IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D8JC-D

PRODUCT NAME: RANDOM JMP-JMS TEST

DATE CREATED: JUNE 11, 1971

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: BRUCE HANSEN

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 FROM1

     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   7430          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    LP1,    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 LP1
            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 I 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
```

```
           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    ATYP1,  TYPAC+1

        0154  0047    AMSG1,  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 ATYP1
        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
```

```
            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 ATYP1
            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 ATYP1
            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 INS13
0517  1145          TAD SAVE+2
0520  0147          AND MSK7
0521  1150          TAD TW6
0522  3114          DCA INS14
0523  1146          TAD SAVE+3
0524  0147          AND MSK7
0525  1150          TAD TW6
0526  3115          DCA INS15
0527  1333          TAD .+4
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 INS16
0540  1144          TAD SAVE+1
0541  0147          AND MSK7
0542  1150          TAD TW6
0543  3123          DCA INS17
0544  1145          TAD SAVE+2
0545  0147          AND MSK7
0546  1150          TAD TW6
0547  3124          DCA INS18
0550  1146          TAD SAVE+3
0551  0147          AND MSK7
0552  1150          TAD TW6
0553  3125          DCA INS19

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
```

```
0570  5356              JMP TYPE
0571  7604              LAS
0572  7700              SMA CLA
0573  7402              HLT              /HALT ON ERROR
0574  5017              JMP RETURN

                 S
```

)   )   )