IDENTIFICATION

Product Code:	MAINDEC-9A-D0DB-D
Product Name:	JMP-Self Test
Date:	September 6, 1967
Maintainer:	Diagnostic Group
Author:	E. Steinberger

1. ABSTRACT

JMP-Self Test checks the PDP-9 to ensure that the JMP . instruction can be executed properly. The computer is held in a JMP to the current location instruction for a definite time interval. If, during this interval, the JMP instruction fails, the error will be indicated to the operator. If the JMP instruction does not fail, it is moved elsewhere and the check is repeated. All memory locations not occupied by the program are tested.

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 17500 to 17762 and tests all memory location below 17500.

2.3 Preliminary Programs

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

3. LOADING PROCEDURE

3.1 Method

a. Put HRI tape of program in reader

b. Set ADDRESS SWITCHES to 17500

c. Depress and release KEY 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:

CONTROL 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 location
	0	Don't loop on current location
4	1	Repeat whole test (all locations)
	0	Don't repeat whole test.

N is an arbitrary number (initially $400_{(8)}$) which is controlled by the LAW-N instruction in location 17500 and may be changed at the operator's discretion.

4.2 Starting Address

The starting address of the program is 17500.

4.3 Program and/or Operator Action

a. Set ADDRESS SWITCHES to 17500.

b. Set ACCUMULATOR SWITCHES to desired positions (see section 4.1). Normal setting is 520000.

c. Depress I/O RESET. Assure clock can be enabled.

d. Depress START.

5. OPERATING PROCEDURE

5.1 Operational Switch Settings.

(see section 4.1)

5.2 Subroutine Abstracts

(None)

5.3 Program and/or Operator Action

To put the program in the in SCOPE mode, the ACCUMULATOR SWITCH REGISTER should be set to 240000 (don't halt, don't print, bell after N passes, loop on current location).

The length of time for the execution of a JMP . instruction is controlled by the clock. It is arbitrarily set to 16.6 msec by the CLA!CMA instruction in location 17512. To change the length of time for the execution of a JMP . , store the appropriate LAW-N instruction in location 17512.

6. ERRORS

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

6.1 Error Halts and Description

There is only one error halt in the program at location 17605. This error halt will occur if the JMP . instruction drops a bit and CAL's out. The computer will halt in location 17551 if the whole test is not repeated.

6.2 Error Recovery

If AC switch 0 is a 1, the computer will halt on an error. To recover and repeat the failure, reset AC switches 0 to 3 as necessary (see section 4.1) and then depress CONTINUE.

To test a particular location below 17500, store the address to be tested in location 17756 (POINT). Restart the program at location 17506 (HERE + 1) with AC switch 3 a 1.

6.3 Error Typeout Example

```
JMP . TEST
JMP AT  CAL  FROM
0 0 1234  0 0 1230
```

The above typeout shows that the JMP . at location 1234 dropped bit 15 and CALed from location 1230.

7. RESTRICTIONS

7.1 Starting Restrictions

(None)

7.2 Operating Restrictions

(None)

8. MISCELLANEOUS

8.1 Execution Time

Approximately 10 minutes to test from 0 to $17477_{(8)}$.

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 program is synchronized with the clock.

b. Then a location in the program, which indicates where the present JMP . is to be, is set to zero.

c. All of memory is then cleared, locations 1 and 21 are initialized and the JMP . instruction is formed and stored in the appropriate memory location.

d. Location 7 (the clock) is then set and started with all flags cleared. The interrupt system is then turned on and control is transferred to the JMP . instruction.

e. After the clock has timed out, assuming no error (see h.) control is returned to the program via the program interrupt facility. A check is made to see if the current JMP . should be repeated (switch 3). If so, then the program returns to c. except that memory is not cleared again.

f. If the current JMP . is not repeated, a check is made about ringing the bell (switch 2) and then the number in the internal JMP . pointer is incremented and checked to see that it is not 1, 7, 21, or the first address in the program. If it is 1, 7, or 21, it is incremented again. The program then returns to c.

g. After testing all memory locations, a check is made to see if the test should be repeated (switch 4). If so, the program returns to a. If not, the program halts.

h. If an error occurs, it is expected that the computer will CAL. When this takes place, control is transferred to an error reporting routine which turns off the interrupt facility, rings the bell (if appropriate), prints the error (if appropriate), stops (if appropr-ate) and returns to e.

10. LISTING

```
                        .TITLE JMP .
                        /
                        /JMP SELF TEST
                        /
                        .FULL
17500                   .LOC 17500
                        /
17500   777400  BEGIN   LAW 17400          /SET UP TO COUNT
17501   057747          DAC COUNT          /LOOPS
17502   117705          JMS SYNC           /SYNCHRONIZE THE CLOCK
17503   217746          LAC CON4
17504   057567          DAC CHANGE         /SET CHANGE TO LAW MESS1
                        /
17505   157756  HERE1   DZM POINT          /ZERO POINTER
17506   117647          JMS CLEAR          /CLEAR MEMORY
17507   217756          LAC POINT          /GET LOCATION OF JUMP.
17510   257750          XOR JMPCON         /FORM JMP. INSTRUCTION
17511   077756          DAC* POINT                 /STORE INSTRUCTION IN MEMORY
17512   750001          CLA!CMA            /THEN START THE CLOCK
17513   703302          CAF
17514   700044          CLON
17515   040007          DAC 7
17516   754000          CLA!CLL
17517   700042          ION                /TURN ON INTERRUPT
17520   637756          JMP* POINT                 /EXECUTE JMP .
                        /
17521   750004  RETURN  LAS
17522   517753          AND MASK1
17523   740200          SZA                /LOOP ON CURRENT LOCATION
17524   617507          JMP HERE1+2        /YES
17525   750004          LAS
17526   742010          RTL
17527   740100          SMA                /RING BELL?
17530   117610          JMS BELL           /YES
17531   457756          ISZ POINT          /NO, INCREMENT POINT FOR NEXT LOCATION
17532   217756          LAC POINT
17533   557751          SAD LOC1           /IS IT 1?
17534   617544          JMP .+10           /YES
17535   557752          SAD LOC2           /IS IT 21?
17536   617544          JMP .+6            /YES
17537   557760          SAD SEVEN          /IS IT 7?
17540   617544          JMP .+4            /YES
17541   557762          SAD UPLIM1         /IS IT THE UPPER LIMIT?
17542   617546          JMP .+4            /YES
17543   617506          JMP HERE1+1        /NO
17544   457756          ISZ POINT          /INCREMENT POINT
17545   617506          JMP HERE1+1        /GO BACK
17546   750004          LAS
17547   517754          AND MASK2
17550   741200          SNA                /REPEAT WHOLE TEST
17551   740040          XX                 /STOP
17552   617500          JMP BEGIN          /REPEAT
                        .EJECT
```

```
↑↑↑↑
                                /ERROR REPORTING ROUTINE
                                /
     17553      700002          ERROR1    IOF                 /TURN OFF INTERRUPT
     17554      750004                    LAS
     17555      742010                    RTL
     17556      740100                    SMA                 /BELL ON ERROR?
     17557      617562                    JMP .+3             /NO
     17560      760207                    LAW 207
     17561      117621                    JMS TYPE
     17562      750004                    LAS
     17563      740010                    RAL
     17564      741100                    SPA                 /PRINT ERRORS?
     17565      617603                    JMP HALT            /NO
     17566      117714                    JMS CRLF            /CR-LF
                                /
     17567      777722          CHANGE    LAW MESS1
     17570      117664                    JMS TYPOUT          /TYPE OUT HEADER
     17571      217745                    LAC CON3            /CHANGE INSTRUCTION
     17572      057567                    DAC CHANGE          /IN CHANGE
     17573      217756                    LAC POINT
     17574      117627                    JMS PRINT           /PRINT LOCATION OF JMP,
     17575      760240                    LAW 240
     17576      117621                    JMS TYPE            /1 SPACE
     17577      750001                    CLA!CMA
     17600      340020                    TAD 20
     17601      117627                    JMS PRINT           /LOCATION OF CAL
     17602      117714                    JMS CRLF
                                /
     17603      750004          HALT      LAS
     17604      741100                    SPA                 /HALT ON ERROR?
     17605      740040                    XX                  /YES
     17606      117705                    JMS SYNC
     17607      617521                    JMP RETURN          /SEE ABOUT OTHER STUFF
                                          .EJECT
```

```
****

                                /USEFUL SUBROUTINES
                                /
17610     000000        BELL    0
17611     457747                ISZ COUNT
17612     637610                JMP* BELL
17613     417500                XCT BEGIN
17614     057747                DAC COUNT
17615     760207                LAW 207
17616     117621                JMS TYPE
17617     117705                JMS SYNC
17620     637610                JMP* BELL
                                /
17621     000000        TYPE    0
17622     517757                AND RUBOUT
17623     700406                TLS
17624     700401                TSF
17625     617624                JMP .-1
17626     637621                JMP* TYPE
                                /
17627     000000        PRINT   0
17630     057761                DAC TEMP
17631     777772                LAW 17772
17632     057742                DAC CNTR
17633     217761                LAC TEMP
17634     740010                RAL
17635     740010                RAL
17636     742010                RTL
17637     057761                DAC TEMP
17640     517760                AND SEVEN
17641     257741                XOR ASKII
17642     117621                JMS TYPE
17643     217761                LAC TEMP
17644     457742                ISZ CNTR
17645     617635                JMP .-10
17646     637627                JMP* PRINT
                                .EJECT
```

```
****

                                /SUBROUTINE TO CLEAR MEMORY
                                /
17647   000000          CLEAR   0
17650   157755                  DZM PNTR
17651   177755                  DZM* PNTR
17652   457755                  ISZ PNTR
17653   217755                  LAC PNTR
17654   557762                  SAD UPLIM1
17655   741000                  SKP
17656   617651                  JMP CLEAR+2
17657   217743                  LAC CON1
17660   040001                  DAC 1
17661   217744                  LAC CON2
17662   040021                  DAC 21
17663   637647                  JMP* CLEAR
                                /
17664   000000          TYPOUT  0
17665   057755                  DAC PNTR
17666   237755                  LAC* PNTR
17667   740020                  RAR
17670   742020                  RTR
17671   742020                  RTR
17672   742020                  RTR
17673   742020                  RTR
17674   117621                  JMS TYPE
17675   557757                  SAD RUBOUT
17676   637664                  JMP* TYPOUT
17677   237755                  LAC* PNTR
17700   117621                  JMS TYPE
17701   557757                  SAD RUBOUT
17702   637664                  JMP* TYPOUT
17703   457755                  ISZ PNTR
17704   617666                  JMP TYPOUT+2
                                /
17705   000000          SYNC    0
17706   750001                  CLA!CMA
17707   700044                  CLON
17710   040007                  DAC 7
17711   700001                  CLSF
17712   617711                  JMP .-1
17713   637705                  JMP* SYNC
                                /
17714   000000          CRLF    0
17715   760215                  LAW 215
17716   117621                  JMS TYPE
17717   760212                  LAW 212
17720   117621                  JMS TYPE
17721   637714                  JMP* CRLF
                                .EJECT
```

↑↑↑↑

```
                                /ERROR MESSAGE
                                /
17722   312315          MESS1   312315          /J,M
17723   320240                  320240          /P,SP
17724   256240                  256240          /.,SP
17725   324305                  324305          /T,E
17726   323324                  323324          /S,T
17727   215212                  215212          /CR,LF
17730   312315                  312315          /J,M
17731   320240                  320240          /P,SP
17732   301324                  301324          /A,T
17733   240303                  240303          /SP,C
17734   301314                  301314          /A,L
17735   240306                  240306          /SP,F
17736   322317                  322317          /R,O
17737   315215                  315215          /M,CR
17740   212377                  212377          /LF,RO
                                /
                                /
                                /CONSTANTS AND VARIABLES
                                /
17741   000260          ASKII   260
17742   000000          CNTR    0
17743   617521          CON1    JMP RETURN
17744   617553          CON2    JMP ERROR1
17745   617573          CON3    JMP CHANGE+4
17746   777722          CON4    LAW MESS1
17747   000000          COUNT   0
17750   600000          JMPCON  JMP
17751   000001          LOC1    1
17752   000021          LOC2    21
17753   040000          MASK1   40000
17754   020000          MASK2   20000
17755   000000          PNTR    0
17756   000000          POINT   0
17757   000377          RUBOUT  377
17760   000007          SEVEN   7
17761   000000          TEMP    0
17762   017500          UPLIM1  BEGIN
        000000                  .END
```

ASKII	17741
BEGIN	17500
BELL	17610
CHANGE	17567
CLEAR	17647
CNTR	17742
CON1	17743
CON2	17744
CON3	17745
CON4	17746
COUNT	17747
CRLF	17714
ERROR1	17553
HALT	17603
HERE1	17505
JMPCON	17750
LOC1	17751
LOC2	17752
MASK1	17753
MASK2	17754
MESS1	17722
PNTR	17755
POINT	17756
PRINT	17627
RETURN	17521
RUBOUT	17757
SEVEN	17760
SYNC	17705
TEMP	17761
TYPE	17621
TYPOUT	17664
UPLIM1	17762

BEGIN	17500
HERE1	17505
RETURN	17521
ERROR1	17553
CHANGE	17567
HALT	17603
BELL	17610
TYPE	17621
PRINT	17627
CLEAR	17647
TYPOUT	17664
SYNC	17705
CRLF	17714
MESS1	17722
ASKII	17741
CNTR	17742
CON1	17743
CON2	17744
CON3	17745
CON4	17746
COUNT	17747
JMPCON	17750
LOC1	17751
LOC2	17752
MASK1	17753
MASK2	17754
PNTR	17755
POINT	17756
RUBOUT	17757
SEVEN	17760
TEMP	17761
UPLIM1	17762