

IDENTIFICATION

PRODUCT CODE: MAINDEC-X8-DIKAC-B-D
PRODUCT NAME: DEC/X8 MODULE "OPRATE"
OPERATE INSTRUCTION TEST
DATE CREATED: APRIL 21, 1972
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: JOHN VROBEL

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MAYNARD, MASS, 01754

1, MODULE DESCRIPTION

"OPRATE" IS A DEC/X8 SOFTWARE MODULE WHICH TESTS OPERATE INSTRUCTIONS AND THEIR MICROPROGRAMS AS ARE LEGAL IN SPECIFIED FAMILY-OF-8 PROCESSORS. THE MODULE MAY BE "INITIALIZED" TO BYPASS THE ADDITIONAL TESTS FOR ROTATE/IAC MICROPROGRAMS AND/OR SPECIAL PDP-8/E AND 8/M OPERATES. THE METHODS USED ARE OBVIOUS, HENCE ALL SPECIFICS MAY BE GAINED FROM THE PROGRAM LISTING.

2, REQUIREMENTS

- 1, PROCESSORS: PDP-8, 8/I, 8/L, 8/E, 8/M AND PDP-12,
- 2, OPTIONS: NONE
- 3, SPECIAL: NONE

3, RESTRICTIONS

NONE

4, OPERATING INFORMATION

4.1 SPECIAL CONSIDERATIONS

SR5 SHOULD BE SET TO 0 WHEN "OPRATE" IS SET UP TO TEST 8/E - 8/M MQ OPERATES.

4.2 BUILDING

- 1, JOB TYPE: BACKGROUND
- 2, PRIORITY: MUST BE LOWER THAN ALL INTERRUPT DRIVEN JOBS; OTHERWISE UNIMPORTANT,
- 3, JOB SLOTS: ANY EXISTENT JOB SLOT; 2 PAGES REQUIRED.

4.3 INITIALIZING

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1. PRESET CONDITION: IF "OPRATE" IS NEVER INITIALIZED IT WILL TEST ALL OPERATES AND MICROPROGRAMS WHICH ARE LEGAL ON THE PDP-8/E, 8/M.
 2. PARAMETER INPUT: AFTER "OPRATE" IS PRINTED THE USER SHOULD TYPE THE NUMERICAL CODE INDICATED TO ACHIEVE THE RESULTS DESIRED.

CODE	FULL TEST OF:	TESTS INCLUDED:
----	-----	-----
0	PDP-8	ALL OPERATES LEGAL ON PDP-8
1	PDP-8/I, 8/L, 12	SAME AS "0" PLUS ROTATE/IAC MICROPROGRAM TESTS.
2	PDP-8/E, 8/M	SAME AS "1" PLUS MQ AND BSW OPERATES.

4.4 DEVICE SETUP

NONE

4.5 RUNNING

-
1. CNTR: UPDATED AFTER EACH COMPLETE PASS OF THE MODULE.
 2. SR10: NO EFFECT
 3. SR11: NO EFFECT

5. ERROR INFORMATION

ALL ERRORS ARE CONSIDERED FATAL AND RESULT IN A PROGRAM HALT. ANY RECOVERY IS QUESTIONABLE.

6. LISTING (ATTACHED)

/DEC/X8 EXTERNAL SYMBOL TABLE "EXTSYM"
/FOR USE IN ASSEMBLING DEC/X8 SOFTWARE MODULES;
/COPYRIGHT 1972, DIGITAL EQUIPMENT CORP., MAYNARD, MASS.
XLIST
PAUSE

/MAINDEC-X8-DIKAC-B-L "DEC/X8" OPRATE
/BASIC PROCESSOR TEST FOR DEC/X8 WHICH TESTS FAMILY OF 8 OPERATE INSTRUCTIONS;
/COPYRIGHT 1972, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS;
/THIS MODULE OPERATIONAL ON PDP-8, 8/I, 8/L, 8/E AND PDP-12;
/PRG: JOHN VROBEL (XS621)

/BUILDER INSTRUCTIONS

/1; PRIORITY BACKGROUND JOB - MUST BE PLACED AFTER ALL INTERRUPT
/JOBS; OTHERWISE PLACEMENT IS NOT IMPORTANT;
/2; JOB SLOT: 2 PAGES REQUIRED, ANY EXISTENT JOB SLOT;

/INITIALIZER INSTRUCTIONS:

/1; FOLLOWING THE "OPRATE" PRINTOUT TYPE IN I B FOR PDP-8, A 1 FOR A PDP-8/I,
/2 FOR PDP-8/E;
/2; NO INITIALIZATION WILL RESULT IN TEST ON PDP-8 INSTRUCTIONS ONLY;

7002	BSW=7002
7501	HQA=7501
7421	HQL=7421
7521	SWP=7521
7401	HONOP=7401
7601	HQCL=7601
	/
	/START OF MODULE TABLE
0200	*0200
	/
0200	0000
0201	1720
0202	2201
0203	2405
0204	0200
0205	0411
0206	1301
0207	0355
0210	0200
0211	0000
0212	7402
0213	5611
0214	6202
0215	4426
0216	7777
0217	7777
0220	7777
0221	0000

	TEXT, TEXT	"OPRATE"
	TEXT	"DIKAC-B"
	HOMEDF, B	
		HLT
	INTACK, CIF	I HOMEDF
		00
		JMS I IHRET
		-1
	KILL,	-1
	KILLED,	-1
	CNTR,	0

/END MODULE TABLE

```

0222 0000 OUT, 0
0223 1217 TAD KILL
0224 7450 SNA
0225 5230 JMP ,=3
0226 3220 DCA KILLED
0227 5004 SERVEX
0230 1222 TAD OUT
0231 5004 SERVEX
0232 0000 CHKOUT, 0
0233 2246 ISE RTCNT4
0234 5632 JMP I CHKOUT
0235 4222 JMS OUT
0236 1131 TAD E M200
0237 3246 DCA RTCNT4
0240 5632 JMP I CHKOUT

0241 2525 K2525, 2525
0242 7763 SANCNT, 7763
0243 0000 RTCNT1, 0
0244 0000 RTCNT2, 0
0245 0000 RTCNT3, 0
0246 0000 RTCNT4, 0

/ROTATE ALL COMBINATIONS OF NUMBERS IN AC ONCE RIGHT THEN TWICE
/LEFT 13 TIMES, THEN ONCE LEFT AND TWICE RIGHT 13 TIMES.

0247 3221 RUN, DCA CNTR /CLEAR MONITOR COUNTER
0250 3245 DCA RTCNT3 /CLEAR ROTATE COUNTER
0251 1242 TAD SANCNT
0252 3243 DCA RTCNT1 /SETUP COUNTER
0253 1242 TAD SANCNT
0254 3244 DCA RTCNT2 /SETUP COUNTER
0255 7020 CML TAD RTCNT3 /NUMBER TO BE SHIFTED
0256 1245 RAR
0257 7010 RAL
0260 7006 RTL
0261 2243 ISE RTCNT1
0262 5237 JMP ,=3
0263 7004 RAL
0264 7012 RTR
0265 2244 ISE RTCNT2
0266 5263 JMP ,=3
0267 7041 CIA
0270 1245 TAD RTCNT3 /COMPARE TO THIS NUMBER
0271 7420 SNL
0272 7440 SEA /AC FAILED ON ROTATE
0273 7402 HLT
0274 4232 JMS CHKOUT
0275 2245 ISE RTCNT3
0276 5251 JMP RUN +2

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//TEST IAC LOGIC

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0277 7320 CLA CLL CML
0300 3243 DCA RTCNT1
0301 7001 IAC /IAC 4096 TIMES
0302 2243 ISE RTCNT1
0303 5301 JMP ,=2
0304 7041 CIA
0305 1243 TAD RTCNT1 /COMPARE TO THIS NUMBER
0306 7430 SEL /WON'T SKIP LINK = 1
0307 7440 SEA /WILL SKIP AC = 0000
0310 7402 HLT /IAC FAILED

/TEST CML + CMA LOGIC

0311 1241 TAD K2525
0312 7000 CML CMA
0313 2243 ISE RTCNT1
0314 5312 JMP ,=2
0315 7041 CIA
0316 1241 TAD K2525 /COMPARE TO THIS NUMBER
0317 7420 SNL /WON'T SKIP LINK = 1
0320 7440 SEA /WILL SKIP AC = 0000
0321 7402 HLT

/SHIFT A ONE IN AC TO CHECK SEA LOGIC

0322 7320 SKPTST, CLA CLL CML
0323 7010 RAR
0324 7440 SEA /SHOULD ONLY SKIP WHEN AC = 0000
0325 5323 JMP ,=2
0326 7041 CMA IAC /OVERFLOW CLEAR LINK AND SET AC = 0000
0327 7420 SNL /LINK SHOULD = 0
0330 7440 SEA /AC SHOULD = 0000
0331 7402 HLT /AC OR LINK FAILED

/SHIFT A 1 IN AC TO CHECK SNA LOGIC

0332 7020 CML /AC = 0000 - LINK = 1
0333 7004 RAL /SHOULD ONLY SKIP IF AC NOT = 0000
0334 7450 SNA
0335 7410 SKP
0336 5333 JMP ,=3
0337 7061 CMA CML IAC /OVERFLOW SET LINK AND SET AC = 0000
0340 7430 SEL /LINK SHOULD = 1
0341 7440 SEA /AC SHOULD = 0000
0342 7402 HLT /AC OR LINK FAILED

/TRY ALL COMBINATIONS OF SKIP INSTRUCTIONS

0343 7320 CLA CLL CML
0344 7370 SPA SNA SEL /WON'T SKIP AC = 0000
0345 7360 SMA SEA SNL /WILL SKIP AC = 0000
0346 7402 HLT /SKIP FAILED
0347 7070 CML CMA RAR /AC = 3777 - LINK = 1
0350 7370 SPA SNA SEL /WON'T SKIP LINK = 1
0351 7360 SMA SEA SNL /WILL SKIP LINK = 1

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0352	7402	HLT	/SKIP FAILED
0353	7141	CLL CMA IAC	/AC = 4001 - LINK = 0
0354	7570	SPA SNA SZL	/HON'T SKIP AC0=1
0355	7560	SMA SEA SNL	/WILL SKIP AC0=1
0356	7402	HLT	/SKIP FAILED
0357	7040	CMA	/AC = 3776
0360	7560	SMA SEA SNL	/HON'T SKIP NONE TRUE
0361	7770	SPA SNA SZL CLA	/WILL SKIP ALL TRUE
0362	7402	HLT	/SKIP FAILED
0363	7440	SEA	/AC SHOULD = 0000
0364	7402	HLT	/SKIP CLEAR AC FAILED
0365	7001	IAC	/AC = 0001 - LINK = 0
0366	7760	SMA SEA SNL CLA	/HON'T SKIP NONE TRUE
0367	7440	SEA	/AC SHOULD = 0000
0370	7402	HLT	/SKIP CLEAR AC FAILED

//TEST FOR OTHER 0/S

0371	1776	TAD I XFLAG	/0=0, 1=01, OTHER=0E
0372	7650	SNA CLA	
0373	5777	JMP I KEXIT	/IS A PDP-8
0374	5775	JMP I XROTES	/TEST IAC & ROTATES

0375	0400	XROTES, RUNIR	
0376	0570	XFLAG, FLAG	
0377	0551	KEXIT, EXIT	

0400

//TEST INCREMENTS AND ROTATES

0400	7360	RUNIR, CLA CLL CMA CML	
0401	7367	CLA CLL CMA CML IAC RTL	/AC = 0000 - LINK = 0
0402	7420	SNL	
0403	7440	SEA	
0404	7402	HLT	/IAC OR ROTATE FAILED

0405	7060	CMA CML	
0406	7373	CLA CLL CMA CML IAC RTR	/AC = 0000 - LINK = 0
0407	7420	SNL	
0410	7440	SEA	
0411	7402	HLT	/IAC OR ROTATE FAILED

//TEST ALL COMBINATIONS OF IAC AND ROTATES

0412	3366	DCA REGA	/CLEAR COUNT REGISTER
0413	1366	RUNRT, TAD REGA	/GET NUMBER TO BE TESTED
0414	7165	CLL CML CMA IAC RAL	
0415	7010	RAR	
0416	7073	CML CMA IAC RTR	
0417	7006	RTL	
0420	7071	CML CMA IAC RAR	
0421	7004	RAL	

0422	7067	CML CMA IAC RTL	
0423	7012	RTR	
0424	7041	CIA	
0425	1366	TAD REGA	/COMPARE TO THIS NUMBER
0426	7430	SEL	/LINK = 0
0427	7440	SEA	/AC = 0000
0430	7402	HLT	/LINK OR AC FAILED
0431	2366	ISE REGA	
0432	5213	JMP RUNRT	/TEST 4096 TIMES

//TEST FOR 0E

0433	7340	CLA CLL CMA	
0434	1370	TAD FLAG	
0435	7650	SNA CLA	
0436	5351	JMP EXIT	/IS AN 01

//TEST BSW + HQ INSTRUCTIONS

//TEST ALL COMBINATIONS OF BSW'S

0437	3366	DCA REGA	
0440	4777	RNM0BS, JMS I ICHKOUT	
0441	1366	TAD REGA	
0442	7106	RTL CLL	
0443	7006	RTL	
0444	7006	RTL	/PUT 6-11 IN 0-5
0445	0371	AND K7700	
0446	3367	DCA REGB	
0447	1366	TAD REGA	
0450	7112	RTR CLL	
0451	7012	RTR	
0452	7012	RTR	/PUT 0-5 IN 6-11
0453	0372	AND K0077	
0454	1367	TAD REGB	
0455	7002	BSW	/SWAP 0-5 AND 6-11
0456	7041	CIA	
0457	1366	TAD REGA	
0460	7440	SEA	/COMPARE TO THIS NUMBER
0461	7402	HLT	/BSW FAILED

//TEST HQ INSTRUCTIONS ALL COMBINATIONS

0462	1366	TAD REGA	
0463	7040	CMA	
0464	3367	DCA REGB	
0465	1366	TAD REGA	
0466	7420	HQL	/LOAD HQ 742I CLEAR AC
0467	7440	SEA	
0470	7402	HLT	/HQL CLEAR AC
0471	1367	TAD REGB	
0472	7321	SWP	/SWAP AC 0-5 HQ
0473	7401	HONOP	/HQ NOP
0474	7041	CIA	
0475	1366	TAD REGA	

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0476 7440 SEA
0477 7402 HLT
0500 1366 TAD REGA
0501 7601 MQLA
0502 7440 SEA
0503 7402 HLT
0504 1366 TAD REGA
0505 7701 CLA MQA
0506 7041 CIA
0507 1367 TAD REGB
0510 7440 SEA
0511 7402 HLT
0512 1367 TAD REGB
0513 7501 MQA
0514 7041 CIA
0515 1367 TAD REGB
0516 7440 SEA
0517 7402 HLT
0520 1366 TAD REGA
0521 7501 MQA
0522 7040 CMA
0523 7440 SEA
0524 7402 HLT
0525 1366 TAD REGA
0526 7621 CLA MQL
0527 7440 SEA
0530 7402 HLT
0531 7701 CLA MQA
0532 7440 SEA
0533 7402 HLT
0534 1366 TAD REGA
0535 7421 MQL
0536 1367 TAD REGB
0537 7721 CLA SHP
0540 7041 CIA
0541 1366 TAD REGA
0542 7440 SEA
0543 7402 HLT
0544 7701 CLA MQA
0545 7440 SEA
0546 7402 HLT
0547 2366 ISE REGA
0550 5240 JMP RNMQBS

0551 2775 EXIT, ISE I KCNTR
0552 7000 NOP
0553 4774 JMS I KOUT
0554 5773 JMP I KRUN

/***** /UPDATE PASS COUNTER
/REV B INSERT 4/21/72 L'E'B;
/EXIT TO MONITOR
/RESUME TESTING

/INITIALIZATION ROUTINE

0555 1376 INIT, TAD (TEXT1
0556 3360 DCA ,+2
0557 4444 MESSAGE
0560 0000 0

```

```

0561 4455 SPACE2
0562 4442 ONEOCT
0563 5361 JMP ,+2
0564 3370 DCA FLAG
0565 5020 INITEX

0566 0000 REGA, 0
0567 0000 REGB, 0
0570 0002 FLAG, 0002
0571 7700 K7700, 7700
0572 0077 K0077, 0077

0573
/
/
0573 0250 KRUN, RUN +1
0574 0222 KOUT, OUT
0575 0221 KCNTR, CNTR

0576 0201
0577 0232

```

0000
0100
0200
0300
0400
0500
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

11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111


```

0001          FIELD 1
//LOADER CALL
0600 0555          INIT
0601 0247          RUN
0602 0000          0
0603 0000          0
0604 0000          0
0605 0000          0
0606 0000          0
/
S

```

```

0000
0100

0200
0300

0400
0500

```

```

0600 1111110 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
0700 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

```

```

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

ASBUFF	4460	K5402	0003
ASBUFF	2060	K64	0070
AUTO	0017	K7	0075
BSW	7002	K70	0105
CHKOUT	0232	K7510	0125
CNTR	0221	K7520	0126
CRLF	4454	K7540	0127
CRLFP	0054	K7600	0131
ERRP	0061	K77	0106
EXINIT	0020	K7700	0571
EXIT	0551	K7735	0132
EXSERV	0004	K7740	0133
EXTMEM	0161	K7750	0134
FLAG	0570	K7760	0135
FOROCP	0043	K7771	0136
FOROCT	4443	K7773	0137
HOMEDP	0211	K7774	0140
IHRETP	0026	K7775	0141
INIT	0555	KCDF	0064
INITEX	5020	KCIF	0005
INTACK	0214	KCIFDF	0000
IOPNSP	0056	KCNTR	0575
K0	0066	KILL	0217
K0077	0572	KILLED	0220
K10	0076	KIOF	0064
K100	0107	KOUT	0574
K11	0077	KRUN	0573
K116	0071	LISN	4440
K13	0100	LISNP	0040
K17	0101	M20	0135
K177	0130	M200	0131
K20	0102	M240	0127
K200	0110	M260	0126
K2000	0122	M270	0125
K212	0111	M3	0141
K215	0112	M30	0134
K240	0113	M4	0140
K2525	0241	M40	0133
K260	0114	M43	0132
K272	0115	M5	0137
K277	0116	M7	0136
K3	0072	MESSAGE	4444
K30	0103	MSGP	0044
K301	0117	HQA	7501
K32	0067	MOCLA	7401
K323	0120	HQL	7401
K4	0073	HQNOP	7401
K40	0104	MUL26P	0065
K400	0121	ONEOCP	0042
K5	0074	ONEOCT	4442
K5200	0123	OUT	0222
K540	0124	PRNT1	4451

PRNT1P	0051
PRNT2	4452
PRNT2P	0052
PRNT4	4453
PRNT4P	0053
REGA	0566
REGB	0567
RLBUFF	4457
RLBUFF	0057
RNMGBS	0440
RTCNT1	0243
RTCNT2	0244
RTCNT3	0245
RTCNT4	0246
RUN	0247
RUNIR	0400
RUNRT	0413
SAMCNT	0242
SERVEX	5004
SKPTST	0322
SPACE2	4455
SPACEP	0055
SHP	7521
TEXT1	0201
THOOCF	0041
THOOCF	4431
TYPE	4450
TYPEP	0050
XEXIT	0377
XFLAG	0376
XROTES	0375

ERRORS DETECTED: 0
LINKS GENERATED: 0
RUN-TIME: 4 SECONDS
2K CORE USED