IDENTIFICATION

Product Code:	MAINDEC-08-DO5B-D
Product Name:	Random JMP-JMS Test
Date Created:	December 28, 1967
Maintainer:	Diagnostic Group
Author:	R. Green

1. ABSTRACT

This is a diagnostic program to test the JMS instruction of the PDP-8. Random FROM and TO addresses are selected for each test. The JMP instruction is tested in that each test requires a JMP to reach the JMS.

2. REQUIREMENTS

2.1 Equipment

PDP-8 equipped with Teletype.

2.2 Storage

Locations 0000 - 0574

The Binary Loader must be stored in the last memory page.

2.3 Preliminary Programs

It is assumed that MAINDEC 08-D01(n), 08-D02(n), 08-D03(n), and 08-D04(n) have been run successfully.

3. LOADING PROCEDURE

3.1 Method

Use the standard Binary Loader

4. STARTING PROCEDURE

4.1 Control Switch Settings

SR0	Halt on error.
SR2	Hold the FROM address constant (1).
	Select random FROM addresses (0).
SR3	Hold the TO address constant (1).
	Select random TO addresses (0).

4.2 Starting Address

0200

Restart Address - 0215

4.3 Operator Action

a. Set SR to 0200 and press LOAD ADDRESS.

b. If it is desired to set either SR2 or SR3, the FROM or TO address may be specified by entering the address into the locations shown below.

FROM = Location 130

TO = Location 126

If SR2 or SR3 is set after the program has been started, the last address taken from the random number generator is used repeatedly.

c. Push START.

5. OPERATING PROCEDURE

Same as section 4.

6. ERRORS

6.1 Error Halts

All unused memory locations are loaded with HLT instructions. If the program executes one of these background HLTs, it is probable that the interrupt failed to occur following the JMS instruction. The FROM and TO address may be checked at any time to locate the test JMS instructions.

6.2 Error Printouts

F xxxx TO yyyy

(TO) = mmmm

(nnnn) = rrrr

6.2.1 Explanation

(FROM) F xxxx: xxxx = address of JMS instruction being tested.

(TO) TO yyyy: yyyy = address that the JMS instruction is going to.

(TO) = mmmm; mmmm = the contents of the address TO. This should equal xxxx + 1.

(nnnn) = rrrr: nnnn is the address minus one that was stored in location 0000 during the interrupt. rrrr is the content of address nnnn.

6.2.2 Examples

a. The following is a forced error printout where no error occurred.

F 5236 TO 6354
(TO) = 5237
(6354) = 5237

The test JMS instruction was in location 5236. The JMS was trying to jump to location 6354. The contents of TO (location 6354) was 5237. This is correct since the PC is stored on a JMS instruction.

To gain any knowledge from the third line of the printout, the user must understand the sequence of events when a JMS instruction is followed by an interrupt. As an end result of this sequence, the address of the location following the cell where the PC is stored is placed into cell 0. To derive this third line of the printout, the address in cell 0 is decremented by one and printed on the Teletype; then the contents of that address are printed.

b. The following is a typical error printout.

F 5236 TO 6354
(TO) = 7402
(4354) = 5237

Line 1 is simply a statement of the problem. Line 2 says that the contents of location 6354 are not 5237 as they should be, but are 7402 instead. 7402 is a HLT instruction. Since memory is filled with a background of HLT orders, it is evident that the PC was not stored in location 6354 during the JMS.

Line 3 of the printout reveals where the PC was stored. Since on the interrupt 4355 was stored in location zero and (4354) contains the correctly stored PC, 5237, it is apparent that a jump error occurred. The JMS instruction should have jumped to 6354, but it actually jumped to 4354. Bit 1 was lost.

c. The following is another typical error printout.

F 5236 TO 6354
(TO) = 7237
(6354) = 7237

Line 1 is again simply a statement of the problem. Line 2 says that the contents of location 6354 are not 5237 as expected, but are instead 7237. Since the contents are not a HLT order, 7402, it is evident that the PC was stored here, but the number stored was wrong. Comparing the good (5237), and the bad (7237), it is apparent that bit 1 was "picked up" during the store PC operation of the JMS instruction.

6.3 Error Recovery

The program continues testing following an error printout. When enough information has been gathered from the error printouts, a FROM and TO address is selected for use in the scope mode loop. Enter the chosen addresses into proper locations (see section 4.3.b). Enter 5531 into location 1 and restart the program with SR2 and SR3 set.

The scope mode loop is:

Location	Coding
0000	
0001	JMP 1 FROM 1
xxxx	A, ION
xxxx	JMS 1 TO
0131	FROM 1 A

To discontinue the scope mode loop, restore the original contents (7200) of location 1 and restart.

7. RESTRICTIONS

(None)

8. MISCELLANEOUS

8.1 Execution Time

4,726 random tests/second

9. PROGRAM DESCRIPTION

The JMS instruction is checked through use of the interrupt function. A random number generator selects a FROM and a TO address. An ION instruction is then placed at FROM -1 and the JMS instruction at FROM. The program jumps to the address specified by TO. After executing the ION and JMS instructions, an interrupt occurs starting the program counter at location 1. A checking routine located here verifies that the operation was successful before starting the next test.

Random addresses are restricted as follows: 0600 < random address < 7600.

The area between 0600 and 7600 is filled with HLT instructions in case the interrupt fails.

"05" is printed after every 61,000 tests.

```
                0200            *200
                                /RANDOM JMP-JMS TEST
                                /SR0=HALT ON ERROR
                                /SR2=FIXED FROM
                                /SR3=FIXED TO
                                /SPREAD HALTS THROUGH MEMORY
                                /BETWEEN THE LIMLO AND LIMHI
                                /LIMITS

0200  4154                     BEGIN,  JMS PATCH       /CLA
0201  1135                             TAD LIMLO
0202  7041                             CIA
0203  3126                             DCA TO
0204  1152                     GON,    TAD HALT
0205  3526                             DCA I TO
0206  1126                             TAD TO
0207  7001                             IAC
0210  3126                             DCA TO
0211  1126                             TAD TO
0212  1136                             TAD LIMHI
0213  7640                             SZA CLA
0214  5204                             JMP GON
0215  1042                             TAD M15
0216  3041                             DCA CT1
0217  3040                             DCA CT

                                /CHECK FOR FIXED FROM

0220  7604                     LOOP,   LAS
0221  7004                             RAL
0222  7006                             RTL
0223  7630                             SZL CLA
0224  5246                             JMP LOOP1+6

                                /GET RANDOM FROM

0225  1133                     GETRAN, TAD RANUM
0226  7104                             RAL CLL
0227  7430                             SZL
0230  1134                             TAD THREE
0231  3133                             DCA RANUM
0232  1133                             TAD RANUM
0233  7510                             SPA
0234  5241                             JMP .+5
0235  1135                             TAD LIMLO
0236  7710                             SPA CLA
0237  5225                             JMP GETRAN
0240  5244                             JMP .+4
0241  1136                             TAD LIMHI
0242  7700                             SMA CLA
0243  5225                             JMP GETRAN

0244  1133                             TAD RANUM
0245  3130                             DCA FROM
```

```
0246  1130          TAD FROM
0247  7001          IAC
0250  3132          DCA FROMP1
0251  7040          CMA
0252  1130          TAD FROM
0253  3131          DCA FROM1
```

```
                        /CHECK FOR FIXED TO

0254  7604               LOOP1,  LAS
0255  7006                       RTL
0256  7006                       RTL
0257  7630                       SZL CLA
0260  5302                       JMP CRSCK-5

                        /GET RANDOM TO

0261  1133               GTRAN1, TAD RANUM
0262  7104                       RAL CLL
0263  7430                       SZL
0264  1134                       TAD THREE
0265  3133                       DCA RANUM
0266  1133                       TAD RANUM
0267  7510                       SPA
0270  5275                       JMP .+5
0271  1135                       TAD LIMLO
0272  7710                       SPA CLA
0273  5261                       JMP GTRAN1
0274  5300                       JMP .+4
0275  1136                       TAD LIMHI
0276  7700                       SMA CLA
0277  5261                       JMP GTRAN1
0300  1133                       TAD RANUM
0301  3126                       DCA TO
0302  1126                       TAD TO
0303  7001                       IAC
0304  3127                       DCA TOP1
0305  1130               CRSCK,  TAD FROM
0306  7041                       CIA
0307  1126                       TAD TO
0310  7650                       SNA CLA
0311  5220                       JMP LOOP

                        /BRING UP THE FLAG

0312  7040                       CMA
0313  6041                       TSF
0314  6046                       TLS
0315  6041                       TSF
0316  5315                       JMP .-1
```

```
                        /PLACE THE INSTRUCTIONS

0317  7200                      CLA
0320  1157                      TAD ITON
0321  3531                      DCA I FROM1
0322  1153                      TAD JMP1
0323  3530                      DCA I FROM
0324  3000                      DCA 0

                        /GO DO IT

0325  5531                      JMP I FROM1
0326  7402                      HLT

                        /PRINTOUT SUBROUTINE

0327  0000              TYPAC,  0
0330  3143                      DCA SAVE+3
0331  1143                      TAD SAVE+3
0332  7012                      RTR
0333  7010                      RAR
0334  3142                      DCA SAVE+2
0335  1142                      TAD SAVE+2
0336  7012                      RTR
0337  7010                      RAR
0340  3141                      DCA SAVE+1
0341  1141                      TAD SAVE+1
0342  7012                      RTR
0343  7010                      RAR
0344  3140                      DCA SAVE
0345  5727                      JMP I TYPAC


                        /SUCCESS PRINTOUT
0346  1041              SUP,    TAD CT1
0347  7001                      IAC
0350  3041                      DCA CT1
0351  1041                      TAD CT1
0352  7640                      SZA CLA
0353  5437                      JMP I ALOOP
0354  1573                      TAD AMSG2
0355  3124                      DCA WORK
0356  1124              LP1,    TAD WORK
0357  7001                      IAC
0360  3124                      DCA WORK
0361  1524                      TAD I WORK
0362  6046                      TLS
0363  6041                      TSF
0364  5363                      JMP .-1
0365  1043                      TAD M265
0366  7640                      SZA CLA
0367  5356                      JMP LP1
0370  1042                      TAD M15
0371  3041                      DCA CT1
```

```
0372 5437          JMP I ALOOP
```

```
0373  0373              AM562,  .
0374  0215                      215             /CR
0375  0212                      212             /LF
0376  0260                      260             /0
0377  0265                      265             /5

      0000              *0
0000  0000                      0               /FOR SCOPE MODE INSERT
0001  5001                      JMP 1           /JMP I FROM 1 (5531) IN LOC1
0002  0002                      2               /GET STORED ADDRESS
0003  0003                      3
0004  1132                      TAD FRMP1
0005  7640                      SZA CLA
0006  5546                      JMP I AER               /ADDRESS STORED IN (TO) WRONG
0007  1127                      TAD TOP1
0010  7041                      CIA
0011  1000                      TAD 0
0012  7640                      SZA CLA
0013  5546                      JMP I AER               /ADDRESS STORED IN (0) WRONG
0014  1152              RETURN, TAD HALT
0015  3530                      DCA I FROM
0016  1152                      TAD HALT
0017  3526                      DCA I TO
0020  7040                      CMA
0021  1000                      TAD 0
0022  3000                      DCA 0
0023  1152                      TAD HALT
0024  3400                      DCA I 0
0025  1152                      TAD HALT
0026  3531                      DCA I FROM1
0027  7001                      IAC
0030  1040                      TAD CT
0031  3040                      DCA CT
0032  1040                      TAD CT
0033  7640                      SZA CLA
0034  5437                      JMP I ALOOP
0035  5436                      JMP I .+1
0036  0346                      SUP
0037  0220              ALOOP,  LOOP
0040  0000              CT,     0
0041  0000              CT1,    0
0042  7763              M15,    -15
0043  7513              M265,   -265
```

```
0044  0215          MSG1,   215             /CR
0045  0212                  212             /LF
0046  0212                  212             /LF
0047  0306                  306             /F = FROM
0050  0240                  240             /SPACE
0051  0000          INS1,   0               /X ADDRESS OF JMS INSTRUCTION
0052  0000          INS2,   0               /X
0053  0000          INS3,   0               /X
0054  0000          INS4,   0               /X
0055  0240                  240             /SPACE
0056  0324                  324             /T
0057  0317                  317             /O
0060  0240                  240             /SPACE
0061  0000          INS5,   0               /X
0062  0000          INS6,   0               /X
0063  0000          INS7,   0               /X
0064  0000          INS8,   0               /X
0065  0215                  215             /CR
0066  0212                  212             /LF
0067  0377                  377             /RUBOUT
0070  0250                  250             /(
0071  0324          MSG2,   324             /T
0072  0317                  317             /O
0073  0251                  251             /)
0074  0240                  240             /SPACE
0075  0275                  275             /=
0076  0240                  240             /SPACE
0077  0000          INS9,   0               /X STORED ADDRESS
0100  0000          INS10,  0               /X S/B FRMP1
0101  0000          INS11,  0               /X
0102  0000          INS12,  0               /X
0103  0215                  215             /CR
0104  0212                  212             /LF
0105  0377                  377             /RUBOUT
0106  0250                  250             /(
0107  0000          MSG3,   0               /X ADDRESS-1 STORED
0110  0000          INS13,  0               /X IN LOC 0 AT INTERRUPT
0111  0000          INS14,  0               /X
0112  0000          INS15,  0               /X
0113  0251                  251             /)
0114  0240                  240             /SPACE
0115  0275                  275             /=
0116  0240                  240             /SPACE
0117  0000          INS16,  0               /X CONTENTS OF ABOVE
0120  0000          INS17,  0               /X ADDRESS
0121  0000          INS18,  0               /X
0122  0000          INS19,  0               /X
0123  0207                  207             /END MARK
0124  0000          WORK,   0
0125  7571          M207,   -207
```

/CONSTANTS

```
0126  0000          TO,     0
0127  0000          TOP1,   0
0130  0000          FROM,   0
0131  0000          FROM1,  0
0132  0000          FRMP1,  0
0133  2525          RANUM,  2525
0134  0003          THREE,  3
0135  7200          LIMLO,  -600
0136  0200          LIMHI,  -7600
0137  6001          ITON,   ION
0140  0000          SAVE,   0
0141  0000                  0
0142  0000                  0
0143  0000                  0
0144  0007          MSK7,   7
0145  0260          TW6,    260
0146  0400          AER,    ER
0147  0327          ATYP,   TYPAC
0150  0330          ATYP1,  TYPAC*1

0151  0044          AMSG1,  MSG1

0152  7402          HALT,   HLT
0153  4526          JMP1,   JMS I TO
```

```
0154  0000          PATCH,  0                 /RESTORE THEN GO AWAY
0155  3000                  DCA 0
0156  1167                  TAD X1
0157  3001                  DCA 1
0160  1170                  TAD X2
0161  3002                  DCA 2
0162  1171                  TAD X3
0163  3003                  DCA 3
0164  1172                  TAD X4
0165  3573                  DCA I X5
0166  5554                  JMP I PATCH

0167  7200          X1,     7200
0170  1526          X2,     1526              /TAD I TO
0171  7041          X3,     7041
0172  7200          X4,     CLA
0173  0200          X5,     200
```

```
        0400            *400

0400  1204      ER,     TAD .+4
0401  3547              DCA I ATYP
0402  1130              TAD FROM
0403  5550              JMP I ATYP1
0404  0405              .+1
0405  1140              TAD SAVE
0406  0144              AND MSK7
0407  1145              TAD TW6
0410  3051              DCA INS1
0411  1141              TAD SAVE+1
0412  0144              AND MSK7
0413  1145              TAD TW6
0414  3052              DCA INS2
0415  1142              TAD SAVE+2
0416  0144              AND MSK7
0417  1145              TAD TW6
0420  3053              DCA INS3
0421  1143              TAD SAVE+3
0422  0144              AND MSK7
0423  1145              TAD TW6
0424  3054              DCA INS4

0425  1231              TAD .+4
0426  3547              DCA I ATYP
0427  1126              TAD TO
0430  5550              JMP I ATYP1
0431  0432              .+1
0432  1140              TAD SAVE
0433  0144              AND MSK7
0434  1145              TAD TW6
0435  3061              DCA INS5
0436  1141              TAD SAVE+1
0437  0144              AND MSK7
0440  1145              TAD TW6
0441  3062              DCA INS6
0442  1142              TAD SAVE+2
0443  0144              AND MSK7
0444  1145              TAD TW6
0445  3063              DCA INS7
0446  1143              TAD SAVE+3
0447  0144              AND MSK7
0450  1145              TAD TW6
0451  3064              DCA INS8
0452  1256              TAD .+4
0453  3547              DCA I ATYP
0454  1526              TAD I TO
0455  5550              JMP I ATYP1
0456  0457              .+1
```

```
0457  1140          TAD SAVE
0460  0144          AND MSK/
0461  1145          TAD TW6
0462  3077          DCA INS9
0463  1141          TAD SAVE+1
0464  0144          AND MSK/
0465  1145          TAD TW6
0466  3100          DCA INS10
0467  1142          TAD SAVE+2
0470  0144          AND MSK/
0471  1145          TAD TW6
0472  3101          DCA INS11
0473  1143          TAD SAVE+3
0474  0144          AND MSK/
0475  1145          TAD TW6
0476  3102          DCA INS12
0477  7040          CMA
0500  1000          TAD 0
0501  3000          DCA 0

0502  1306          TAD .+4
0503  3547          DCA I ATYP
0504  1000          TAD 0
0505  5550          JMP I ATYP1
0506  0507          .+1
0507  1140          TAD SAVE
0510  0144          AND MSK/
0511  1145          TAD TW6
0512  3107          DCA MSG3
0513  1141          TAD SAVE+1
0514  0144          AND MSK/
0515  1145          TAD TW6
0516  3110          DCA INS13
0517  1142          TAD SAVE+2
0520  0144          AND MSK/
0521  1145          TAD TW6
0522  3111          DCA INS14
0523  1143          TAD SAVE+3
0524  0144          AND MSK/
0525  1145          TAD TW6
0526  3112          DCA INS15
0527  1333          TAD .+4
0530  3547          DCA I ATYP
0531  1400          TAD I 0
0532  5550          JMP I ATYP1
0533  0534          .+1
0534  1140          TAD SAVE
0535  0144          AND MSK/
0536  1145          TAD TW6
0537  3117          DCA INS16
0540  1141          TAD SAVE+1
0541  0144          AND MSK/
0542  1145          TAD TW6
0543  3120          DCA INS17
0544  1142          TAD SAVE+2
```

```
0545  0144        AND MSK/
0546  1145        TAD T=6
0547  3121        DCA INS18
0550  1143        TAD SAVE+3
0551  0144        AND MSK/
0552  1145        TAD T=6
0553  3122        DCA INS19
```

```
0554  1151                TAD AMSG1
0555  3124                DCA WORK
0556  1524          TYPE, TAD I WORK
0557  6046                TLS
0560  6041                TSF
0561  5360                JMP .-1
0562  7201                CLA IAC
0563  1124                TAD WORK
0564  3124                DCA WORK
0565  1524                TAD I WORK
0566  1125                TAD M200/
0567  7640                SZA CLA
0570  5356                JMP TYPE
0571  7604                LAS
0572  7710                SPA CLA
0573  7402                HLT                 /HALT ON ERROR
0574  5014                JMP RETURN

$
```

THERE ARE NO ERRORS

SYMBOL TABLE

AER	0146
ALOOP	0037
AMSG1	0151
AMSG2	0373
ATYP	0147
ATYP1	0150
BEGIN	0200
CRSCK	0305
CT	0040
CT1	0041
ER	0400
FRMP1	0132
FROM	0130
FROM1	0131
GETRAN	0225
GUN	0204
GTRAN1	0261
HALT	0152
INS1	0051
INS10	0100
INS11	0101
INS12	0102
INS13	0110
INS14	0111
INS15	0112
INS16	0117
INS17	0120
INS18	0121
INS19	0122
INS2	0052
INS3	0053
INS4	0054
INS5	0061
INS6	0062
INS7	0063
INS8	0064
INS9	0077
ITON	0137
JMP1	0153
LIMHI	0136
LIMLO	0135
LOOP	0220
LOOP1	0254
LP1	0356
MSG1	0044
MSG2	0071
MSG3	0107
MSK7	0144
M15	0042
M207	0125
M265	0043
PATCH	0154
RANUM	0133

SYMBOL TABLE

RETURN	0014
SAVE	0140
SUP	0346
THREE	0134
TU	0126
TUP1	0127
TW6	0145
TYPAC	0327
TYPE	0556
WORK	0124
X1	0167
X2	0170
X3	0171
X4	0172
X5	0173

SYMBOL TABLE

RETURN	0014
ALOOP	0037
CT	0040
CT1	0041
M15	0042
M265	0043
MSG1	0044
INS1	0051
INS2	0052
INS3	0053
INS4	0054
INS5	0061
INS6	0062
INS7	0063
INS8	0064
MSG2	0071
INS9	0077
INS10	0100
INS11	0101
INS12	0102
MSG3	0107
INS13	0110
INS14	0111
INS15	0112
INS16	0117
INS17	0120
INS18	0121
INS19	0122
WORK	0124
M207	0125
TU	0126
TUP1	0127
FROM	0130
FROM1	0131
FRMP1	0132
RANUM	0133
THREE	0134
LIMLO	0135
LIMHI	0136
ITON	0137
SAVE	0140
MSK7	0144
T_W6	0145
AER	0146
ATYP	0147
ATYP1	0150
AMSG1	0151
HALT	0152
JMP1	0153
PATCH	0154
X1	0167
X2	0170
X3	0171

SYMBOL TABLE

X4	0172
X5	0173
BEGIN	0200
GON	0204
LOOP	0220
GETRAN	0225
LOOP1	0254
GTRAN1	0261
CHSCK	0305
TYPAC	0327
SUP	0346
LP1	0356
AMSG2	0373
ER	0400
TYPE	0556