PDP-15
CPU

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IDENTIFICATION

PRODUCT CODE:	MAINDEC-15-DAKAA-A-D REPLACES: MAINDEC-15-DOFB-D
PRODUCT NAME:	JMS Y - INTERRUPT TEST
DATE CREATED:	NOVEMBER 7, 1972
MAINTAINER:	DIAGNOSTIC GROUP
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1. ABSTRACT

The JMS Y - Interrupt Test determine if the PDP-15 will complete a JMS Y (where Y is some random value) instruction before it goes into program interrupt. This is done by setting an I/O flag and then transferring control to an ION/JMS Y instruction group (which is located at some random place in memory). The computer should complete the JMS Y plus the next instruction before the computer goes into program interrupt. If no error occurs, the ION/JMS 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-15 Computer.

2.2 Storage

The program uses all of 4K memory for the program or as a test area. The program occupies memory from location 07300 to 07711 and tests all locations below 07277.

2.3 Preliminary Programs

Basic Instruction Tests

3. LOADING PROCEDURE

3.1 Method

a. Put HRI tape of program in reader (high speed if available)

b. Set ADDRESS SWITCHES to 07300; the BANK MODE switch on a 1.

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 in the program.

AC Switch	Set As	Action
0	1	Halt on error.
	0	Don't halt on error.
1	1	Don't print error.
	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 07300 and may be changed at the operator's discretion.

4.2 Starting Address

The starting address of the program is 07300.

4.3 Program and/or Operator Action

a. Set ADDRESS SWITCHES to 07300.

b. Set ACCUMULATOR SWITCHES to desired positions (see section 4.1)

Normal setting is 500000.

c. Depress I/O RESET.

d. Depress START.

5. OPERATING PROCEDURE

See Section 4.1.

5.1 Subroutine Abstracts

None.

5.2 Program and/or Operator Action

To put the program in the scope mode, the ACCUMULATOR SWITCH REGISTER should be set to 260000 (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 Teletype.

6.1 Error Halts and Description

There is one error halt inside the program at location 07507. 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 of memory. If the computer does not go into program interrupt immediately after executing the next instruction (a NOP) after the JMS Y, the computer will halt at location Y + 2.

6.2 Error Recovery

6.2.1 Program Diagnosed Error

If AC switch 0 is a 1, the computer will halt on a 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.

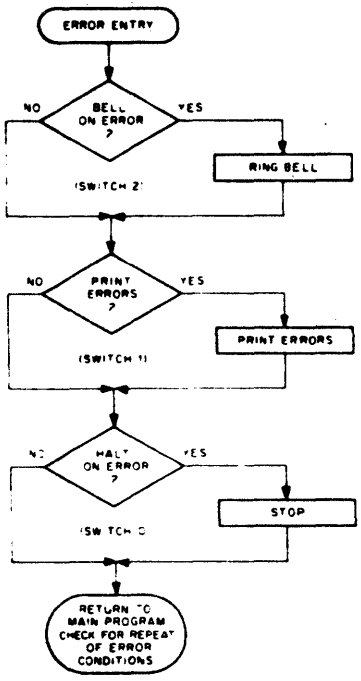
6.2.2 Interrupt Failures

Interrupt failures will cause a halt at location Y + 1. To recover, reset AC switches 0 to 4 as necessary (see section 4.1) and then start the computer at location 07300 (BEGIN) after depressing I/O RESET.

6.2.3 Test for ION, JMS Y, and Y

To test particular memory locations for the ION, JMS Y, and/or Y, store the address of the ION in location Ø7672 (POINT1), that address +1 in location Ø7673(POINT2), the address Y in location Ø7674 (POINT3). Then set AC switches 3 and 4 to 1, depress I/O RESET, and start the computer at location 07300 (BEGIN). Y and location of ION must be less than 07277 and not 00000 or 00001.

6.3 Error Switch Hierarchy



6.4 Error Typeout Example

```
ION-JMS Y
JMS AT          "Y"          C(0)          C(Y)
001234        007654         001235        740040
```

The above example shows that a JMS 7654 instruction was stored in location 1234 (it is implied that the ION is in 1233). The 1235 stored in location 00000 as well as the 740040 (HLT) in Y indicates the JMS was not completed before the computer went into program interrupt.

7. MISCELLANEOUS

7.1 Execution Time

Approximately 96 ms per ION/JMS Y instruction group.

8. 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 rung 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 JMS 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 or Y + 1, not equal to 00000 or 00001, and stored in Point 1 and incremented and stored in POINT2.

c. Then a check is made to see if the number Y should be changed (switch 3). If it is not, 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 at least 2 below the program, not equal to the location of ION or JMS Y instructions, not equal to 00000 or 000001, and stored in POINT3.

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

e. Upon return from the program interrupt, the contents of location Y are checked as well as the contents of location 00000 to make sure the proper numbers were stored in these locations. 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.

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                        .TITLE IONJMS
                        /COPYRIGHT 1969, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
                        /REVISED NOVEMBER 7, 1972 BY EARL L. BOUSE
                        /UPDATED PROGRAM TO ACCOMODATE ECO #50.
                        /
                        /JMS Y-INTERRUPT TEST
                        /
                                .ABS
            000200              .LOC 0200
                        /CHECK ACS AGAINST C(0)
00200 750004 CHECK      LAS
00201 507602            AND KONST
00202 047603            DAC CTEMP
00203 200000            LAC @
00204 047604            DAC SAV0
00205 507602            AND KONST
00206 547603            SAD CTEMP
00207 607400            JMP BEGIN
00210 607552            JMP ERROR
            007400              .LOC 7400
07400 207605 BEGIN      LAC (740000
07401 047564            DAC COUNT               /SET UP TO COUNT LOOPS
07402 760207            LAW 207
07403 700406            TLS                     /RING BELL TO SET UP I70 FLAG
07404 700401            TSF
07405 607404            JMP .-1
                        /
07406 107527 HERE1      JMS RANDOM      /GENERATE RANDOM ADDRESS
07407 507567            AND MASK
07410 047573            DAC POINT1      /STORE IN "ION" POINTER
07411 047574            DAC POINT2      /STORE IN "JMS Y" POINTER
07412 447574            ISZ POINT2      /AND INCREMENT
07413 741200            SNA             /IS "ION"=0?
07414 607406            JMP HERE1               /YES
07415 547570            SAD ONE         /HOW ABOUT 1?
07416 607406            JMP HERE1               /YES
07417 347576            TAD UPLIM               /IS THE "ION" POINTER
07420 741100            SMA             /INSIDE THIS PROGRAM?
07421 607406            JMP HERE1               /YES, GENERATE ANOTHER
07422 207574            LAC POINT2      /NO, NOW HOW ABOUT
07423 347576            TAD UPLIM               /THE "JMS Y" POINTER
07424 741100            SMA             /IS IT OK?
07425 607406            JMP HERE1               /NO, TRY AGAIN
07426 207575            LAC POINT3      /OK SO FAR, NOW IS "Y" POINTER
07427 547573            SAD POINT1      /EQUAL TO "ION" POINTER?
07430 607406            JMP HERE1               /YES
07431 547574            SAD POINT2      /NO, EQUAL TO "JMS Y" POINTER?
07432 607406            JMP HERE1               /YES
07433 347570            TAD ONE         /ADD 1 AND CHECK
07434 547573            SAD POINT1      /THAT THERE IS AT LEAST
07435 607406            JMP HERE1               /ONE LOCATION BETWEEN "Y" & "ION"
                        .EJECT
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```
07436 107540  HERE2   JMS RANDUM      /YES, GENERATE RANDOM ADDRESS
07437 507567          AND MASK
07440 347575          DAC POINT3      /AND STORE IN POINT 3
07441 741200          SNA             /IS "Y"=0?
07442 607436          JMP HERE2               /YES
07443 547570          SAD ONE         /HOW ABOUT 1?
07444 607436          JMP HERE2               /YES
07445 347600          TAD UPLIM2      /IS "Y" INSIDE PROGRAM OR
07446 740100          SMA             /FIRST LOCATION BEFORE
07447 607436          JMP HERE2               /YES
07450 207575          LAC POINT3      /OK SO FAR NOW IS "Y" POINTER
07451 547573          SAD POINT1      /EQUAL TO "ION" POINTER
07452 607436          JMP HERE2               /YES
07453 547574          SAD POINT2      /NO, EQUAL TO "JMS Y" POINTER
07454 607436          JMP HERE2               /YES
07455 347570          TAD ONE         /ADD 1 AND CHECK
07456 547573          SAD POINT1      /THAT THERE IS AT LEAST
07457 607436          JMP HERE2               /ONE LOCATION BETWEEN "Y" & "ION"
                      /
07460 107513  HERE3   JMS HALT                /STORE "JMP ERROR" IN MEMORY
07461 207565          LAC IONCON      /THEN THE ION VIA
07462 067573          DAC* POINT1     /"ION" POINTER
07463 207575          LAC POINT3      /GET "Y"
07464 247566          XOR JMSCON      /FORM JMS "Y"
07465 067574          DAC* POINT2     /STORE VIA "JMS Y" POINTER
07466 754000          CLA!CLL         /CLEAR AC & L
07467 627573          JMP* POINT1     /EXECUTE ION=JMS Y
07470 207574  RETURN  LAC POINT2      /GET LOCATION OF JMS
07471 347570          TAD ONE         /FORM ADDRESS STORED IN "Y"
07472 047601          DAC VAR1
07473 227575          LAC* POINT3
07474 507567          AND MASK
07475 547601          SAD VAR1
07476 741000          SKP             /YES, ALL OK
07477 607504          JMP ERRCON      /THE 'PC' SAVED ON THE 'JMS' IS WRONG,
07500 200000          LAC 0           /GET THE 'PC' SAVED ON THE INTERRUPT,
07501 507567          AND MASK        /MASK OUT THE ADDRESS,
07502 547606          SAD (ERROR      /SHOULD EQUAL 'ERROR' SUBROUTINE ADDR,
07503 741000          SKP             /YES
07504 607552  ERRCON  JMP ERROR       /THE 'PC' SAVED ON THE INTERRUPT IS WRONG,
07505 207604          LAC SAV0
07506 741100          SPA
07507 607550          JMP DONE
07510 447564          ISE COUNT               /DONE ENOUGH?
07511 607406          JMP HERE1               /NO
07512 607550          JMP DONE                /YES
                      .EJECT
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