

IDENTIFICATION

Product Code: MAINDEC-08-DO5B-D
Product Name: Random JMP-JMS Test
Date Created: December 28, 1967
Maintainer: Diagnostic Group
Author: R. Green

1. ABSTRACT

This is a diagnostic program to test the JMS instruction of the PDP-8. 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-8 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 08-D01(n), 08-D02(n), 08-D03(n), and 08-D04(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	Halt on error.
SR2	Hold the FROM address constant (1). Select random FROM addresses (0).
SR3	Hold the TO address constant (1). Select random TO addresses (0).

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 130

TO = Location 126

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. Push START.

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 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 evident 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 printouts, 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.b). Enter 5531 into location 1 and restart the program with SR2 and SR3 set.

The scope mode loop is:

<u>Location</u>	<u>Coding</u>
0000	
0001	JMP 1 FROM 1
xxxx	A, ION
xxxx	JMS 1 TO
0131	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: $0600 < \text{random address} < 7600$.

The area between 0600 and 7600 is filled with HLT instructions in case the interrupt fails.

"05" is printed after every 61,000 tests.

```

0200
*200
/RANDOM JMP-JMS TEST
/SPREAD HALT ON ERROR
/SPREAD FIXED FROM
/SPREAD FIXED TO
/SPREAD HALTS THROUGH MEMORY
/BETWEEN THE LIMLO AND LIMHI
/LIMITS

0200 4154 BEGIN, JMS PATCH /CLA
0201 1135 TAD LIMLO
0202 7041 CIA
0203 3126 DCA TO
0204 1152 GUN, TAD HALT
0205 3526 DCA I TO
0206 1126 TAD TO
0207 7001 IAC
0210 3126 DCA TO
0211 1126 TAD TO
0212 1136 TAD LIMHI
0213 7640 SZA CLA
0214 5204 JMP GUN
0215 1042 TAD M15
0216 3041 DCA CT1
0217 3040 DCA CT

/CHECK FOR FIXED FROM

0220 7604 LOOP, LAS
0221 7004 RAL
0222 7006 RTL
0223 7630 SEL CLA
0224 5246 JMP LOOP1-6

/GET RANDOM FROM

0225 1133 GETRAN, TAD RANUM
0226 7104 RAL CLL
0227 7430 SEL
0230 1134 TAD THREE
0231 3133 DCA RANUM
0232 1133 TAD RANUM
0233 7510 SPA
0234 5241 JMP ,+5
0235 1135 TAD LIMLO
0236 7710 SPA CLA
0237 5225 JMP GETRAN
0240 5244 JMP ,+4
0241 1136 TAD LIMHI
0242 7700 SMA CLA
0243 5225 JMP GETRAN

0244 1133 TAD RANUM
0245 3130 DCA FROM

```

0246 1130
0247 7001
0250 3132
0251 7040
0252 1130
0253 3131

TAD FROM
IAC
DCA FROM1
CMA
TAD FROM
DCA FROM1

/CHECK FOR FIXED TU

0254 7604
 0255 7006
 0256 7006
 0257 7630
 0260 5302

LOOP1, LAS
 RTL
 RTL
 S&L CLA
 JMP CRSCK-5

/GET RANDOM TU

0261 1133
 0262 7104
 0263 7430
 0264 1134
 0265 3133
 0266 1133
 0267 7510
 0270 5275
 0271 1135
 0272 7710
 0273 5261
 0274 5300
 0275 1136
 0276 7700
 0277 5261
 0300 1133
 0301 3126
 0302 1126
 0303 7001
 0304 3127
 0305 1130
 0306 7041
 0307 1126
 0310 7650
 0311 5220

GTRAN1, TAD RANUM
 RAL CLL
 S&L
 TAD THREE
 DCA RANUM
 TAD RANUM
 SPA
 JMP ,+5
 TAD LIMLO
 SPA CLA
 JMP GTRAN1
 JMP ,+4
 TAD LIMHI
 SMA CLA
 JMP GTRAN1
 TAD RANUM
 DCA TU
 TAD TU
 IAC
 DCA TOP1
 CRSCK, TAD FROM
 CIA
 TAD TU
 SNA CLA
 JMP LOOP

/BRING UP THE FLAG

0312 7040
 0313 6041
 0314 6046
 0315 6041
 0316 5315

CMA
 TSF
 TLS
 TSF
 JMP ,+1

/PLACE THE INSTRUCTIONS

0317	7200	CLA
0320	1137	TAD ITON
0321	3531	DCA I FROM1
0322	1153	TAD JMP1
0323	3530	DCA I FROM
0324	3000	DCA A

/GO DO IT

0325	5531	JMP I FROM1
0326	7402	HLT

/PRINTOUT SUBROUTINE

0327	0000	TYPAC, 0
0330	3143	DCA SAVE+3
0331	1143	TAD SAVE+3
0332	7012	RTR
0333	7010	RAR
0334	3142	DCA SAVE+2
0335	1142	TAD SAVE+2
0336	7012	RTR
0337	7010	RAR
0340	3141	DCA SAVE+1
0341	1141	TAD SAVE+1
0342	7012	RTR
0343	7010	RAR
0344	3140	DCA SAVE
0345	5727	JMP I TYPAC

/SUCCESS PRINTOUT

0346	1041	SUP, TAD CT1
0347	7001	IAC
0350	3041	DCA CT1
0351	1041	TAD CT1
0352	7640	SZA CLA
0353	5437	JMP I ALDOP
0354	1573	TAD MSG2
0355	3124	DCA WORK
0356	1124	LP1, TAD WORK
0357	7001	IAC
0360	3124	DCA WORK
0361	1524	TAD I WORK
0362	6046	TLS
0363	6041	TSE
0364	5363	JMP ,71
0365	1043	TAD M260
0366	7640	SZA CLA
0367	5356	JMP LP1
0370	1042	TAD M15
0371	3041	DCA CT1

1/11/ 3128,22

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0372 5437

JMP I AL00P

0373 0373
 0374 0215
 0375 0212
 0376 0260
 0377 0265

AM502,

1
 215
 212
 260
 265

/CH
 /LF
 /E
 /D

0000 0000
 0001 5001
 0002 0002
 0003 0003
 0004 1132
 0005 7640
 0006 5546
 0007 1127
 0010 7041
 0011 1000
 0012 7640
 0013 5546
 0014 1152
 0015 3530
 0016 1152
 0017 3526
 0020 7040
 0021 1000
 0022 3000
 0023 1152
 0024 3400
 0025 1152
 0026 3531
 0027 7001
 0030 1040
 0031 3040
 0032 1040
 0033 7640
 0034 5437
 0035 5436
 0036 0346
 0037 0220
 0040 0000
 0041 0000
 0042 7763
 0043 7513

*0

0
 JMP 1
 2
 3

/FOR SCOPE MODE INSERT
 /JMP 1 FROM 1 (5531) IN LUC1
 /GET STORED ADDRESS

TAD FRMP1
 SZA CLA
 JMP I AER
 TAD TUPI
 CIA
 TAD 0
 SZA CLA
 JMP I AER

/ADDRESS STORED IN (TO) WRONG

RETURN,

TAD HALT
 DCA I FROM
 TAD HALT
 DCA I TO
 CMA
 TAD 0
 DCA 0
 TAD HALT
 DCA I 0
 TAD HALT
 DCA I FROM1
 IAC
 TAD CT
 DCA CT
 TAD CT
 SZA CLA
 JMP I ALQOP
 JMP I ,+1
 SUP

/ADDRESS STORED IN (0) WRONG

ALQOP,

LOOP

CT,

0

CT1,

0

M15,

-15

M265,

-265

0044	0215	MSG1,	215	/CR
0045	0212		212	/LF
0046	0212		212	/LF
0047	0306		306	/F = FROM
0050	0240		240	/SPACE
0051	0000	INS1,	0	/X ADDRESS OF JMS INSTRUCTION
0052	0000	INS2,	0	/X
0053	0000	INS3,	0	/X
0054	0000	INS4,	0	/X
0055	0240		240	/SPACE
0056	0324		324	/I
0057	0317		317	/U
0060	0240		240	/SPACE
0061	0000	INS5,	0	/X
0062	0000	INS6,	0	/X
0063	0000	INS7,	0	/X
0064	0000	INS8,	0	/X
0065	0215		215	/CR
0066	0212		212	/LF
0067	0377		377	/RUBOUT
0070	0250		250	/I
0071	0324	MSG2,	324	/T
0072	0317		317	/U
0073	0251		251	/I
0074	0240		240	/SPACE
0075	0275		275	/F
0076	0240		240	/SPACE
0077	0000	INS9,	0	/X STORED ADDRESS
0100	0000	INS10,	0	/X S/B FRMP1
0101	0000	INS11,	0	/X
0102	0000	INS12,	0	/X
0103	0215		215	/CR
0104	0212		212	/LF
0105	0377		377	/RUBOUT
0106	0250		250	/I
0107	0000	MSG3,	0	/X ADDRESS=1 STORED
0110	0000	INS13,	0	/X IN LOC 0 AT INTERRUPT
0111	0000	INS14,	0	/X
0112	0000	INS15,	0	/X
0113	0251		251	/I
0114	0240		240	/SPACE
0115	0275		275	/F
0116	0240		240	/SPACE
0117	0000	INS16,	0	/X CONTENTS OF ABOVE
0120	0000	INS17,	0	/X ADDRESS
0121	0000	INS18,	0	/X
0122	0000	INS19,	0	/X
0123	0207		207	/END MARK
0124	0000	WORK,	0	
0125	7571	W207,	-207	

/CONSTANTS

0126	0000	TO,	0
0127	0000	TOP1,	0
0130	0000	FROM,	0
0131	0000	FROM1,	0
0132	0000	FRMP1,	0
0133	2525	RAVUM,	2525
0134	0003	THREE,	3
0135	7200	LIMLO,	-000
0136	0200	LIMHI,	-7600
0137	6001	ITON,	ION
0140	0000	SAVE,	0
0141	0000		0
0142	0000		0
0143	0000		0
0144	0007	MSK7,	7
0145	0260	Tw6,	260
0146	0400	AER,	ER
0147	0327	ATYP,	TYPAC
0150	0330	ATYP1,	TYPAC*1
0151	0044	AMSG1,	MSG1
0152	7402	HALT,	HLT
0153	4526	JMP1,	JMS I TO

0154 0000
0155 3000
0156 1167
0157 3001
0160 1170
0161 3002
0162 1171
0163 3003
0164 1172
0165 3573
0166 5554

PATCH, 0

/RESTORE THEN GO AWAY

DCA 2
TAD X1
DCA 1
TAD X2
DCA 2
TAD X3
DCA 3
TAD X4
DCA 1 X5
JMP 1 PATCH

0167 7200
0170 1526
0171 7041
0172 7200
0173 0200

X1, 7200
X2, 1526
X3, 7041
X4, CLA
X5, 200

/TAD 1 TO

0400

*400

0400	1204	E4,	TAD ,+4
0401	3547		DCA I ATYP
0402	1130		TAD FROM
0403	5550		JMP I ATYP1
0404	0405		,+1
0405	1140		TAD SAVE
0406	0144		AND MSK/
0407	1145		TAD TW6
0410	3051		DCA INS1
0411	1141		TAD SAVE+1
0412	0144		AND MSK/
0413	1145		TAD TW6
0414	3052		DCA INS2
0415	1142		TAD SAVE+2
0416	0144		AND MSK/
0417	1145		TAD TW6
0420	3053		DCA INS3
0421	1143		TAD SAVE+3
0422	0144		AND MSK/
0423	1145		TAD TW6
0424	3054		DCA INS4
0425	1231		TAD ,+4
0426	3547		DCA I ATYP
0427	1126		TAD TU
0430	5550		JMP I ATYP1
0431	0432		,+1
0432	1140		TAD SAVE
0433	0144		AND MSK/
0434	1145		TAD TW6
0435	3061		DCA INS5
0436	1141		TAD SAVE+1
0437	0144		AND MSK/
0440	1145		TAD TW6
0441	3062		DCA INS6
0442	1142		TAD SAVE+2
0443	0144		AND MSK/
0444	1145		TAD TW6
0445	3063		DCA INS/
0446	1143		TAD SAVE+3
0447	0144		AND MSK/
0450	1145		TAD TW6
0451	3064		DCA INS8
0452	1256		TAD ,+4
0453	3547		DCA I ATYP
0454	1526		TAD I TU
0455	5550		JMP I ATYP1
0456	0457		,+1

0457 1140
0460 0144
0461 1145
0462 3077
0463 1141
0464 0144
0465 1145
0466 3100
0467 1142
0470 0144
0471 1145
0472 3101
0473 1143
0474 0144
0475 1145
0476 3102
0477 7040
0500 1000
0501 3000

0502 1306
0503 3547
0504 1000
0505 5550
0506 0507
0507 1140
0510 0144
0511 1145
0512 3107
0513 1141
0514 0144
0515 1145
0516 3110
0517 1142
0520 0144
0521 1145
0522 3111
0523 1143
0524 0144
0525 1145
0526 3112
0527 1333
0530 3547
0531 1400
0532 5550
0533 0534
0534 1140
0535 0144
0536 1145
0537 3117
0540 1141
0541 0144
0542 1145
0543 3120
0544 1142

TAD SAVE
AND MSK/
TAD TW6
DCA INS9
TAD SAVE+1
AND MSK/
TAD TW6
DCA INS10
TAD SAVE+2
AND MSK/
TAD TW6
DCA INS11
TAD SAVE+3
AND MSK/
TAD TW6
DCA INS12
CMA
TAD 0
DCA 0

TAD ,+4
DCA I ATYP
TAD 0
JMP I ATYP1
,+1
TAD SAVE
AND MSK/
TAD TW6
DCA MSG3
TAD SAVE+1
AND MSK/
TAD TW6
DCA INS13
TAD SAVE+2
AND MSK/
TAD TW6
DCA INS14
TAD SAVE+3
AND MSK/
TAD TW6
DCA INS15
TAD ,+4
DCA I ATYP
TAD I 0
JMP I ATYP1
,+1
TAD SAVE
AND MSK/
TAD TW6
DCA INS16
TAD SAVE+1
AND MSK/
TAD TW6
DCA INS17
TAD SAVE+2

0545 0144
0546 1145
0547 3121
0550 1143
0551 0144
0552 1145
0553 3122

AND MSK/
TAD T_W6
DCA INS18
TAD SAVE+3
AND MSK/
TAD T_W6
DCA INS19

0554 1151
0555 3124
0556 1524
0557 6046
0560 6041
0561 5360
0562 7201
0563 1124
0564 3124
0565 1524
0566 1125
0567 7640
0570 5356
0571 7604
0572 7710
0573 7402
0574 5014

TYPE,

TAD AMSU1
DCA WORK
TAD I WORK
TLS
TSF
JMP , -1
CLA IAC
TAD WORK
DCA WORK
TAD I WORK
TAD MZ0/
SEA CLA
JMP TYPE
LAS
SPA CLA
HLT
JMP RETURN

/HALT ON ERROR

b

THERE ARE NO ERRORS

SYMBOL TABLE

AER	0146
ALDUP	0037
AMSG1	0151
AMSG2	0373
AIYP	0147
AIYP1	0150
BEGIN	0200
CRSCK	0305
CT	0040
CT1	0041
ER	0400
FMMP1	0132
FROM	0130
FROM1	0131
GETRAN	0225
GUN	0204
GTRAN1	0261
HALT	0152
INS1	0051
INS10	0100
INS11	0101
INS12	0102
INS13	0110
INS14	0111
INS15	0112
INS16	0117
INS17	0120
INS18	0121
INS19	0122
INS2	0052
INS3	0053
INS4	0054
INS5	0061
INS6	0062
INS7	0063
INS8	0064
INS9	0077
ITON	0137
JMP1	0153
LIMHI	0136
LIMLO	0135
LOOP	0220
LOOP1	0254
L*1	0356
MSG1	0044
MSG2	0071
MSG3	0107
MSK7	0144
M15	0042
M20/	0125
M265	0043
PATCH	0154
RANUM	0133

SYMBOL TABLE

RETURN	0014
SAVE	0140
SUP	0346
THREE	0134
TU	0126
TUP1	0127
TW6	0145
TYPAC	0327
TYPE	0556
WORK	0124
X1	0167
X2	0170
X3	0171
X4	0172
X5	0173

SYMBOL TABLE

RETURN	0014
ALOP	0037
CT	0040
CT1	0041
M15	0042
M265	0043
MSG1	0044
INS1	0051
INS2	0052
INS3	0053
INS4	0054
INS5	0061
INS6	0062
INS7	0063
INS8	0064
MSG2	0071
INS9	0077
INS10	0100
INS11	0101
INS12	0102
MSG3	0107
INS13	0110
INS14	0111
INS15	0112
INS16	0117
INS17	0120
INS18	0121
INS19	0122
WORK	0124
M207	0125
TJ	0126
TUP1	0127
FROM	0130
FROM1	0131
FRMP1	0132
RANUM	0133
THREE	0134
LIMLO	0135
LIMHI	0136
ITION	0137
SAVE	0140
MSK7	0144
T _w 6	0145
AER	0146
ATYP	0147
ATYP1	0150
AMSG1	0151
HALT	0152
JMP1	0153
PATCH	0154
X1	0167
X2	0170
X3	0171

SYMBOL TABLE

X4	0172
X5	0173
REGIN	0200
GON	0204
LOOP	0220
GETHAN	0225
LOOP1	0254
GTRAN1	0261
CKSCK	0305
TYPAC	0327
SUP	0346
LP1	0356
AMSG2	0373
ER	0400
TYPE	0556