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IDENTIFICATION

PRODUCT CODE: MAINDEC-8E-D@JB-D
PRODUCT NAME: RANDOM JHP-JHS TEST
DATE CREATED: DECEMBER 10, 1970
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: BRUCE HANSEN

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1. ABSTRACT

THIS IS A DIAGNOSTIC PROGRAM TO TEST THE JMS INSTRUCTION OF THE PDP-8E. 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-8E EQUIPPED WITH TELETYPE.

2.2 STORAGE

LOCATIONS 0000-0074

THE BINARY LOADER MUST BE STORED IN THE LAST MEMORY PAGE.

2.3 PRELIMINARY PROGRAMS

IT IS ASSUMED THAT M41N000-0E-00A* AND M41N000-0E-00B* HAVE BEEN RUN SUCCESSFULLY.

3. LOADING PROCEDURE

3.1 METHOD

USE THE STANDARD BINARY LOADER

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

SR0(0) HALT ON ERROR.
SR2(0) HOLD THE FROM ADDRESS CONSTANT
SR2(1) SELECT RANDOM FROM ADDRESSES
SR3(0) HOLD THE TO ADDRESS CONSTANT
SR3(1) SELECT RANDOM TO ADDRESSES

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 133
TO = LOCATION 131

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. PRESS CLEAR, AND THEN CONT.

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.) 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 AGAIN 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 5534 INTO LOCATION 1 AND RESTART THE PROGRAM WITH SR2 AND SR3 SET.

THE SCOPE MODE LOOP IS:

LOCATION	CODING
0000	
0001	JMP 1 FROM1
XXXX	A, IDN
XXXX	JMS 1 TO
0134	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<RANDOM A
ADDRESS<7600

THE AREA BETWEEN 0600 AND 7600 IS FILLED WITH HLT INSTRUCTIONS IN CASE THE INTERRUPT FAILS.

"JB" IS PRINTED AFTER EVERY 61,000 TESTS.

```

/RANDOM JMP-JMS TEST
/SR0(0)=HALT ON ERROR
/SR2(1)=FIXED FROM
/SR3(1)=FIXED TO
/SPREAD HALTS THROUGH MEMORY
/BETWEEN THE LIMLO AND LIMHI
/LIMITS

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      0200      *200
0200  4157  BEGIN,  JMS PATCH      /CLA
0201  1140          TAD LIMLO
0202  7041          CIA
0203  3131          DCA TO
0204  1155  GON,   TAD HALT
0205  3531          DCA I TO
0206  1131          TAD TO
0207  7001          IAC
0210  3131          DCA TO
0211  1131          TAD TO
0212  1141          TAD LIMHI
0213  7640          SZA CLA
0214  5204          JMP GON
0215  1045          TAD M15
0216  3044          DCA CT1
0217  3043          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  1136  GETRAN, TAD RANUM
0226  7104          RAL CLL
0227  7430          SEL
0230  1137          TAD THREE
0231  3136          DCA RANUM
0232  1136          TAD RANUM
0233  7510          SPA
0234  5241          JMP .+5
0235  1140          TAD LIMLO
0236  7710          SPA CLA
0237  5225          JMP GETRAN
0240  5244          JMP .+4
0241  1141          TAD LIMHI
0242  7700          SMA CLA
0243  5225          JMP GETRAN

0244  1136          TAD RANUM

```


0245	3133	DCA FROM
0246	1133	TAD FROM
0247	7001	IAC
0250	3135	DCA FRMP1
0251	7040	CMA
0252	1133	TAD FROM
0253	3134	DCA FROM1

/CHECK FOR FIXED TO

0254	7604	LOOP1, LAS
0255	7006	RTL
0256	7006	RTL
0257	7630	SZL CLA
0260	9302	JMP CRSCK-3

/GET RANDOM TO

0261	1136	GTRAN1, TAD RANUM
0262	7104	RAL CLL
0263	7430	SZL
0264	1137	TAD THREE
0265	3136	DCA RANUM
0266	1136	TAD RANUM
0267	7510	SPA
0270	9275	JMP .+5
0271	1140	TAD LIMLO
0272	7710	SPA CLA
0273	9261	JMP GTRAN1
0274	9300	JMP .+4
0275	1141	TAD LIMWI
0276	7700	SMA CLA
0277	9261	JMP GTRAN1
0300	1136	TAD RANUM
0301	3131	DCA TO
0302	1131	TAD TO
0303	7001	IAC
0304	3132	DCA TOP1
0305	1133	CRSCK, TAD FROM
0306	7041	CIA
0307	1131	TAD TO
0310	7650	SNA CLA
0311	9220	JMP LOOP

/BRING UP THE FLAG

0312	7040	CMA
0313	6041	TSF
0314	6046	TLS
0315	6041	TSF
0316	5315	JMP .-1

/PLACE THE INSTRUCTIONS

```
0317 7200      CLA
0320 1142      TAD ITON
0321 3534      DCA I FROM1
0322 1156      TAD JMP1
0323 3533      DCA I FROM
0324 3000      DCA 0
```

/GO DO IT

```
0325 5534      JMP I FROM1
0326 7402      HLT
```

/PRINTOUT SUBROUTINE

```
0327 0000      TYPAC, 0
0330 3146      DCA SAVE+3
0331 1146      TAD SAVE+3
0332 7012      RTR
0333 7010      RAR
0334 3145      DCA SAVE+2
0335 1145      TAD SAVE+2
0336 7012      RTR
0337 7010      RAR
0340 3144      DCA SAVE+1
0341 1144      TAD SAVE+1
0342 7012      RTR
0343 7010      RAR
0344 3143      DCA SAVE
0345 5727      JMP I TYPAC
```

/SUCCESS PRINTOUT

```
0346 1044      SUP, TAD CT1
0347 7001      IAC
0350 3044      DCA CT1
0351 1044      TAD CT1
0352 7640      SZA CLA
0353 5442      JMP I ALOOP
0354 1373      TAD AMMSG2
0355 3127      DCA WORK
0356 1127      LP1, TAD WORK
0357 7001      IAC
0360 3127      DCA WORK
0361 1527      TAD I WORK
0362 6046      TLS
0363 6041      TSF
0364 5363      JMP .-1
0365 1046      TAD M302
0366 7640      SZA CLA
0367 5356      JMP LP1
0370 1045      TAD M15
0371 3044      DCA CT1
0372 5442      JMP I ALOOP
```

0373	0373	AMSG2,	.	
0374	0215		215	/CR
0375	0212		212	/LF
0376	0312		312	/J
0377	0302		302	/B
	0000	*0		
0000	0000		0	/FOR SCOPE MODE INSERT
0001	0001		JMP 1	/JMP I FROM 1 (5534) IN LOC1
0002	0002		2	/GET STORED ADDRESS
0003	0003		3	
0004	0000		0	
0005	0000		0	
0006	7041		CIA	
0007	1135		TAD FRMP1	
0010	7640		SZA CLA	
0011	9551		JMP I AER	/ADDRESS STORED IN (TO) WRONG
0012	1132		TAD TOP1	
0013	7041		CIA	
0014	1000		TAD 0	
0015	7640		SZA CLA	
0016	9551		JMP I AER	/ADDRESS STORED IN (0) WRONG
0017	1155	RETURN,	TAD HALT	
0020	3533		DCA I FROM	
0021	1155		TAD HALT	
0022	3531		DCA I TO	
0023	7040		CMA	
0024	1000		TAD 0	
0025	3000		DCA 0	
0026	1155		TAD HALT	
0027	3400		DCA I 0	
0030	1155		TAD HALT	
0031	3534		DCA I FROM1	
0032	7001		IAC	
0033	1043		TAD CT	
0034	3043		DCA CT	
0035	1043		TAD CT	
0036	7640		SZA CLA	
0037	5442		JMP I ALOOP	
0040	5441		JMP I .+1	
0041	0346		SUP	
0042	0220	ALOOP,	LOOP	
0043	0000	CT,	0	
0044	0000	CT1,	0	
0045	7763	M15,	-15	
0046	7476	M302,	-302	
0047	0215	MSG1,	215	/CR
0050	0212		212	/LF
0051	0212		212	/LF
0052	0306		306	/F = FROM
0053	0240		240	/SPACE
0054	0000	INS1,	0	/X ADDRESS OF JMS INSTRUCTION

0055	0000	INS2,	0	/X
0056	0000	INS3,	0	/X
0057	0000	INS4,	0	/X
0060	0240		240	/SPACE
0061	0324		324	/T
0062	0317		317	/O
0063	0240		240	/SPACE
0064	0000	INS5,	0	/X
0065	0000	INS6,	0	/X
0066	0000	INS7,	0	/X
0067	0000	INS8,	0	/X
0070	0215		215	/CR
0071	0212		212	/LF
0072	0377		377	/RUBOUT
0073	0250		250	/(
0074	0324	MSG2,	324	/T
0075	0317		317	/O
0076	0251		251	/)
0077	0240		240	/SPACE
0100	0275		275	/=
0101	0240		240	/SPACE
0102	0000	INS9,	0	/X STORED ADDRESS
0103	0000	INS10,	0	/X S/B FRMP1
0104	0000	INS11,	0	/X
0105	0000	INS12,	0	/X
0106	0215		215	/CR
0107	0212		212	/LF
0110	0377		377	/RUBOUT
0111	0250		250	/(
0112	0000	MSG3,	0	/X ADDRESS-1 STORED
0113	0000	INS13,	0	/X IN LOC 0 AT INTERRUPT
0114	0000	INS14,	0	/X
0115	0000	INS15,	0	/X
0116	0251		251	/)
0117	0240		240	/SPACE
0120	0275		275	/=
0121	0240		240	/SPACE
0122	0000	INS16,	0	/X CONTENTS OF ABOVE
0123	0000	INS17,	0	/X ADDRESS
0124	0000	INS18,	0	/X
0125	0000	INS19,	0	/X
0126	0207		207	/END MARK
0127	0000	WORK,	0	
0130	7571	M207,	-207	

/CONSTANTS

0131	0000	TO,	0
0132	0000	TOP1,	0
0133	0000	FROM,	0
0134	0000	FROM1,	0
0135	0000	FRMP1,	0
0136	2525	RANUM,	2525
0137	0003	THREE,	3

0140 7200 LIMLO, -600
 0141 0200 LINHI, -7600
 0142 0001 ITON, 10N
 0143 0000 SAVE, 0
 0144 0000 0
 0145 0000 0
 0146 0000 0
 0147 0007 MSK7, 7
 0150 0260 TW6, 260
 0151 0400 AER, ER
 0152 0327 ATYP, TYPAC
 0153 0330 ATYP1, TYPAC+1

 0154 0047 AMSG1, MSG1

 0155 7402 HALT, HLT
 0156 4531 JMP1, JMS I TO

0157 0000 PATCH, 0
 0160 3000 DCA 0
 0161 1172 TAD X1
 0162 3001 DCA 1
 0163 1173 TAD X2
 0164 3002 DCA 2
 0165 1174 TAD X3
 0166 3003 DCA 3
 0167 1175 TAD X4
 0170 3576 DCA I X5
 0171 0557 JMP I PATCH

/RESTORE THEN GO AWAY

0172 7200 X1, CLA
 0173 1531 X2, TAD I TO
 0174 0006 X3, JMP 6
 0175 7200 X4, CLA
 0176 0200 X5, 200

/TAD I TO

0400 *400

0400 1204 ER, TAD .+4
 0401 3552 DCA I ATYP
 0402 1133 TAD FROM
 0403 0553 JMP I ATYP1
 0404 0405 .+1
 0405 1143 TAD SAVE
 0406 0147 AND MSK7
 0407 1150 TAD TW6
 0410 3054 DCA INS1
 0411 1144 TAD SAVE+1
 0412 0147 AND MSK7
 0413 1150 TAD TW6
 0414 3055 DCA INS2
 0415 1145 TAD SAVE+2
 0416 0147 AND MSK7

0417	1150	TAD TW6
0420	3056	DCA INS3
0421	1146	TAD SAVE+3
0422	0147	AND MSK7
0423	1150	TAD TW6
0424	3057	DCA INS4
0425	1231	TAD .+4
0426	3552	DCA I ATYP
0427	1131	TAD TO
0430	9553	JMP I ATYP1
0431	0432	+.1
0432	1143	TAD SAVE
0433	0147	AND MSK7
0434	1150	TAD TW6
0435	3064	DCA INS5
0436	1144	TAD SAVE+1
0437	0147	AND MSK7
0440	1150	TAD TW6
0441	3065	DCA INS6
0442	1145	TAD SAVE+2
0443	0147	AND MSK7
0444	1150	TAD TW6
0445	3066	DCA INS7
0446	1146	TAD SAVE+3
0447	0147	AND MSK7
0450	1150	TAD TW6
0451	3067	DCA INS8
0452	1256	TAD .+4
0453	3552	DCA I ATYP
0454	1531	TAD I TO
0455	9553	JMP I ATYP1
0456	0457	+.1
0457	1143	TAD SAVE
0460	0147	AND MSK7
0461	1150	TAD TW6
0462	3102	DCA INS9
0463	1144	TAD SAVE+1
0464	0147	AND MSK7
0465	1150	TAD TW6
0466	3103	DCA INS10
0467	1145	TAD SAVE+2
0470	0147	AND MSK7
0471	1150	TAD TW6
0472	3104	DCA INS11
0473	1146	TAD SAVE+3
0474	0147	AND MSK7
0475	1150	TAD TW6
0476	3105	DCA INS12
0477	7040	CMA
0500	1000	TAD 0
0501	3000	DCA 0
0502	1306	TAD .+4

0503 3552
0504 1000
0505 0553
0506 0507
0507 1143
0510 0147
0511 1150
0512 3112
0513 1144
0514 0147
0515 1150
0516 3113
0517 1145
0520 0147
0521 1150
0522 3114
0523 1146
0524 0147
0525 1150
0526 3115
0527 1333
0530 3552
0531 1400
0532 0553
0533 0534
0534 1143
0535 0147
0536 1150
0537 3122
0540 1144
0541 0147
0542 1150
0543 3123
0544 1145
0545 0147
0546 1150
0547 3124
0550 1146
0551 0147
0552 1150
0553 3125

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

0554 1154
0555 3127
0556 1527
0557 6046
0560 6041
0561 0360
0562 7201
0563 1127
0564 3127
0565 1527
0566 1130
0567 7640

TYPE,

TAD AMSG1
DCA WORK
TAD I WORK
TLS
TSF
JMP . -1
CLA IAC
TAD WORK
DCA WORK
TAD I WORK
TAD M207
SZA CLA

0570	9356	JMP	TYPE
0571	7604	LAS	
0572	7700	SMA	CLA
0573	7402	HLT	/HALT ON ERROR
0574	9017	JMP	RETURN

S

0000	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
0100	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
0200	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
0300	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
0400	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111
0500	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111000

0600
0700

1000
1100

1200
1300

1400
1500

1600
1700

2000
2100

2200
2300

2400
2500

2600
2700

3000
3100

3200
3300

3400
3500

3600
3700

4000

4100

4200

4300

4400

4500

4600

4700

5000

5100

5200

5300

5400

5500

5600

5700

6000

6100

6200

6300

6400

6500

6600

6700

7000

7100

7200

7300

7400

7500

7600

7700

A 0151
 AL 0042
 AMSG1 0154
 AMSG2 0373
 ATYP 0152
 ATYP1 0153
 BEGIN 0200
 CRSCK 0305
 CT 0043
 CT1 0044
 ER 0400
 FRMP1 0135
 FROM 0133
 FROM1 0134
 GETRAN 0225
 GON 0204
 GTRAN1 0261
 HALT 0155
 INS1 0054
 INS10 0103
 INS11 0104
 INS12 0105
 INS13 0113
 INS14 0114
 INS15 0115
 INS16 0122
 INS17 0123
 INS18 0124
 INS19 0125
 INS2 0055
 INS3 0056
 INS4 0057
 INS5 0064
 INS6 0065
 INS7 0066
 INS8 0067
 INS9 0102
 ITON 0142
 JMP1 0156
 LIMHI 0141
 LIMLO 0140
 LOOP 0220
 LOOP1 0254
 LP1 0356
 M15 0045
 M207 0130
 M302 0046
 MSG1 0047
 MSG2 0074
 MSG3 0112
 MSK7 0147
 PATCH 0157

RANUM 0136
 RETURN 0017
 SAVE 0143
 SUP 0346
 THREE 0137
 TO 0131
 TOP1 0132
 TW6 0150
 TYPAC 0327
 TYPE 0556
 WORK 0127
 X1 0172
 X2 0173
 X3 0174
 X4 0175
 X5 0176

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