT     #SW6,   @SWR     ;CHECK FOR INHIBIT PARITY ERROR CHECKING.
3752  017616  001033                  BNE     4$               ;BR IF PARITY ERROR CHECKING INHIBITED.
3753  017620  010346                  MOV     R3,-(SP)         ;;PUSH R3 ON STACK
3754  017622  016703  162002          MOV     .MPRX,  R3       ;GET PARITY REG TABLE POINTER.
3755  017626  005733          1$:     TST     @(R3)+           ;CHECK THE PARITY REG FOR AN ERROR FLAG.
3756  017630  100023                  BPL     3$               ;BR IF NO ERROR
3757  017632  032773  000001  177776          BIT     #BIT0,  @-2(R3)  ;CHECK IF A TRAP SHOULD HAVE OCCURRED.
3758  017640  001010                  BNE     2$               ;BR IF NO ACTION ENABLE.
3759  017642  004767  000422          64$:    JSR     PC,     SPRNTQ   ;SET UP VALUES FOR ERROR PRINTING.
3760  017646  004767  001732                  JSR     PC,     $ERROR   ;*** ERROR *** (GO TYPE A MESSAGE)
3761  017652  000026                  .WORD   26               ;ERROR TYPE CODE.
3762  017654  000411                  BR      3$
3763  017656  004767  000026                  JSR     PC,     PSCAN    ;GO SCAN ALL MEMORY FOR PARITY ERRORS.
3764  017662                          2$:
3765  017662  004767  000402          65$:    JSR     PC,     SPRNTQ   ;SET UP VALUES FOR ERROR PRINTING.
3766  017666  004767  001712                  JSR     PC,     $ERROR   ;*** ERROR *** (GO TYPE A MESSAGE)
3767  017672  000027                  .WORD   27               ;ERROR TYPE CODE.
3768  017674  004767  000010                  JSR     PC,     PSCAN    ;GO SCAN ALL MEMORY FOR PARITY ERRORS.
3769  017700  005713          3$:     TST     (R3)             ;CHECK FOR TABLE TERMINATOR.
3770  017702  001351                  BNE     1$               ;BR IF MORE.
3771  017704  012603                  MOV     (SP)+,R3         ;;POP STACK INTO R3
3772  017706  000207          4$:     RTS     PC               ;RETURN.
3773
3774                                  ;;*****************************************************************
3775                                  ;*  THIS SUBROUTINE WILL SCAN ALL OF MEMORY LOOKING FOR BAD PARITY,
3776                                  ;*  TYPE OUT ALL LOCATIONS FOUND TO BE BAD, AND WRITE BACK INTO THE
3777                                  ;*  LOCATIONS IN ORDER TO RESTORE GOOD PARITY.
3778                                  ;;*****************************************************************
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3779  017710                                PSCAN:
3780  017710  010046                              MOV     R0,-(SP)        ;;PUSH R0 ON STACK
3781  017712  010146                              MOV     R1,-(SP)        ;;PUSH R1 ON STACK
3782  017714  010246                              MOV     R2,-(SP)        ;;PUSH R2 ON STACK
3783  017716  010346                              MOV     R3,-(SP)        ;;PUSH R3 ON STACK
3784  017720  010446                              MOV     R4,-(SP)        ;;PUSH R4 ON STACK
3785  017722  013746  000114                      MOV     @#114,-(SP)     ;;PUSH @#114 ON STACK
3786  017726  013746  000116                      MOV     @#116,-(SP)     ;;PUSH @#116 ON STACK
3787  017732  004567  003520                      JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3788  017736  026602                              .WORD   SCANM           ;ADDRESS OF MESSAGE TO BE TYPED
3789                                                                      ;"SCANNING MEMORY FOR BAD PARITY."
3790  017740  012700  000001                      MOV     #BIT0,  R0      ;SET BIT POINTER TO FIRST BANK.
3791  017744  005001                              CLR     R1              ;CLR HI 64K POINTER.
3792  017746  005002                              CLR     R2              ;INIT ADDRESS POINTER.
3793  017750  005004                              CLR     R4              ;INIT ERROR DETECTED FLAG.
3794  017752  004767  000256                      JSR     PC,     CLRPAR  ;CLEAR THE PARITY REGISTERS.
3795  017756  012737  000116  000114              MOV     #116,   @#114   ;HALT IF ANOTHER PARITY TRAP.
3796  017764  005037  000116                      CLR     @#116
3797  017770  005767  160612                      TST     MMAVA           ;CHECK FOR MEMORY MANAGEMENT.
3798  017774  001406                              BEQ     1$              ;BR IF NO MEM MGMT.
3799  017776  013746  172344                      MOV     @#KIPAR2,-(SP)          ;;PUSH @#KIPAR2 ON STACK
3800  020002  005037  172344                      CLR     @#KIPAR2        ;INIT MEM MGMT TO POINT TO BANK 0.
3801  020006  012702  040000                      MOV     #40000, R2      ;SET ADR POINTER TO PAR2.
3802  020012  030067  161506          1$:         BIT     R0,     MEMMAP  ;CHECK IF THIS BANK OF MEM EXISTS.
3803  020016  001003                              BNE     2$              ;BR IF THIS BANK EXISTS.
3804  020020  030167  161502                      BIT     R1,     MEMMAP+2 ;CHECK HI 64K MAP.
3805  020024  001442                              BEQ     10$             ;BR IF THIS BANK DOESN'T EXIST.
3806  020026                            2$:
3807  020026  010146                              MOV     R1,-(SP)        ;;PUSH R1 ON STACK
3808  020030  111201                    3$:       MOVB    (R2),   R1      ;READ THE LOCATION TO SEE IF IT HAS A PARITY ERROR.
3809  020032  016703  161572                      MOV     .MPRX,  R3      ;SET UP POINTER TO PARITY REGISTERS.
3810  020036  005733                    4$:       TST     @(R3)+          ;CHECK FOR THE ERROR FLAG.
3811  020040  100024                              BPL     6$              ;BR IF NO ERROR FLAG.
3812  020042  005704                              TST     R4              ;CHECK IF FIRST ERROR, THIS SCAN.
3813  020044  001003                              BNE     5$              ;BR IF MORE THAN ONE ERROR FOUND.
3814  020046  005367  161040                      DEC     $ERTTL          ;ADJUST ERROR COUNT.
3815  020052  005204                              INC     R4              ;SET FLAG TO INDICATE ERROR FOUND.
3816  020054                            5$:
3817  020054  004767  000210          64$:      JSR     PC,     SPRNTQ  ;SET UP VALUES FOR ERROR PRINTING.
3818  020060  004767  001520                      JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
3819  020064  000030                              .WORD   30              ;ERROR TYPE CODE.
3820  020066  111212                              MOVB    (R2),   (R2)    ;REWRITE THE LOCATION TO CLEAR BAD PARITY.
3821  020070  005053                              CLR     @-(R3)          ;CLEAR THE ERROR FLAG.
3822  020072  105712                              TSTB    (R2)            ;CHECK IF THE PARITY ERROR WAS CLEARED.
3823  020074  005733                              TST     @(R3)+          ;CHECK FOR THE ERROR FLAG.
3824  020076  100005                              BPL     6$              ;BR IF IT IS OK.
3825  020100  004567  003352                      JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3826  020104  026644                              .WORD   PEWNC           ;ADDRESS OF MESSAGE TO BE TYPED
3827                                                                      ;"PARITY ERROR WILL NOT CLEAR."
3828  020106  005073  177776                      CLR     @-2(R3)         ;CLEAR OUT THE PARITY ERROR FLAG.
3829  020112  005713                    6$:       TST     (R3)            ;CHECK FOR THE END OF REG ADR TABLE.
3830  020114  001350                              BNE     4$              ;BR IF MORE PARITY REGISTERS.
3831  020116  005202                              INC     R2              ;GO TO NEXT MEMORY ADDRESS.
3832  020120  032702  017777                      BIT     #MASK4K,R2      ;CHECK FOR END OF 4K BANK.
3833  020124  001341                              BNE     3$              ;BR IF MORE MEMORY THIS BANK.
3834  020126  012601                              MOV     (SP)+,R1        ;;POP STACK INTO R1
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3835  020130  000402                          BR      11$             ;BR TO CHECK FOR NEXT BANK.
3836  020132  062702  020000          10$:    ADD     #20000, R2      ;SKIP BANKS THAT AREN'T THERE.
3837  020136  005767  160444          11$:    TST     MMAVA           ;CHECK FOR MEM MGMT.
3838  020142  001413                          BEQ     12$             ;BR IF NO MEM MGMT.
3839  020144  062737  000200  172344          ADD     #200,   @#KIPAR2 ;UPDATE MEM MGMT REG TO NEXT 4K.
3840  020152  012702  040000                  MOV     #40000, R2      ;RESET ADDRESS POINTER TO BEGINNING OF BANK.
3841  020156  006300                          ASL     R0              ;UPDATE BANK POINTER.
3842  020160  006101                          ROL     R1              ;...HI 64K.
3843  020162  100313                          BPL     1$              ;BR IF MORE BANKS.
3844  020164  012637  172344                  MOV     (SP)+,@#KIPAR2          ;;POP STACK INTO @#KIPAR2
3845  020170  000402                          BR      20$             ;GO CHECK IF ANY ERRORS FOUND.
3846  020172  106300          12$:    ASLB    R0              ;UPDATE POINTER TO NEXT BANK.
3847  020174  100306                          BPL     1$              ;BR IF MORE BANKS.
3848  020176  005704          20$:    TST     R4              ;CHECK IF ANY PARITY ERRORS DETECTED.
3849  020200  001003                          BNE     21$             ;BR IF ERRORS DETECTED.
3850  020202  004567  003250                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3851  020206  025652                          .WORD   NOPES           ;ADDRESS OF MESSAGE TO BE TYPED
3852  020210                          21$:
3853  020210  012637  000116                  MOV     (SP)+,@#116     ;;POP STACK INTO @#116
3854  020214  012637  000114                  MOV     (SP)+,@#114     ;;POP STACK INTO @#114
3855  020220  012604                          MOV     (SP)+,R4        ;;POP STACK INTO R4
3856  020222  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
3857  020224  012602                          MOV     (SP)+,R2        ;;POP STACK INTO R2
3858  020226  012601                          MOV     (SP)+,R1        ;;POP STACK INTO R1
3859  020230  012600                          MOV     (SP)+,R0        ;;POP STACK INTO R0
3860  020232  000207                          RTS     PC              ;RETURN.
3861
3862                                  ;;*****************************************************************
3863                                  ;ROUTINE TO CLEAR ALL PARITY REGISTERS PRESENT
3864                                  ;;*****************************************************************
3865  020234                          CLRPAR:
3866  020234  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
3867  020236  016703  161366                  MOV     .MPRX,  R3      ;GET PARITY REGISTER TABLE POINTER.
3868  020242  005713          1$:     TST     (R3)            ;CHECK FOR THE TABLE TERMINATOR.
3869  020244  001402                          BEQ     2$              ;BR IF DONE ALL PARITY REGISTERS.
3870  020246  005033                          CLR     @(R3)+          ;CLEAR THE PARITY REGISTER.
3871  020250  000774                          BR      1$              ;BR FOR MORE
3872  020252                          2$:
3873  020252  012603                          MOV     (SP)+,R3        ;;POP STACK INTO R3
3874  020254  000207                          RTS     PC              ;RETURN.
3875
3876                                  .SBTTL  SUBROUTINES TO SET UP DATA FOR ERROR PRINTOUT ROUTINE.
3877                                  ;;*****************************************************************
3878                                  ;*  THESE ROUTINES ARE USED TO TRANSFER DATA TO COMMON TAG AREA (.$CMT)
3879                                  ;*  FOR ERROR PRINTOUT BY .$ERROR & .$ERRTYP ROUTINES FROM **SYSMAC**.
3880                                  ;;*****************************************************************
3881  020256  010267  160636  SPRNT:   MOV     R2,     $GDADR  ;SAVE THE ADDRESS UNDER TEST.
3882  020262  005067  160636          CLR     $GDDAT          ;SHOULD BE DATA IS "0".
3883  020266  000430                  BR      SPRNTB
3884
3885  020270  014367  160664  SPRNTQ: MOV     -(R3),  $TMPO   ;GET THE PARITY REGISTER ADDRESS.
3886  020274  013367  160662          MOV     @(R3)+, $TMP1   ;GET THE CONTENTS OF THE PARITY REG.
3887  020300  000402                  BR      SPRNTO
3888
3889  020302  011367  160652  SPRNTP: MOV     (R3),   $TMPO   ;GET THE PARITY REGISTER ADDRESS.
3890  020306  010267  160606  SPRNTO: MOV     R2,     $GDADR  ;GET THE MEMORY ADDRESS BEING TESTED
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3891  020312  000414                          BR      SPRNTA          ;BR TO COMMON SECTION.
3892
3893  020314  010267  160600          SPRNT1: MOV     R2,     $GDADR  ;GET THE MEMORY ADDRESS BEING TESTED
3894  020320  005367  160574                  DEC     $GDADR          ;ADJUST IT FOR PRINTOUT.
3895  020324  000407                          BR      SPRNTA          ;BR TO COMMON SECTION.
3896
3897  020326  010367  160626          SPRNT3: MOV     R3,     $TMPO   ;GET THE DATA IN R3.
3898  020332  010267  160562          SPRNT2: MOV     R2,     $GDADR  ;GET THE MEMORY ADDRESS BEING TESTED
3899  020336  162767  000002  160554          SUB     #2,     $GDADR  ;ADJUST IT FOR PRINTOUT.
3900  020344  010067  160554          SPRNTA: MOV     R0,     $GDDAT  ;GET WHAT THE DATA SHOULD BE
3901  020350  010167  160552          SPRNTB: MOV     R1,     $BDDAT  ;GET WHAT THE DATA WAS
3902  020354  000207                          RTS     PC              ;RETURN TO ENTER ERROR ROUTINES
3903
3904                                  ;;*****************************************************************
3905                                  ;*  SUBROUTINE TO TYPE OUT A MAP OF 4K BANK.
3906                                  ;*  R0 POINTS TO THE MAP UPON ENTERING THIS ROUTINE.
3907                                  ;;*****************************************************************
3908  020356  005710                  TYPMAP: TST     (R0)            ;CHECK IF ANY MEMORY IN MAP...LO 64K.
3909  020360  001007                          BNE     1$              ;BR IF MEMORY IN MAP.
3910  020362  005760  000002                  TST     2(R0)           ;...HI 64K.
3911  020366  001004                          BNE     1$              ;BR IF MEMORY IN MAP.
3912  020370  004567  003062                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3913  020374  026232                          .WORD   NOMEM           ;ADDRESS OF MESSAGE TO BE TYPED
3914                                                                  ;"NO MEMORY FOUND."
3915  020376  000475                          BR      6$              ;EXIT
3916  020400                          1$:
3917  020400  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
3918  020402  010246                          MOV     R2,-(SP)        ;;PUSH R2 ON STACK
3919  020404  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
3920  020406  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
3921  020410  012701  000001                  MOV     #BIT0,  R1      ;SET UP BANK POINTER...LO 64K.
3922  020414  005002                          CLR     R2              ;...HI 64K.
3923  020416  012703  177777                  MOV     #-1,    R3      ;SET UP ADDRESS POINTER TO -1.
3924  020422  010304                          MOV     R3,     R4      ;HI BITS OF ADDRESS AS WELL.
3925  020424  030110                  2$:     BIT     R1,     (R0)    ;CHECK THE MAP FOR THIS BANK.
3926  020426  001014                          BNE     3$              ;BR IF THIS BANK PRESENT.
3927  020430  030260  000002                  BIT     R2,     2(R0)   ;CHECK HI 64K MAP.
3928  020434  001011                          BNE     3$              ;BR IF THIS BANK PRESENT.
3929  020436  105703                          TSTB    R3              ;CHECK FOR PREVIOUS PRINTOUT.
3930  020440  001042                          BNE     5$              ;BR IF ALREADY TYPED "TO"
3931  020442  162703  000001                  SUB     #1,     R3      ;BACK UP TO LAST ADR OF PREVIOUS BANK.
3932  020446  005604                          SBC     R4              ;...HI ADDRESS BITS.
3933  020450  004567  003002                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3934  020454  025463                          .WORD   TO              ;ADDRESS OF MESSAGE TO BE TYPED
3935  020456  000410                          BR      4$              ;GO TO TYPE THE ADDRESS.
3936  020460  105703                  3$:     TSTB    R3              ;CHECK FOR PREVIOUS TYPEOUT.
3937  020462  001431                          BEQ     5$              ;BR IF ALREADY TYPE "FROM".
3938  020464  062703  000001                  ADD     #1,     R3      ;POINT TO FIRST ADDRESS OF THIS BANK.
3939  020470  005504                          ADC     R4              ;...HI BITS OF ADDRESS.
3940  020472  004567  002760                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
3941  020476  025453                          .WORD   FROM            ;ADDRESS OF MESSAGE TO BE TYPED
3942  020500                          4$:
3943  020500  010346                          MOV     R3,-(SP)        ;;PUSH R3 ON STACK
3944  020502  010446                          MOV     R4,-(SP)        ;;PUSH R4 ON STACK
3945  020504  006303                          ASL     R3              ;BIT 15 INTO C-BIT
3946  020506  006104                          ROL     R4              ;BIT 15 INTO R4.
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                        ROR     R3              ;RESTORE BITS 14-0.
                        MOV     R4,-(SP)        ;;SAVE R4 FOR TYPEOUT
                                                ;;TYPE ADDRESS BITS 21-15
                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOS ROUTINE
                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
                        MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
                        JSR     PC,     $TYPOS  ;GO TO THE SUBROUTINE
                        .BYTE   3               ;;TYPE 3 DIGIT(S)
                        .BYTE   0               ;;SUPPRESS LEADING ZEROS
                        MOV     R3,-(SP)        ;;SAVE R3 FOR TYPEOUT
                                                ;;TYPE ADDRESS BITS 14-0
                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOS ROUTINE
                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
                        MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
                        JSR     PC,     $TYPOS  ;GO TO THE SUBROUTINE
                        .BYTE   5               ;;TYPE 5 DIGIT(S)
                        .BYTE   1               ;;TYPE LEADING ZEROS
                        MOV     (SP)+,R4        ;;POP STACK INTO R4
                        MOV     (SP)+,R3        ;;POP STACK INTO R3
                5$:     ADD     #20000, R3      ;UPDATE TO NEXT BANK.
                        ADC     R4              ;...HI ADDRESS BITS.
                        ASL     R1              ;SHIFT POINTER...LO 64K.
                        ROL     R2              ;...HI 64K.
                        BCC     2$              ;BR IF MORE BANKS.
                        MOV     (SP)+,R4        ;;POP STACK INTO R4
                        MOV     (SP)+,R3        ;;POP STACK INTO R3
                        MOV     (SP)+,R2        ;;POP STACK INTO R2
                        MOV     (SP)+,R1        ;;POP STACK INTO R1
                6$:     RTS     PC              ;RETURN.

                .SBTTL  SCOPE HANDLER ROUTINE

                ;;**************************************************************
                ;*THIS ROUTINE CONTROLS THE LOOPING OF SUBTESTS. IT WILL INCREMENT
                ;*AND LOAD THE TEST NUMBER($TSTNM) INTO THE DISPLAY REG.(DISPLAY<7:0>)
                ;*AND LOAD THE ERROR FLAG ($ERFLG) INTO DISPLAY<15:08>
                ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                ;*SW14=1         LOOP ON TEST
                ;*SW11=1         INHIBIT ITERATIONS
                ;*SW09=1         LOOP ON ERROR
                ;*SW08=1         LOOP ON TEST IN SWR<4:0>
                ;*CALL
                ;*      SCOPE           ;;SCOPE=IOT

                $SCOPE:
                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $CKSWR ROUTINE
                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
                        MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
                        JSR     PC,     $CKSWR  ;GO TO THE SUBROUTINE
                        MOV     (R5)+,  R4      ;SAVE MINIMUM BLOCK MASK ;NEXT TEST.
                        MOV     R5,     (SP)    ;PUT RETURN PC ONTO STACK, SIMULATE JSR PC.
                1$:     BIT     #BIT14,@SWR     ;;LOOP ON PRESENT TEST?
                        BNE     $OVER           ;;YES IF SW14=1
                ;*****START OF CODE FOR THE XOR TESTER*****
                $XTSTR: BR      6$              ;;IF RUNNING ON THE "XOR" TESTER CHANGE
                                                ;;THIS INSTRUCTION TO A "NOP" (NOP=240)
```

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4003  020622  013746  000004          MOV     @#ERRVEC,-(SP)  ;;SAVE THE CONTENTS OF THE ERROR VECTOR
4004  020626  012737  020646  000004  MOV     #5$,@#ERRVEC    ;;SET FOR TIMEOUT
4005  020634  005737  177060          TST     @#177060        ;;TIME OUT ON XOR?
4006  020640  012637  000004          MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
4007  020644  000466                  BR      $SVLAD          ;;GO TO THE NEXT TEST
4008  020646  022626                5$:       CMP     (SP)+,(SP)+     ;;CLEAR THE STACK AFTER A TIME OUT
4009  020650  012637  000004          MOV     (SP)+,@#ERRVEC  ;;RESTORE THE ERROR VECTOR
4010  020654  000426                  BR      7$              ;;LOOP ON THE PRESENT TEST
4011  020656                        6$:;*****END OF CODE FOR THE XOR TESTER*****
4012  020656  032777  000400  160254  BIT     #BIT08,@SWR     ;;LOOP ON SPEC. TEST?
4013  020664  001407                  BEQ     2$              ;;BR IF NO
4014  020666  017746  160246          MOV     @SWR,-(SP)      ;;SET DESIRED TEST NUM. FROM SWR
4015  020672  042716  000340          BIC     #$SWRMK,(SP)    ;;STRIP AWAY UNDESIRED BITS
4016  020676  122667  160200          CMPB    (SP)+,$TSTNM    ;;ON THE RIGHT TEST?
4C17  020702  001465                  BEQ     $OVER           ;;BR IF YES
4018  020704  105767  160173        2$:       TSTB    $ERFLG          ;;HAS AN ERROR OCCURRED?
4019  020710  001421                  BEQ     3$              ;;BR IF NO
4020  020712  126767  160177  160163  CMPB    $ERMAX,$ERFLG   ;;MAX. ERRORS FOR THIS TEST OCCURRED?
4021  020720  101015                  BHI     3$              ;;BR IF NO
4022  020722  032777  001000  160210  BIT     #BIT09,@SWR     ;;LOOP ON ERROR?
4023  020730  001404                  BEQ     4$              ;;BR IF NO
4024  020732  016767  160152  160146  7$:       MOV     $LPERR,$LPADR   ;;SET LOOP ADDRESS TO LAST SCOPE
4025  020740  000446                  BR      $OVER
4026  0207 2  105067  160135        4$:       CLRB    $ERFLG          ;;ZERO THE ERROR FLAG
4027  020746  005067  160216          CLR     $TIMES          ;;CLEAR THE NUMBER OF ITERATIONS TO MAKE
4028  020752  000415                  BR      1$              ;;ESCAPE TO THE NEXT TEST
4029  020754  032777  004000  160156  3$:       BIT     #BIT11,@SWR     ;;INHIBIT ITERATIONS?
4030  020762  001011                  BNE     1$              ;;BR IF YES
4031  020764  005767  160222          TST     $PASS           ;;IF FIRST PASS OF PROGRAM
4032  020770  001406                  BEQ     1$              ;;      INHIBIT ITERATIONS
4033  020772  005267  160106          INC     $ICNT           ;;INCREMENT ITERATION COUNT
4034  020776  026767  160166  160100  CMP     $TIMES,$ICNT    ;;CHECK THE NUMBER OF ITERATIONS MADE
4035  021004  002024                  BGE     $OVER           ;;BR IF MORE ITERATION REQUIRED
4036  021006  012767  000001  160070  1$:       MOV     #1,$ICNT        ;;REINITIALIZE THE ITERATION COUNTER
4037  021014  016767  000552  160146          MOV     $MXCNT,$TIMES   ;;SET NUMBER OF ITERATIONS TO DO
4038  021022  105267  160054        $SVLAD:   INCB    $TSTNM          ;;COUNT TEST NUMBERS
4039  021026  116767  160050  160154          MOVB    $TSTNM,$TESTN   ;;SET TEST NUMBER IN APT MAILBOX
4040  021034  011667  160046                  MOV     (SP),$LPADR     ;;SAVE SCOPE LOOP ADDRESS
4041  021040  011667  160044                  MOV     (SP),$LPERR     ;;SAVE ERROR LOOP ADDRESS
4042  021044  005067  160122                  CLR     $ESCAPE         ;;CLEAR THE ESCAPE FROM ERROR ADDRESS
4043  021050  112767  000001  160037          MOVB    #1,$ERMAX       ;;ONLY ALLOW ONE(1) ERROR ON NEXT TEST
4044  021056  016777  160020  160056  $OVER:    MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER
4045  021064  016716  160016                  MOV     $LPADR,(SP)     ;;FUDGE RETURN ADDRESS
4046  021070  020516                INSERT:   CMP     R5,     (SP)    ;CHECK FOR LOOP ON TEST.
4047  021072  001402                          BEQ     1$              ;BR IF START NEXT TEST.
4048  021074  000167  000470                  JMP     ENDINS          ;JMP IF LOOP ON LAST TEST.
4049  021100  012767  037777  160500  1$:       MOV     #37777, BLKMSK  ;SET 8K BOUNDRY MASK.
4050  021106  005767  160100                  TST     $PASS           ;CHECK FOR PASS 0.
4051  021112  001404                          BEQ     2$              ;BR IF PASS 0
4052  021114  126727  157762  000021          CMPB    $TSTNM, #21     ;CHECK IF IN SECTION 3.
4053  021122  103002                          BHIS    3$              ;BR IF IN SECTION 3.
4054  021124  006267  160456        2$:       ASR     BLKMSK          ;RESET BOUNDRY TO 4K.
4055  021130  016767  160426  160426  3$:       MOV     FSTADR, TMPFAD  ;GET FIRST ADDRESS.
4056  021136  005767  157436                  TST     RELOCF          ;CHECK IF PRG RELOCATED.
4057  021142  001430                          BEQ     4$              ;BR IF NOT RELOCATED.
4058  021144  032777  000040  157766          BIT     #SW05,  @SWR    ;CHECK IF LOC 0-776 TO BE PROTECTED.
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4059  021152  001424                        BEQ     4$                ;BR IF SW NOT SET.
4060  021154  026727  160404  001000        CMP     TMPFAD, #1000     ;CHECK IF NOT BEING TESTED.
4061  021162  103020                        BHIS    4$                ;BR IF ALREADY PROTECTED.
4062  021164  012767  001000  160372        MOV     #1000,  TMPFAD    ;RESET FIRST ADDRESS.
4063  021172  052767  000001  160370        BIS     #BIT0,  FADMAP    ;SET FLAG IN FIRST BANK.
4064  021200  026727  160370  001000        CMP     LSTADR, #1000     ;CHECK IF GONE PAST LAST ADR.
4065  021206  101006                        BHI     4$                ;BR IF ENOUGH MEMORY.
4066  021210  004567  002242                JSR     R5,     $PRINT    ;GO PRINT OUT THE FOLLOWING MESSAGE.
4067  021214  026703                        .WORD   NOMTST            ;ADDRESS OF MESSAGE TO BE TYPED
4068                                                                  ;"NO MEMORY TESTED"
4069  021216  016716  160422                MOV     .TST32, (SP)      ;ADJUST RETURN ADR FOR ABORT.
4070  021222  000207                        RTS     PC                ;ABORT.
4071  021224  016767  160344  160344  4$:   MOV     LSTADR, TMPLAD    ;GET LAST ADDRESS.
4072  021232  016767  160276  160270        MOV     SAVTST, TSTMAP    ;GET TEST MAP, LO 64K.
4073  021240  016767  160272  160264        MOV     SAVTST+2,TSTMAP+2 ;...HI 64K.
4074  021246  046767  157330  160254        BIC     PRGMAP, TSTMAP    ;DON'T TEST OVER THE PROGRAM.
4075  021254  046767  157324  160250        BIC     PRGMAP+2,TSTMAP+2
4076  021262  005767  157724                TST     $PASS             ;CHECK FOR FIRST PASS
4077  021266  001011                        BNE     10$               ;BR IF NOT FIRST PASS.
4078  021270  032767  000003  160232        BIT     #3,     TSTMAP    ;CHECK IF FIRST TWO BANKS AVAILABLE.
4079  021276  001405                        BEQ     10$               ;NOT TESTING FIRST 2 BANKS.
4080  021300  042767  177774  160222        BIC     #177774,TSTMAP    ;CLR ALL BUT FIRST 2 BANKS.
4081  021306  005067  160220                CLR     TSTMAP+2
4082  021312  005704                10$:    TST     R4                ;CHECK FOR A MINIMUM BLOCK SIZE.
4083  021314  001503                        BEQ     20$               ;BR IF NO MIN BLOCK SIZE.
4084  021316  030467  160242                BIT     R4,     TMPFAD    ;CHECK IF FIRST ADR ON BLOCK BOUNDRY.
4085  021322  001416                        BEQ     11$               ;BR IF FIRST ADR ON BLOCK BOUNDRY.
4086  021324  050467  160234                BIS     R4,     TMPFAD    ;ADJUST FIRST ADR TO END OF BLOCK.
4087  021330  005267  160230                INC     TMPFAD            ;FIRST ADR TO FIRST ADR OF NEXT BLOCK.
4088  021334  032767  017777  160222        BIT     #MASK4K,TMPFAD    ;CHECK IF FIRST ADR REACHED 4K BOUNDRY.
4 39  021342  001006                        BNE     11$               ;BR IF NOT ON 4K BOUNDRY.
4090  021344  046767  160220  160156        BIC     FADMAP, TSTMAP    ;DON'T TEST FIRST BANK.
4091  021352  046767  160214  160152        BIC     FADMAP+2,TSTMAP+2
4092  021360  030467  160212          11$:  BIT     R4,     TMPLAD    ;CHECK IF LAST ADR ON BLOCK BOUNDRY.
4093  021364  001414                        BEQ     12$               ;BR IF ON BLOCK BOUNDRY.
4094  021366  040467  160204                BIC     R4,     TMPLAD    ;ADJUST LAST ADR DOWN TO NEXT BLOCK BOUNDRY.
4095  021372  032767  017777  160176        BIT     #MASK4K,TMPLAD    ;CHECK IF ADJUSTED TO 4K BOUNDRY.
4096  021400  001006                        BNE     12$               ;BR IF NOT ON 4K BOUNDRY.
4097  021402  046767  160174  160120        BIC     LADMAP, TSTMAP    ;SKIP TESTING LAST BANK.
4098  021410  046767  160170  160114        BIC     LADMAP+2,TSTMAP+2
4099  021416  036767  160146  160156  12$:  BIT     FADMAP, LADMAP    ;CHECK IF FIRST AND LAST IN SAME BANK.
4100  021424  001004                        BNE     13$               ;BR IF IN SAME BANK.
4101  021426  036767  160140  160150        BIT     FADMAP+2,LADMAP+2 ;...UPPER 64K.
4102  021434  001404                        BEQ     14$               ;BR IF FIRST AND LAST NOT SAME BANK.
4103  021436  026767  160134  160120  13$:  CMP     TMPLAD, TMPFAD    ;CHECK IF ANY MEMORY LEFT.
4104  021444  101406                        BLOS    15$               ;BR IF NO MEMORY TO TEST.
4105  021446  005767  160056          14$:  TST     TSTMAP            ;CHECK IF ANY BANKS LEFT TO TEST!!
4106  021452  001017                        BNE     16$               ;BR IF TEST MAP NOT EMPTY.
4107  021454  005767  160052                TST     TSTMAP+2          ;CHECK FOR ANY BANKS.
4108  021460  001014                        BNE     16$               ;BR IF TEST MAP NOT EMPTY.
4109  021462                          15$:
4110  021462  004567  001770                JSR     R5,     $PRINT    ;GO PRINT OUT THE FOLLOWING MESSAGE.
4111  021466  026727                        .WORD   SKPMES            ;ADDRESS OF MESSAGE TO BE TYPED
4112                                                                  ;"SKIPPING TEST #"
4113  021470  005046                        CLR     -(SP)             ;CLEAR THE WORD ON THE STACK.
4114  021472  116716  157404                MOVB    $TSTNM, (SP)      ;PUT THE DATA ON THE STACK.
```

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                                        ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOS ROUTINE
                                        ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
021476  013746  177776                          MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
021502  004767  003122                          JSR     PC,     $TYPOS  ;GO TO THE SUBROUTINE
021506     003                                  .BYTE   3               ;TYPE 3 DIGITS.
021507     001                                  .BYTE   1               ;TYPE LEADING ZEROS.
021510  000427                                  BR      ENDINS          ;RETURN TO SKIP TEST.
021512  062716  000004                  16$:    ADD     #4,     (SP)    ;SKIP THE SKIP ON RETURN.
021516  062767  000004  157362                  ADD     #4,     $LPADR  ;ADJUST THE LOOP ADR PAST THE SKIP.
021524  012767  017777  160034          20$:    MOV     #MASK4K,FADMSK  ;GET 4K MASK.
021532  016705  160026                          MOV     TMPFAD, R5      ;GET FIRST ADR.
021536  040567  160024                  21$:    BIC     R5,     FADMSK  ;CLR MASK ABOVE LOWEST BIT OF FIRST ADR.
021542  006305                                  ASL     R5              ;MOVE LOWEST BIT UP ONE.
021544  001374                                  BNE     21$             ;LOOP UNTIL OVERFLOW.
021546  012767  017777  160024                  MOV     #MASK4K,LADMSK  ;SET MASK BITS
021554  016705  160016                          MOV     TMPLAD, R5      ;GET LAST ADR.
021560  040567  160014                  22$:    BIC     R5,     LADMSK  ;CLR ALL MASK BITS ABOVE LOWEST BIT IN LAST ADR.
021564  006305                                  ASL     R5              ;MOVE LOWEST BIT OF LAST ADR UP ONE.
021566  001374                                  BNE     22$             ;LOOP UNTIL OVERFLOW.
021570  000207                          ENDINS: RTS     PC              ;EXIT SCOPE ROUTINE BACK TO TEST.
021572  000004                          $MXCNT: 4                       ;MAX. NUMBER OF ITERATIONS
                                        ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $CKSWR ROUTINE
                                        ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
021574  013746  177776                          MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
021600  004767  000524                          JSR     PC,     $CKSWR  ;GO TO THE SUBROUTINE
                                        .SBTTL  ERROR HANDLER ROUTINE

                                        ;;*****************************************************************
                                        ;*THIS ROUTINE WILL INCREMENT THE ERROR FLAG AND THE ERROR COUNT,
                                        ;*SAVE THE ERROR ITEM NUMBER AND THE ADDRESS OF THE ERROR CALL
                                        ;*AND GO TO $ERRTYP ON ERROR
                                        ;*THE SWITCH OPTIONS PROVIDED BY THIS ROUTINE ARE:
                                        ;*SW15=1         HALT ON ERROR
                                        ;*SW13=1         INHIBIT ERROR TYPEOUTS
                                        ;*SW10=1         BELL ON ERROR
                                        ;*SW09=1         LOOP ON ERROR
                                        ;*CALL
                                        ;*      ERROR   N       ;;ERROR=EMT AND N=ERROR ITEM NUMBER

021604                                  $ERROR:
                                        ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $CKSWR ROUTINE
                                        ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
021604  013746  177776                          MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
021610  004767  000514                          JSR     PC,     $CKSWR  ;GO TO THE SUBROUTINE
021614  062716  000002                          ADD     #2,     (SP)    ;ADJUST POINTER PAST CODE WORD.
021620  105267  157257                  7$:     INCB    $ERFLG          ;;SET THE ERROR FLAG
021624  001775                                  BEQ     7$              ;;DON'T LET THE FLAG GO TO ZERO
021626  016777  157250  157306                  MOV     $TSTNM,@DISPLAY ;;DISPLAY TEST NUMBER AND ERROR FLAG
021634  032777  002000  157276                  BIT     #BIT10,@SWR     ;;BELL ON ERROR?
021642  001403                                  BEQ     1$              ;;NO - SKIP
021644  004567  001606                          JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
021650  001174                                  .WORD   $BELL           ;ADDRESS OF MESSAGE TO BE TYPED
021652  005267  157234                  1$:     INC     $ERTTL          ;;COUNT THE NUMBER OF ERRORS
021656  011667  157234                          MOV     (SP),$ERRPC     ;;GET ADDRESS OF ERROR INSTRUCTION
021662  162767  000002  157226                  SUB     #2,$ERRPC
021670  117767  157222  157216                  MOVB    @$ERRPC,$ITEMB  ;;STRIP AND SAVE THE ERROR ITEM CODE
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4171  021676  032777  020000  157234          BIT     #BIT13,@SWR     ;;SKIP TYPEOUT IF SET
4172  021704  001005                          BNE     20$             ;;SKIP TYPEOUTS
4173  021706  004767  000116                  JSR     PC,$ERRTYP      ;;GO TO USER ERROR ROUTINE
4174  021712  004567  001540                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4175  021716  001201                          .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
4176  021720                          20$:
4177  021720  122767  000001  157276          CMPB    #AP^ENV,$ENV    ;;RUNNING IN APT MODE
4178  021726  001007                          BNE     2$              ;;NO,SKIP APT ERROR REPORT
4179  021730  116767  157160  000004          MOVB    $ITEMB,21$      ;;SET ITEM NUMBER AS ERROR NUMBER
4180  021736  004767  002044                  JSR     PC,$ATY4        ;;REPORT FATAL ERROR TO APT
4181  021742     000                  21$:    .BYTE   0
4182  021743     000                          .BYTE   0
4183  021744  000777                  22$:    BR      22$             ;;APT ERROR LOOP
4184  021746  005777  157166          2$:     TST     @SWR            ;;HALT ON ERROR
4185  021752  100005                          BPL     3$              ;;SKIP IF CONTINUE
4186  021754  000000                          HALT                    ;;HALT ON ERROR!
4187                                  ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $CKSWR ROUTINE
4188                                  ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
4189  021756  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4190  021762  004767  000342                  JSR     PC,     $CKSWR  ;GO TO THE SUBROUTINE
4191  021766  032777  001000  157144  3$:     BIT     #BIT09,@SWR     ;;LOOP ON ERROR SWITCH SET?
4192  021774  001402                          BEQ     4$              ;;BR IF NO
4193  021776  016716  157106                  MOV     $LPERR,(SP)     ;;FUDGE RETURN FOR LOOPING
4194  022002  005767  157164          4$:     TST     $ESCAPE         ;;CHECK FOR AN ESCAPE ADDRESS
4195  022006  001402                          BEQ     5$              ;;BR IF NONE
4196  022010  016716  157156                  MOV     $ESCAPE,(SP)    ;;FUDGE RETURN ADDRESS FOR ESCAPE
4197  022014                          5$:
4198  022014  022737  014174  000042          CMP     #$ENDAD,@#42    ;;ACT-11 AUTO-ACCEPT?
4199  022022  001001                          BNE     6$              ;;BRANCH IF NO
4200  022024  000000                          HALT                    ;;YES
4201  022026                          6$:
4202  022026  000207                          RTS     PC
4203                                  ;;*****************************************************************
4204
4205                                  .SBTTL  ERROR MESSAGE TYPEOUT ROUTINE
4206
4207                                  ;*THIS ROUTINE USES THE "ITEM CONTROL BYTE" ($ITEMB) TO DETERMINE WHICH
4208                                  ;*ERROR IS TO BE REPORTED. IT THEN OBTAINS, FROM THE "ERROR TABLE" ($ERRTB),
4209                                  ;*AND REPORTS THE APPROPRIATE INFORMATION CONCERNING THE ERROR.
4210
4211  022030                          $ERRTYP:
4212  022030  004567  001422                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4213  022034  001201                          .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
4214  022036  010046                          MOV     R0,-(SP)                ;SAVE R0
4215  022040  005000                          CLR     R0                      ;PICKUP THE ITEM INDEX
4216  022042  156700  157046                  BISB    $ITEMB,R0
4217  022046  001007                          BNE     1$                      ;IF ITEM NUMBER IS ZERO, JUST
4218                                                                          ;TYPE THE PC OF THE ERROR
4219  022050  016746  157042                  MOV     $ERRPC,-(SP)    ;;SAVE $ERRPC FOR TYPEOUT
4220                                                                  ;;ERROR ADDRESS
4221                                  ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOC ROUTINE
4222                                  ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
4223  022054  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4224  022060  004767  002570                  JSR     PC,     $TYPOC  ;GO TO THE SUBROUTINE
4225  022064  000513                          BR      10$                     ;GET OUT
4226  022066  016767  157024  157420  1$:     MOV     $ERRPC, $VERPC  ;SET UP VIRTUAL PC FOR TYPEOUT.
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4227  022074  166767  156500  157412          SUB     RELOCF, $VERPC  ;MAKE VIRTUAL IF NOT ALREADY.
4228  022102  005300                          DEC     R0              ;ADJUST THE INDEX SO THAT IT WILL
4229  022104  006300                          ASL     R0              ;       WORK FOR THE ERROR TABLE
4230  022106  006300                          ASL     R0
4231  022110  006300                          ASL     R0
4232  022112  066700  157522                  ADD     .ERRTB, R0      ;FORM TABLE POINTER
4233  022116  012067  000006                  MOV     (R0)+,2$        ;PICKUP "ERROR MESSAGE" POINTER
4234  022122  001406                          BEQ     3$              ;SKIP TYPEOUT IF NO POINTER
4235  022124  004567  001326                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4236  022130  000000          2$:     .WORD   0                       ;"ERROR MESSAGE" POINTER GOES HERE
4237  022132  004567  001320                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4238  022136  001201                          .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
4239  022140  012067  000006          3$:     MOV     (R0)+,4$        ;PICKUP "DATA HEADER" POINTER
4240  022144  001406                          BEQ     5$              ;SKIP TYPEOUT IF 0
4241  022146  004567  001304                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4242  022152  000000          4$:     .WORD   0                       ;"DATA HEADER" POINTER GOES HERE
4243  022154  004567  001276                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4244  022160  001201                          .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
4245  022162  010146          5$:     MOV     R1,-(SP)                ;SAVE R1
4246  022164  012001                  MOV     (R0)+,R1                ;PICKUP "DATA TABLE" POINTER
4247  022166  001451                  BEQ     9$                      ;BR IF NO DATA TO BE TYPED
4248  022170  066701  156404                  ADD     RELOCF, R1      ;ADJUST POINTER
4249  022174  012000                  MOV     (R0)+,R0                ;PICKUP "DATA FORMAT" POINTER
4250  022176  066700  156376                  ADD     RELOCF, R0      ;ADJUST POINTER.
4251  022202  105720          6$:     TSTB    (R0)+                   ;CHECK THE FORMAT
4252  022204  001006                  BNE     7$                      ;BR IF NOT 16-BIT OCTAL
4253  022206  013146                  MOV     @(R1)+,-(SP)    ;;SAVE @(R1)+ FOR TYPEOUT
4254                          ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOC ROUTINE
4255                          ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
4256  022210  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4257  022214  004767  002434                  JSR     PC,     $TYPOC  ;GO TO THE SUBROUTINE
4258  022220  000426                          BR      8$
4259  022222  100406          7$:     BMI     17$                     ;BRANCH IF NOT DECIMAL
4260  022224  013146                  MOV     @(R1)+,  -(SP)  ;;SAVE @(R1)+ FOR TYPEOUT
4261                          ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPDS ROUTINE
4262                          ;*  WIHTOUT USING A "TRAP"  STRUCTION AS CALLED FOR BY **SYSMAC**.
4263  022226  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4264  022232  004767  002140                  JSR     PC,     $TYPDS  ;GO TO THE SUBROUTINE
4265  022236  000417                          BR      8$              ;SKIP
4266  022240  122760  177777  177777  17$:     CMPB    #-1,    -1(R0)  ;CHECK FOR 18-BIT ADDRESS FORMAT.
4267  022246  001004                          BNE     18$             ;BR IF NOT 18-BIT ADDRESS FORMAT.
4268  022250  013146                  MOV     @(R1)+, -(SP)   ;PUT THE DAT  ON THE STACK.
4269  022252  004767  002640                  JSR     PC,     $TYPAD  ;DETERMINE  HE PHYSICAL ADDRESS AND TYPE IT.
4270  022256  000407                          BR      8$              ;SKIP
4271  022260                          18$:
4272  022260  005046                  CLR     -(SP)                   ;CLEAR THE WORD ON THE STACK.
4273  022262  113116                  MOVB    @(R1)+, (SP)            ;PUT THE DATA ON THE STACK.
4274                          ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOS ROUTINE
4275                          ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
4276  022264  013746  177776                  MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4277  022270  004767  002334                  JSR     PC,     $TYPOS  ;GO TO THE SUBROUTINE
4278  022274     003                          .BYTE   3               ;TYPE 3 DIGITS.
4279  022275     001                          .BYTE   1               ;TYPE LEADING ZEROS.
4280  022276  005711          8$:     TST     (R1)                    ;IS THERE ANOTHER NUMBER?
4281  022300  001404                          BEQ     9$              ;BR IF NO
4282  022302  004567  001150                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
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4283  022306  022326                        .WORD   11$             ;ADDRESS OF MESSAGE TO BE TYPED
4284  022310  000734                        BR      6$                      ;LOOP
4285
4286  022312  012601                9$:     MOV     (SP)+,R1                ;RESTORE R1
4287  022314  012600                10$:    MOV     (SP)+,R0                ;RESTORE R0
4288  022316  004567  001134                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4289  022322  001201                        .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
4290  022324  000207                        RTS     PC                      ;RETURN
4291  022326  000011                11$:    .ASCIZ  /       /       ;TAB CHARACTER.
4292                                        .EVEN
4293                                .SBTTL  TTY INPUT ROUTINE
4294
4295                                ;;**********************************************************************
4296                                .ENABL  LSB
4297
4298                                ;;**********************************************************************
4299                                ;*SOFTWARE SWITCH REGISTER CHANGE ROUTINE.
4300                                ;*ROUTINE IS ENTERED FROM THE TRAP HANDLER, AND WILL
4301                                ;*SERVICE THE TEST FOR CHANGE IN SOFTWARE SWITCH REGISTER TRAP CALL
4302                                ;*WHEN OPERATING IN TTY FLAG MODE.
4303  022330  022767  000176  156602 $CKSWR: CMP     #SWREG,SWR              ;;IS THE SOFT-SWR SELECTED?
4304  022336  001104                        BNE     15$                     ;;BRANCH IF NO
4305  022340  105777  156600                TSTB    @$TKS                   ;;CHAR THERE?
4306  022344  100101                        BPL     15$                     ;;IF NO, DON'T WAIT AROUND
4307  022346  117746  156574                MOVB    @$TKB,-(SP)             ;;SAVE THE CHAR
4308  022352  042716  177600                BIC     #^C177,(SP)             ;;STRIP-OFF THE ASCII
4309  022356  022726  000007                CMP     #7,(SP)+                ;;IS IT A CONTROL G?
4310  022362  001072                        BNE     15$                     ;;NO, RETURN TO USER
4311  022364  126727  156544  000001        CMPB    $AUTOB,#1               ;;ARE WE RUNNING IN AUTO-MODE?
4312  022372  001466                        BEQ     15$                     ;;BRANCH IF YES
4313
4314  022374  004567  001056                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4315  022400  023255                        .WORD   $CNTLG          ;ADDRESS OF MESSAGE TO BE TYPED
4316  022402                        $GTSWR:
4317  022402  004567  001050                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4318  022406  023262                        .WORD   $MSWR           ;ADDRESS OF MESSAGE TO BE TYPED
4319  022410  016746  155562                MOV     SWREG,-(SP)             ;;SAVE SWREG FOR TYPEOUT
4320                                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPOC ROUTINE
4321                                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
4322  022414  013746  177776                MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4323  022420  004767  002230                JSR     PC,     $TYPOC  ;GO TO THE SUBROUTINE
4324  022424  004567  001026                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4325  022430  023273                        .WORD   $MNEW           ;ADDRESS OF MESSAGE TO BE TYPED
4326  022432  005046                19$:    CLR     -(SP)                   ;;CLEAR COUNTER
4327  022434  005046                        CLR     -(SP)                   ;;THE NEW SWR
4328  022436  105777  156502        7$:     TSTB    @$TKS                   ;;CHAR THERE?
4329  022442  100375                        BPL     7$                      ;;IF NOT TRY AGAIN
4330
4331  022444  117746  156476                MOVB    @$TKB,-(SP)             ;;PICK UP CHAR
4332  022450  042716  177600                BIC     #^C177,(SP)             ;;MAKE IT 7-BIT ASCII
4333
4334
4335
4336  022454  021627  000025        9$:     CMP     (SP),#25                ;;IS IT A CONTROL-U?
4337  022460  001006                        BNE     10$                     ;;BRANCH IF NOT
4338  022462  004567  000770                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
```

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022466 023250                           .WORD   $CNTLU          ;ADDRESS OF MESSAGE TO BE TYPED
022470 062706 000006            20$:    ADD     #6,SP           ;;IGNORE PREVIOUS INPUT
022474 000756                           BR      19$             ;;LET'S TRY IT AGAIN


022476 021627 000015            10$:    CMP     (SP),#15        ;;IS IT A <CR>?
022502 001023                           BNE     16$             ;;BRANCH IF NO
022504 005766 000004                    TST     4(SP)           ;;YES, IS IT THE FIRST CHAR
022510 001403                           BEQ     11$             ;;BRANCH IF YES
022512 016677 000002 156420             MOV     2(SP),@SWR      ;;SAVE NEW SWR
022520 062706 000006            11$:    ADD     #6,SP           ;;CLEAR UP STACK
022524                          14$:
022524 004567 000726                    JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE
022530 001201                           .WORD   $CRLF           ;ADDRESS OF MESSAGE TO BE TYPED
022532 126727 156377 000001             CMPB    $INTAG,#1       ;;RE-ENABLE TTY KBD INTERRUPTS?
022540 001003                           BNE     15$             ;;BRANCH IF NOT
022542 012777 000100 156374             MOV     #100,@$TKS      ;;RE-ENABLE TTY KBD INTERRUPTS
022550 000002                   15$:    RTI                     ;;RETURN
022552 004767 001142            16$:    JSR     PC,$TYPEC       ;;ECHO CHAR
022556 021627 000060                    CMP     (SP),#60        ;;CHAR < 0?
022562 002420                           BLT     18$             ;;BRANCH IF YES
022564 021627 000067                    CMP     (SP),#67        ;;CHAR > 7?
022570 003015                           BGT     18$             ;;BRANCH IF YES
022572 042726 000060                    BIC     #60,(SP)+       ;;STRIP-OFF ASCII
022576 005766 000002                    TST     2(SP)           ;;IS THIS THE FIRST CHAR
022602 001403                           BEQ     17$             ;;BRANCH IF YES
022604 006316                           ASL     (SP)            ;;NO, SHIFT PRESENT
022606 006316                           ASL     (SP)            ;;    CHAR OVER TO MAKE
022610 006316                           ASL     (SP)            ;;    ROOM FOR NEW ONE.
022612 005266 000002            17$:    INC     2(SP)           ;;KEEP COUNT OF CHAR
022616 056616 177776                    BIS     -2(SP),(SP)     ;;SET IN NEW CHAR
022622 000705                           BR      7$              ;;GET THE NEXT ONE
022624                          18$:
022624 004567 000626                    JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
022630 001200                           .WORD   $QUES           ;ADDRESS OF MESSAGE TO BE TYPED
022632 000716                           BR      20$             ;;SIMULATE CONTROL-U
                                .DSABL  LSB


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

022634 011646                   $RDCHR: MOV     (SP),-(SP)      ;;PUSH DOWN THE PC
022636 016666 000004 000002             MOV     4(SP),2(SP)     ;;SAVE THE PS
022644 105777 156274            1$:     TSTB    @$TKS           ;;WAIT FOR
022650 100375                           BPL     1$              ;;A CHARACTER
022652 117766 156270 000004             MOVB    @$TKB,4(SP)     ;;READ THE TTY
022660 042766 177600 000004             BIC     #^C<177>,4(SP)  ;;GET RID OF JUNK IF ANY
022666 026627 000004 000023             CMP     4(SP),#23       ;;IS IT A CONTROL-S?
022674 001013                           BNE     3$              ;;BRANCH IF NO
022676 105777 156242            2$:     TSTB    @$TKS           ;;WAIT FOR A CHARACTER
```

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 4395  022702  100375                        BPL     2$              ;;LOOP UNTIL ITS THERE
 4396  022704  117746  156236                MOVB    @$IKB,-(SP)     ;;GET CHARACTER
 4397  022710  042716  177600                BIC     #^C177,(SP)     ;;MAKE IT 7-BIT ASCII
 4398  022714  022627  000021                CMP     (SP)+,#21       ;;IS IT A CONTROL-Q?
 4399  022720  001366                        BNE     2$              ;;IF NOT DISCARD IT
 4400  022722  000750                        BR      1$              ;;YES, RESUME
 4401  022724  026627  000004  000140  3$:   CMP     4(SP),#140      ;;IS IT UPPER CASE?
 4402  022732  002407                        BLT     4$              ;;BRANCH IF YES
 4403  022734  026627  000004  000175        CMP     4(SP),#175      ;;IS IT A SPECIAL CHAR?
 4404  022742  003003                        BGT     4$              ;;BRANCH IF YES
 4405  022744  042766  000040  000004        BIC     #40,4(SP)       ;;MAKE IT UPPER CASE
 4406  022752  000002              4$:       RTI                     ;;GO BACK TO USER
 4407                                ;;*****************************************************************
 4408                                ;*THIS ROUTINE WILL INPUT A STRING FROM THE TTY
 4409                                ;*CALL:
 4410                                ;*      RDLIN                   ;;INPUT A STRING FROM THE TTY
 4411                                ;*      RETURN HERE             ;;ADDRESS OF FIRST CHARACTER WILL BE ON THE STACK
 4412                                ;*                              ;;TERMINATOR WILL BE A BYTE OF ALL 0'S
 4413
 4414  022754  010346              $RDLIN: MOV     R3,-(SP)        ;;SAVE R3
 4415  022756  005046                      CLR     -(SP)           ;;CLEAR THE RUBOUT KEY
 4416  022760  012703  023240        1$:   MOV     #$TTYIN,R3      ;;GET ADDRESS
 4417  022764  022703  023250        2$:   CMP     #$TTYIN+8.,R3   ;;BUFFER FULL?
 4418  022770  101467                      BLOS    4$              ;;BR IF YES
 4419                                ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $RDCHR ROUTINE
 4420                                ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
 4421  022772  013746  177776                MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
 4422  022776  004767  177632                JSR     PC,     $RDCHR  ;GO TO THE SUBROUTINE
 4423  023002  112613                        MOVB    (SP)+,(R3)      ;;GET CHARACTER
 4424  023004  122713  000177        10$:   CMPB    #177,(R3)       ;;IS IT A RUBOUT
 4425  023010  001024                        BNE     5$              ;;BR IF NO
 4426  023012  005716                        TST     (SP)            ;;IS THIS THE FIRST RUBOUT?
 4427  023014  001010                        BNE     6$              ;;BR IF NO
 4428  023016  112767  000134  000212        MOVB    #'\,9$          ;;TYPE A BACK SLASH
 4429  023024  004567  000426                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
 4430  023030  023236                        .WORD   9$              ;ADDRESS OF MESSAGE TO BE TYPED
 4431  023032  012716  177777                MOV     #-1,(SP)        ;;SET THE RUBOUT KEY
 4432  023036  005303                6$:     DEC     R3              ;;BACKUP BY ONE
 4433  023040  020327  023240                CMP     R3,#$TTYIN      ;;STACK EMPTY?
 4434  023044  103441                        BLO     4$              ;;BR IF YES
 4435  023046  111367  000164                MOVB    (R3),9$         ;;SETUP TO TYPEOUT THE DELETED CHAR.
 4436  023052  004567  000400                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
 4437  023056  023236                        .WORD   9$              ;ADDRESS OF MESSAGE TO BE TYPED
 4438  023060  000741                        BR      2$              ;;GO READ ANOTHER CHAR.
 4439  023062  005716                5$:     TST     (SP)            ;;RUBOUT KEY SET?
 4440  023064  001407                        BEQ     7$              ;;BR IF NO
 4441  023066  112767  000134  000142        MOVB    #'\,9$          ;;TYPE A BACK SLASH
 4442  023074  004567  000356                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
 4443  023100  023236                        .WORD   9$              ;ADDRESS OF MESSAGE TO BE TYPED
 4444  023102  005016                        CLR     (SP)            ;;CLEAR THE RUBOUT KEY
 4445  023104  122713  000025        7$:     CMPB    #25,(R3)        ;;IS CHARACTER A CTRL U?
 4446  023110  001004                        BNE     8$              ;;BR IF NO
 4447  023112  004567  000340                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
 4448  023116  023250                        .WORD   $CNTLU          ;ADDRESS OF MESSAGE TO BE TYPED
 4449  023120  000717                        BR      1$              ;;GO START OVER
 4450  023122  122713  000022        8$:     CMPB    #22,(R3)        ;;IS CHARACTER A "^R"?
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4451  023126  001014                          BNE     3$                      ;;BRANCH IF NO
4452  023130  105013                          CLRB    (R3)                    ;;CLEAR THE CHARACTER
4453  023132  004567  000320                  JSR     R5,     $PRINT          ;GO PRINT OUT THE FOLLOWING MESSAGE.
4454  023136  001201                          .WORD   $CRLF                   ;ADDRESS OF MESSAGE TO BE TYPED
4455  023140  004567  000312                  JSR     R5,     $PRINT          ;GO PRINT OUT THE FOLLOWING MESSAGE.
4456  023144  023240                          .WORD   $TTYIN                  ;ADDRESS OF MESSAGE TO BE TYPED
4457  023146  000706                          BR      2$                      ;;GO PICKUP ANOTHER CHACTER
4458  023150                          4$:
4459  023150  004567  000302                  JSR     R5,     $PRINT          ;GO PRINT OUT THE FOLLOWING MESSAGE.
4460  023154  001200                          .WORD   $QUES                   ;ADDRESS OF MESSAGE TO BE TYPED
4461  023156  000700                          BR      1$                      ;;CLEAR THE BUFFER AND LOOP
4462  023160  111367  000052          3$:     MOVB    (R3),9$                 ;;ECHO THE CHARACTER
4463  023164  004567  000266                  JSR     R5,     $PRINT          ;GO PRINT OUT THE FOLLOWING MESSAGE.
4464  023170  023236                          .WORD   9$                      ;ADDRESS OF MESSAGE TO BE TYPED
4465  023172  122723  000015                  CMPB    #15,(R3)+               ;;CHECK FOR RETURN
4466  023176  001272                          BNE     2$                      ;;LOOP IF NOT RETURN
4467  023200  105063  177777                  CLRB    -1(R3)                  ;;CLEAR RETURN (THE 15)
4468  023204  004567  000246                  JSR     R5,     $PRINT          ;GO PRINT OUT THE FOLLOWING MESSAGE.
4469  023210  001202                          .WORD   $LF                     ;ADDRESS OF MESSAGE TO BE TYPED
4470  023212  005726                          TST     (SP)+                   ;;CLEAN RUBOUT KEY FROM THE STACK
4471  023214  012603                          MOV     (SP)+,R3                ;;RESTORE R3
4472  023216  011646                          MOV     (SP),-(SP)              ;;ADJUST THE STACK AND PUT ADDRESS OF THE
4473  023220  016666  000004  000002          MOV     4(SP),2(SP)             ;;      FIRST ASCII CHARACTER ON IT
4474  023226  012766  023240  000004          MOV     #$TTYIN,4(SP)
4475  023234  000002                          RTI                             ;;RETURN
4476  023236     000          9$:     .BYTE   0                               ;;STORAGE FOR ASCII CHAR. TO TYPE
4477  023237     000                  .BYTE   0                               ;;TERMINATOR
4478  023240  000010          $TTYIN: .BLKB   8.                              ;;RESERVE 8 BYTES FOR TTY INPUT
4479  023250  052536  005015  000     $CNTLU: .ASCIZ  /^U/<15><12>            ;;CONTROL "U"
4480  023255     136  006507  000012  $CNTLG: .ASCIZ  /^G/<15><12>            ;;CONTROL "G"
4481  023262  005015  053523  020122  $MSWR:  .ASCIZ  <15><12>/SWR = /
4482  023270  020075     000
4483  023273     040  047040  053505  $MNEW:  .ASCIZ  /  NEW = /
4484  023300  036440  000040
4485                                  .SBTTL  READ AN OCTAL NUMBER FROM THE TTY
4486
4487                                  ;;**************************************************************
4488                                  ;*THIS ROUTINE WILL READ AN OCTAL (ASCII) NUMBER FROM THE TTY AND
4489                                  ;*CHANGE IT TO BINARY.
4490                                  ;*THE INPUT CHARACTERS WILL BE CHECKED TO INSURED THEY ARE LEGAL
4491                                  ;*OCTAL DIGITS. IF AN ILLEGAL CHARACTER IS READ A "?" WILL BE TYPED
4492                                  ;*FOLLOWED BY A CARRIAGE RETURN-LINE FEED. THE COMPLETE NUMBER MUST
4493                                  ;*THEN BE RETYPED. THE INPUT IS TERMINATED BY TYPING A CARRIAGE RETURN.
4494                                  ;*CALL:
4495                                  ;*      RDOCT                           ;;READ AN OCTAL NUMBER
4496                                  ;*      RETURN HERE                     ;;LOW ORDER BITS ARE ON TOP OF THE STACK
4497                                  ;*                                      ;;HIGH ORDER BITS ARE IN $HIOCT
4498
4499  023304  011646          $RDOCT: MOV     (SP),-(SP)              ;;PROVIDE SPACE FOR THE
4500  023306  016666  000004  000002          MOV     4(SP),2(SP)             ;;INPUT NUMBER
4501  023314  010046                          MOV     R0,-(SP)                ;;PUSH R0 ON STACK
4502  023316  010146                          MOV     R1,-(SP)                ;;PUSH R1 ON STACK
4503  023320  010246                          MOV     R2,-(SP)                ;;PUSH R2 ON STACK
4504  023322                          1$:
4505                                  ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $RDLIN ROUTINE
4506                                  ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
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4507  023322  013746  177776                MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4508  023326  004767  177422                JSR     PC,     $RDLIN  ;GO TO THE SUBROUTINE
4509  023332  012600                        MOV     (SP)+,R0        ;;GET ADDRESS OF 1ST CHARACTER
4510  023334  010067  000102                MOV     R0,5$           ;;AND SAVE IT
4511  023340  005001                        CLR     R1              ;;CLEAR DATA WORD
4512  023342  005002                        CLR     R2
4513  023344  112046                2$:     MOVB    (R0)+,-(SP)     ;;PICKUP THIS CHARACTER
4514  023346  001420                        BEQ     3$              ;;IF ZERO GET OUT
4515  023350  122716  000060                CMPB    #'0,(SP)        ;;MAKE SURE THIS CHARACTER
4516  023354  003026                        BGT     4$              ;;IS AN OCTAL DIGIT
4517  023356  122716  000067                CMPB    #'7,(SP)
4518  023362  002423                        BLT     4$
4519  023364  006301                        ASL     R1              ;;*2
4520  023366  006102                        ROL     R2
4521  023370  006301                        ASL     R1              ;;*4
4522  023372  006102                        ROL     R2
4523  023374  006301                        ASL     R1              ;;*8
4524  023376  006102                        ROL     R2
4525  023400  042716  177770                BIC     #^C7,(SP)       ;;STRIP THE ASCII JUNK
4526  023404  062601                        ADD     (SP)+,R1        ;;ADD IN THIS DIGIT
4527  023406  000756                        BR      2$              ;;LOOP
4528  023410  005726                3$:     TST     (SP)+           ;;CLEAN TERMINATOR FROM STACK
4529  023412  010166  000012                MOV     R1,12(SP)       ;;SAVE THE RESULT
4530  023416  010267  000032                MOV     R2,$HIOCT
4531  023422  012602                        MOV     (SP)+,R2        ;;POP STACK INTO R2
4532  023424  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
4533  023426  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
4534  023430  000002                        RTI                     ;;RETURN
4535  023432  005726                4$:     TST     (SP)+           ;;CLEAN PARTIAL FROM STACK
4536  023434  105010                        CLRB    (R0)            ;;SET A TERMINATOR
4537  023436  004567  000014                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4538  023442  000000                5$:     .WORD   0
4539  023444  004567  000006                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4540  023450  001200                        .WORD   $QUES           ;ADDRESS OF MESSAGE TO BE TYPED
4541  023452  000723                        BR      1$              ;;TRY AGAIN
4542  023454  000000                $HIOCT: .WORD   0               ;;HIGH ORDER BITS GO HERE
4543
4544                                        ;;*****************************************************************
4545                                        ;* SUBROUTINE TO PASS RELOCATED MESSAGE ADDRESSES TO THE $TYPE ROUTINE.
4546                                        ;*  CALL:       JSR     R5,     $PRINT
4547                                        ;*              <MESSAGE VIRTUAL ADDRESS>
4548                                        ;*****************************************************************
4549  023456  012567  000016        $PRINT: MOV     (R5)+,  1$      ;GET THE MESSAGE VIRTUAL ADDRESS.
4550  023462  066767  155112  000010        ADD     RELOCF, 1$      ;MAKE IT PHYSICAL.
4551                                        ;*  THE NEXT TWO INSTRUCTIONS PROVIDE AN INTERFACE TO THE $TYPE ROUTINE
4552                                        ;*  WIHTOUT USING A "TRAP" INSTRUCTION AS CALLED FOR BY **SYSMAC**.
4553  023470  013746  177776                MOV     @#PSW,  -(SP)   ;PUT THE PROCESSOR STATUS ON THE STACK
4554  023474  004767  000004                JSR     PC,     $TYPE   ;GO TO THE SUBROUTINE
4555  023500  000000                1$:     .WORD   0               ;CONTAINS THE PHYSICAL MESSAGE ADDRESS.
4556  023502  000205                        RTS     R5              ;RETURN.
4557
4558                                        .SBTTL  TYPE ROUTINE
4559
4560                                        ;;*****************************************************************
4561                                        ;*ROUTINE TO TYPE ASCIZ MESSAGE. MESSAGE MUST TERMINATE WITH A 0 BYTE.
4562                                        ;*THE ROUTINE WILL INSERT A NUMBER OF NULL CHARACTERS AFTER A LINE FEED.
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4563                                    ;*NOTE1:        $NULL CONTAINS THE CHARACTER TO BE USED AS THE FILLER CHARACTER.
4564                                    ;*NOTE2:        $FILLS CONTAINS THE NUMBER OF FILLER CHARACTERS REQUIRED.
4565                                    ;*NOTE3:        $FILLC CONTAINS THE CHARACTER TO FILL AFTER.
4566                                    ;*
4567                                    ;*CALL:
4568                                    ;*1) USING A TRAP INSTRUCTION
4569                                    ;*      TYPE    ,MESADR         ;;MESADR IS FIRST ADDRESS OF AN ASCIZ STRING
4570                                    ;*OR
4571                                    ;*      TYPE
4572                                    ;*      MESADR
4573                                    ;*
4574
4575  023504  105767  155447           $TYPE:  TSTB    $TPFLG          ;;IS THERE A TERMINAL?
4576  023510  100002                          BPL     1$              ;;BR IF YES
4577  023512  000000                          HALT                    ;;HALT HERE IF NO TERMINAL
4578  023514  000430                          BR      3$              ;;LEAVE
4579  023516  010046                  1$:     MOV     R0,-(SP)        ;;SAVE R0
4580  023520  017600  000002                  MOV     @2(SP),R0       ;;GET ADDRESS OF ASCIZ STRING
4581  023524  122767  000001  155472          CMPB    #APTENV,$ENV    ;;RUNNING IN APT MODE
4582  023532  001011                          BNE     62$             ;;NO,GO CHECK FOR APT CONSOLE
4583  023534  132767  000100  155463          BITB    #APTSPOOL,$ENVM ;;SPOOL MESSAGE TO APT
4584  023542  001405                          BEQ     62$             ;;NO,GO CHECK FOR CONSOLE
4585  023544  010067  000004                  MOV     R0,61$          ;;SETUP MESSAGE ADDRESS FOR APT
4586  023550  004767  000222                  JSR     PC,$ATY3        ;;SPOOL MESSAGE TO APT
4587  023554  000000                  61$:    .WORD   0               ;;MESSAGE ADDRESS
4588  023556  132767  000040  155441  62$:    BITB    #APTCSUP,$ENVM  ;;APT CONSOLE SUPPRESSED
4589  023564  001003                          BNE     60$             ;;YES,SKIP TYPE OUT
4590  023566  112046                  2$:     MOVB    (R0)+,-(SP)     ;;PUSH CHARACTER TO BE TYPED ONTO STACK
4591  023570  001005                          BNE     4$              ;;BR IF IT ISN'T THE TERMINATOR
4592  023572  005726                          TST     (SP)+           ;;IF TERMINATOR POP IT OFF THE STACK
4593  023574  012600                  60$:    MOV     (SP)+,R0        ;;RESTORE R0
4594  023576  062716  000002          3$:     ADD     #2,(SP)         ;;ADJUST RETURN PC
4595  023602  000002                          RTI                     ;;RETURN
4596  023604  122716  000011          4$:     CMPB    #HT,(SP)        ;;BRANCH IF <HT>
4597  023610  001431                          BEQ     8$
4598  023612  122716  000200                  CMPB    #CRLF,(SP)      ;;BRANCH IF NOT <CRLF>
4599  023616  001007                          BNE     5$
4600  023620  005726                          TST     (SP)+           ;;POP  <CR><LF> EQUIV
4601  023622  004567  177630                  JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4602  023626  001201                          $CRLF
4603  023630  105067  000130                  CLRB    $CHARCNT        ;;CLEAR CHARACTER COUNT
4604  023634  000754                          BR      2$              ;;GET NEXT CHARACTER
4605  023636  004767  000056          5$:     JSR     PC,$TYPEC       ;;GO TYPE THIS CHARACTER
4606  023642  126726  155310          6$:     CMPB    $FILLC,(SP)+    ;;IS IT TIME FOR FILLER CHARS.?
4607  023646  001347                          BNE     2$              ;;IF NO GO GET NEXT CHAR.
4608  023650  016746  155300                  MOV     $NULL,-(SP)     ;;GET # OF FILLER CHARS. NEEDED
4609                                                                  ;;AND THE NULL CHAR.
4610  023654  105366  000001          7$:     DECB    1(SP)           ;;DOES A NULL NEED TO BE TYPED?
4611  023660  002770                          BLT     6$              ;;BR IF NO--GO POP THE NULL OFF OF STACK
4612  023662  004767  000032                  JSR     PC,$TYPEC       ;;GO TYPE A NULL
4613  023666  105367  000072                  DECB    $CHARCNT        ;;DO NOT COUNT AS A COUNT
4614  023672  000770                          BR      7$              ;;LOOP
4615
4616                                    ;HORIZONTAL TAB PROCESSOR
4617
4618  023674  112716  000040          8$:     MOVB    #' ,(SP)        ;;REPLACE TAB WITH SPACE
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4619  023700  004767  000014          9$:     JSR     PC,$TYPEC       ;;TYPE A SPACE
4620  023704  132767  000007  000052          BITB    #7,$CHARCNT     ;;BRANCH IF NOT AT
4621  023712  001372                          BNE     9$              ;;TAB STOP
4622  023714  005726                          TST     (SP)+           ;;POP SPACE OFF STACK
4623  023716  000723                          BR      2$              ;;GET NEXT CHARACTER
4624  023720  105777  155224          $TYPEC: TSTB    @$TPS           ;;WAIT UNTIL PRINTER IS READY
4625  023724  100375                          BPL     $TYPEC
4626  023726  116677  000002  155216          MOVB    2(SP),@$TPB     ;;LOAD CHAR TO BE TYPED INTO DATA REG.
4627  023734  122766  000015  000002          CMPB    #CR,2(SP)       ;;IS CHARACTER A CARRIAGE RETURN?
4628  023742  001003                          BNE     1$              ;;BRANCH IF NO
4629  023744  105067  000014                  CLRB    $CHARCNT        ;;YES--CLEAR CHARACTER COUNT
4630  023750  000406                          BR      $TYPEX          ;;EXIT
4631  023752  122766  000012  000002  1$:     CMPB    #LF,2(SP)       ;;IS CHARACTER A LINE FEED?
4632  023760  001402                          BEQ     $TYPEX          ;;BRANCH IF YES
4633  023762  105227                          INCB    (PC)+           ;;COUNT THE CHARACTER
4634  023764  000000          $CHARCNT:.WORD  0               ;;CHARACTER COUNT STORAGE
4635  023766  000207          $TYPEX: RTS     PC
4636
4637                          .SBTTL  APT COMMUNICATIONS ROUTINE
4638
4639                          ;;**************************************************************
4640  023770  112767  000001  000376 $ATY1:  MOVB    #1,$FFLG        ;;TO REPORT FATAL ERROR
4641  023776  112767  000001  000366 $ATY3:  MOVB    #1,$MFLG        ;;TO TYPE A MESSAGE
4642  024004  000403                          BR      $ATYC
4643  024006  112767  000001  000360 $ATY4:  MOVB    #1,$FFLG        ;;TO ONLY REPORT FATAL ERROR
4644  024014                          $ATYC:
4645  024014  010046                          MOV     R0,-(SP)        ;;PUSH R0 ON STACK
4646  024016  010146                          MOV     R1,-(SP)        ;;PUSH R1 ON STACK
4647  024020  105767  000346                  TSTB    $MFLG           ;;SHOULD TYPE A MESSAGE?
4648  024024  001450                          BEQ     5$              ;;IF NOT:  BR
4649  024026  122767  000001  155170          CMPB    #APTENV,$ENV    ;;OPERATING UNDER APT?
4650  024034  001031                          BNE     3$              ;;IF NOT:  BR
4651  024036  132767  000100  155161          BITB    #APTSPOOL,$ENVM ;;SHOULD SPOOL MESSAGES?
4652  024044  001425                          BEQ     3$              ;;IF NOT:  BR
4653  024046  017600  000004                  MOV     @4(SP),R0       ;;GET MESSAGE ADDR.
4654  024052  062766  000002  000004          ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
4655  024060  005767  155120          1$:     TST     $MSGTYPE        ;;SEE IF DONE W/ LAST XMISSION?
4656  024064  001375                          BNE     1$              ;;IF NOT:  WAIT
4657  024066  010067  155126                  MOV     R0,$MSGAD       ;;PUT ADDR IN MAILBOX
4658  024072  105720                  2$:     TSTB    (R0)+           ;;FIND END OF MESSAGE
4659  024074  001376                          BNE     2$
4660  024076  166700  155116                  SUB     $MSGAD,R0       ;;SUB START OF MESSAGE
4661  024102  006200                          ASR     R0              ;;GET MESSAGE LNGTH IN WORDS
4662  024104  010067  155112                  MOV     R0,$MSGLGT      ;;PUT LENGTH IN MAILBOX
4663  024110  012767  000004  155066          MOV     #4,$MSGTYPE     ;;TELL APT TO TAKE MSG.
4664  024116  000413                          BR      5$
4665  024120  017667  000004  000016  3$:     MOV     @4(SP),4$       ;;PUT MSG ADDR IN JSR LINKAGE
4666  024126  062766  000002  000004          ADD     #2,4(SP)                ;;BUMP RETURN ADDRESS
4667  024134  016746  153636                  MOV     177776,-(SP)    ;;PUSH 177776 ON STACK
4668  024140  004767  177340                  JSR     PC,$TYPE        ;;CALL TYPE MACRO
4669  024144  000000                  4$:     .WORD   0
4670  024146                          5$:
4671  024146  105767  000221                  TSTB    $LFLG           ;;SHOULD LOG AN ERROR?
4672  024152  001422                          BEQ     10$             ;;IF NOT:  BR
4673  024154  017600  000004                  MOV     @4(SP),R0               ;;GET ERROR #
4674  024160  062766  000002  000004          ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
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4675  024166  012701  001344          MOV     #$ASTAT,R1      ;;POINT TO TABLE START
4676  024172  005711          6$:     TST     (R1)            ;;END OF TABLE?
4677  024174  100404                  BMI     8$              ;;IF SO:  BR
4678  024176  020021                  CMP     R0,(R1)+        ;;PROPER ENTRY?
4679  024200  001406                  BEQ     9$              ;;IF SO:  BR
4680  024202  005721                  TST     (P1)+           ;;MOVE PAST COUNTER WORD
4681  024204  000772                  BR      6$              ;;KEEP LOOKING
4682  024206  026701  155300    8$:     CMP     $APTR,R1        ;;TABLE FULL?
4683  024212  001402                  BEQ     10$             ;;IF SO:  BR -- NO MORE ROOM
4684  024214  010021                  MOV     R0,(R1)+        ;;SET UP NEW ENTRY
4685  024216  005211          9$:     INC     (R1)            ;;BUMP ERROR COUNT
4686  024220  105767  000150  10$:    TSTB    $FFLG           ;;SHOULD REPORT FATAL ERROR?
4687  024224  001416                  BEQ     12$             ;;IF NOT:  BR
4688  024226  005767  154772          TST     $ENV            ;;RUNNING UNDER APT?
4689  024232  001413                  BEQ     12$             ;;IF NOT:  BR
4690  024234  005767  154744  11$:    TST     $MSGTYPE        ;;FINISHED LAST MESSAGE?
4691  024240  001375                  BNE     11$             ;;IF NOT:  WAIT
4692  024242  017667  000004  154736  MOV     @4(SP),$FATAL   ;;GET ERROR #
4693  024250  062766  000002  000004  ADD     #2,4(SP)                ;;BUMP RETURN ADDR.
4694  024256  005267  154722          INC     $MSGTYPE        ;;TELL APT TO TAKE ERROR
4695  024262  105067  000106  12$:    CLRB    $FFLG           ;;CLEAR FATAL FLAG
4696  024266  105067  000101          CLRB    $LFLG           ;;CLEAR LOG FLAG
4697  024272  105067  000074          CLRB    $MFLG           ;;CLEAR MESSAGE FLAG
4698  024276  012601                  MOV     (SP)+,R1        ;;POP STACK INTO R1
4699  024300  012600                  MOV     (SP)+,R0        ;;POP STACK INTO R0
4700  024302  000207                  RTS     PC              ;;RETURN
4701  024304                  $ATY6:
4702  024304  010046                  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
4703  024306  016700  155200          MOV     $APTR,R0
4704  024312  162700  001344          SUB     #$ASTAT,R0      ;;GET SIZE OF STAT TABLE
4705  024316  005767  154662  1$:     TST     $MSGTY          ;;SEE IF DONE LAST COMMUNICATION
4706  024322  001375                  BNE     1$              ;;IF NOT:  WAIT
4707  024324  010067  154672          MOV     R0,$MSGLG       ;;SET MESSAGE LENGTH
4708  024330  012767  001344  154662  MOV     #$ASTAT,$MSGAD  ;;SET MESSAGE ADDR.
4709  024336  012767  000002  154640  MOV     #2,$MSGTY       ;;TELL APT TO TAKE STATS.
4710  024344  012600                  MOV     (SP)+,R0        ;;POP STACK INTO R0
4711  024346  000207                  RTS     PC              ;;RETURN
4712  024350                  $ATY7:
4713  024350  010046                  MOV     R0,-(SP)        ;;PUSH R0 ON STACK
4714  024352  012701  001344          MOV     #$ASTAT,R1      ;;GET START OF TABLE
4715  024356  005721          1$:     TST     (R1)+           ;;END OF TABLE?
4716  024360  100402                  BMI     2$              ;;IF SO:  BR
4717  024362  005021                  CLR     (R1)+           ;;CLEAR ERROR COUNT
4718  024364  000774                  BR      1$              ;;KEEP CLEARING
4719  024366                  2$:
4720  024366  012600                  MOV     (SP)+,R0        ;;POP STACK INTO R0
4721  024370  000207                  RTS     PC              ;;RETURN
4722  024372     000  $MFLG:  .BYTE   0       ;;MESSG. FLAG
4723  024373     000  $LFLG:  .BYTE   0       ;;LOG FLAG
4724  024374     000  $FFLG:  .BYTE   0       ;;FATAL FLAG
4725        024376          .EVEN
4726        000200  APTSIZE=200
4727        000001  APTENV=001
4728        000100  APTSPOOL=100
4729        000040  APTCSUP=040
4730                ;;**************************************************************************
```

```
                                        .SBTTL  CONVERT BINARY TO DECIMAL AND TYPE ROUTINE

                                        ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 5-DIGIT
                                        ;*SIGNED DECIMAL (ASCII) NUMBER AND TYPE IT. DEPENDING ON WHETHER THE
                                        ;*NUMBER IS POSITIVE OR NEGATIVE A SPACE OR A MINUS SIGN WILL BE TYPED
                                        ;*BEFORE THE FIRST DIGIT OF THE NUMBER. LEADING ZEROS WILL ALWAYS BE
                                        ;*REPLACED WITH SPACES.
                                        ;*CALL:
                                        ;*      MOV     NUM,-(SP)       ;;PUT THE BINARY NUMBER ON THE STACK
                                        ;*      TYPDS                   ;;GO TO THE ROUTINE

024376                                  $TYPDS:
024376  010046                                 MOV     R0,-(SP)        ;;PUSH R0 ON STACK
024400  010146                                 MOV     R1,-(SP)        ;;PUSH R1 ON STACK
024402  010246                                 MOV     R2,-(SP)        ;;PUSH R2 ON STACK
024404  010346                                 MOV     R3,-(SP)        ;;PUSH R3 ON STACK
024406  010546                                 MOV     R5,-(SP)        ;;PUSH R5 ON STACK
024410  012746  020200                        MOV     #20200,-(SP)    ;;SET BLANK SWITCH AND SIGN
024414  016605  000020                        MOV     20(SP),R5       ;;GET THE INPUT NUMBER
024420  100004                                BPL     1$              ;;BR IF INPUT IS POS.
024422  005405                                NEG     R5              ;;MAKE THE BINARY NUMBER POS.
024424  112766  000055  000001                MOVB    #'-,1(SP)       ;;MAKE THE ASCII NUMBER NEG.
024432  016700  154142              1$:       MOV     RELOCF, R0      ;GET RELOCATION FACTOR.
024436  012703  024620                        MOV     #$DBLK,R3       ;SETUP THE OUTPUT POINTER
024442  060003                                ADD     R0,     R3      ;ADD IN RELOCATION FACTOR.
024444  112723  000040                        MOVB    #' ,(R3)+       ;;SET THE FIRST CHARACTER TO A BLANK
024450  005002              2$:       CLR     R2              ;;CLEAR THE BCD NUMBER
024452  016001  024610                        MOV     $DTBL(R0),R1    ;;GET THE CONSTANT
024456  160105              3$:       SUB     R1,R5           ;;FORM THIS BCD DIGIT
024460  002402                                BLT     4$              ;;BR IF DONE
024462  005202                                INC     R2              ;;INCREASE THE BCD DIGIT BY 1
024464  000774                                BR      3$
024466  060105              4$:       ADD     R1,R5           ;;ADD BACK THE CONSTANT
024470  005702                                TST     R2              ;;CHECK IF BCD DIGIT=0
024472  001002                                BNE     5$              ;;FALL THROUGH IF 0
024474  105716                                TSTB    (SP)            ;;STILL DOING LEADING 0'S?
024476  100407                                BMI     7$              ;;BR IF YES
024500  106316              5$:       ASLB    (SP)            ;;MSD?
024502  103003                                BCC     6$              ;;BR IF NO
024504  116663  000001  177777                MOVB    1(SP),-1(R3)    ;;YES--SET THE SIGN
024512  052702  000060              6$:       BIS     #'0,R2          ;;MAKE THE BCD DIGIT ASCII
024516  052702  000040              7$:       BIS     #' ,R2          ;;MAKE IT A SPACE IF NOT ALREADY A DIGIT
024522  110223                                MOVB    R2,(R3)+        ;;PUT THIS CHARACTER IN THE OUTPUT BUFFER
024524  005720                                TST     (R0)+           ;;JUST INCREMENTING
024526  020067  155110                        CMP     R0,     .EIGHT  ;CHECK THE TABLE INDEX
024532  103746                                BLO     2$              ;GO DO THE NEXT DIGIT
024534  101002                                BHI     8$              ;;GO TO EXIT
024536  010502                                MOV     R5,R2           ;;GET THE LSD
024540  000764                                BR      6$              ;;GO CHANGE TO ASCII
024542  105726              8$:       TSTB    (SP)+           ;;WAS THE LSD THE FIRST NON-ZERO?
024544  100003                                BPL     9$              ;;BR IF NO
024546  116663  177777  177776                MOVB    -1(SP),-2(R3)   ;;YES--SET THE SIGN FOR TYPING
024554  105013              9$:       CLRB    (R3)            ;;SET THE TERMINATOR
024556  012605                                MOV     (SP)+,R5        ;;POP STACK INTO R5
024560  012603                                MOV     (SP)+,R3        ;;POP STACK INTO R3
```

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4787  024562  012602                        MOV     (SP)+,R2        ;;POP STACK INTO R2
4788  024564  012601                        MOV     (SP)+,R1        ;;POP STACK INTO R1
4789  024566  012600                        MOV     (SP)+,R0        ;;POP STACK INTO R0
4790  024570  004567  176662                JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4791  024574  024620                        .WORD   $DBLK           ;ADDRESS OF MESSAGE TO BE TYPED
4792  024576  016666  000002  000004        MOV     2(SP),4(SP)     ;;ADJUST THE STACK
4793  024604  012616                        MOV     (SP)+,(SP)
4794  024606  000002                        RTI                     ;;RETURN TO USER
4795  024610  023420                $DTBL:  10000.
4796  024612  001750                        1000.
4797  024614  000144                        100.
4798  024616  000012                        10.
4799  024620  000004                $DBLK:  .BLKW   4
4800                                .SBTTL  BINARY TO OCTAL (ASCII) AND TYPE
4801
4802                                ;;*****************************************************************
4803                                ;*THIS ROUTINE IS USED TO CHANGE A 16-BIT BINARY NUMBER TO A 6-DIGIT
4804                                ;*OCTAL (ASCII) NUMBER AND TYPE IT.
4805                                ;*$TYPOS---ENTER HERE TO SETUP SUPPRESS ZEROS AND NUMBER OF DIGITS TO TYPE
4806                                ;*CALL:
4807                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
4808                                ;*      TYPOS                   ;;CALL FOR TYPEOUT
4809                                ;*      .BYTE   N               ;;N=1 TO 6 FOR NUMBER OF DIGITS TO TYPE
4810                                ;*      .BYTE   M               ;;M=1 OR 0
4811                                ;*                                      ;;1=TYPE LEADING ZEROS
4812                                ;*                                      ;;0=SUPPRESS LEADING ZEROS
4813                                ;*
4814                                ;*$TYPON----ENTER HERE TO TYPE OUT WITH THE SAME PARAMETERS AS THE LAST
4815                                ;*$TYPOS OR $TYPOC
4816                                ;*CALL:
4817                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
4818                                ;*      TYPON                   ;;CALL FOR TYPEOUT
4819                                ;*
4820                                ;*$TYPOC---ENTER HERE FOR TYPEOUT OF A 16 BIT NUMBER
4821                                ;*CALL:
4822                                ;*      MOV     NUM,-(SP)       ;;NUMBER TO BE TYPED
4823                                ;*      TYPOC                   ;;CALL FOR TYPEOUT
4824
4825  024630  017646  000000        $TYPOS: MOV     @(SP),-(SP)     ;;PICKUP THE MODE
4826  024634  116667  000001  000213        MOVB    1(SP),$OFILL    ;;LOAD ZERO FILL SWITCH
4827  024642  112667  000211                MOVB    (SP)+,$OMODE+1  ;;NUMBER OF DIGITS TO TYPE
4828  024646  062716  000002                ADD     #2,(SP)         ;;ADJUST RETURN ADDRESS
4829  024652  000406                        BR      $TYPON
4830  024654  112767  000001  000173  $TYPOC: MOVB   #1,$OFILL      ;;SET THE ZERO FILL SWITCH
4831  024662  112767  000006  000167        MOVB    #6,$OMODE+1     ;;SET FOR SIX(6) DIGITS
4832  024670  112767  000005  000156  $TYPON: MOVB   #5,$OCNT       ;;SET THE ITERATION COUNT
4833  024676  010346                        MOV     R3,-(SP)        ;;SAVE R3
4834  024700  010446                        MOV     R4,-(SP)        ;;SAVE R4
4835  024702  010546                        MOV     R5,-(SP)        ;;SAVE R5
4836  024704  116704  000147                MOVB    $OMODE+1,R4     ;;GET THE NUMBER OF DIGITS TO TYPE
4837  024710  005404                        NEG     R4
4838  024712  062704  000006                ADD     #6,R4           ;;SUBTRACT IT FOR MAX. ALLOWED
4839  024716  110467  000134                MOVB    R4,$OMODE       ;;SAVE IT FOR USE
4840  024722  116704  000127                MOVB    $OFILL,R4       ;;GET THE ZERO FILL SWITCH
4841  024726  016605  000012                MOV     12(SP),R5       ;;PICKUP THE INPUT NUMBER
4842  024732  005003                        CLR     R3              ;;CLEAR THE OUTPUT WORD
```

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 4843  024734  006105                1$:     ROL     R5              ;;ROTATE MSB INTO "C"
 4844  024736  000404                        BR      3$              ;;GO DO MSB
 4845  024740  006105                2$:     ROL     R5              ;;FORM THIS DIGIT
 4846  024742  006105                        ROL     R5
 4847  024744  006105                        ROL     R5
 4848  024746  010503                        MOV     R5,R3
 4849  024750  006103                3$:     ROL     R3              ;;GET LSB OF THIS DIGIT
 4850  024752  105367  000100              DECB    $OMODE          ;;TYPE THIS DIGIT?
 4851  024756  100017                        BPL     7$              ;;BR IF NO
 4852  024760  042703  177770              BIC     #177770,R3      ;;GET RID OF JUNK
 4853  024764  001002                        BNE     4$              ;;TEST FOR 0
 4854  024766  005704                        TST     R4              ;;SUPPRESS THIS 0?
 4855  024770  001403                        BEQ     5$              ;;BR IF YES
 4856  024772  005204                4$:     INC     R4              ;;DON'T SUPPRESS ANYMORE 0'S
 4857  024774  052703  000060              BIS     #'0,R3          ;;MAKE THIS DIGIT ASCII
 4858  025000  052703  000040        5$:   BIS     #' ,R3          ;;MAKE ASCII IF NOT ALREADY
 4859  025004  110367  000042              MOVB    R3,8$           ;;SAVE FOR TYPING
 4860  025010  004567  176442              JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
 4861  025014  025052                        .WORD   8$              ;ADDRESS OF MESSAGE TO BE TYPED
 4862  025016  105367  000032        7$:   DECB    $OCNT           ;;COUNT BY 1
 4863  025022  003346                        BGT     2$              ;;BR IF MORE TO DO
 4864  025024  002402                        BLT     6$              ;;BR IF DONE
 4865  025026  005204                        INC     R4              ;;INSURE LAST DIGIT ISN'T A BLANK
 4866  025030  000743                        BR      2$              ;;GO DO THE LAST DIGIT
 4867  025032  012605                6$:     MOV     (SP)+,R5        ;;RESTORE R5
 4868  025034  012604                        MOV     (SP)+,R4        ;;RESTORE R4
 4869  025036  012603                        MOV     (SP)+,R3        ;;RESTORE R3
 4870  025040  016666  000002  000004       MOV     2(SP),4(SP)     ;;SET THE STACK FOR RETURNING
 4871  025046  012616                        MOV     (SP)+,(SP)
 4872  025050  000002                        RTI                     ;;RETURN
 4873  025052     000                8$:     .BYTE   0               ;;STORAGE FOR ASCII DIGIT
 4874  025053     000                        .BYTE   0               ;;TERMINATOR FOR TYPE ROUTINE
 4875  025054     000                $OCNT:  .BYTE   0               ;;OCTAL DIGIT COUNTER
 4876  025055     000                $OFILL: .BYTE   0               ;;ZERO FILL SWITCH
 4877  025056  000000                $OMODE: .WORD   0               ;;NUMBER OF DIGITS TO TYPE
 4878                                ;ERROR TRAP SERVICE ROUTINE
 4879  025060  005727                ERRTRP: TST     (PC)+           ;CHECK IF PREV TRAP TO 4 REPORTED
 4880  025062  000000                1$:     .WORD   0               ;CONTAINS ERROR REPORTED FLAG
 4881  025064  001010                        BNE     2$              ;BRANCH IF NOT REPORTED
 4882  025066  005267  177770              INC     1$              ;SET DOUBLE TRAP FLAG.
 4883  025072  011667  154070              MOV     (SP),   $TMP3   ;SAVE THE BAD PC FOR TYPOUT.
 4884  025076  004767  174502              JSR     PC,     $ERROR  ;*** ERROR *** (GO TYPE A MESSAGE)
 4885  025102  000031                        .WORD   31              ;ERROR TYPE CODE.
 4886  025104  000401                        BR      3$              ;SKIP HALT
 4887  025106  000000                2$:     HALT                    ;ERROR! SECOND TRAP TO 4 OCCURRED
 4888                                                                ;BEFORE FIRST WAS PRINTED
 4889  025110  005067  177746        3$:   CLR     1$
 4890  025114  000002                        RTI                     ;RETURN TO PROGRAM AND TRY TO RECOVER
 4891
 4892                                .SBTTL  PHYSICAL ADDRESS TYPE ROUTINE
 4893                                ;*  ROUTINE TO TYPE A PHYSICAL ADDRESS (18 BITS).
 4894  025116                        $TYPAD:
 4895  025116  010046                        MOV     R0,-(SP)        ;;PUSH R0 ON STACK
 4896  025120  010146                        MOV     R1,-(SP)        ;;PUSH R1 ON STACK
 4897  025122  010246                        MOV     R2,-(SP)        ;;PUSH R2 ON STACK
 4898  025124  010346                        MOV     R3,-(SP)        ;;PUSH R3 ON STACK
```

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4899  025126  016602  000012            MOV     12(SP), R2      ;GET BASE ADDRESS
4900  025132  005003                    CLR     R3              ;WORKING & INDEX REGISTER
4901  025134  005767  153446            TST     MMAVA           ;CHECK FOR MEM MGMT AVAILABLE
4902  025140  001430                    BEQ     1$              ;BRANCH IF NO MEM MGMT
4903  025142  032737  000001  177572    BIT     #1,     @#SR0   ;CHECK IF MEM MGMT ENABLED
4904  025150  001424                    BEQ     1$              ;BRANCH IF MEM MGMT NOT ENABLED
4905  025152  010201                    MOV     R2,     R1      ;COPY VIRTUAL ADR
4906  025154  006101                    ROL     R1              ;SHUFFLE BITS 13,14,15 INTO 1,2,3
4907  025156  006101                    ROL     R1
4908  025160  006101                    ROL     R1
4909  025162  006101                    ROL     R1
4910  025164  006101                    ROL     R1
4911  025166  042701  177761            BIC     #177761, R1     ;CLR ALL EXCEPT BITS 1,2,3
4912  025172  062701  172340            ADD     #KIPAR0, R1     ;SET TO APPROPRIATE PAR
4913  025176  011101                    MOV     (R1),   R1      ;GET CONTENTS OF PAR
4914  025200  012700  000006            MOV     #6,     R0      ;SET UP COUNTER
4915  025204  006301            4$:     ASL     R1              ;SHIFT PAR
4916  025206  006103                    ROL     R3              ;SAVE OVERFLOW BITS
4917  025210  077003                    SOB     R0,     4$      ;COUNT SIX SHIFTS
4918  025212  042702  160000            BIC     #160000, R2     ;SAVE BANK BITS
4919  025216  060102                    ADD     R1,     R2      ;COMPUTE PHYSICAL ADDRESS
4920  025220  005503                    ADC     R3              ;MAKE SURE CARRY ISN'T LOST!
4921  025222  006302            1$:     ASL     R2              ;FIRST DIGIT TO R3
4922  025224  006103                    ROL     R3
4923  025226  012700  000006            MOV     #6,R0           ;DIGIT COUNT
4924  025232  000404                    BR      3$              ;PRINT FIRST DIGIT
4925  025234  006302            2$:     ASL     R2
4926  025236  006103                    ROL     R3
4927  025240  005301                    DEC     R1
4928  025242  001374                    BNE     2$
4929  025244  012701  000003    3$:     MOV     #3,R1           ;DIGIT SHIFT COUNT
4930  025250  062703  000060            ADD     #60,    R3      ;MAKE IT AN ASCII DIGIT
4931  025254  110367  000036            MOVB    R3,     8$      ;LOAD DIGIT INTO MESSAGE
4932  025260  004567  176172            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4933  025264  025316                    .WORD   8$              ;ADDRESS OF MESSAGE TO BE TYPED
4934  025266  005003                    CLR     R3              ;CLEAR INDEX
4935  025270  005300                    DEC     R0              ;DEC DIGIT COUNT
4936  025272  001360                    BNE     2$
4937  025274  012603                    MOV     (SP)+,R3        ;;POP STACK INTO R3
4938  025276  012602                    MOV     (SP)+,R2        ;;POP STACK INTO R2
4939  025300  012601                    MOV     (SP)+,R1        ;;POP STACK INTO R1
4940  025302  012600                    MOV     (SP)+,R0        ;;POP STACK INTO R0
4941  025304  012616                    MOV     (SP)+,  (SP)    ;ADJUST THE STACK TO CLEAR DATA
4942  025306  004567  176144            JSR     R5,     $PRINT  ;GO PRINT OUT THE FOLLOWING MESSAGE.
4943  025312  026751                    .WORD   FILL2           ;ADDRESS OF MESSAGE TO BE TYPED
4944  025314  000207                    RTS     PC              ;RETURN
4945  025316     000            8$:     .BYTE   0               ;ONE DIGIT MESSAGE BUFFER
4946  025317     000                    .BYTE   0               ;MESSAGE TERMINATOR
4947
4948                                    .SBTTL  STANDARD PROGRAM MESSAGES
4949                            ;;*****************************************************************
4950                            ;VARIOUS MESSAGE PRINTOUTS USED THRUOUT
4951                            ;THE PROGRAM
4952                            ;;*****************************************************************
4953  025320  005015  052113  030461    MMAMES: .ASCIZ  <15><12>'KT11 (MEMORY MANAGEMENT) AVAILABLE'
4954  025326  024040  042515  047515
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 4955  025334  054522  046440  047101
 4956  025342  043501  046505  047105
 4957  025350  024524  040440  040526
 4958  025356  046111  041101  042514
 4959  025364     000
 4960  025365     015  046412  046505  MEMMES: .ASCIZ  <15><12>'MEMORY MAP:'
 4961  025372  051117  020131  040515
 4962  025400  035120     000
 4963  025403     015  041012  052131  BYTMES: .ASCIZ  <15><12>'BYTE MEMORY MAP:'
 4964  025410  020105  042515  047515
 4965  025416  054522  046440  050101
 4966  025424  000072
 4967  025426  005015  040520  044522  MTMAP:  .ASCIZ  <15><12>'PARITY MEMORY MAP:'
 4968  025434  054524  046440  046505
 4969  025442  051117  020131  040515
 4970  025450  035120     000
 4971  025453     015  043012  047522  FROM:   .ASCIZ  <15><12>'FROM '
 4972  025460  020115     000
 4973  025463     040  047524  000040  TO:     .ASCIZ  ' TO '
 4974  025470  005015  047111  052523  INSUFF: .ASCIZ  <15><12>'INSUFFICIENT MEMORY...FIRST 16K NOT ALL THERE!'
 4975  025476  043106  041511  042511
 4976  025504  052116  046440  046505
 4977  025512  051117  027131  027056
 4978  025520  044506  051522  020124
 4979  025526  033061  020113  047516
 4980  025534  020124  046101  020114
 4981  025542  044124  051105  020505
 4982  025550     000
 4983  025551     015  047012  020117  MTR:    .ASCIZ  <15><12>'NO PARITY REGISTERS FOUND'
 4984  025556  040520  044522  054524
 4985  025564  051040  043505  051511
 4986  025572  042524  051522  043040
 4987  025600  052517  042116     000
 4988  025605     015  051012  051505  PWRMSG: .ASCIZ  <15><12>'RESTARTING AFTER A POWER FAILURE'<15><12>
 4989  025612  040524  052122  047111
 4990  025620  020107  043101  042524
 4991  025626  020122  020101  047520
 4992  025634  042527  020122  040506
 4993  025642  046111  051125  006505
 4994  025650  000012
 4995  025652  005015  047516  050040  NOPES:  .ASCIZ  <15><12>'NO PARITY ERRORS FOUND ON MEMORY SCAN'<15><12>
 4996  025660  051101  052111  020131
 4997  025666  051105  047522  051522
 4998  025674  043040  052517  042116
 4999  025702  047440  020116  042515
 5000  025710  047515  054522  051440
 5001  025716  040503  006516  000012
 5002  025724  005015  051120  043517  PROREL: .ASCII  <15><12>'PROGRAM NOW RESIDES BACK AT 0 TO 8K'
 5003  025732  040522  020115  047516
 5004  025740  020127  042522  044523
 5005  025746  042504  020123  040502
 5006  025754  045503  040440  020124
 5007  025762  020060  047524  034040
 5008  025770     113
 5009  025771     015  044012  052111          .ASCIZ  <15><12>'HIT CONTINUE FOR NORMAL RUNNING'<15><12>
 5010  025776  041440  047117  044524
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5011  026004  052516  020105  047506
5012  026012  020122  047516  046522
5013  026020  046101  051040  047125
5014  026026  044516  043516  005015
5015  026034     000
5016  026035     015  051012  043505  MX1:    .ASCIZ  <15><12>'REGISTER AT '
5017  026042  051511  042524  020122
5018  026050  052101  000040
5019  026054  041440  047117  051124  MX2:    .ASCIZ  ' CONTROLS '
5020  026062  046117  020123     000
5021  026067     015  041412  051117  MX3:    .ASCIZ  <15><12>'CORE PARITY '
5022  026074  020105  040520  044522
5023  026102  054524  000040
5024  026106  005015  047515  020123  MX4:    .ASCIZ  <15><12>'MOS PARITY '
5025  026114  040520  044522  054524
5026  026122  000040
5027  026124  005015  051515  030461  MX5:    .ASCIZ  <15><12>'MS11-K CSR '
5028  026132  045455  041440  051123
5029  026140  000040
5030  026142  051515  030461  045455  MX6:    .ASCIZ  'MS11-K MEMORY PRESENT!! TO COMPLETELY TEST RUN DZMML...'
5031  026150  046440  046505  051117
5032  026156  020131  051120  051505
5033  026164  047105  020524  020041
5034  026172  047524  041440  046517
5035  026200  046120  052105  046105
5036  026206  020131  042524  052123
5037  026214  051040  047125  042040
5038  026222  046532  046115  027056
5039  026230  000056
5040  026232  005015  047516  046440  NOMEM:  .ASCIZ  <15><12>'NO MEMORY FOUND.'
5041  026240  046505  051117  020131
5042  026246  047506  047125  027104
5043  026254     000
5044  026255     015  005012  044412  FADMES: .ASCII  <15><12><12><12>'INPUT ALL PARAMETERS IN OCTAL.'
5045  026262  050116  052125  040440
5046  026270  046114  050040  051101
5047  026276  046501  052105  051105
5048  026304  020123  047111  047440
5049  026312  052103  046101     056
5050  026317     015  043012  051111          .ASCIZ  <15><12>'FIRST ADDRESS:  '
5051  026324  052123  040440  042104
5052  026332  042522  051523  020072
5053  026340  000040
5054  026342  005015  040514  052123  LADMES: .ASCIZ  <15><12>'LAST ADDRESS:   '
5055  026350  040440  042104  042522
5056  026356  051523  020072  020040
5057  026364     000
5058  026365     015  037412  042101  BADADR: .ASCIZ  <15><12>''?ADDRESS IN UNMAPPED BANK?'
5059  026372  051104  051505  020123
5060  026400  047111  052440  046516
5061  026406  050101  042520  020104
5062  026414  040502  045516  000077
5063  026422  005015  042523  042514  CONST:  .ASCIZ  <15><12>'SELECT CONSTANT:'
5064  026430  052103  040440  047117
5065  026436  052123  047101  035124
5066  026444     000
```

```
5067  026445  015     052412  042516  UNEXPT: .ASCIZ  <15><12>'UNEXPECTED MEMORY PARITY ERROR'
5068  026453  050130  041505  042524
5069  026460  020104  042515  047515
5070  026466  054522  050040  05110.
5071  026474  052111  020131  051105
5072  026502  047522  000122
5073  026506  005015  051120  043517  PRELOC: .ASCIZ  <15><12>'PROGRAM RELOCATED TO '
5074  026514  040522  020115  042522
5075  026522  047514  040503  042524
5076  026530  020104  047524  000040
5077  026536  005015  047515  042522  MTOE:   .ASCIZ  <15><12>'MORE THAN ONE PARITY ERROR FOUND.'
5078  026544  052040  040510  020116
5079  026552  047117  020105  040520
5080  026560  044522  054524  042440
5081  026566  051122  051117  043040
5082  026574  052517  042116  000056
5083  026602  005015  041523  047101  SCANM:  .ASCIZ  <15><12>'SCANNING MEMORY FOR BAD PARITY.'
5084  026610  044516  043516  046440
5085  026616  046505  051117  020131
5086  026624  047506  020122  040502
5087  026632  020104  040520  044522
5088  026640  054524  000056
5089  026644  005015  040520  044522  PEWNC:  .ASCIZ  <15><12>'PARITY ERROR WILL NOT CLEAR.'
5090  026652  054524  042440  051122
5091  026660  051117  053440  046111
5092  026666  020114  047516  020124
5093  026674  046103  040505  027122
5094  026702  000
5095  026703  015     047012  020117  NOMTST: .ASCIZ  <15><12>'NO MEMORY TESTED.'
5096  026710  042515  047515  054522
5097  026716  052040  051505  042524
5098  026724  027104  000
5099  026727  015     051412  044513  SKPMES: .ASCIZ  <15><12>'SKIPPING TEST #'
5100  026734  050120  047111  020107
5101  026742  042524  052123  021440
5102  026750  000
5103  026751  377     000377          FILL2:  .ASCIZ  <377><377>
5104
5105                                  .SBTTL  ERROR REPORTING MESSAGES AND TABLES.
5106                                  ;;*****************************************************************
5107                                  ;* MESSAGE BLOCK FOR ERROR TABLE TYPEOUTS
5108                                  ;;*****************************************************************
5109  026754  040520  044522  054524  DM1:    .ASCIZ  'PARITY REGISTER DATA ERROR.'
5110  026762  051040  043505  051511
5111  026770  042524  020122  040504
5112  026776  040524  042440  051122
5113  027004  051117  000056
5114  027010  042101  051104  051505  DM2:    .ASCIZ  'ADDRESS TEST ERROR(TST1-5).'
5115  027016  020123  042524  052123
5116  027024  042440  051122  051117
5117  027032  052050  052123  026461
5118  027040  024465  000056
5119  027044  047503  051516  040524  DM4:    .ASCIZ  'CONSTANT DATA ERROR(TST6-10).'
5120  027052  052116  042040  052101
5121  027060  020101  051105  047522
5122  027066  024122  051524  033124
```

```
5123  027074  030455  024460  000056
5124  027102  047522  040524  044524  DM5:    .ASCIZ  'ROTATING BIT ERROR(TST11-12).'
5125  027110  043516  041040  052111
5126  027116  042440  051122  051117
5127  027124  052050  052123  030461
5128  027132  030455  024462  000056
5129  027140  047515  020123  042522  DM6:    .ASCIZ  'MOS REFRESH TEST ERROR (TST 30-31).'
5130  027146  051106  051505  020110
5131  027154  042524  052123  042440
5132  027162  051122  051117  024040
5133  027170  051524  020124  030063
5134  027176  031455  024461  000056
5135  027204  020063  047530  020122  DM7:    .ASCIZ  '3 XOR 9 PATTERN ERROR(TST13-16).'
5136  027212  020071  040520  052124
5137  027220  051105  020116  051105
5138  027226  047522  024122  051524
5139  027234  030524  026463  033061
5140  027242  027051     000
5141  027245     115  051101  044103  DM10:   .ASCIZ  "MARCHING 1'S AND 0'S ERROR(TST 27)."
5142  027252  047111  020107  023461
5143  027260  020123  047101  020104
5144  027266  023460  020123  051105
5145  027274  047522  024122  051524
5146  027302  020124  033462  027051
5147  027310     000
5148  027311     120  051101  052111  DM11:   .ASCIZ  'PARITY MEMORY ADDRESS ERROR(TST17).'
5149  027316  020131  042515  047515
5150  027324  054522  040440  042104
5151  027332  042522  051523  042440
5152  027340  051122  051117  052050
5153  027346  052123  033461  027051
5154  027354     000
5155  027355     104  052101  050111  DM12:   .ASCIZ  "DATIP WITH WRONG PARITY DIDN'T TRAP(TST17)."
5156  027362  053440  052111  020110
5157  027370  051127  047117  020107
5158  027376  040520  044522  054524
5159  027404  042040  042111  023516
5160  027412  020124  051124  050101
5161  027420  052050  052123  033461
5162  027426  027051     000
5163  027431     127  047522  043516  DM13:   .ASCIZ  'WRONG PARITY TRAPPED, BUT NO REGISTER SHOWS ERROR FLAG.'
5164  027436  050040  051101  052111
5165  027444  020131  051124  050101
5166  027452  042520  026104  041040
5167  027460  052125  047040  020117
5168  027466  042522  044507  052123
5169  027474  051105  051440  047510
5170  027502  051527  042440  051122
5171  027510  051117  043040  040514
5172  027516  027107     000
5173  027521     120  051101  052111  DM14:   .ASCIZ  'PARITY REGISTER NOT MAPPED AS CONTROLLING THIS ADDRESS(TST17).'
5174  027526  020131  042522  044507
5175  027534  052123  051105  047040
5176  027542  052117  046440  050101
5177  027550  042520  020104  051501
5178  027556  041440  047117  051124
```

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5179  027564  046117  044514  043516
5180  027572  052040  044510  020123
5181  027600  042101  051104  051505
5182  027606  024123  051524  030524
5183  027614  024467  000056
5184  027620  047515  042522  052040  DM16:   .ASCIZ  'MORE THAN ONE REGISTER INDICATED PARITY ERROR.'
5185  027626  040510  020116  047117
5186  027634  020105  042522  044507
5187  027642  052123  051105  044440
5188  027650  042116  041511  052101
5189  027656  042105  050040  051101
5190  027664  052111  020131  051105
5191  027672  047522  027122     000
5192  027677     104  052101  020101  DM17:   .ASCIZ  "DATA SHOULDN'T HAVE CHANGED WHEN PARITY ERROR TRAPPED(TST17)."
5193  027704  044123  052517  042114
5194  027712  023516  020124  040510
5195  027720  042526  041440  040510
5196  027726  043516  042105  053440
5197  027734  042510  020116  040520
5198  027742  044522  054524  042440
5199  027750  051122  051117  052040
5200  027756  040522  050120  042105
5201  027764  052050  052123  033461
5202  027772  027051     000
5203  027775     122  047101  047504  DM20:   .ASCIZ  'RANDOM DATA ERROR(TST20).'
5204  030002  020115  040504  040524
5205  030010  042440  051122  051117
5206  030016  052050  052123  030062
5207  030024  027051     000
5208  030027     111  051516  051124  DM21:   .ASCIZ  'INSTRUCTION EXECUTION ERROR(TST21-26).'
5209  030034  041525  044524  047117
5210  030042  042440  042530  052503
5211  030050  044524  047117  042440
5212  030056  051122  051117  052050
5213  030064  052123  030462  031055
5214  030072  024466  000056
5215  030076  051120  043517  040522  DM23:   .ASCIZ  'PROGRAM CODE CHANGED WHEN RELOCATED.'
5216  030104  020115  047503  042504
5217  030112  041440  040510  043516
5218  030120  042105  053440  042510
5219  030126  020116  042522  047514
5220  030134  040503  042524  027104
5221  030142     000
5222  030143     124  040522  050120  DM24:   .ASCIZ  'TRAPPED, BUT NO REGISTER HAD ERROR BIT SET.'
5223  030150  042105  020054  052502
5224  030156  020124  047516  051040
5225  030164  043505  051511  042524
5226  030172  020122  040510  020104
5227  030200  051105  047522  020122
5228  030206  044502  020124  042523
5229  030214  027124     000
5230  030217     124  040522  050120  DM25:   .ASCIZ  'TRAPPED TO 114.'
5231  030224  042105  052040  020117
5232  030232  030461  027064     000
5233  030237     106  044501  042514  DM26:   .ASCIZ  'FAILED TO TRAP.'
5234  030244  020104  047524  052040
```

```
5235  030252  040522  027120     000
5236  030257     050  041501  044524  DM27:   .ASCIZ  "(ACTION ENABLE WASN'T SET)."
5237  030264  047117  042440  040516
5238  030272  046102  020105  040527
5239  030300  047123  052047  051440
5240  030306  052105  027051     000
5241  030313     015  052012  040522  DM31:   .ASCIZ  <15,<12>'TRAPPED TO 4 '
5242  030320  050120  042105  052040
5243  030326  020117  020064     000
5244
5245                                 ;;*****************************************************************
5246                                 ;DATA COLUMN HEADINGS
5247                                 ;;*****************************************************************
5248
5249  030333     120  004503  042522  DH1:    .ASCIZ  'PC     REG     S/B     WAS'
5250  030340  004507  027523  004502
5251  030346  040527  000123
5252  030352  027526  041520  050011  DH2:    .ASCIZ  'V/PC   P/PC    MA      S/B     WAS'
5253  030360  050057  004503  040515
5254  030366  051411  041057  053411
5255  030374  051501     000
5256  030377     126  050057  004503  DH12:   .ASCIZ  'V/PC   P/PC    MA      S/B'
5257  030404  027520  041520  046411
5258  030412  004501  027523  000102
5259  030420  027526  041520  050011  DH14:   .ASCIZ  'V/PC   P/PC    REG     MA'
5260  030426  050057  004503  042522
5261  030434  004507  040515     000
5262  030441     126  050057  004503  DH15:   .ASCIZ  'V/PC   P/PC    MAUT    REG     S/B     WAS'
5263  030446  027520  041520  046411
5264  030454  052501  004524  042522
5265  030462  004507  027523  004502
5266  030470  040527  000123
5267  030474  027526  041520  050011  DH21:   .ASCIZ  'V/PC   P/PC    IUT     MA      S/B     WAS'
5268  030502  050057  004503  052511
5269  030510  004524  040515  051411
5270  030516  041057  0534'1  051501
5271  030524     000
5272  030525     126  050057  004503  DH23:   .ASCIZ  'V/PC   P/PC    SRC MA  DST MA  S/B     WAS'
5273  030532  027520  041520  051411
5274  030540  041522  046440  004501
5275  030546  051504  020124  040515
5276  030554  051411  041057  053411
5277  030562  051501     000
5278  030565     126  050057  004503  DH24:   .ASCIZ  'V/PC   P/PC    TRP/PC'
5279  030572  027520  041520  052011
5280  030600  050122  050057  000103
5281  030606  027526  041520  050011  DH25:   .ASCIZ  'V/PC   P/PC    TRP/PC  REG     WAS'
5282  030614  050057  004503  051124
5283  030622  027520  041520  051011
5284  030630  043505  053411  051501
5285  030636     000
5286  030637     126  050057  004503  DH26:   .ASCIZ  'V/PC   P/PC    REG     WAS'
5287  030644  027520  041520  051011
5288  030652  043505  053411  051501
5289  030660     000
5290  030661     122  043505  053411  DH30:   .ASCIZ  'REG    WAS     MA      WAS'
```

```
 5291  030666  051501  046411  004501
 5292  030674  040527  000123
 5293
 5294                                  ;;*****************************************************************
 5295                                  ;* DATA FORMAT TABLE FOR ERROR PRINTOUT.
 5296                                  ;;*****************************************************************
 5297  030700      000      377      000  DF1:     .BYTE   0,-1,0,0
 5298  030703      000
 5299  030704      000      377      377  DF2:     .BYTE   0,-1,-1,0,0
 5300  030707      000      000
 5301  030711      000      377      377  DF3:     .BYTE   0,-1,-1,-2,-2
 5302  030714      376      376
 5303  030716      000      377      377  DF14:    .BYTE   0,-1,-1,-1,0,0
 5304  030721      377      000      000
 5305  030724      000      377      000  DF21:    .BYTE   0,-1,0,-1,0,0
 5306  030727      377      000      000
 5307  030732      377      000      377  DF30:    .BYTE   -1,0,-1,-2
 5308  030735      376
 5309                                             .EVEN
 5310
 5311          032110                     . = 32110                    ;THE LOADERS ARE SAVE HERE TO END OF 8K
 5312
 5313          000001                             .END
```

```
ABASE = 000000            384      425
ACDW1 = 000000            384      427
ACDW2 = 000000            384      428
ACPUOP= 000000            384      399
ADDW0 = 000000            384      429
ADDW1 = 000000            384      430
ADDW10= 000000            384      439
ADDW11= 000000            384      440
ADDW12= 000000            384      441
ADDW13= 000000            384      442
ADDW14= 000000            384      443
ADDW15= 000000            384      444
ADDW2 = 000000            384      431
ADDW3 = 000000            384      432
ADDW4 = 000000            384      433
ADDW5 = 000000            384      434
ADDW6 = 000000            384      435
ADDW7 = 000000            384      436
ADDW8 = 000000            384      437
ADDW9 = 000000            384      438
ADEVCT= 000000            384      390
ADEVM = 000000            384      426
AE    = 000001            179*    2426     2512     3740
AENV  = 000000            384      395
AENVM = 000000            384      396
AFATAL= 000000            384      387
AMADR1= 000000            384      412
AMADR2= 000000            384      416
AMADR3= 000000            384      419
AMADR4= 000000            384      422
AMAMS1= 000000            384      406
AMAMS2= 000000            384      414
AMAMS3= 000000            384      417
AMAMS4= 000000            384      420
AMSGAD= 000000            384      392
AMSGLG= 000000            384      393
AMSGTY= 000000            384      386
AMTYP1= 000000            384      407
AMTYP2= 000000            384      415
AMTYP3= 000000            384      418
AMTYP4= 000000            384      421
APASS = 000000            384      389
APRIOR= 000000            384
APTCSU= 000040           4588     4729*
APTENV= 000001           4177     4581     4649     4727*
APTSIZ= 000200            876     4726*
APTSPO= 000100           4583     4651     4728*
ASWREG= 000000            384      397
ATESTN= 000000            384      388
AUNIT = 000000            384      391
AUSWR = 000000            384      398
AVECT1= 000000            384      423
AVECT2= 000000            384      424
BADADR  026365           1439     5058*
BANKNO  016074           1625     1634     1660     1670     3387*
BITPT   001544            522*    1127*    1128*    1164     1165     1166     1167     1175*    1176*    1185     1187     1190     1193*
```

```
                    2402    2404    2460    2462    3138*   3139*   3146    3148    3151*   3152*   3155    3157    3162
                    3163    3182    3185*   3188    3189    3203    3204    3205    3207    3216*   3217*   3221*   3226
                    3228    3249*   3250*   3252    3254    3256    3258    3262    3263    3293*   3295    3297    3300
                    3307    3309    3314    3315    3330    3332    3340*   3341*   3343    3345    3350*   3352    3354
                    3356    3390    3391
BIT0  = 000001       123*     235     251    1032    1206    1362    1373    1463    1484    2449    2478    2494    3138
                    3757    3790    3921    4063
BIT00 = 000001       113*     123
BIT01 = 000002       112*     122
BIT02 = 000004       111*     121
BIT03 = 000010       110*     120
BIT04 = 000020       109*     119
BIT05 = 000040       108*     118
BIT06 = 000100       107*     117
BIT07 = 000200       106*     116
BIT08 = 000400       105*     115    4012
BIT09 = 001000       104*     114    4022    4191
BIT1  = 000002       122*
BIT10 = 002000       103*    4163
BIT11 = 004000       102*    4029
BIT12 = 010000       101*
BIT13 = 020000       100*    3164    3191    3264    3301    4171
BIT14 = 040000        99*     217    3998
BIT15 = 100000        98*    2478    3216    3517
BIT2  = 000004       121*
BIT3  = 000010       120*
BIT4  = 000020       119*
BIT5  = 000040       118*
BIT6  = 000100       117*
BIT7  = 000200       116*
BIT8  = 000400       115*    3221    3550
BIT9  = 001000       114*
BLKMSK  001606       547*    3141    3212    3244    4049*   4054*
BPTVEC= 000014       130*
BYTMES  025403      1026    4963*
CASFLG  001616       551*     930*    933*   1476
CASREG  001620       552*    1478*
CKPMER  017602      1748    2410    3321    3749*
CLRPAR  020234      1126    1201    3794    3865*
CONST   026422      1451    5063*
CR    = 000015        38*    4627    4637
CRLF  = 000200        39*     906    4598    4637
CTRLS   005046      1266    1276*
DDISP = 177570        45*     361     864
DF1     030700       719    5297*
DF14    030716       774     779     784     806     811     816    5303*
DF2     030704       724     734     739     744     749     754     795     821     826    5299*
DF21    030724       800    5305*
DF3     030711       729     759     764     769     790    5301*
DF30    030732       831     836    5307*
DH1     030333       717    5249*
DH12    030377       762     767    5256*
DH14    030420       772     782    5259*
DH15    030441       777    5262*
DH2     030352       722     727     732     737     742     747     752     757     788     793    5252*
DH21    030474       798    5267*
```

```
DH23    030525            804    5272#
DH24    030565            809    5278#
DH25    030606            814    5281#
DH26    030637            819     824    5286#
DH30    030661            829    5290#
DIDBH   012746           2704#
DIDBL   012654           2655#
DIDO    012564           2606#
DIPDO   013044           2754#
DISPLA  001142            361#    864#    872#    881#   3584#   3637#   4044#   4162#
DISPRE  000174            195#    872
DM1     026754            716     776    5109#
DM10    027245            751    5141#
DM11    027311            756    5148#
DM12    027355            761    5155#
DM13    027431            766    5163#
DM14    027521            771    5173#
DM16    027620            781    5184#
DM17    027677            786    5192#
DM2     027010            721     726    5114#
DM20    027775            792    5203#
DM21    030027            797    5208#
DM23    030076            803    5215#
DM24    030143            808    5222#
DM25    030217            813    5230#
DM26    030237            818    5233#
DM27    030257            823    5236#
DM31    030313            833    5241#
DM4     027044            731    5119#
DM5     027102            736    5124#
DM6     027140            741    5129#
DM7     027204            746    5135#
DONE    013752           3031#
DPDBH   013230           2852#
DPDBL   013136           2803#
DSWR  = 177570              44#     360     863
DT1     001646            573#    718
DT12    001674            577#    763     768
DT14    001706            579#    773     783
DT15    001720            581#    778
DT2     001660            575#    723     728     733     738     743     748     753     758     789     794
DT21    001736            584#    799
DT23    001754            587#    805
DT24    001772            590#    810
DT25    002002            592#    815
DT26    002016            594#    820     825
DT30    002030            596#    830
DT31    002042            598#    835
EMTVEC= 000030            133#
ENDINS  021570           4048    4121    4134#
ERRTRP  025060            206     997    1105    3675    4879#
ERRVEC= 000004            126#    205     861     862#    873#    920#    931#    957#    997#   1020#   1030#   1090#   1105#
                         3578#   3631#   3671#   3675#   4003    4004#   4006#   4009#
FADMAP  001570            540#   1414#   1415#   3205    3207    3330    3332    3354    3356   4063#   4090    4091    4099
                         4101
FADMES  026255           1367    5044#
```

```
FADMSK  001566            538#   3358   4124*  4126*
FILL2   026751           4943    5103#
FLAG8K  001557            532#   3197*  3287*  3290*  3308*
FROM    025453           1039    3941   4971#
FSTADR  001562            535#   1350   1448*  3734   4055
GMPR    004046           1006    1086#
GMPRA   004074           1091#   1103
GMPRB   004110           1090    1097#
GMPRC   004116           1095    1099#
GMPRD   004156           1088    1111#
GNS     = ****** U        194     905
HT      = 000011           36#   4596   4637
IMPCHE= 177746            186#   932*
IMPCK   003246            919     920    929#
INITDN  015030           1521    1557   1584   1659   1669   3212#
INITEX  015142           3208    3210   3229   3231#
INITMM  014372           1504    1547   1595   1624   1633   1701   1715   1751   1772   1795   1820   1830   1873
                         1922    1933   1976   2025   2036   2084   2210   2221   2269   2401   2548   2609   2658
                         2707    2757   2806   2855   2899   2951   2970   2983   3003   3016   3138#  3407
INSERT  021070           4046#
INSUFF  025470           1008    4974#
IOTVEC= 000020            131#
KIPAR0= 172340            166#    242    261*   3123*  3544*  3610*  4912
KIPAR1= 172342            167#    267*  3124*  3545*  3611*
KIPAR2= 172344            168#    968    988*   1065*  1174*  1178   2477   3125*  3144*  3150*  3161   3218*  3248*
                         3266    3339*  3371   3526*  3529*  3544   3605*  3799   3800*  3839*  3844*
KIPAR3= 172346            169#   1062   1065   1066*  3126*  3161*  3166*  3266*  3267*  3515*  3518*  3526   3545
                         3606*
KIPAR4= 172350            170#   3127*
KIPAR5= 172352            171#   3128*
KIPAR6= 172354            172#   3129*
KIPAR7= 172356            173#   3130*
KIPDR0= 172300            155#    237   3115*
KIPDR1= 172302            156#   3116*
KIPDR2= 172304            157#   3117*
KIPDR3= 172306            158#   3118*
KIPDR4= 172310            159#   3119*
KIPDR5= 172312            160#   3120*
KIPDR6= 172314            161#   3121*
KIPDR7= 172316            162#   3122*
LADMAP  001602            546#   1442*  1443*  1466*  1467*  3155   3157   3174   3176   3189   3198   3226   3228
                         3240    3242   3256   3258   3275   3277   3297   3307   3309   4097   4098   4099   4101
LADMES  026342           1394    5054#
LADMSK  001600            544#   3159   3178   3200   3260   3279   3299   3311   4129*  4131*
LDDISP  001522            508#    880*
LF      = 000012           37#   4631   4637
LMAD    001520            507#   3649   3660*  3667   3681*
LSTADR  001574            541#   1356*  1406*  1410   1421   1460*  1461*  1462*  1463*  1464   3230   4064   4071
MAMF    017502           1481    2539   3726#
MAMF1   017566           3740#   3742
MAMF2   017600           3727    3729   3735   3744#
MANUAL  005342           1112    1267   1336   1349#  1441
MANUL1  005400           1355    1362#
MANUL2  006002           1357    1458#
MAPMEM  003300            931     945#
MAPRB   004224           1131    1141#
```

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MASK4K= 017777  183*  959   384   1058  1412  1464  3202  3313  3832  4088  4095  4124  4129
MEMMAP  001524  230   509*  946   947   1185  1187  1190  1387  1389  1428  1430  1433  1435
                3522  3524  3533  3535  3555  3560  3802  3804
MEMMES  025365  955   4960*
MMAMES  025320  925   4953*
MMAVA   000606  233   290*  917*  923*  965   986   1017* 1023* 1060  1130  1172  1444  1458
                1482  2474  3142  3214  3245  3337  3368  3513  3603  3652  3661  3797  3837
                4901
MMDOWN  015640  1533  1569  1591  1665  1681  3224  3330*
MMINIT  014244  922   1022  1133  1486  3114*
MMORE   001554  528*  3222* 3223* 3231* 3316  3359
MMUP    015150  1517  1553  1609  1629  1644  1705  1726  1762  1785  1808  1824  1867  1910
                1926  1970  2013  2029  2077  2197  2214  2262  2382  2538  2573  2623  2672
                2722  2771  2820  2870  2952  2976  2996  3009  3029  3240* 3411
MMVEC = 000250  144*
MPAMEM  004164  1107  1126*
MPEND   002074  617*
MPPATS  002050  565   606*
MPRX    002276  563   697*  1086  1102  1106  1169  1241  1254  1265  1281  1327  1335  2394
                3319  3726  3749
MPR0    002076  562   632*  1089  1143  1205  1276  1321  1330
MPR1    002106  636*
MPR10   002216  672*
MPR11   002226  676*
MPR12   002236  680*
MPR13   002246  684*
MPR14   002256  688*  1180  1246  1248  1249  1255  1258*
MPR15   002266  692*  1182  1250  1252  1253  1259  1262*
MPR2    002116  640*
MPR3    002126  644*
MPR4    002136  648*
MPR5    002146  652*
MPR6    002156  656*
MPR7    002166  660*
MPR8    002176  664*
MPR9    002206  668*
MTMAP   025426  1203  4967*
MTOE    026536  3709  5077*
MTR     025551  1109  4983*
MX1     026035  1227  5016*
MX2     026054  1235  5019*
MX3     026067  1211  5021*
MX4     026106  1217  5024*
MX5     026124  1223  5027*
MX6     026142  1264  5030*
NOMEM   026232  3913  5040*
NOMTST  026703  4067  5095*
NOPES   025652  3851  4995*
OEFLG   001560  533*  2421* 2531*
PARVEC= 000114  180*  2435* 2439* 2446* 3580* 3633* 3736* 3737*
PBTRP   012026  564   2446*
PESRV   017374  566   3689*
PEWNC   026644  3826  5089*
PHYADR  016020  1505  1522  1548  1558  1585  1596  3366*
PIRQ  = 177772  43*
PIRQVE= 000240  137*
```

```
PMEMAP  001540   519#  1141*  1142*  1166*  1167*  1248*  1249*  1252*  1253*  2402  2404
PRELOC  026506  3496  5073#
PRGMAP  000602   253   259   274   289#   911*   912*  3036  3038  3042  3507  3539  3547*  3565
                3591*  3600  3640*  3641*  4074  4075
PROREL  025724  5002#
PR0    = 000000    60#
PR1    = 000040    61#
PR2    = 000100    62#
PR3    = 000140    63#
PR4    = 000200    64#
PR5    = 000240    65#
PR6    = 000300    66#
PR7    = 000340    67#
PS     = 177776    40#    41
PSCAN   017710  3715  3763  3768  3779#
PSW    = 177776    41#   899  1232  1371  1398  1455  3083  3952  3960  3994  4117  4138  4157
                4189  4223  4256  4263  4276  4322  4421  4507  4553
PWRMSG  025605   326  4988#
PWRVEC= 000024   132#   295*   296*   305*   311*   323*   324*   856*   857*  3579*  3632*
RADTAB  001622   559#  3585  3624
RANTST  012444  2546#
RELOC   016302  3471#  3541  3570  3607  3617
RELOCF  000600   269   288#   913*  1480  3223  3573*  3577*  3586  3594  3615  3639*  3730  4056
                4227  4248  4250  4550  4754
RELTOP  016424  3048  3507#
RELO    017026   276  3051  3600#
RESCHK  005226  1282  1321#
RESLDR  017234   282  3054  3649#
RESRVD  001516   505#   561  1285*  1289  1294  1299  1307  2479*  2480  2481  2510
RESTAR  000300   201   226#   328   910
RESTOR  000304   202   228#
REST1   000306   227   229#
REST2   000324   231   233#
RESVEC= 000010   127#
ROTATE  016154  1774  1797  3416#
RW     = 000006   176#  3115  3116  3117  3118  3122
SAVLDR  017314   914  3098  3667#
SAVTST  001534   515#  1001*  1002*  1374*  1375*  1416*  1417*  3036  3038  4072  4073
SCANM   026602  3788  5083#
SELECT  002646   199   846#
SELFLG  001556   531#   844*   846*  1354
SETAE   017546  2409  3731  3733  3736#
SETCON  016134  1771  1794  2400  3406#
SKPMES  026727  4111  5099#
SPRNT   020256  1291  1309  1342  2417  3881#
SPRNTA  020344  3891  3895  3900#
SPRNTB  020350  3883  3901#
SPRNTP  020302  2464  2485  2498  2515  3889#
SPRNTQ  020270  3712  3759  3765  3817  3885#
SPRNTO  020306  1302  1527  1563  1675  2440  2456  2524  3887  3890#
SPRNTI  020314  1638  3893#
SPRNT2  020332  1510  1602  1720  1756  1779  1802  1836  1843  1850  1857  1880  1889  1898
                1939  1946  1953  1960  1983  1992  2001  2042  2049  2056  2063  2090  2099
                2108  2115  2124  2133  2140  2149  2158  2165  2174  2183  2227  2234  2241
                2248  2275  2284  2293  2300  2309  2318  2325  2334  2343  2350  2359  2368
                2563  2909  2918  2940  2989  3022  3898#
```

```
SPRNT3  020326            2616    2665    2715    2764    2813    2863    3897#
SR0   = 177572             148#     235     251#    921#   1021#   1484   3131#   3654#   3663#   4903
SR1   = 177574             149#
SR2   = 177576             150#
SR3   = 172516             151#
STACK = 001100              31#     229     270     272     560     854     929     945    1016
START   002640             198     844#
STARTA  002654             232     284     845     847#
STARTI  006060             281    1465    1475#   1479    3049    3100
STKLMT= 177774              42#
SWR     001140             303     316#    360#    852     863#    865     871#    878#    895     918    1018    1087    1730
                          1732    2396    3040    3581    3583#   3634    3636#   3728    3732    3751    3998    4012    4014
                          4022    4029    4058    4163    4171    4184    4191    4303    4348#
SWREG   000176             196#    871     895    4303    4319
SW0   = 000001              95#
SW00  = 000001              85#      95
SW01  = 000002              84#      94
SW02  = 000004              83#      93
SW03  = 000010              82#      92
SW04  = 000020              81#      91
SW05  = 000040              80#      90    4058
SW06  = 000100              79#      89    1087    2396
SW07  = 000200              78#      88    3040
SW08  = 000400              77#      87    1730
SW09  = 001000              76#      86
SW1   = 000002              94#
SW10  = 002000              75#
SW11  = 004000              74#
SW12  = 010000              73#     918    1018
SW13  = 020000              72#
SW14  = 040000              71#
SW15  = 100000              70#
SW2   = 000004              93#
SW3   = 000010              92#
SW4   = 000020              91#
SW5   = 000040              90#    3732
SW6   = 000100              89#    3728    3751
SW7   = 000200              88#
SW8   = 000400              87#
SW9   = 001000              86#
TBITVE= 000014             128#
TEMP    001614             550#    2900#   2949
TIMOUT  003576             203     1016#   1078
TKVEC = 000060             135#
TMAP    004536            1177     1201#
TMPFAD  001564             537#    3209    3334    4055#   4060    4062#   4084    4086#   4087#   4088    4103    4125
TMPLAD  001576             543#    3160#   3179#   3261#   3280#   3283    4071#   4092    4094#   4095    4103    4130
TMPPT   001550             525#    3162#   3163#   3167#   3168#   3170    3172    3174    3176    3188#   3193#   3195    3198
                          3203#   3204#   3240    3242    3262#   3263#   3268#   3269#   3271    3273    3275    3277    3300#
                          3303#   3305    3314#   3315#
TO      025463            1049    1071    3934    4973#
TPVEC = 000064             136#
TRAPVE= 000034             134#
TRTVEC= 000014             129#
TSTMAP  001530             512#    3146    3148    3170    3172    3182    3195    3252    3254    3271    3273    3295    3305
                          3343    3345    3352    4072#   4073#   4074#   4075#   4078    4080#   4081#   4090#   4091#   4097#
```

```
                    4098*   4105    4107
TST1     006142     1483    1485    1497*
TST10    007014     1731    1735    1744*
TST11    007076     1750    1767*
TST12    007162     1790*
TST13    007244     1812*
TST14    007570     1816    1914*
TST15    010120     1918    2017*
TST16    010742     2021    2202*
TST17    011564     2206    2391*
TST2     006266     1543*
TST20    012436     2398    2543*
TST21    012552     2600*
TST22    012642     2604    2649*
TST23    012734     2653    2698*
TST24    013032     2702    2748*
TST25    013124     2752    2797*
TST26    013216     2801    2846*
TST27    013312     2850    2896*
TST3     006362     1580*
TST30    013526     2967*
TST31    013640     3000*
TST32    013760      569    1501    3034*
TST4     006466     1620*
TST5     006556     1655*
TST6     006652     1697*   1737
TST6A    006660     1700*   1738
TST7     006702     1711*   1737
TYPMAP   020356      998    1239    3908*
UNEXPT   026445     3691    5067*
UP     = 000000      175*   3115    3116    3117    3118    3122
WWP      001612      549*   1146    1150    1184*   2425    2432
WWPBYT   011626     2402*
WWPB0    011572     2394*
WWPB1    011666     2411*   2537
WWPB2    011732     2423*   2533
WWPB3    012302     2493    2502*
WWPB4    012372     2443    2459    2528*
WWPB5    012416     2408    2414    2535*
W3X9     016222     1821    1923    2026    2211    3439*
$APTHD   001330      456     462*
$APTR    001512      499*   4682    4703
$ASTAT   001344      472*    499    4671    4675    4701    4704    4708    4714
$ASTEN   001510      498*
$ATYC    024014     4642    4644*
$ATY1    023770     4640*
$ATY3    023776     4586    4641*
$ATY4    024006     4180    4643*
$ATY6    024304     4701*
$ATY7    024350     4712*
$AUTOB   001134      357*    902*   4311    4485
$BASE    001260      425*
$BDADR   001122      352*    587     590     592    3487*   3689*
$BDDAT   001126      354*    573     575     581     584     587     596    3485*   3901*
$BELL    001174      376*   4166    4203
$CDW1    001264      427*
```

```
$CDW2   001256            428#
$CMGAC  023764           4603#  4613#  4620   4629#  4634#
$CMSLB  022330           3995   4139   4158   419C   4303#
$CMTAG  001100            340#   849    850    858
$CR3    =  000000         370#
$CRN    =  000004         370#   371#   372#   373#   374#
$CNTLG  023255           4315   4480#
$CNTLL  023250           4339   4448   4479#
$CPUOP  001232            399#
$CRLF   001201            378#  1000   1244   3057   4175   4203   4213   4238   4244   4299   4352   4454   4479
                         4543  4602   4637
$DBLK   024620           4755  4791   4799#
$DDW0   001270            429#
$DDW1   001272            430#
$DDW10  001314            439#
$DDW11  001316            440#
$DDW12  001320            441#
$DDW13  001322            442#
$DDW14  001324            443#
$DDW15  001326            444#
$DDW2   001274            431#
$DDW3   001276            432#
$DDW4   001300            433#
$DDW5   001302            434#
$DDW6   001304            435#
$DDW7   001306            436#
$DDW8   001310            437#
$DDW9   001312            438#
$DEVCT  001214            390#
$DEVM   001262            426#
$DOAGN  014220           3074   3090   3097   3099#
$DTBL   024610           4759   4795#
$ENDAD  014174            215    886   3092#  4198
$ENDCT  014130            858   3076#
$ENDMG  014224           3079   3101#
$ENULL  014241           3086   3104#
$ENV    001224            395#   893   3046   4177   4581   4649   4688
$ENVM   001225            396#   876   4583   4588   4651
$EOP    014100           3039   3041   3067#
$EOPCT  014122            858#  3073#  3077
$ERFLG  001103            343#  3982   4018   4020   4026#  4136   4160#  4203
$ERMAX  001115            349#  4020   4043#  4138
$ERROR  021604           1292  1303   1310   1317   1511   1528   1564   1603   1639   1676   1721   1757   1780
                         1803  1837   1844   1851   1858   1881   1890   1899   1940   1947   1954   1961   1984
                         1993  2002   2043   2050   2057   2064   2091   2100   2109   2116   2125   2134   2141
                         2150  2159   2166   2175   2184   2228   2235   2242   2249   2276   2285   2294   2301
                         2310  2319   2326   2335   2344   2351   2360   2369   2418   2441   2457   2465   2486
                         2499  2516   2525   2584   2617   2666   2716   2765   2814   2864   2910   2919   2941
                         2990  3023   3488   3700   3713   3760   3766   3818   4154#  4884
$ERRPC  001116            350#   573   575    577    579    581    584    587    590    592    594   4168#  4169#
                         4170  4203   4219   4226
$ERRTB  002340            567    714#
$ERRTY  022030           4173  4211#
$ERTTL  001112            347#  3814#  4167#  4203
$ESCAP  001172            375#  4042#  4194   4196   4233
$ETABL  001224            394#
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$ETEND  001330  445#  468
$FATAL  001206  387#  4692#
$FFLG   024374  4640#  4643#  4686  4695#  4724#
$FILLC  001156  368#  4606  4637
$FILLS  001155  367#  4637
$GDADR  001120  351#  573  575  577  579  581  584  587  596  3486#  3881#  3890#  3893#
                3894#  3898#  3899#
$GDDAT  001124  353#  573  575  577  581  584  587  3484#  3882#  3900#
$GET42  014164  3087#
$GTSWR  022402  900  4316#
$HD     =  000000  12
$HIBTS  001330  463#
$HIOCT  023454  1378  1391  1402  1405#  1407  1418  4530#  4542#
$ICNT   001104  344#  4033#  4034  4036#  4135
$ILLUP  000756  295  311  330#
$INTAG  001135  358#  4353  4485
$ITEMB  001114  348#  4170#  4179  4203  4216
$LF     001202  379#  4203  4469  4479  4543  4637
$LFLG   024373  4671  4696#  4723#
$LPADR  001106  345#  1479#  1480#  1737#  4024#  4040#  4045  4123#  4135
$LPERR  001110  346#  4024  4041#  4135  4193
$MADR1  001236  412#
$MADR2  001242  416#
$MADR3  001246  419#
$MADR4  001252  422#
$MAIL   001204  385#  464  468  875  893  4039  4177  4581
$MAMS1  001234  406#
$MAMS2  001240  414#
$MAMS3  001244  417#
$MAMS4  001250  420#
$MBADR  001332  464#
$MFLG   024372  4641#  4647  4697#  4722#
$MNEW   023273  4325  4483#
$MSGAD  001220  392#  4657#  4660  4708#
$MSGLG  001222  393#  4662#  4707#
$MSGTY  001204  386#  4655  4663#  4690  4694#  4705  4709#
$MSWR   023262  4318  4481#
$MTYP1  001235  407#
$MTYP2  001241  415#
$MTYP3  001245  418#
$MTYP4  001251  421#
$MXCNT  021572  4037  4135#
$NULL   001154  366#  4608  4637
$NWTST= 000001  1488#  1490  1534#  1536  1571#  1573  1611#  1613  1646#  1648  1687#  1689  1690
                1707#  1709  1740#  1742  1764#  1787#  1809#  1911#  2014#  2199#  2383#  2395  2540#
                2575#  2577  2624#  2626  2673#  2675  2723#  2725  2772#  2774  2821#  2823  2872#
                2874  2954#  2956  2997#
$OCNT   025054  4832#  4862#  4875#
$OMODE  025056  4827#  4831#  4836  4839#  4850#  4877#
$OVER   021056  3999  4017  4025  4035  4044#
$PASS   001212  389#  875#  3070#  3071#  3080  3101  4031  4050  4076  4136
$PASTM  001336  866#
$PRINT  023456  325  888  924  954  999  1007  1025  1038  1048  1070  1108  1202  1210
                1216  1222  1226  1234  1243  1263  1366  1393  1438  1450  3056  3078  3085
                3495  3690  3708  3787  3825  3850  3912  3933  3940  4066  4110  4165  4174
                4212  4235  4237  4241  4243  4282  4288  4314  4318  4324  4338  4351  4372
```

```
                    4429    4436    4442    4447    4453    4455    4459    4463    4468    4537    4539    4549#   4601
                    4790    4860    4932    4942
$PWRAD  000752       328#
$PWRDN  000610       295#    323     856
$PWRMG  000746       326#
$PWRUP  000662       305     311#
$QUES   001200       327#    4203    4373    4460    4479    4540    4543    4637
$RDCHR  022634      4386#    4422
$RDLIN  022754      4414#    4508
$RDOCT  023304      1372     1399    1456    4499#
$RDSZ = 000010      4407#
$SAVR6  000762       304#    312     313#    314#    332#
$SCOPE  020574      1498     1544    1581    1621    1656    1698    1712    1745    1768    1791    1813    1915    2018
                    2203     2392    2544    2601    2650    2699    2749    2798    2847    2897    2968    3001    3032
                    3991#
$SETUP= 000130       188#    855     856     858     859     886     890     3069    3992    4155    4187    4198    4298
                    4485
$STUP = 177777       188#
$SVLAD  021022      4007     4038#
$SVPC = 000010       213#    218
$SWR  = 167400         1#      12      17      18      19      20      21      22      23      24     329     374     375
                     376     859    1503    1546    1583    1623    1658    1700    1714    1747    1770    1793    1818
                    1920    2023    2208    2394    2546    2606    2655    2704    2754    2803    2852    2899    2950
                    3003    3064    3069    3083    3100    3101    3983    3984    3985    3986    3998    3998    4010
                    4012    4013    4018    4019    4020    4027    4028    4029    4047    4044    4135    4146    4147
                    4148    4149    4150    4163    4171    4184    4191    4203
$SWREG  001226       397#    878
$SWRMK= 000340         1#      24      25    3987    3988    4014    4015
$TESTN  001210       388#    4039#
$TIMES  001170       279#    374#    3034#   3069#   4027#   4034    4037#   4135
$TKB    001146       363#    4296    4307    4331    4390    4396
$TKS    001144       362#    4296    4305    4328    4355#   4388    4394
$TMP0   001160       370#    579     581     584     592     594     596     3367#   3377#   3379#   3885#   3889#   3897#
$TMP1   001162       371#    592     594     596    3886#
$TMP2   001164       372#    963#    964#    967#    978#   1356    1404
$TMP3   001166       373#    598     953#    969#    975#    977#    979#   1405    4883#
$TN   - 000032         1#      12    1488    1503#   1534    1546#   1571    1583#   1611    1623#   1646    1658#   1687
                    1700#   1707    1709    1714#   1727    1740    1747#   1750    1764    1770#   1787    1793#   1809
                    1812    1818#   1911    1914    1920#   2014    2017    2023#   2199    2202    2208#   2383    2394#
                    2540    2546#   2575    2600    2606#   2624    2649    2655#   2673    2698    2704#   2723    2748
                    2754#   2772    2797    2803#   2821    2846    2852#   2872    2699#   2954    2970#   2997    3003#
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$TPFLG  001157       369#    4575    4637
$TPS    001150       364#    4624    4637
$TSTM   001334       465#
$TSTNM  001102       280#     342#   1736#   3035#   3982    4016    4038#   4039    4044    4052    4114    4136    4162
                    4203
$TTYIN  023240      4416     4417    4433    4456    4474    4478#
$TYPAD  025116      1042     1053    1075    3499    4269    4894#
$TYPDS  024376      3084     4264    4743#
$TYPE   023504      4554     4575#   4668
$TYPEC  023720      4357     4605    4612    4619    4624#   4625
$TYPEX  023766      4630     4632    4635#
$TYPOC  024654      1233     4224    4257    4323    4830#
$TYPON  024670      4829     4832#
$TYPOS  024630      3953     3961    4118    4277    4825#
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$UNITM  001340            467#
$USWR   001230            398#
$VECT1  001254            423#
$VECT2  001256            424#
$VERPC  001514            504#   575    577    579    581    584    587    590    592    594   4226#  4227#
$XTSTR  020620           4001#
$OFILL  025055           4826#  4830#  4840   4876#
$40CAT= ****** U         3998   4173
.       = 032110          190#   194#   205#   213    214#   216#   218#   219#   307    331   339#   380    452
                          453#   455#   457#   534#   697#   853    908   3101   3105   4135  4136   4203   4296
                         4478#  4479   4485   4543   4637   4725#  4799#  5311#
.CONST  001610            548#  1457#  1700   1714
.EIGHT  001642            568#  4776
.ERRTB  001640            567#  4232
.MPPAT  001634            565#  1747
.MPRX   001630            563#  2424   2431   2454   2492   3695   3739   3754   3809   3867
.MPRO   001626            562#  2448
.PBTRP  001632            564#  2435
.PESRV  001636            566#  2439   2446   3736
.RESRV  001624            561#
.STACK  001622            560#  1475
.TST32  001644            569#  4069
.$ASTA= ****** U         4641   4644
.$X     = 001330          452#   457
.3X9    007256           1818#
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F16


```
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CKSWR      1#   3992   4136  4155  4187
CKWD       1#   1300   1508  1525  1600  1636  1673  1718  1754  1777  1800  1834  1841  1848  1855
        1878    1887   1896  1937  1944  1951  1958  1981  1990  1999  2040  2047  2054  2061  2088
        2097    2106   2113  2122  2131  2138  2147  2156  2163  2172  2181  2225  2232  2239  2246
        2273    2282   2291  2298  2307  2316  2323  2332  2341  2348  2357  2366  2483  2513  2561
        2614    2663   2713  2762  2811  2861  2907  2916  2938  2987  3020
CKWD2      1#   1507   1598  1716  1753  1832  1840  1847  1854  1876  1886  1895  1935  1943  1950
        1957    1979   1989  1998  2038  2046  2053  2060  2086  2096  2105  2112  2121  2130  2137
        2146    2155   2162  2171  2180  2223  2231  2238  2245  2271  2281  2290  2297  2306  2315
        2322    2331   2340  2347  2356  2365  2560  2985  3018
COMMEN     1#    138#   838  1469
ENDCOM     1#     12    138#  842  1473
ERROR     32#
ESCAPE     1#    138#
GETPRI     1#    138#
GETSWR     1#    138#   890#
GTSWR      1#    897
LDPDR      1#   3114   3116  3117  3118  3122
MORETA   333#    447
MULT       1#    138#
NEWTST     1#    138#  1488  1534  1571  1611  1646  1687  1707  1740  1764  1787  1809  1911  2014
        2199    2383   2540  2575  2624  2673  2723  2772  2821  2872  2954  2997
POP        1#    138#   316   317  2508  2521  3381  3398  3500  3592  3630  3717  3743  3771  3834
        3844    3852   3872  3964  3971  4531  4698  4699  4710  4719  4785  4937
PRINT      1#    924    954   999  1007  1024  1038  1048  1070  1108  1202  1210  1216  1222  1225
        1234    1366   1392  1438  1449  3055  3495  3690  3708  3787  3825  3850  3912  4066  4109
        4932    4942
PUSH       1#    138#   297   303  2467  2490  3370  3388  3471  3510  3527  3623  3693  3738  3753
        3779    3799   3806  3865  3916  3942  4501  4644  4646  4667  4701  4712  4743  4894
RDCHR      1#   4419
RDDEC      1#
RDLIN      1#   4504
RDOCT      1#   1369   1396  1453
REPORT     1#    138#
RESREG     1#
SAVREG     1#
SCOPE     33#
SCOPEX  3977#   4046
SCOPIN  3977#   3996
SETPRI     1#    138#
SETUP      1#    138#   847
SIMTRP     1#    897   1230  1369  1396  1453  3081  3950  3958  3992  4115  4136  4155  4187  4221
        4254    4261   4274  4320  4419  4505  4551
SKIP       1#    138#  1750
SLASH      1#    138#   621   631
SPACE    138#
STARS      1#    138#   211   220   225   293   309   335   380   383   449   451   458   471   501
         503     554    558   570   572   602   604   935   944  1012  1015  1081  1084  1115  1124
        1135    1139   1196  1199  1270  1274  1316  1319  1359  1361  1488  1496  1534  1542  1571
        1579    1611   1619  1646  1654  1683  1686  1687  1696  1707  1710  1740  1743  1764  1766
        1787    1789   1809  1811  1826  1828  1869  1871  1911  1913  1929  1931  1972  1974  2014
        2016    2031   2033  2079  2081  2199  2201  2216  2218  2264  2266  2383  2390  2540  2542
        2575    2599   2624  2648  2673  2697  2723  2747  2772  2796  2821  2845  2872  2895  2954
        2966    2997   2999  3058  3107  3113  3135  3137  3234  3239  3324  3329  3362  3365  3384
        3386    3403   3405  3413  3415  3436  3438  3468  3470  3504  3506  3597  3599  3644  3648
```

```
            3684    3688    3722    3725    3746    3748    3774    3778    3862    3864    3877    3880    3904    3907    3979
            4142    4203    4295    4298    4378    4407    4487    4544    4548    4560    4639    4730    4802    4949    4952
            5106    5108    5245    5247    5294    5296
SWRSU          1#    138#    859#
SWROR3         1#    2067    2072    2187    2192    2252    2257    2372    2377    3463
SIREGS      1488#    1490    1536    1573    1613    1648    1690
TYPADR         1#    1041    1052    1074    3498    4268
TYPBIN         1#    138#
TYPBN          1#
TYPBYT         1#    4113    4271
TYPDEC         1#    138#    3080    4260
TYPDS          1#    3081    4261
TYPE           1#     325     888     924     954     999    1007    1025    1038    1048    1070    1108    1202    1210    1216
            1222    1226    1234    1366    1393    1438    1450    3056    3078    3085    3495    3690    3708    3787    3825
            3850    3912    3933    3940    4066    4110    4165    4174    4212    4235    4237    4241    4243    4282    4288
            4314    4316    4324    4338    4350    4371    4429    4436    4442    4447    4453    4455    4458    4463    4468
            4537    4539    4601    4790    4860    4932    4942
TYPNAM         1#    138#    882
TYPNUM         1#    138#
TYPOC          1#    1230    4221    4254    4320
TYPOCS         1#    138#    3948    3956
TYPOCT         1#    138#    1229    4219    4253    4319
TYPON          1#
TYPOS          1#    3950    3958    4115    4274
TYPTXT         1#    138#
$CKWD          1#    1301    1341    1509    1526    1562    1601    1637    1674    1719    1755    1778    1801    1835    1842
            1849    1856    1879    1888    1897    1938    1945    1952    1959    1982    1991    2000    2041    2048    2055
            2062    2089    2098    2107    2114    2123    2132    2139    2148    2157    2164    2173    2182    2226    2233
            2240    2247    2274    2283    2292    2299    2308    2317    2324    2333    2342    2349    2358    2367    2416
            2484    2514    2523    2562    2615    2664    2714    2763    2812    2862    2908    2917    2939    2988    3021
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            1933    1976    2025    2036    2084    2210    2221    2269    2401    2548    2609    2658    2707    2757    2806
            2855    2899    2970    2983    3003    3016    3406
$MMDN          1#    1531    1567    1589    1663    1679
$MMUP          1#    1515    1551    1607    1627    1642    1703    1724    1760    1783    1806    1822    1865    1908    1924
            1968    2011    2027    2075    2195    2212    2260    2380    2570    2621    2670    2720    2769    2818    2868
            2974    2994    3007    3027    3409
$$CkWD         1#    1291    1302    1309    1342    1510    1527    1563    1602    1638    1675    1720    1756    1779    1802
            1836    1843    1850    1857    1880    1889    1898    1939    1946    1953    1960    1983    1992    2001    2042
            2049    2056    2063    2090    2099    2108    2115    2124    2133    2140    2149    2158    2165    2174    2183
            2227    2234    2241    2248    2275    2284    2293    2300    2309    2318    2325    2334    2343    2350    2359
            2368    2417    2440    2456    2464    2485    2498    2515    2524    2563    2616    2665    2715    2764    2813
            2863    2909    2918    2940    2989    3022    3711    3759    3764    3816
$$CMRE      333#
$$CMTM      333#     370     371     372     373
$$ESCA         1#    138#
$$NEWT         1#    138#    1488    1534    1571    1611    1646    1687    1707    1740    1764    1787    1809    1911    2014
            2199    2383    2540    2575    2624    2673    2723    2772    2821    2872    2954    2997
$$SETM      875#
$$SKIP         1#    138#    1750
.CHBHD      2954#    2956
.C11        2383#    2385
.DIDBH      2673#    2675
.DIDBL      2624#    2626
.DIDO       2575#    2577
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.DIPDO   2723#   2725
.DPDBH   2821#   2823
.DPDBL   2772#   2774
.EQUAT      1#     28
.ERROR      1#   1292   1303   1310   1343   1511   1528   1564   1603   1639   1676   1721   1757   1780   1803
          1837   1844   1851   1858   1881   1890   1899   1940   1947   1954   1961   1984   1993   2002   2043
          2050   2057   2064   2091   2100   2109   2116   2125   2134   2141   2150   2159   2166   2175   2184
          2228   2235   2242   2249   2276   2285   2294   2301   2310   2319   2326   2335   2344   2351   2360
          2369   2418   2441   2457   2465   2486   2499   2516   2525   2564   2617   2666   2716   2765   2814
          2864   2910   2919   2941   2990   3023   3488   3700   3713   3760   3766   3818   4884
.HEADE      1#      2
.KT11       1#    140
.MARHD   2872#   2874
.SCOPE      1#   1497   1543   1580   1620   1655   1697   1711   1744   1767   1790   1812   1914   2017   2202
          2391   2543   2600   2649   2698   2748   2797   2846   2896   2967   3000   3031
.SETUP      1#    188
.SWRHI      1#     13
.SWRLO      1#     25#
.TM7     1707#   1709
.$ACT1      1#    209
.$APTB      1#    381#
.$APTH      1#    447
.$APTY      1#   4637
.$ASTA      1#    469
.$CATC      1#    188
.$CMTA      1#    333
.$DB2D      1#
.$DB2O      1#
.$DIV       1#
.$EOP       1#   3058
.$ERRO      1#   4140
.$ERRT      1#   4203
.$MULT      1#
.$POWE      1#    291
.$RAND      1#
.$RDDE      1#
.$RDOC      1#   4485
.$READ      1#   4293
.$R2AZ      1#
.$SAVE      1#
.$SB2D      1#
.$SB2O      1#
.$SCOP      1#   3977
.$SIZE      1#
.$SUPR      1#
.$TRAP      1#
.$TYPB      1#
.$TYPD      1#   4730
.$TYPE      1#   4558
.$TYPO      1#   4800
.$4OCA      1#
.1170       1#

. ABS.   032110     000
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```
 ERRORS DETECTED:  0

 CZQMCE.BIN,CZQMCE.LST/CRF/SOL/NL:TOC=CZQMCE.SML,CZQMCE.P11
 RUN-TIME:  22 29 2 SECONDS
 RUN-TIME RATIO: 325/54=5.9
 CORE USED:  39K  (77 PAGES)
```