IDENTIFICATION

Product Code:	MAINDEC-9A-D0EA-D
Product Name:	JMP Y - Interrupt Test
Date:	May 15, 1967
Maintainer:	Diagnostic Group
Author:	Edward P. Steinberger

1. ABSTRACT

The JMP Y - Interrupt Test determines if the PDP-9 will complete a JMP Y (where Y is some random value) instruction before it goes into program interrupt. This is done by setting a I/O flag and then transferring control to an ION/JMP Y instruction group (located at a random place in memory). The computer should complete the JMP Y instruction before the computer goes into program interrupt. If no error occurs, the ION/JMP Y instruction group is moved to other random memory locations and the test is repeated. Errors are indicated to the operator via the Teletype or error halts.

2. REQUIREMENTS

2.1 Equipment

Standard PDP-9 computer

2.2 Storage

The program uses all of 8K memory for the program or as a test area. The program occupies memory from location 17400 to 17733 and tests all locations below 17400.

2.3 Preliminary Programs

Instruction Test - Parts 1 and 2 (MAINDEC 9A-D01A-D and MAINDEC 9A-D02A-D)

3. LOADING PROCEDURE

a. Put HRI tape of program in reader

b. Set ADDRESS SWITCHES to 17400

c. Depress and release READ-IN key.

4. STARTING PROCEDURE

4.1 Control Switch Settings

The following is a table of accumulator switch settings and their action on the program:

ACCUMULATOR SWITCH SETTINGS

AC Switch	Set As	Action
0	1	Halt on error
	0	Don't halt on error
1	1	Don't print errors
	0	Print errors
2	1	Ring bell on error
	0	Ring bell after N passes
3	1	Loop on current Y
	0	Don't loop on current Y
4	1	Loop on current location
	0	Don't loop on current location

N is an arbitrary number (initially $100_{(8)}$) which is controlled by the LAW-N instruction in location 17400 and may be changed at the operator's discretion.

4.2 Starting Address

The starting address of the program is 17400.

4.3 Program and/or Operator Action

a. ADDRESS SWITCHES to 17400

b. Set ACCUMULATOR SWITCHES to desired positions (see 4.1). Normal setting is 500000.

c. Depress I/O RESET

d. Depress START

5. OPERATING PROCEDURE

5.1 Operational Switch Settings (see 4.1)

5.2 Subroutine Abstracts

(None)

5.3 Program and/or Operator Action

To put the program in the scope mode, the ACCUMULATOR SWITCH REGISTER should be set to 26000 (don't halt, don't print, bell after N passes, loop on current Y, loop on current location).

6. ERRORS

Unless AC switch 1 is a 1, errors will be printed on the Teletype.

6.1 Error Halts and Description

There is one error halt inside the program at location 17544. Any program diagnosed errors will cause a halt at this location if AC switch 0 is a 1. The program stores HALT in all locations of the test area memory. If the computer does not go into program interrupt immediately after executing the JMP Y, the computer will halt at location Y.

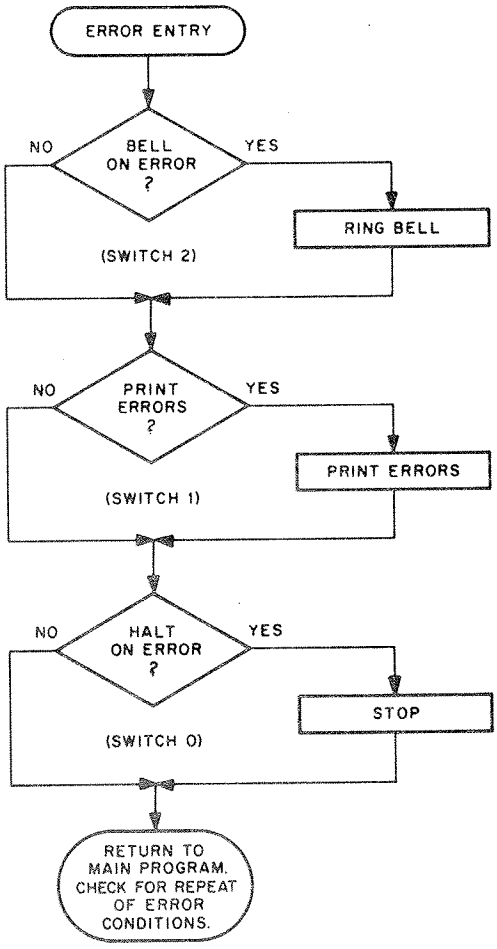
6.2 Error Recovery

6.2.1 Program Diagnosed Error - If AC switch 0 is a 1, the computer will halt on a program diagnosed error. To recover from this type of error, reset AC switches 0 to 4 as necessary (see section 4.1) and then depress CONTINUE.

6.2.2 Interrupt Failures - Interrupt failures will cause a halt at location Y. To recover, reset AC switches 0 to 4 as necessary (see section 4.1) and then start the computer at location 17400 (BEGIN) after depressing I/O RESET.

6.2.3 Test for ION, JMP Y, and Y - To test particular memory locations for the ION, JMP Y, and/or Y, store the address of the ION in location 17731 (POINT1), that address + 1 in location 17732 (POINT2), the address Y in location 17733 (POINT3). Then set AC switches 3 and 4 to 1, depress I/O RESET, and start the computer at location 17400 (BEGIN). All addresses must be less than 17400 and not 00001.

6.3 Error Switch Hierachy



6.4 Error Typeout Example

```
ION-JMP  Y
JMP  AT      "Y"        C(0)
001234    007654    001235
```

The above example shows that a JMP 7654 instruction was stored in location 1234 (it is implied that the ION is in 1233). The 1235 stored in location 00000 indicates the JMP was not completed before the computer went into program interrupt.

7. RESTRICTIONS

7.1 Starting Restrictions

(None)

7.2 Operating Restrictions

(None)

8. MISCELLANEOUS

8.1 Execution Time

Approximately 96 msec per ION/JMP Y instruction group.

9. PROGRAM DESCRIPTION

a. The first function that is performed is that of initialization. A register to count loops and a location to assure typeout of the error message header are initialized, and the bell on the Teletype is run to raise the teleprinter flag to assure a flag for program interrupt.

b. Then a check is made to see if the locations of the ION and JMP Y instructions. should be changed (switch 4). If they are not changed, the program proceeds to c. If they are, a number is obtained from a random number generator, made into an address, and checked that it is below the program, not equal to Y, not equal to 00000 or 000001, and stored in POINT 1 and incremented and stored in POINT 2.

c. Then a check is made to see if the number Y should be changed (switch 3). If it is not changed, the program proceeds to d. If it is, a number is obtained from a different random number generator than was used in b., made into an address, checked to see that it was below the program, not equal to location of ION or JMP Y instructions, not equal to 00001, and stored in POINT 3.

d. Then HALT is stored in all memory locations in the test area of memory. The ION instruction is stored, as well as the JMP Y instruction after it has been formed from Y and JMP. The AC and Link are then cleared and control is transferred to the ION/JMP Y instruction group.

e. Upon return from the program interrupt, the contents of location 00000 are checked to make sure the proper number was stored. If not, the error subroutine is called.

f. A check is then made to see if the scope mode (AC switches 3 and 4 a 1) has been requested and if so, control is immediately transferred back to the instruction group.

g. If the instruction group is not being scoped, a check is made on ringing the bell (switch 2), after which control goes back to b.

10. LISTINGS

```
                                .TITLE IONJMP
                        /
                        /JMP Y-INTERRUPT TEST
                                .FULL
                                .LOC 17400
17400                           .LOC 17400
17400   777700  BEGIN   LAW 17700
17401   057706          DAC COUNT       /SET UP TO COUNT LOOPS
17402   760207          LAW 207
17403   117556          JMS TYPE        /RING BELL TO SET I/O FLAG
17404   777671          LAW MESS1
17405   057523          DAC ERROR1+13   /INITIALIZE ERROR TYPEOUT ROUTINE
17406   750004  HERE1   LAS
17407   517714          AND MASK2
17410   740200          SZA             /VARY CURRENT LOCATION
17411   617437          JMP HERE2       /NO
17412   117606          JMS RANDOM      /YES, GENERATE RANDOM ADDRESS
17413   517712          AND MASK
17414   057722          DAC POINT1      /STORE IN "ION" POINTER
17415   057723          DAC POINT2      /STORE IN "JMP Y" POINTER
17416   457723          ISZ POINT2      /AND INCREMENT
17417   741200          SNA             /IS "ION"=0?
17420   617412          JMP HERE1+4     /YES
17421   557717          SAD ONE         /HOW ABOUT 1?
17422   617412          JMP HERE1+4     /YES
17423   357732          TAD UPLIM       /IS THE "ION" POINTER
17424   740100          SMA             /INSIDE THIS PROGRAM?
17425   617412          JMP HERE1+4     /YES, GENERATE ANOTHER
17426   217723          LAC POINT2      /NO, NOW HOW ABOUT
17427   357732          TAD UPLIM       /THE "JMP Y" POINTER?
17430   740100          SMA             /IS IT OK?
17431   617412          JMP HERE1+4     /NO, TRY AGAIN
17432   217724          LAC POINT3      /OK SO FAR, NOW IS "Y" POINTER
17433   557722          SAD POINT1      /EQUAL TO "ION" POINTER
17434   617412          JMP HERE1+4     /YES
17435   557723          SAD POINT2      /NO, EQUAL TO "JMP Y" POINTER
17436   617412          JMP HERE1+4     /YES
17437   750004  HERE2   LAS
17440   517713          AND MASK1
17441   740200          SZA             /VARY "Y" POINTER?
17442   617460          JMP HERE3       /NO
17443   117617          JMS RANDUM      /YES, GENERATE RANDOM ADDRESS
17444   517712          AND MASK
17445   057724          DAC POINT3      /AND STORE IN POINT3
17446   557717          SAD ONE         /IS "Y"=1?
17447   617443          JMP HERE2+4     /YES
17450   357732          TAD UPLIM       /IS "Y" INSIDE THE PROGRAM?
17451   740100          SMA
17452   617443          JMP HERE2+4     /YES
17453   217724          LAC POINT3      /NO, CHECK IT AGAINST
17454   557722          SAD POINT1      /POINT1
17455   617443          JMP HERE2+4     /AND
17456   557723          SAD POINT2      /POINT2
17457   617443          JMP HERE2+4
```

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```
****
     17460     117572          HERE3     JMS HALT            /STORE HALTS IN MEMORY
     17461     217710                    LAC IONCON          /THEN STORE THE ION
     17462     077722                    DAC* POINT1         /VIA THE "ION" POINTER
     17463     217724                    LAC POINT3          /GET "Y"
     17464     257711                    XOR JMPCON          /FORM JMP "Y"
     17465     077723                    DAC* POINT2         /STORE VIA "JMP Y" POINTER
     17466     754000                    CLA!CLL             /CLEAR AC AND L
     17467     637722                    JMP* POINT1         /EXECUTE ION-JMP Y
                                         /
     17470     217724          RETURN    LAC POINT3                    /GET "Y"
     17471     540000                    SAD Ø               /DOES C(Ø)="Y+1"
     17472     741000                    SKP                 /YES
     17473     117510                    JMS ERROR1          /NO, ERROR
     17474     750004                    LAS
     17475     742010                    RTL
     17476     742010                    RTL                 /MOVE BITS 3 + 4 INTO LINK AND AC
     17477     740400                    SNL                 /LOOP ON CURRENT "Y"?
     17500     617503                    JMP .+3             /NO
     17501     755100                    SPA!CLA!CLL         /YES, LOOP ON CURRENT LOCATION?
     17502     637722                    JMP* POINT1         /YES, RETURN TO ION-JMP Y
     17503     750004                    LAS                 /NO, SEE ABOUT RINGING BELL
     17504     742010                    RTL
     17505     740100                    SMA                 /RING BELL?
     17506     117546                    JMS BELL            /YES
     17507     617406                    JMP HERE1
```

```
↑↑↑↑
                        /ERROR TYPEOUT SUBROUTINE
                        /
    17510   000000      ERROR1  0
    17511   750004              LAS
    17512   742010              RTL
    17513   740100              SMA                 /RING BELL?
    17514   617517              JMP .+3             /NO
    17515   760207              LAW 207
    17516   117556              JMS TYPE
    17517   750004              LAS
    17520   740010              RAL
    17521   741100              SPA                 /PRINT ERRORS?
    17522   617542              JMP .+20            /NO
    17523   777671              LAW MESS1
    17524   117650              JMS MPRINT          /PRINT HEADER
    17525   217716              LAC NEWINS
    17526   057523              DAC ERROR1+13       /CHANGE SO THAT HEADER PRINTS ONLY ONCE
    17527   217723              LAC POINT2
    17530   117630              JMS PRINT           /PRINT LOCATION OF JMP Y
    17531   760240              LAW 240
    17532   117556              JMS TYPE            /1 SPACE
    17533   217724              LAC POINT3
    17534   117630              JMS PRINT           /PRINT "Y"
    17535   760240              LAW 240
    17536   117556              JMS TYPE            /1 SPACE
    17537   200000              LAC 0
    17540   117630              JMS PRINT           /PRINT C(0)
    17541   117564              JMS CRLF            /CR-LF
    17542   750004              LAS
    17543   741100              SPA                 /HALT ON ERROR?
    17544   740040              XX                  /YES
    17545   637510              JMP* ERROR1         /EXIT
```

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```
↑↑↑↑
                            /USEFUL SUBROUTINES
                            /
     17546      000000      BELL        0
     17547      457706                  ISZ COUNT
     17550      637546                  JMP* BELL
     17551      417400                  XCT BEGIN
     17552      057706                  DAC COUNT
     17553      760207                  LAW 207
     17554      117556                  JMS TYPE
     17555      637546                  JMP* BELL
                            /
     17556      000000      TYPE        0
     17557      517725                  AND RUBOUT
     17560      700406                  TLS
     17561      700401                  TSF
     17562      617561                  JMP .-1
     17563      637556                  JMP* TYPE
                            /
     17564      000000      CRLF        0
     17565      760215                  LAW 215
     17566      117556                  JMS TYPE
     17567      760212                  LAW 212
     17570      117556                  JMS TYPE
     17571      637564                  JMP* CRLF
```

```
↑↑↑↑
                        /SUBROUTINE TO STORE HALTS IN MEMORY
                        /
17572   000000  HALT    0
17573   157720          DZM PNTR
17574   217707          LAC HLTCON
17575   077720          DAC* PNTR
17576   457720          ISZ PNTR
17577   217720          LAC PNTR
17600   557733          SAD UPLIM1
17601   741000          SKP
17602   617574          JMP HALT+2
17603   217705          LAC CON1
17604   040001          DAC 1
17605   637572          JMP* HALT
                        /
                        /
                        /RANDOM NUMBER GENERATORS
                        /
17606   000000  RANDOM  0
17607   217615          LAC RAND1
17610   744010          RAL!CLL
17611   741400          SZL
17612   357616          TAD RAND1+1
17613   057615          DAC RAND1
17614   637606          JMP* RANDOM
                        /
17615   000137  RAND1   137
17616   000003          3
                        /
17617   000000  RANDUM  0
17620   217626          LAC RAND2
17621   744010          RAL!CLL
17622   741400          SZL
17623   357627          TAD RAND2+1
17624   057626          DAC RAND2
17625   637617          JMP* RANDUM
                        /
17626   000065  RAND2   65
17627   000003          3
```

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```
****
                                /OCTAL PRINT SUBROUTINE
                                /
17630   000000          PRINT   0
17631   057730                  DAC TEMP
17632   777772                  LAW 17772
17633   057727                  DAC TALLY
17634   217730                  LAC TEMP
17635   744010                  RAL!CLL
17636   740010                  RAL
17637   742010                  RTL
17640   057730                  DAC TEMP
17641   517726                  AND SEVEN
17642   357704                  TAD ASKII
17643   117556                  JMS TYPE
17644   217730                  LAC TEMP
17645   457727                  ISZ TALLY
17646   617636                  JMP .-10
17647   637630                  JMP* PRINT
                                /
                                /MESSAGE PRINT SUBROUTINE
                                /
17650   000000          MPRINT  0
17651   057721                  DAC PNTR1
17652   237721                  LAC* PNTR1
17653   742020                  RTR;    RTR;    RTR;
17654   742020
17655   742020
17656   742020                  RTR;    RAR
17657   740020
17660   117556                  JMS TYPE
17661   557725                  SAD RUBOUT
17662   637650                  JMP* MPRINT
17663   237721                  LAC* PNTR1
17664   117556                  JMS TYPE
17665   557725                  SAD RUBOUT
17666   637650                  JMP* MPRINT
17667   457721                  ISZ PNTR1
17670   617652                  JMP MPRINT+2
                                /
                                /ERROR MESSAGE HEADER
17671   215212          MESS1   215212          /CR,LF
17672   311317                  311317          /I,O
17673   316255                  316255          /N,-
17674   312315                  312315          /J,M
17675   320240                  320240          /P,SP
17676   331215                  331215          /Y,CR
17677   212312                  212312          /LF,J
17700   315320                  315320          /M,P
17701   240301                  240301          /SP,A
17702   324240                  324240          /T,SP
17703   240240                  240240          /SP,SP
```

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```
↑↑↑↑
                        /CONSTANTS AND VARIABLES
                        /
    17704   000260      ASKII   260
    17705   617470      CON1    JMP RETURN
    17706   000000      COUNT   0
    17707   740040      HLTCON  HLT
    17710   700042      IONCON  ION
    17711   600000      JMPCON  JMP
    17712   017777      MASK    17777
    17713   040000      MASK1   40000
    17714   020000      MASK2   20000
    17715   010000      MASK3   10000
    17716   617527      NEWINS  JMP ERROR1+17
    17717   000001      ONE     1
    17720   000000      PNTR    0
    17721   000000      PNTR1   0
    17722   000002      POINT1  2
    17723   000003      POINT2  3
    17724   000004      POINT3  4
    17725   000377      RUBOUT  377
    17726   000007      SEVEN   7
    17727   000000      TALLY   0
    17730   000000      TEMP    0
    17731   000002      TWO     2
    17732   760400      UPLIM   -BEGIN
    17733   017400      UPLIM1  BEGIN
                        /
            000000              .END
```

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ASKII	17704
BEGIN	17400
BELL	17546
CON1	17705
COUNT	17706
CRLF	17564
ERROR1	17510
HALT	17572
HERE1	17406
HERE2	17437
HERE3	17460
HLTCON	17707
IONCON	17710
JMPCON	17711
MASK	17712
MASK1	17713
MASK2	17714
MASK3	17715
MESS1	17671
MPRINT	17650
NEWINS	17716
ONE	17717
PNTR	17720
PNTR1	17721
POINT1	17722
POINT2	17723
POINT3	17724
PRINT	17630
RANDOM	17606
RANDUM	17617
RAND1	17615
RAND2	17626
RETURN	17470
RUBOUT	17725
SEVEN	17726
TALLY	17727
TEMP	17730
TWO	17731
TYPE	17556
UPLIM	17732
UPLIM1	17733

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BEGIN	17400
HERE1	17406
HERE2	17437
HERE3	17460
RETURN	17470
ERROR1	17510
BELL	17546
TYPE	17556
CRLF	17564
HALT	17572
RANDOM	17606
RAND1	17615
RANDUM	17617
RAND2	17626
PRINT	17630
MPRINT	17650
MESS1	17671
ASKII	17704
CON1	17705
COUNT	17706
HLTCON	17707
IONCON	17710
JMPCON	17711
MASK	17712
MASK1	17713
MASK2	17714
MASK3	17715
NEWINS	17716
ONE	17717
PNTR	17720
PNTR1	17721
POINT1	17722
POINT2	17723
POINT3	17724
RUBOUT	17725
SEVEN	17726
TALLY	17727
TEMP	17730
TWO	17731
UPLIM	17732
UPLIM1	17733