

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

- 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 "EXTSYN"
 /FOR USE IN ASSEMBLING DEC/X8 SOFTWARE MODULES;
 /COPYRIGHT 1972, DIGITAL EQUIPMENT CORP., MAYNARD, MASS;
 XLIST
 PAUSE

PAL10 V141 21-APR-72 14127 PAGE 2

/MAINDEC-X8-DIKAC-B-L "DEC/X8" OPRATE
 /BASIC PROCESSOR TEST FOR DEC/X8 WHICH TESTS FAMILY OF 8 OPRATE INSTRUCTIONS;
 /COPYRIGHT 1972, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS;
 /THIS MODULE OPERATIONAL ON PDP-8, 8/1, 8/L, 8/E AND PDP-12;
 /PRG1 JOHN VROBEL (X3621)

/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 1 8 FOR PDP-8, A 1 FOR A PDP-8/1,
 /2 FOR PDP-8/E;
 /2; NO INITIALIZATION WILL RESULT IN TEST ON PDP-8 INSTRUCTIONS ONLY;

7002	B\$W=7002
7501	HQA=7501
7421	HQL=7421
7521	SWP=7521
7401	HONOP=7401
7601	HQCL=7601
0200	/START OF MODULE TABLE
0200	0000
0201	1720
0202	2201
0203	2405
0204	0000
0205	0411
0206	1301
0207	0335
0210	0200
0211	0000
0212	7402
0213	5611
0214	6202
0215	4426
0216	7777
0217	7777
0220	7777
0221	0000

TEXT1, TEXT "OPRATE"

TEXT "DIKAC-B"

HOMEDF, 0

HLT

JMP I HOMEDF

INTACK, CIF 00

JMS I JHRET

-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 RTCT4
0234 5632 JMP I CHKOUT
0235 4222 JMS OUT
0236 1131 TAD E M200
0237 3246 DCA RTCT4
0240 5632 JMP I CHKOUT

0241 2525 K2925, 2525
0242 7763 SAMCNT, 7763
0243 0000 RTCT1, 0
0244 0000 RTCT2, 0
0245 0000 RTCT3, 0
0246 0000 RTCT4, 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 RTCT3 /CLEAR ROTATE COUNTER
0251 1242 TAD SAMCNT
0252 3243 DCA RTCT1 /SETUP COUNTER
0253 1242 TAD SAMCNT
0254 3244 DCA RTCT2 /SETUP COUNTER
0255 7020 CML
0256 1245 TAD RTCT3 /NUMBER TO BE SHIFTED
0257 7010 RAR
0260 7006 RTL
0261 2243 ISE RTCT1
0262 5257 JMP ,+3
0263 7004 RAL
0264 7012 RTR
0265 2244 ISE RTCT2
0266 5263 JMP ,+3
0267 7041 CIA
0270 1245 TAD RTCT3 /COMPARE TO THIS NUMBER
0271 7420 SNL
0272 7440 SEA
0273 7402 HLT /AC FAILED ON ROTATE
0274 4232 JMS CHKOUT
0275 2245 ISE RTCT3
0276 5251 JMP RUN +2

```

/TEST IAC LOGIC

```

0277 7320 CLA CLL CML
0300 3243 DCA RTCT1
0301 7001 IAC /IAC 4096 TIMES
0302 2243 ISE RTCT1
0303 5301 JMP ,+2
0304 7041 CIA
0305 1243 TAD RTCT1 /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 K2925
0312 7060 CML CMA
0313 2243 ISE RTCT1
0314 5312 JMP ,+2
0315 7041 CIA
0316 1241 TAD K2925 /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
0333 7004 RAL /AC = 0000 = LINK = 1
0334 7450 SNA /SHOULD ONLY SKIP IF AC NOT = 0000
0335 7410 SKP
0336 5333 JMP ,+3
0337 7041 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 7570 SPA SNA SEL /WON'T SKIP AC = 0000
0345 7560 SNA SEA SNL /WILL SKIP AC = 0000
0346 7402 HLT /SKIP FAILED
0347 7070 CML CMA RAR /AC = 3777 = LINK = 1
0350 7570 SPA SNA SEL /WON'T SKIP LINK = 1
0351 7560 SNA SEA SNL /WILL SKIP LINK = 1

```

```

0392 7402 HLT /SKIP FAILED
0393 7141 CLL CMA IAC /AC = 4001 - LINK = 0
0394 7570 SPA SNA SZL /WONT SKIP AC=1
0395 7560 SMA SEA SNL /WILL SKIP AC=1
0396 7402 HLT /SKIP FAILED
0397 7040 CMA /AC = 3776
0398 7560 SMA SEA SNL /WONT SKIP NONE TRUE
0399 7770 SPA SNA SZL CLA /WILL SKIP ALL TRUE
0400 7402 HLT /SKIP FAILED
0401 7440 SEA /AC SHOULD = 0000
0402 7402 HLT /SKIP CLEAR AC FAILED
0403 7001 IAC /AC = 0001 - LINK = 0
0404 7760 SMA SEA SNL CLA /WONT SKIP NONE TRUE
0405 7440 SEA /AC SHOULD = 0000
0406 7402 HLT /SKIP CLEAR AC FAILED

```

/TEST FOR OTHER 8/8

```

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

```

0375

```

0375 0400 XROTAS, RUNIR
0376 0570 XFLAG, FLAG
0377 0551 XEXIT, 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
0408 7440 SEA
0409 7402 HLT /IAC OR ROTATE FAILED

```

/TEST ALL COMBINATIONS OF IAC AND ROTATES

```

0412 3366 DCA REGA /CLEAR COUNT REGISTER
0413 1366 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
0418 7071 CML CMA IAC RAR
0419 7004 RAL

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```

0422 7067 CML CMA IAC RTL
0423 7012 RTR
0424 7041 CIA
0425 1366 TAD REGA /COMPARE TO THIS NUMBER
0426 7430 SZL /LINK = 0
0427 7440 SEA /AC = 0000
0428 7402 HLT /LINK OR AC FAILED
0429 2366 ISE REGA
0430 5213 JMP RUNIR /TEST 4096 TIMES

```

/TEST FOR 0E

```

0433 7340 CLA CLL CMA
0434 1370 TAD FLAG
0435 7650 SNA CLA
0436 5391 JMP EXIT /IS AN 01

```

/TEST BSW + MQ INSTRUCTIONS

/TEST ALL COMBINATIONS OF BSW'S

```

0437 3366 DCA REGA
0438 4777 RNNQBS, JMS I CHKOUT
0439 1366 TAD REGA
0440 7106 RTL CLL
0441 7006 RTL
0442 7006 RTL /PUT 6-11 IN 0-5
0443 0371 AND K7700
0444 3367 DCA REGA
0445 1366 TAD REGA
0446 7112 RTR CLL
0447 7012 RTR
0448 7012 RTR /PUT 0-5 IN 6-11
0449 0372 AND K0077
0450 1367 TAD REGA
0451 7002 BSW /SWAP 0-5 AND 6-11
0452 7041 CIA
0453 1366 TAD REGA
0454 7440 SEA /COMPARE TO THIS NUMBER
0455 7402 HLT /BSW FAILED

```

/TEST MQ INSTRUCTIONS ALL COMBINATIONS

```

0462 1366 TAD REGA
0463 7040 CMA
0464 3367 DCA REGA
0465 1366 TAD REGA
0466 7421 MOL /LOAD MQ 7421 CLEAR AC
0467 7440 SEA
0468 7402 HLT /MOL CLEAR AC
0469 1367 TAD REGA
0470 7521 SWP /SWAP AC < 5 MQ
0471 7401 MGNOP /MQ NOP
0472 7041 CIA
0473 1366 TAD REGA

```

```

0476 7440 SZA
0477 7402 HLT /AC OR HQ FAILED
0500 1366 TAD REGA /HQ CLEAR THE AC 7601
0501 7601 MOCLA
0502 7440 SZA
0503 7402 HLT /HQ CLEAR THE AC FAILED
0504 1366 TAD REGA
0505 7701 CLA MQA /LOAD HQ TO AC
0506 7041 CIA
0507 1367 TAD REGB
0510 7440 SZA
0511 7402 HLT /AC OR HQ FAILED
0512 1367 TAD REGB /OR HQ TO AC
0513 7501 MQA
0514 7041 CIA
0515 1367 TAD REGB
0516 7440 SZA
0517 7402 HLT /AC OR HQ FAILED
0520 1366 TAD REGA /OR HQ TO AC
0521 7501 MQA
0522 7040 CMA
0523 7440 SZA
0524 7402 HLT /AC OR HQ FAILED
0525 1366 TAD REGA
0526 7621 CLA HQL /CLEAR AC AND HQ
0527 7440 SZA
0530 7402 HLT /AC OR HQ FAILED
0531 7701 CLA MQA /LOAD HQ TO AC
0532 7440 SZA
0533 7402 HLT /AC OR HQ FAILED
0534 1366 TAD REGA
0535 7421 HQL
0536 1367 TAD REGB
0537 7721 CLA SHP /AC-HQ, CLEAR HQ
0540 7041 CIA
0541 1366 TAD REGA
0542 7440 SZA
0543 7402 HLT /AC OR HQ FAILED
0544 7701 CLA MQA /LOAD HQ TO AC
0545 7440 SZA
0546 7402 HLT /AC OR HQ FAILED
0547 2366 ISE REGA
0550 5240 JMP RNMQBS

0551 2775 EXIT, ISE I KCNTR /UPDATE PASS COUNTER
0552 7000 NOP /REV B INSERT 4721772 L'E;B;
0553 4774 JMS I KOUT /EXIT TO MONITOR
0554 5773 JMP I KRUN /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 /WAIT FOR MESSAGE INPUT
0563 5361 JMP ,*2 /ERROR ON INPUT REV
0564 3370 DCA FLAG /SAVE 0=0, 1=01, 2 OR MORE =0E
0565 5020 INITEX /EXIT TO MONITOR

0566 0000 /
0567 0000 REGA, 0
0570 0002 REGB, 0
0571 7700 FLAG, 0002 /SET UP FOR 0/E 0/M
0572 0077 K7700, 7700
0573 0077 K0077, 0077

0573 0250 /
0574 0222 KRUN, RUN +1
0575 0221 KOUT, OUT
0576 0201 KCNTR, CNTR
0577 0232 /

```

0000
0100

0200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
0300 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
0400 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
0500 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111

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


```

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
          /
          $
    
```

0000
0100

0200
0300

0400
0500

0600 1111110 00000000 00000000 00000000 00000000 00000000 00000000 00000000
0700 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
CRLF	0054	K7600	0131
ERRP	0061	K77	0106
EXINIT	0020	K7700	0071
EXIT	0551	K7735	0132
EXSERV	0004	K7740	0133
EXTMEM	0161	K7750	0134
FLAG	0570	K7760	0135
FOROCP	0043	K7771	0136
FOROCT	4443	K7773	0137
HOMEDF	0211	K7774	0140
IMRETP	0026	K7775	0141
INIT	0555	KCDF	0064
INITEX	5020	KCIF	0005
INTACK	0214	KCIFDF	0000
IOFMS	0056	KCNTR	0575
K0	0066	KILL	0217
K0077	0572	KILLED	0220
K10	0076	KIOF	0004
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	MESAGP	0044
K301	0117	MGA	7501
K32	0067	MOCLA	7601
K323	0120	MQL	7421
K4	0073	MQNOP	7401
K40	0104	MUL26P	0065
K400	0121	ONEOCP	0042
K5	0074	ONEOCT	4442
K5200	0123	OUT	0222
K540	0124	PRNT1	4451

PRNT1P 0001
PRNT2 4492
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
SAMONT 0242
SERVEX 5004
SKPTST 0322
SPACE2 4405
SPACEP 0055
SWP 7521
TEXT1 0201
THOCCP 0041
THOCC 4441
TYPE 4400
TYPEP 0050
XEXIT 0377
XFLAG 0376
XROTES 0375

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