IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D8JC-D

PRODUCT NAME: RANDOM JMP-JMS TEST

DATE CREATED: JUNE 11, 1971

MAINTAINER: DIAGNOSTIC GROUP

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1. ABSTRACT

THIS IS A DIAGNOSTIC PROGRAM TO TEST THE JMS INSTRUCTION OF THE PDP-8E. 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-8E 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-8E-D0A(N), AND MAINDEC-8E-D0B(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(0) HALT ON ERROR.
SR2(1) HOLD THE FROM ADDRESS CONSTANT
SR2(0) SELECT RANDOM FROM ADDRESSES
SR3(1) HOLD THE TO ADDRESS CONSTANT
SR3(0) SELECT RANDOM TO ADDRESSES

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 133
TO = LOCATION 131

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. PRESS CLEAR, AND THEN CONT.

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 AGAIN 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 EVEDENT 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 PRINTOUS, A FROM AND TO ADDRESS IS SELECTED FOR USE IN THE SCOPE MODE LOOP. ENTER THE CHOSEN ADDRESSES INTO PROPER LOCATIONS (SEE SECTION 4.3.8). ENTER 5534 INTO LOCATION 1 AND RESTART THE PROGRAM WITH SR2 AND SR3 SET.

THE SCOPE MODE LOOP IS:

LOCATION	CODING
0000	
0001	JMP 1 PROM1
XXXX	A, ION
XXXX	JMS 1 TO
0134	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 A ADDRESS<7600

THE AREA BETWEEN 0600 AND 7600 IS FILLED WITH HLT INSTRUCTIONS IN CASE THE INTERRUPT FAILS.

"JC" IS PRINTED AFTER EVERY 61,000 TESTS.

```
                    /RANDOM JMP-JMS TEST
                    /SR0(0)=HALT ON ERROR
                    /SR2(1)=FIXED FROM
                    /SR3(1)=FIXED TO
                    /SPREAD HALTS THROUGH MEMORY
                    /BETWEEN THE LIMLO AND LIMHI
                    /LIMITS

          0200      *200

 0200     4157     BEGIN,  JMS PATCH        /CLA
 0201     1140             TAD LIMLO
 0202     7041             CIA
 0203     3131             DCA TO
 0204     1155     GON,    TAD HALT
 0205     3531             DCA I TO
 0206     1131             TAD TO
 0207     7001             IAC
 0210     3131             DCA TO
 0211     1131             TAD TO
 0212     1141             TAD LIMHI
 0213     7640             SZA CLA
 0214     5204             JMP GON
 0215     1045             TAD M15
 0216     3044             DCA CTI
 0217     3043             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     1136     GETRAN, TAD RANUM
 0226     7104             RAL CLL
 0227     7430             SZL
 0230     1137             TAD THREE
 0231     3136             DCA RANUM
 0232     1136             TAD RANUM
 0233     7510             SPA
 0234     5241             JMP .+5
 0235     1140             TAD LIMLO
 0236     7710             SPA CLA
 0237     5225             JMP GETRAN
 0240     5244             JMP .+4
 0241     1141             TAD LIMHI
 0242     7700             SMA CLA
 0243     5225             JMP GETRAN

 0244     1136             TAD RANUM
```

```
0245  3133          DCA FROM
0246  1133          TAD FROM
0247  7001          IAC
0250  3135          DCA FRMP1
0251  7040          CMA
0252  1133          TAD FROM
0253  3134          DCA FROM1

                    /CHECK FOR FIXED TO

0254  7604    LOOP1, LAS
0255  7006          RTL
0256  7006          RTL
0257  7630          SZL CLA
0260  5302          JMP CRSCK-3

                    /GET RANDOM TO

0261  1136    GTRAN1, TAD RANUM
0262  7104          RAL CLL
0263  7438          SZL
0264  1137          TAD THREE
0265  3136          DCA RANUM
0266  1136          TAD RANUM
0267  7510          SPA
0270  5275          JMP .+5
0271  1140          TAD LIMLO
0272  7710          SPA CLA
0273  5261          JMP GTRAN1
0274  5300          JMP .+4
0275  1141          TAD LIMHI
0276  7700          SMA CLA
0277  5261          JMP GTRAN1
0300  1136          TAD RANUM
0301  3131          DCA TO
0302  1131          TAD TO
0303  7001          IAC
0304  3132          DCA TOP1
0305  1133    CRSCK,  TAD FROM
0306  7041          CIA
0307  1131          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  1142          TAD ITON
0321  3534          DCA I FROM1
0322  1156          TAD JMP1
0323  3533          DCA I FROM
0324  3000          DCA 0

                    /GO DO IT

0325  5534          JMP I FROM1
0326  7402          HLT

                    /PRINTOUT SUBROUTINE

0327  0000    TYPAC, 0
0330  3146          DCA SAVE+3
0331  1146          TAD SAVE+3
0332  7012          RTR
0333  7010          RAR
0334  3145          DCA SAVE+2
0335  1145          TAD SAVE+2
0336  7012          RTR
0337  7010          RAR
0340  3144          DCA SAVE+1
0341  1144          TAD SAVE+1
0342  7012          RTR
0343  7010          RAR
0344  3143          DCA SAVE
0345  5727          JMP I TYPAC


                    /SUCCESS PRINTOUT
0346  1044    SUP,  TAD CTI
0347  7001          IAC
0350  3044          DCA CTI
0351  1044          TAD CTI
0352  7640          SZA CLA
0353  5442          JMP I ALOOP
0354  1373          TAD AMSG2
0355  3127          DCA WORK
0356  1127    LPI,  TAD WORK
0357  7001          IAC
0360  3127          DCA WORK
0361  1527          TAD I WORK
0362  6046          TLS
0363  6041          TSF
0364  5363          JMP .-1
0365  1046          TAD M303
0366  7640          SZA CLA
0367  5356          JMP LPI
0370  1045          TAD M15
0371  3044          DCA CTI
0372  5442          JMP I ALOOP
```

```
0373  0373  AMSG2,  .
0374  0215          215             /CR
0375  0212          212             /LF
0376  0312          312             /J
0377  0303          303             /C

      0000  *0
0000  0000          0               /FOR SCOPE MODE INSERT
0001  5001          JMP 1           /JMP I FROM 1 (5534) IN LOC1
0002  0002          2               /GET STORED ADDRESS
0003  0003          3
0004  0000          0
0005  0000          0
0006  7041          CIA
0007  1135          TAD FRMP1
0010  7640          SZA CLA
0011  5551          JMP I AER               /ADDRESS STORED IN (TO) WRONG
0012  1132          TAD TOP1
0013  7041          CIA
0014  1000          TAD 0
0015  7640          SZA CLA
0016  5551          JMP I AER               /ADDRESS STORED IN (0) WRONG
0017  1155  RETURN, TAD HALT
0020  3533          DCA I FROM
0021  1155          TAD HALT
0022  3531          DCA I TO
0023  7040          CMA
0024  1000          TAD 0
0025  3000          DCA 0
0026  1155          TAD HALT
0027  3400          DCA I 0
0030  1155          TAD HALT
0031  3534          DCA I FROM1
0032  7001          IAC
0033  1043          TAD CT
0034  3043          DCA CT
0035  1043          TAD CT
0036  7640          SZA CLA
0037  5442          JMP I ALOOP
0040  5441          JMP I .+1
0041  0346          SUP
0042  0220  ALOOP,  LOOP
0043  0000  CT,     0
0044  0000  CT1,    0
0045  7763  M15,    -15
0046  7475  M303,   -303

0047  0215  MSG1,   215             /CR
0050  0212          212             /LF
0051  0212          212             /LF
0052  0306          306             /F = FROM
0053  0240          240             /SPACE
0054  0000  INS1,   0               /X ADDRESS OF JMS INSTRUCTION
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```
0055  0000    INS2,   0               /X
0056  0000    INS3,   0               /X
0057  0000    INS4,   0               /X
0060  0240            240             /SPACE
0061  0324            324             /T
0062  0317            317             /O
0063  0240            240             /SPACE
0064  0000    INS5,   0               /X
0065  0000    INS6,   0               /X
0066  0000    INS7,   0               /X
0067  0000    INS8,   0               /X
0070  0215            215             /CR
0071  0212            212             /LF
0072  0377            377             /RUBOUT
0073  0250            250             /(
0074  0324    MSG2,   324             /T
0075  0317            317             /O
0076  0251            251             /)
0077  0240            240             /SPACE
0100  0275            275             /=
0101  0240            240             /SPACE
0102  0000    INS9,   0               /X STORED ADDRESS
0103  0000    INS10,  0               /X S/B FRMP1
0104  0000    INS11,  0               /X
0105  0000    INS12,  0               /X
0106  0215            215             /CR
0107  0212            212             /LF
0110  0377            377             /RUBOUT
0111  0250            250             /(
0112  0000    MSG3,   0               /X ADDRESS-1 STORED
0113  0000    INS13,  0               /X IN LOC 0 AT INTERRUPT
0114  0000    INS14,  0               /X
0115  0000    INS15,  0               /X
0116  0251            251             /)
0117  0240            240             /SPACE
0120  0275            275             /=
0121  0240            240             /SPACE
0122  0000    INS16,  0               /X CONTENTS OF ABOVE
0123  0000    INS17,  0               /X ADDRESS
0124  0000    INS18,  0               /X
0125  0000    INS19,  0               /X
0126  0207            207             /END MARK
0127  0000    WORK,   0
0130  7571    M207,   -207

                      /CONSTANTS

0131  0000    TO,     0
0132  0000    TOP1,   0
0133  0000    FROM,   0
0134  0000    FROM1,  0
0135  0000    FRMP1,  0
0136  2525    RANUM,  2525
0137  0003    THREE,  3
```

```
0140  7200  LIMLO,  -600
0141  0200  LIMHI,  -7600
0142  6001  ITON,   ION
0143  0000  SAVE,   0
0144  0000          0
0145  0000          0
0146  0000          0
0147  0007  MSK7,   7
0150  0260  TW6,    260
0151  0400  AER,    ER
0152  0327  ATYP,   TYPAC
0153  0330  ATYPI,  TYPAC+1

0154  0047  AMSGI,  MSG1

0155  7402  HALT,   HLT
0156  4531  JMP1,   JMS I TO


0157  0000  PATCH,  0               /RESTORE THEN GO AWAY
0160  3000          DCA 0
0161  1172          TAD X1
0162  3001          DCA 1
0163  1173          TAD X2
0164  3002          DCA 2
0165  1174          TAD X3
0166  3003          DCA 3
0167  1175          TAD X4
0170  3576          DCA I X5
0171  5557          JMP I PATCH

0172  7200  X1,     CLA
0173  1531  X2,     TAD I TO              /TAD I TO
0174  5006  X3,     JMP 6
0175  7200  X4,     CLA
0176  0200  X5,     200


      0400  .400

0400  1204  ER,     TAD .+4
0401  3552          DCA I ATYP
0402  1133          TAD FROM
0403  5553          JMP I ATYPI
0404  0405          .+1
0405  1143          TAD SAVE
0406  0147          AND MSK7
0407  1150          TAD TW6
0410  3054          DCA INS1
0411  1144          TAD SAVE+1
0412  0147          AND MSK7
0413  1150          TAD TW6
0414  3055          DCA INS2
0415  1145          TAD SAVE+2
0416  0147          AND MSK7
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0417  1150          TAD TW6
0420  3056          DCA INS3
0421  1146          TAD SAVE+3
0422  0147          AND MSK7
0423  1150          TAD TW6
0424  3057          DCA INS4

0425  1231          TAD .+4
0426  3552          DCA I ATYP
0427  1131          TAD TO
0430  5553          JMP I ATYPI
0431  0432          .+1
0432  1143          TAD SAVE
0433  0147          AND MSK7
0434  1150          TAD TW6
0435  3064          DCA INS5
0436  1144          TAD SAVE+1
0437  0147          AND MSK7
0440  1150          TAD TW6
0441  3065          DCA INS6
0442  1145          TAD SAVE+2
0443  0147          AND MSK7
0444  1150          TAD TW6
0445  3066          DCA INS7
0446  1146          TAD SAVE+3
0447  0147          AND MSK7
0450  1150          TAD TW6
0451  3067          DCA INS8
0452  1256          TAD .+4
0453  3552          DCA I ATYP
0454  1531          TAD I TO
0455  5553          JMP I ATYPI
0456  0457          .+1

0457  1143          TAD SAVE
0460  0147          AND MSK7
0461  1150          TAD TW6
0462  3102          DCA INS9
0463  1144          TAD SAVE+1
0464  0147          AND MSK7
0465  1150          TAD TW6
0466  3103          DCA INS10
0467  1145          TAD SAVE+2
0470  0147          AND MSK7
0471  1150          TAD TW6
0472  3104          DCA INS11
0473  1146          TAD SAVE+3
0474  0147          AND MSK7
0475  1150          TAD TW6
0476  3105          DCA INS12
0477  7040          CMA
0500  1000          TAD 0
0501  3000          DCA 0

0502  1306          TAD .+4
```

```
0503  3552          DCA I ATYP
0504  1000          TAD 0
0505  5553          JMP I ATYP1
0506  0507          .+1
0507  1143          TAD SAVE
0510  0147          AND MSK7
0511  1150          TAD TW6
0512  3112          DCA MSG3
0513  1144          TAD SAVE+1
0514  0147          AND MSK7
0515  1150          TAD TW6
0516  3113          DCA IN$13
0517  1145          TAD SAVE+2
0520  0147          AND MSK7
0521  1150          TAD TW6
0522  3114          DCA IN$14
0523  1146          TAD SAVE+3
0524  0147          AND MSK7
0525  1150          TAD TW6
0526  3115          DCA IN$15
0527  1333          TAD .+6
0530  3552          DCA I ATYP
0531  1400          TAD I 0
0532  5553          JMP I ATYP1
0533  0534          .+1
0534  1143          TAD SAVE
0535  0147          AND MSK7
0536  1150          TAD TW6
0537  3122          DCA IN$16
0540  1144          TAD SAVE+1
0541  0147          AND MSK7
0542  1150          TAD TW6
0543  3123          DCA IN$17
0544  1145          TAD SAVE+2
0545  0147          AND MSK7
0546  1150          TAD TW6
0547  3124          DCA IN$18
0550  1146          TAD SAVE+3
0551  0147          AND MSK7
0552  1150          TAD TW6
0553  3125          DCA IN$19

0554  1154          TAD AMSG1
0555  3127          DCA WORK
0556  1527  TYPE,   TAD I WORK
0557  6046          TLS
0560  6041          TSF
0561  5360          JMP .-1
0562  7201          CLA IAC
0563  1127          TAD WORK
0564  3127          DCA WORK
0565  1527          TAD I WORK
0566  1130          TAD M207
0567  7640          SZA CLA
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```
0570  5356          JMP TYPE
0571  7604          LAS
0572  7700          SMA CLA
0573  7402          HLT             /HALT ON ERROR
0574  5017          JMP RETURN

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```