IDENTIFICATION

Product Code: MAINDEC-08-D11A-D

Product Name: Memory Address Test

Date Created: June 8, 1967

Maintainer: Diagnostic Group

Author: R. Green

1. ABSTRACT

The Memory Address Test checks for proper memory address selection on the PDP-8.

2. REQUIREMENTS

2.1 Equipment

Standard PDP-8 Computer.

2.2 Storage

The low version occupies locations 0000-0175. The high version occupies locations 7400-7575. The binary loader must be stored in the last memory page.

2.3 Preliminary Programs

It is assumed that the only malfunction is in the memory addressing circuits.

3. LOADING PROCEDURE

The program is supplied in RIM format.

4. STARTING PROCEDURE

4.1 Control Switch Settings

SR0 Halt after error printout.

4.2 Starting Addresses

0000 Low Storage
7400 High Storage

4.3 Operator Action

a. Load the starting address into the program counter.
b. Set the SWITCH REGISTER to 4000, if halt on error is desired.
c. Push START.

5. OPERATING PROCEDURE

Same as section 4.

6. ERRORS

6.1 Error Printouts

Axxxx Cyyyy (Error printout format)

Axxxx. (Address). xxxx = Address containing the wrong data

Cyyyy. (Contents). yyyy = Contents of location xxxx.

The address should always equal the contents.

6.2 Error Recovery

Analysis of several error printouts should establish a meaningful pattern that will single out a particular address selector card.

If it is necessary to scope the problem, the following two instruction loop may be entered into memory by the operator.

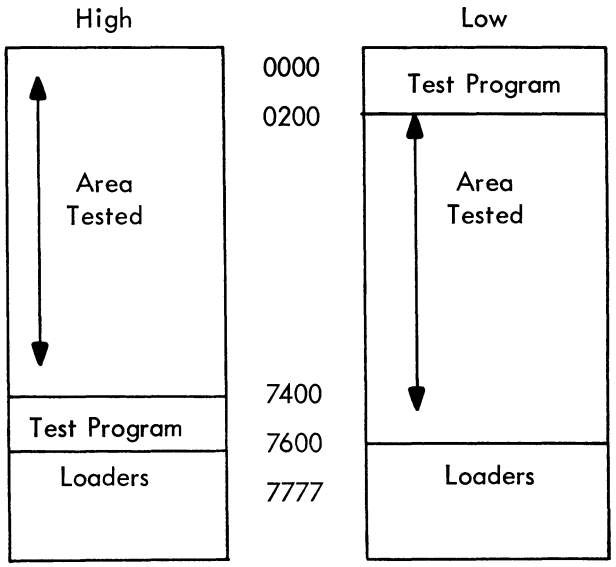
```
TAD [Bad Location]
JMP .-1
```

7. MISCELLANEOUS

7.1 Execution Time

An 11 is printed after every 96 complete program loops (every 28 seconds).

7.2 Memory Maps



8. PROGRAM DESCRIPTION

The program consists of four phases which occur in the following sequence.

Phase 1	Load memory sequentially in the forward direction, starting with the lowest address to be tested.
Phase 2	Read and check memory in the same manner as it was loaded in phase 1.
Phase 3	Load memory sequentially in the reverse direction, starting with the highest address to be tested.
Phase 4	Read and check memory in the same manner as it was loaded in phase 3.

In the load phases the contents of every location to be tested is set equal to its address. If the contents of an address are wrong, the contents specify the address which was in the MA register when the failure occurred. The address whose contents are wrong is the address that was selected in error.

Sample error printout:

A2560 C2760

Explanation - While attempting to write a 2760 into location 2760, the data was written into location 2560.

```
                    /PDP-8 MEMORY ADDRESS TEST (LOW, PAGE 0)
      0000          *0

                    /LOAD MEMORY FORWARD DIRECTION

0000  1075          LOADUP, TAD LIMLO
0001  3073                  DCA ADRES               /SET TEST AREA STARTING ADDRESS
0002  1076                  TAD M7410
0003  3103                  DCA CTR
0004  1073                  TAD ADRES
0005  3473                  DCA I ADRES       /DEPOSIT ADDRESS IN CONTENTS
0006  2073                  ISZ ADRES
0007  2103                  ISZ CTR
0010  5004                  JMP LOADUP+4
0011  1075                  TAD LIMLO
0012  3073                  DCA ADRES
0013  1076                  TAD M7410
0014  3103                  DCA CTR

0015  1473          MEMLUP, TAD I ADRES       /GET CONTENTS FORWARD DIRECTION
0016  7041                  CIA
0017  1073                  TAD ADRES                 /GET ADDRESS
0020  7440                  SZA               /SKIP IF EQUAL
0021  4116                  JMS ERROR                 /CONTENTS NOT SAME AS ADDRESS
0022  2073                  ISZ ADRES                 /SELECT NEXT ADDRESS
0023  2103                  ISZ CTR           /SKIP IF END TEST AREA
0024  5015                  JMP MEMLUP

                    /LOAD MEMORY REVERSE DIRECTION
0025  1074          LOADWN, TAD LIMHI
0026  3073                  DCA ADRES               /SET TEST AREA ENDING ADDRESS
0027  1076                  TAD M7410
0030  3103                  DCA CTR
0031  1073                  TAD ADRES
0032  3473                  DCA I ADRES       /DEPOSIT ADDRESS IN CONTENTS
0033  7240                  CLA CMA           /AC=-1
0034  1073                  TAD ADRES                 /AC=(ADRES)-1
0035  3073                  DCA ADRES                 /DECREMENT ADDRESS
0036  2103                  ISZ CTR           /SKIP WHEN LOWER LIMIT REACHED
0037  5031                  JMP LOADWN+4
0040  1076                  TAD M7410
0041  3103                  DCA CTR
```

```
                        /SEQUENTIAL LOCATION TEST (DOWN)
0042  1074      LOOP2,  TAD LIMHI
0043  3073              DCA ADRES               /SET STARTING ADDRESS
0044  1473              TAD I ADRES     /GET CONTENTS
0045  7041              CIA
0046  1073              TAD ADRES               /GET ADDRESS
0047  7440              SZA             /SKIP IF EQUAL
0050  4116              JMS ERROR               /CONTENTS NOT SAME AS ADDRESS
0051  7240              CLA CMA         /AC=-1
0052  1073              TAD ADRES               /AC=(ADRES)-1
0053  3073              DCA ADRES               /SELECT NEXT ADDRESS
0054  2103              ISZ CTR         /SKIP IF END TEST AREA
0055  5044              JMP LOOP2+2
0056  2077              ISZ COUNT
0057  5000              JMP LOADUP
0060  1100              TAD RESTOR
0061  3077              DCA COUNT
0062  1111              TAD CR
0063  4144              JMS PRINT
0064  1112              TAD LF
0065  4144              JMS PRINT
0066  1101              TAD K261
0067  4144              JMS PRINT
0070  1101              TAD K261
0071  4144              JMS PRINT
0072  5000              JMP LOADUP

                        /CONSTANTS AND VARIABLES
0073  0000      ADRES,  0
0074  7610      LIMHI,  7610
0075  0200      LIMLO,  200
0076  0370      M7410,  -7410

0077  7640      COUNT,  -140
0100  7640      RESTOR, -140
0101  0261      K261,   261
0102  7774      M4,     -4
0103  0000      CTR,    0
0104  0007      MSK7,   7
0105  0260      TW6,    260
0106  0000      STOR,   0
0107  7004      NUM,    RAL
0110  0000      CONT,   0
0111  0215      CR,     215
0112  0212      LF,     212
0113  0240      SPACE,  240
0114  0301      A,      301
0115  0303      C,      303
```

```
                        /ERROR ROUTINE
0116  0000      ERROR,  0
0117  7041              CIA             /RESTORE CONTENTS
0120  1073              TAD ADRES               /OF FAILING ADDRESS
0121  3110              DCA CONT                /PUT RESULT IN CONT

                        /ERROR MESSAGE
0122  1111      MESG,   TAD CR
0123  4144              JMS PRINT
0124  1112              TAD LF
0125  4144              JMS PRINT
0126  1114              TAD A
0127  4144              JMS PRINT
0130  1073              TAD ADRES
0131  4152              JMS TYPAC
0132  1113              TAD SPACE
0133  4144              JMS PRINT
0134  1115              TAD C
0135  4144              JMS PRINT
0136  1110              TAD CONT
0137  4152              JMS TYPAC
0140  7604              LAS
0141  7710              SPA CLA
0142  7402              HLT             /HALT ON ERROR (SR0)
0143  5516              JMP I ERROR

0144  0000      PRINT,  0
0145  6046              TLS
0146  6041              TSF
0147  5146              JMP .-1
0150  7200              CLA
0151  5544              JMP I PRINT
```

```
                        /TYPE (AC) IN OCTAL

0152  0000        TYPAC,  0
0153  3106                DCA STOR
0154  1162                TAD BACK+1
0155  3163                DCA BACK+2
0156  1102                TAD M4
0157  3103                DCA CTR
0160  7100                CLL
0161  1106        BACK,   TAD STOR
0162  7006                RTL
0163  7006                RTL
0164  3106                DCA STOR
0165  1106                TAD STOR
0166  0104                AND MSK7
0167  1105                TAD TW6
0170  4144                JMS PRINT
0171  1107                TAD NUM
0172  3163                DCA BACK+2
0173  2103                ISZ CTR
0174  5161                JMP BACK
0175  5552                JMP I TYPAC

$
```

THERE ARE NO ERRORS

SYMBOL TABLE

A	0114
ADRES	0073
BACK	0161
C	0115
CONT	0110
COUNT	0077
CR	0111
CTR	0103
ERROR	0116
K261	0101
LF	0112
LIMHI	0074
LIMLO	0075
LOADUP	0000
LOADWN	0025
LOOP2	0042
MEMLUP	0015
MESG	0122
MSK7	0104
M4	0102
M/410	0076
NUM	0107
PRINT	0144
RESTOR	0100
SPACE	0113
STOR	0106
TW6	0105
TYPAC	0152

SYMBOL TABLE

LOADUP	0000
MEMLUP	0015
LOADWN	0025
LOOP2	0042
ADRES	0073
LIMHI	0074
LIMLO	0075
M7410	0076
COUNT	0077
RESTOR	0100
K261	0101
M4	0102
CTR	0103
MSK7	0104
TW6	0105
STOR	0106
NUM	0107
CONT	0110
CR	0111
LF	0112
SPACE	0113
A	0114
C	0115
ERROR	0116
MESG	0122
PRINT	0144
TYPAC	0152
BACK	0161

```
                    /PDP-8 MEMORY ADDRESS TEST (HIGH, PAGE 30)
      7400          *7400

                    /LOAD MEMORY FORWARD DIRECTION

7400  1275          LOADUP, TAD LIMLO
7401  3273                  DCA ADRES               /SET TEST AREA STARTING ADDRESS
7402  1276                  TAD M7400
7403  3303                  DCA CTR
7404  1273                  TAD ADRES
7405  3673                  DCA I ADRES     /DEPOSIT ADDRESS IN CONTENTS
7406  2273                  ISZ ADRES
7407  2303                  ISZ CTR
7410  5204                  JMP LOADUP+4
7411  1275                  TAD LIMLO
7412  3273                  DCA ADRES
7413  1276                  TAD M7400
7414  3303                  DCA CTR

7415  1673          MEMLUP, TAD I ADRES     /GET CONTENTS FORWARD DIRECTION
7416  7041                  CIA
7417  1273                  TAD ADRES               /GET ADDRESS
7420  7440                  SZA             /SKIP IF EQUAL
7421  4316                  JMS ERROR               /CONTENTS NOT SAME AS ADDRESS
7422  2273                  ISZ ADRES               /SELECT NEXT ADDRESS
7423  2303                  ISZ CTR         /SKIP IF END TEST AREA
7424  5215                  JMP MEMLUP

                    /LOAD MEMORY REVERSE DIRECTION
7425  1274          LOADWN, TAD LIMHI
7426  3273                  DCA ADRES               /SET TEST AREA ENDING ADDRESS
7427  1276                  TAD M7400
7430  3303                  DCA CTR
7431  1273                  TAD ADRES
7432  3673                  DCA I ADRES     /DEPOSIT ADDRESS IN CONTENTS
7433  7240                  CLA CMA         /AC=-1
7434  1273                  TAD ADRES               /AC=(ADRES)-1
7435  3273                  DCA ADRES               /DECREMENT ADDRESS
7436  2303                  ISZ CTR         /SKIP WHEN LOWER LIMIT REACHED
7437  5231                  JMP LOADWN+4
7440  1276                  TAD M7400
7441  3303                  DCA CTR
```

```
                        /SEQUENTIAL LOCATION TEST (DOWN)
7442  1274      LOOP2,  TAD LIMHI
7443  3273              DCA ADRES               /SET STARTING ADDRESS
7444  1673              TAD I ADRES     /GET CONTENTS
7445  7041              CIA
7446  1273              TAD ADRES               /GET ADDRESS
7447  7440              SZA             /SKIP IF EQUAL
7450  4316              JMS ERROR               /CONTENTS NOT SAME AS ADDRESS
7451  7240              CLA CMA         /AC=-1
7452  1273              TAD ADRES               /AC=(ADRES)-1
7453  3273              DCA ADRES               /SELECT NEXT ADDRESS
7454  2303              ISZ CTR         /SKIP IF END TEST AREA
7455  5244              JMP LOOP2+2
7456  2277              ISZ COUNT
7457  5200              JMP LOADUP
7460  1300              TAD RESTOR
7461  3277              DCA COUNT
7462  1311              TAD CR
7463  4344              JMS PRINT
7464  1312              TAD LF
7465  4344              JMS PRINT
7466  1301              TAD K261
7467  4344              JMS PRINT
7470  1301              TAD K261
7471  4344              JMS PRINT
7472  5200              JMP LOADUP

                        /CONSTANTS AND VARIABLES
7473  0000      ADRES,  0
7474  7377      LIMHI,  7377
7475  0000      LIMLQ,  0
7476  0400      M7400,  -7400

7477  7640      COUNT,  -140
7500  7640      RESTOR, -140
7501  0261      K261,   261
7502  7774      M4,     -4
7503  0000      CTR,    0
7504  0007      MSK7,   7
7505  0260      TW6,    260
7506  0000      STOR,   0
7507  7004      NUM,    RAL
7510  0000      CONT,   0
7511  0215      CR,     215
7512  0212      LF,     212
7513  0240      SPACE,  240
7514  0301      A,      301
7515  0303      C,      303
```

```
                        /ERROR ROUTINE
7516  0000      ERROR,  0
7517  7041              CIA             /RESTORE CONTENTS
7520  1273              TAD ADRES               /OF FAILING ADDRESS
7521  3310              DCA CONT                /PUT RESULT IN CONT

                        /ERROR MESSAGE
7522  1311      MESG,   TAD CR
7523  4344              JMS PRINT
7524  1312              TAD LF
7525  4344              JMS PRINT
7526  1314              TAD A
7527  4344              JMS PRINT
7530  1273              TAD ADRES
7531  4352              JMS TYPAC
7532  1313              TAD SPACE
7533  4344              JMS PRINT
7534  1315              TAD C
7535  4344              JMS PRINT
7536  1310              TAD CONT
7537  4352              JMS TYPAC
7540  7604              LAS
7541  7710              SPA CLA
7542  7402              HLT             /HALT ON ERROR (SR0)
7543  5716              JMP I ERROR

7544  0000      PRINT,  0
7545  6046              TLS
7546  6041              TSF
7547  5346              JMP .-1
7550  7200              CLA
7551  5744              JMP I PRINT
```

```
                        /TYPE (AC) IN OCTAL

7552  0000          TYPAC,  0
7553  3306                  DCA STOR
7554  1362                  TAD BACK+1
7555  3363                  DCA BACK+2
7556  1302                  TAD M4
7557  3303                  DCA CTR
7560  7100                  CLL
7561  1306          BACK,   TAD STOR
7562  7006                  RTL
7563  7006                  RTL
7564  3306                  DCA STOR
7565  1306                  TAD STOR
7566  0304                  AND MSK/
7567  1305                  TAD TW6
7570  4344                  JMS PRINT
7571  1307                  TAD NUM
7572  3363                  DCA BACK+2
7573  2303                  ISZ CTR
7574  5361                  JMP BACK
7575  5752                  JMP I TYPAC

                        $
```

THERE ARE NO ERRORS

SYMBOL TABLE

A	7514
ADRES	7473
BACK	7561
C	7515
CONT	7510
COUNT	7477
CR	7511
CTR	7503
ERROR	7516
K261	7501
LF	7512
LIMHI	7474
LIMLO	7475
LOADUP	7400
LOADWN	7425
LOOP2	7442
MEMLUP	7415
MESG	7522
MSK7	7504
M4	7502
M7400	7476
NUM	7507
PRINT	7544
RESTOR	7500
SPACE	7513
STOR	7506
TW6	7505
TYPAC	7552

SYMBOL TABLE

LOADUP	7400
MEMLUP	7415
LOADWN	7425
LOOP2	7442
ADRES	7473
LIMHI	7474
LIMLO	7475
M7400	7476
COUNT	7477
RESTOR	7500
K261	7501
M4	7502
CTR	7503
MSK7	7504
TW6	7505
STOR	7506
NUM	7507
CONT	7510
CR	7511
LF	7512
SPACE	7513
A	7514
C	7515
ERROR	7516
MESG	7522
PRINT	7544
TYPAC	7552
BACK	7561