

MAINDEC-08-DO5B-D

IDENTIFICATION

Product Code: MAINDEC-08-DO5B-D
Product Name: Random JMP-JMS Test
Date Created: December 28, 1967
Maintainer: Diagnostic Group
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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
 /SR0=HALT ON ERROR
 /SR2=FIXED FROM
 /SR3=FIXED TO
 /SPREAD HALTS THROUGH MEMORY
 /BETWEEN THE LIMLO AND LIMHI
 /LIMITS

0200 4154
 0201 1135
 0202 7041
 0203 3126
 0204 1152
 0205 3526
 0206 1126
 0207 7001
 0210 3126
 0211 1126
 0212 1136
 0213 7640
 0214 5204
 0215 1042
 0216 3041
 0217 3040

BEGIN, JMS PATCH /CLA
 TAD LIMLO
 CIA
 DCA TO
 GON, TAD HALT
 DCA I TO
 TAD TO
 IAC
 DCA TO
 TAD TO
 TAD LIMHI
 SEA CLA
 JMP GON
 TAD M15
 DCA CT1
 DCA CT

/CHECK FOR FIXED FROM

0220 7604
 0221 7004
 0222 7006
 0223 7630
 0224 5246

LOOP, LAS
 RAL
 RTL
 SEL CLA
 JMP LOOP1-6

/GET RANDOM FROM

0225 1133
 0226 7104
 0227 7430
 0230 1134
 0231 3133
 0232 1133
 0233 7510
 0234 5241
 0235 1135
 0236 7710
 0237 5225
 0240 5244
 0241 1136
 0242 7700
 0243 5225
 0244 1133
 0245 3130

GETRAN, TAD RANUM
 RAL CLL
 SEL
 TAD THREE
 DCA RANUM
 TAD RANUM
 SPA
 JMP ,+5
 TAD LIMLO
 SPA CLA
 JMP GETRAN
 JMP ,+4
 TAD LIMHI
 SMA CLA
 JMP GETRAN
 TAD RANUM
 DCA FROM

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

TAD FROM
IAC
DCA FRMP1
CMA
TAD FROM
DCA FROM1

/CHECK FOR FIXED TO

0254 7604
 0255 7006
 0256 7006
 0257 7630
 0260 5302

LOOP1, LAS
 RTL
 RTL
 S&L CLA
 JMP CRSCK-3

/GET RANDOM TO

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 TO
 TAD TO
 IAC
 DCA TOP1
 CRSCK, TAD FROM
 CIA
 TAD TO
 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 0

/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	SEA CLA
0353	5437	JMP I ALOOP
0354	1373	TAD AMSG2
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 ,=1
0365	1043	TAD M265
0366	7640	SEA CLA
0367	5356	JMP LP1
0370	1042	TAD M15
0371	3041	DCA CT1

1/11/68 3:28,22

PAGE 3-1

03/2 5437

JMP I ALDOP

0373 0373
 0374 0215
 0375 0212
 0376 0260
 0377 0265

AMSG2, .
 215 /CR
 212 /LF
 260 /0
 265 /5

0000
 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 /FOR SCOPE MODE INSERT
 JMP 1 /JMP I FROM 1 (5531) IN LOC1
 2 /GET STORED ADDRESS
 3
 TAD FRMP1
 SZA CLA /ADDRESS STORED IN (TO) WRONG
 JMP I AER
 TAD TOP1
 CIA
 TAD 0
 SZA CLA /ADDRESS STORED IN (0) WRONG
 JMP I AER
 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 ALOOP
 JMP I ,+1
 SUP
 ALOOP, 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	/T
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	/(
0071	0324	MSG2,	324	/T
0072	0317		317	/U
0073	0251		251	/)
0074	0240		240	/SPACE
0075	0275		275	/=
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	/(
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	/)
0114	0240		240	/SPACE
0115	0275		275	/=
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	M207,	-207	

/CONSTANTS

0126	0000	TO,	0
0127	0000	TOP1,	0
0130	0000	FROM,	0
0131	0000	FROM1,	0
0132	0000	FRMP1,	0
0133	2525	RANUM,	2525
0134	0003	THREE,	3
0135	7200	LIMLO,	-600
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	PATCH,	0	/RESTORE THEN GO AWAY
0155	3000		DCA 0	
0156	1167		TAD X1	
0157	3001		DCA 1	
0160	1170		TAD X2	
0161	3002		DCA 2	
0162	1171		TAD X3	
0163	3003		DCA 3	
0164	1172		TAD X4	
0165	3573		DCA I X5	
0166	5554		JMP I PATCH	
0167	7200	X1,	7200	
0170	1526	X2,	1526	/TAD I TO
0171	7041	X3,	7041	
0172	7200	X4,	CLA	
0173	0200	X5,	200	

0400	1204	*400	TAD ,+4
0401	3547	ER.	DCA I ATYP
0402	1130		TAD FROM
0403	5550		JMP I ATYP1
0404	0405		,+1
0405	1140		TAD SAVE
0406	0144		AND MSK7
0407	1145		TAD TW6
0410	3051		DCA INS1
0411	1141		TAD SAVE+1
0412	0144		AND MSK7
0413	1145		TAD TW6
0414	3052		DCA INS2
0415	1142		TAD SAVE+2
0416	0144		AND MSK7
0417	1145		TAD TW6
0420	3053		DCA INS3
0421	1143		TAD SAVE+3
0422	0144		AND MSK7
0423	1145		TAD TW6
0424	3054		DCA INS4
0425	1231		TAD ,+4
0426	3547		DCA I ATYP
0427	1126		TAD TO
0430	5550		JMP I ATYP1
0431	0432		,+1
0432	1140		TAD SAVE
0433	0144		AND MSK7
0434	1145		TAD TW6
0435	3061		DCA INS5
0436	1141		TAD SAVE+1
0437	0144		AND MSK7
0440	1145		TAD TW6
0441	3062		DCA INS6
0442	1142		TAD SAVE+2
0443	0144		AND MSK7
0444	1145		TAD TW6
0445	3063		DCA INS7
0446	1143		TAD SAVE+3
0447	0144		AND MSK7
0450	1145		TAD TW6
0451	3064		DCA INS8
0452	1256		TAD ,+4
0453	3547		DCA I ATYP
0454	1526		TAD I TO
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 MSK7
 TAD TW6
 DCA INS9
 TAD SAVE+1
 AND MSK7
 TAD TW6
 DCA INS10
 TAD SAVE+2
 AND MSK7
 TAD TW6
 DCA INS11
 TAD SAVE+3
 AND MSK7
 TAD TW6
 DCA INS12
 CMA
 TAD 0
 DCA 0

TAD ,+4
 DCA I ATYP
 TAD 0
 JMP I ATYP1
 ,+1
 TAD SAVE
 AND MSK7
 TAD TW6
 DCA MSG3
 TAD SAVE+1
 AND MSK7
 TAD TW6
 DCA INS13
 TAD SAVE+2
 AND MSK7
 TAD TW6
 DCA INS14
 TAD SAVE+3
 AND MSK7
 TAD TW6
 DCA INS15
 TAD ,+4
 DCA I ATYP
 TAD I 0
 JMP I ATYP1
 ,+1
 TAD SAVE
 AND MSK7
 TAD TW6
 DCA INS16
 TAD SAVE+1
 AND MSK7
 TAD TW6
 DCA INS17
 TAD SAVE+2

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

AND MSK7
TAD TW6
DCA INS18
TAD SAVE+3
AND MSK7
TAD TW6
DCA INS19

0554	1151		TAD	AMSG1	
0555	3124		DCA	WORK	
0556	1524	TYPE,	TAD	I WORK	
0557	6046		TL5		
0560	6041		T5F		
0561	5360		JMP	:=1	
0562	7201		CLA	IAC	
0563	1124		TAD	WORK	
0564	3124		DCA	WORK	
0565	1524		TAD	I WORK	
0566	1125		TAD	M207	
0567	7640		SZA	CLA	
0570	5356		JMP	TYPE	
0571	7604		LAS		
0572	7710		SPA	CLA	
0573	7402		HLT		/HALT ON ERROR
0574	5014		JMP	RETURN	

5

THERE ARE NO ERRORS

SYMBOL TABLE

AER	0146
ALOUP	0037
AMSG1	0151
AMSG2	0373
AIYP	0147
AIYP1	0150
BEGIN	0200
CRSCK	0305
CT	0040
CT1	0041
ER	0400
FRMP1	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
IION	0137
JMP1	0153
LIMHI	0136
LIMLO	0135
LOOP	0220
LOOP1	0254
LP1	0356
MSG1	0044
MSG2	0071
MSG3	0107
MSK7	0144
M15	0042
M207	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
ALoop	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
TU	0126
TUP1	0127
FROM	0130
FROM1	0131
FRMP1	0132
RANUM	0133
THREE	0134
LIMLO	0135
LIMHI	0136
ITON	0137
SAVE	0140
MSK7	0144
TW6	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
BEGIN	0200
GUN	0204
LOOP	0220
GETRAN	0225
LOOP1	0254
GTRAN1	0261
CKSCK	0305
TYPAC	0327
SUP	0346
LP1	0356
AMSG2	0373
ER	0400
TYPE	0556

(1)

(2)

(3)