

IDENTIFICATION

PRODUCT CODE: MAINDEC-X8-DIKEA-B-D
PRODUCT NAME: DEC/X8 MODULE "EAEALL"
EAE EXERCISE OF MUY, DVI, SHL, LSR,
ASR AND NMI INSTRUCTIONS
DATE CREATED: SEPTEMBER 7, 1972
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: ED FORTMILLER

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DIGITAL EQUIPMENT CORPORATION
MAYNARD, MASS. 01754

1. MODULE DESCRIPTION

"EAEALL" IS A DEC/X8 SOFTWARE MODULE WHICH EXERCISES THE MUY, DVI, SHL, ASR, LSR AND NMI INSTRUCTIONS IN ALL FAMILY-OF-8 EAE'S. IN THE KEB-E EAE BOTH MODES "A" AND "B" ARE UTILIZED. REFER TO PARAGRAPH 4.3 FOR INITIALIZING INFORMATION.

"EAEALL" IS DIVIDED INTO FIVE TEST SECTIONS, TEST X000 THROUGH X004. TEST X000 EXERCISES MUY AND DVI BY SOLVING THE PROBLEM

$$A*B/B*B/A*A/B*B/A=B$$

TEST X001 THROUGH X003 EXERCISE SHL, LSR, AND ASR RESPECTIVELY. THE NUMBER OF SHIFTS RANGE FROM 1 TO 40 (37 IN A KEB-E EAE MODE "B"). THE MAXIMUM NUMBER OF SHIFTS ALLOWED MAY BE CHANGED BY THE USER.

TEST X004 EXERCISES THE NMI INSTRUCTION. THE RESULT OF THE NORMALIZE IS CHECKED BY THE USE OF THE ASR INSTRUCTION.

SINCE TESTS X001 THROUGH X004 MAY CAUSE "DATA REQUEST LATE" OR "DATA RATE" ERRORS ON SOME HIGH SPEED DIRECT MEMORY ACCESS (DATA BREAK) DEVICES, THE USER HAS THE ABILITY TO BYPASS THESE TESTS AND RUN JUST TEST X000. HOWEVER, TEST X000 MAY ALSO CAUSE SIMILAR ERRORS TO OCCUR.

2. REQUIREMENTS

A. PROCESSORS: PDP-8, 8/I, 8/E, 8/M OR PDP-12,

B. OPTIONS: EXTENDED ARITHMETIC ELEMENT (EAE)

C. SPECIAL: NONE

3. RESTRICTIONS

NONE

4. OPERATING INFORMATION

4.1 SPECIAL CONSIDERATIONS

THIS MODULE REQUIRES A NON-VOLATILE STEP COUNTER AND GT FLAG. SR5 SHOULD BE SET TO 0 WHEN THIS MODULE IS RUNNING SINCE THE MQ IS UTILIZED.

"DATA REQUEST LATE" OR "DATA RATE" ERRORS MAY OCCUR IF THIS MODULE IS RUN WHILE EXERCISING A HIGH SPEED DIRECT MEMORY ACCESS (DATA BREAK) DEVICE.

4.2 BUILDING

- A. JOB TYPE: BACKGROUND
- B. PRIORITY: MUST HAVE LOWER PRIORITY THAN ALL INTERRUPT JOBS; OTHERWISE UNIMPORTANT.
- C. JOB SLOTS: JOB SLOTS JF1 AND JF2 ONLY; 4 PAGES REQUIRED.

4.3 INITIALIZING

AFTER "EAEALL" IS PRINTED THE USER SHOULD TYPE THE NUMERICAL CODE NN INDICATED TO ACHIEVE THE DESIRED RESULTS.

CODE	RESULTS
00	SPECIFIES A PDP-8, 8/I OR PDP-12 EAE, OR "A" MODE ONLY IN A KE8=E EAE. SHIFT AND NORMALIZE TESTS ARE BYPASSED.
01	SAME AS "00" EXCEPT ALL TESTS ARE RUN.
10	"B" MODE ONLY IN A KE8=E EAE. SHIFT AND NORMALIZE TESTS ARE BYPASSED.
11	SAME AS "10" EXCEPT ALL TESTS ARE RUN.
20	BOTH "A" AND "B" MODES ARE UTILIZED IN A KE8=E EAE. SHIFT AND NORMALIZE TESTS ARE BYPASSED.
21	SAME AS "20" EXCEPT ALL TESTS ARE RUN.

NOTE: THE PRESET CONDITION IS "21".

IN ADDITION, THE MAXIMUM NUMBER OF SHIFTS CAN BE CONTROLLED BY SETTING LOCATION "KXXXX" (0364) TO THE MAXIMUM NUMBER OF SHIFTS VIA THE *O COMMAND. WHEN IN KE8-E EAE "A" MODE OR IF A PDP-8, 8/I OR PDP-12 EAE, THE MAXIMUM NUMBER OF SHIFTS WILL BE THE SAME AS THAT SPECIFIED IN KXXXX. HOWEVER, IN KE8-E "B" MODE THE MAXIMUM NUMBER OF SHIFTS WILL BE ONE LESS THAN SPECIFIED IN KXXXX. THIS LOCATION IS PRESET TO 0040.

4.4 DEVICE SETUP

NONE

4.5 RUNNING

A. CNTR: UPDATED AFTER ONE PASS THROUGH ALL TESTS.

B. SR10: NO EFFECT.

C. SR11: NO EFFECT.

5. ERROR INFORMATION

ALL ERRORS RESULT IN A "STAT ERR" REPORT. THE MEANINGS OF THE VARIOUS STATUS WORDS, SA, SB, ETC, VARY ACCORDING TO THE CONTENTS OF "CODE".

5.1 "CODE" DEFINITIONS

BIT 0 OF THE "CODE" WORD INDICATES THE EAE MODE WHILE BITS 9-11 INDICATE THE FAILING TEST (0-4).

CODE WORD 000X INDICATES A FAILURE IN TEST X WITH THE EAE IN MODE "A" OR IN A PDP-8, 8/I OR PDP-12.

CODE WORD 400X INDICATES A FAILURE IN TEST X WITH THE EAE IN MODE "B" (KE8-E EAE ONLY).

2
STATUS WORD DEFINITIONS

A. IF CODE=X000 (MUY,DVI ERROR), THEN:

SA: OPERAND A
SB: OPERAND B
SC: FINAL AC (REMAINDER AFTER FINAL DVI)
SD: FINAL MQ (QUOTIENT)
SE: FINAL LINK (BIT 0), GT FLAG (BIT 1) AND STEP COUNTER
(BITS 7-11)
SF: FINAL AC SHOULD BE (SIMULATED)
SG: FINAL MQ SHOULD BE (SIMULATED)
SH: FINAL LINK, GT FLAG AND STEP COUNTER SHOULD BE (SIMULATED)

B. IF CODE=X001 (SHL ERROR), X002 (LSR ERROR), OR X003 (ASR ERROR), THEN:

SA: STARTING AC
SB: STARTING MQ
SC: FINAL AC
SD: FINAL MQ
SE: FINAL LINK (BIT 0), GT FLAG (BIT 1) AND STEP COUNTER
(BITS 7-11).
SF: FINAL AC SHOULD BE (SIMULATED)
SG: FINAL MQ SHOULD BE (SIMULATED)
SH: FINAL LINK, GT FLAG AND STEP COUNTER SHOULD BE (SIMULATED)
SI: NUMBER OF SHIFTS IN BITS 7-11

NOTE: THE ACTUAL NUMBER OF SHIFTS IN A PDP-8, 8/I OR PDP-12
OR IN "A" MODE IS ONE GREATER THAN INDICATED.

C. IF CODE=X004 (NMI ERROR), THEN:

SA: STARTING AC
SB: STARTING MQ
SC: CONTENTS OF AC AFTER NMI
SD: CONTENTS OF MQ AFTER NMI
SE: CONTENTS OF LINK (BIT 0), GT FLAG (BIT 1) AND STEP COUNTER
(BITS 7-11) AFTER NMI.
SF: CONTENTS OF AC AFTER ASR CHECK (MAY BE SIMULATED)
SG: CONTENTS OF MQ AFTER ASR CHECK (MAY BE SIMULATED)

6. LISTING (ATTACHED)

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/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 7-SEP-72 20107 PAGE 2

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/MAINDEC-X8-DIKEA-B-L "DEC/X8" EAEALL
/EAE TEST FOR DEC/X8 EXERCISER WHICH EXERCISES MULTIPLY,
/DIVIDE, SHIFTS, AND NORMALISE IN EITHER "A" AND/OR "B" MODE'S
/FOR THE KES-E EAE OR IN PDP-8, 8/I OR PDP-12 EAE'S,
/COPYRIGHT 1972, DIGITAL EQUIPMENT CORPORATION, MAYNARD, MASS; 01704,
/THIS MODULE OPERATIONAL ON A PDP-8, 8/I, 8/E, 8/M OR PDP-12 WITH EAE;
/PRG: EQ FORTHILLER (X3341)

/BUILDER INSTRUCTIONS:

- /1. PRIORITY: BACKGROUND JOB - MUST BE PLACED AFTER ALL INTERRUPT
/ JOBS, OTHERWISE PLACEMENT IS NOT IMPORTANT;
- /2. JOB SLOT: 4 PAGES REQUIRED, SLOTS JF1 AND JF2 ONLY.

/INITIALIZER INSTRUCTIONS:

- /1. FOLLOWING THE "EAEALL" PRINTOUT, TYPE IN A 0 FOR "A" (0-01-12) MODE,
/ 1 FOR "B" (0E) MODE, OR 2 FOR BOTH "A" AND "B" MODES;
- /2. AFTER THE MODE INITIALIZATION, TYPE IN A 0 FOR MULTIPLY AND
/ DIVIDE OR "1" FOR MULTIPLY, DIVIDE, SHIFTS, AND NORMALISE;
- /3. NO INITIALIZATION WILL RESULT IN TEST OF MULTIPLY,
/ DIVIDE, SHIFTS, AND NORMALISE IN BOTH "A" AND "B" MODES;
- /4. THE MAXIMUM NUMBER OF SHIFTS CAN BE CONTROLLED BY SETTING
/ LOCATION "KXXXX" TO THE MAXIMUM NUMBER OF DESIRED SHIFTS+1.
/ WHEN IN "A" MODE THE NUMBER OF SHIFTS WILL BE THE
/ SAME AS THE NUMBER CONTAINED IN LOCATION "KXXXX", WHEN
/ IN "B" MODE THE MAXIMUM NUMBER OF SHIFTS WILL BE ONE LESS
/ THAN THE NUMBER CONTAINED IN LOCATION "KXXXX", NO
/ INITIALIZATION WILL RESULT IN A MAXIMUM OF 40 SHIFTS IN
/ "A" MODE AND 37 SHIFTS IN "B" MODE.

0200	0200	*0200
0201	0201	
0202	0202	TEXT1, TEXT 'EAEALL'
0203	1414	
0204	0000	
0205	0411	TEXT 'DIKEA-B'
0206	1305	
0207	0155	
0210	0200	
0211	0000	HOMEDF, 0
0212	7402	HLT
0213	5011	JMP I HOMEDF
0214	0202	INTACK, CIP 00
0215	4426	JMS I INHRETP

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62 0216 7777      =1
63 0217 7777      KILL, =1
64 0220 7777      KILLED, =1
65 0221 0000      CNTR, 0
66 0222 0000      ERROR, 0
67 0223 3234      DCA      ,+11
68 0224 7604      LAS
69 0225 0073      AND 2    K4
70 0226 7440      SZA
71 0227 3217      DCA      KILL
72 0230 4211      JMS      HOMEOP
73 0231 0002      IOF
74 0232 0202      CTF      00
75 0233 4401      JMS 1    ERRP
76 0234 0000      0
77 0235 5622      JMP 1    ERROR
78 0236 0000      CODE, 0
79 0237 0000      0
80 0240 7777      A,      7777
81
82 0241 7776      B,      7776
83 0242 0000      BAC, 0
84 0243 0000      BMQ, 0
85 0244 0000      BLQISC, 0
86 0245 0000      SIMAC, 0
87 0246 0000      SIMHQ, 0
88 0247 0000      SLGTSC, 0
89 0250 0000      STSC, 0
90 0251 0002      SMODE, 2
91 0252 0000      TEMPA, 0
92 0253 0000      MODE, 0
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/XXXX="A"; 4XXX="B";
 /OPERAND "A" FOR MUY&DIVI STARTING AC FOR SHIFTS&NMI;
 /OPERAND "B" FOR MUY&DIVI STARTING HQ FOR SHIFTS&NMI
 /BAD AC
 /BAD HQ
 /BAD LINK, GT, AND SC (BIT 0=LINK, BIT 1=GT, BITS 7=11&SC);
 /SIMULATED AC
 /SIMULATED HQ
 /SIMULATED LINK, GT, AND SC (BIT 0=LINK, BIT 1=GT, BITS 7=11&SC);
 /NUMBER OF SHIFTS IN BITS 7=11
 /SELECTED MODE OF OPERATION, 00A; 1=0; 2=BOTH
 /B="A"; 7777="B"
 /EQUATE STATEMENTS:
 HQA=7501
 MQL=7421
 CAH=7621
 SWP=7521
 MQCLA=7601
 MQNOP=7401
 SCA=7441
 SHAB=7431
 SHBA=7447
 MUY=7403
 DIV=7407
 SHL=7413
 ASR=7415
 LSR=7417
 NHI=7411
 GTF=6004
 SGT=6006
 OPEN=0000
 BSC=AUTO
 /INCLUSIVE OR THE HQ WITH THE AC;
 /LOAD HQ FROM AC THEN CLEAR THE AC;
 /CLEAR AC AND HQ;
 /SWAP AC AND HQ;
 /EAE CLEAR AC;
 /EAE NOP;
 /INCLUSIVE OR THE STEP COUNTER WITH THE AC;
 /SET EAE TO "B" MODE;
 /SET EAE TO "A" MODE;
 /MULTIPLY;
 /DIVIDE;
 /SHIFT LEFT;
 /ARITHMETIC SHIFT RIGHT;
 /LOGICAL SHIFT RIGHT;
 /NORMALIZE;
 /GET INTERRUPT FLAG; (PDP-9/E ONLY);
 /SKIP ON GREATER THAN FLAG; (PDP-9/E ONLY);
 /PROGRAM MODIFIABLE;
 /ASSIGN BAD STEP COUNTER TO AUTO INDEX REGISTER;

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117
118 0254 4444      INIT,  MESSAGE
119 0255 0201      TEXT1
120 0256 4455      SPACE2
121 0257 4442      ONEOCT
122 0260 5256      JMP      ,+2
123 0261 3251      DCA      SMODE
124 0262 1251      TAD      SMODE
125 0263 7041      CMA IAC
126 0264 3253      DCA      MODE
127 0265 7326      CLA CLL CML RYL
128 0266 1253      TAD      MODE
129 0267 7650      SNA CLA
130 0270 3253      DCA      MODE
131 0271 0201      GDF      00
132 0272 1765      TAD 1    A1432
133 0273 4211      JMS      HOMEOP
134 0274 3777      DCA      XINST
135 0275 4442      ONEOCT
136 0276 5256      JMP      INIT+2
137 0277 3776      DCA      TEST
138 0300 5020      INITEX
139
140
141 0301 3221      RUN,   DCA      CNTR
142 0302 3346      DCA      SHIFTS
143 0303 1136      TAD 2    M7
144 0304 3252      DCA      TEMPA
145 0305 1217      TAD      KILL
146 0306 7450      SNA
147 0307 5312      JMP      ,+3
148 0310 3220      DCA      KILLED
149 0311 5004      SERVEX
150 0312 2221      ISR      CNTR
151 0313 2252      ISR      TEMPA
152 0314 5321      JMP      ,+5
153 0315 1136      TAD 2    M7
154 0316 3252      DCA      TEMPA
155 0317 1375      TAD      (+2
156 0320 5004      SERVEX
157 0321 2240      ISR      A
158 0322 5774      JMP      MOSEQ
159 0323 2241      ISR      0
160 0324 5774      JMP      MOSEQ
161 0325 5774      JMP      MOSEQ
162
163
164
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166
167 0326 0000      SHIFT, OPEN
168 0327 1346      TAD      SHIFTS
169 0330 1253      TAD      MODE
170 0331 7101      IAC CLL
171 0332 7650      SNA CLA

```

/GET SELECTED MODES
 /AND NEGATE IT
 /B="A"; 7777="B";
 /CHECK FOR BOTH SELECTED;
 /HAS BOTH MODES SELECTED?
 /YES, SET MODE TO 0000;
 /ROUTINE TO PERFORM EAE SHIFT;
 /GET NUMBER OF SHIFTS
 /ADD MODE
 /ADD 1
 /"B" MODE AND 0 SHIFTS?

172	0333	2346	ISE	SHIFTS	/SET SHIFTS TO 1
173	0334	1726	TAD I	SHIFT	/OBTAIN THE SHIFT INSTRUCTION
174	0335	3345	DCA	SHIFTS-1	/AND STORE IT FOR EXECUTION
175	0336	2326	ISE	SHIFT	/+1 FOR EXIT
176	0337	1346	TAD	SHIFTS	/SET PRINTOUT
177	0340	3250	DCA	STSC	/LOCATION
178	0341	1241	TAD	B	/LOAD STARTING NO
179	0342	7421	MOL		
180	0343	1249	TAD	A	/LOAD STARTING AC
181	0344	7000	NOF		/DUMMY
182	0345	0000	OPEN		/SHIFT INSTRUCTION
183	0346	0000	SHIFTS, OPEN		/NUMBER OF SHIFTS
184	0347	4773	JMS	SAVREG	/SAVE THE REGISTERS
185	0350	1366	TAD	K37	/SET UP
186	0351	0253	AND	MODE	/THE SIMULATED
187	0352	3771	DCA	SIMSC	/STEP COUNTER
188	0353	4771	JMS	CHECK	/CHECK ACTUAL AGAINST SIMULATED
189	0354	0346	ISE	SHIFTS	/SET UP FOR NEXT SHIFT
190	0355	1364	TAD	KXXXX	
191	0356	7041	CMA IAC		
192	0357	1346	TAD	SHIFTS	
193	0360	7640	SEA CLA		/FINISH SHIFTING
194	0361	5726	JMP I	SHIFT	/NO
195	0362	0326	ISE	SHIFT	/+1 FOR EXIT
196	0363	5726	JMP I	SHIFT	/TEST COMPLETE
197					
198	0364	0040	KXXXX,	40	/MAXIMUM NUMBER OF SHIFTS+1
199	0365	1432	A1432,	1432	
200	0366	0037	K37,	37	
201					
202		0367	EOP1,		
203		0255	+INIT+1		
204	0255	0201	TEXT1		
205		0367	+EOP1		
206					
207					
208	0371	0616			
209	0372	0755			
210	0373	0600			
211	0374	0400			
212	0375	0321			
213	0376	0955			
214	0377	0457			
215		0400			
216	0400	1351	MOSEQ, TAD	K7770	/
217	0401	3777	DCA	CODE+1	/
218	0402	4240	JMS	PROB	/ A + B
219	0403	1776	TAD	B	
220	0404	7040	CMA		
221	0405	3776	DCA	B	
222	0406	4240	JMS	PROB	/ A + NOT B
223	0407	1775	TAD	A	
224	0410	7040	CMA		
225	0411	3775	DCA	A	

226	0412	4240	JMS	PROB	/ NOT A + NOT B
227	0413	1776	TAD	B	
228	0414	7040	CMA		
229	0415	3776	DCA	B	
230	0416	4240	JMS	PROB	/ NOT A + B
231	0417	1775	TAD	A	
232	0420	7040	CMA		
233	0421	3775	DCA	A	/ A + B
234	0422	1355	TAD	TEST	/
235	0423	7640	SEA CLA		/
236	0424	5774	JMP	SHLTST	/PERFORM SHIFT TEST
237	0425	7344	SHFRET, CLA CLL	CMA RAL	/B
238	0426	1773	TAD	SMODE	/ADD VALUE OF SMODE AND
239	0427	7640	SEA CLA		/SEE IF BOTH MODES ARE SELECTED
240	0430	5772	JMP	RUN+4	/ONLY ONE MODE SELECTED
241	0431	1771	TAD	MODE	/GET PRESENT MODE
242	0432	7040	CMA		/AND COMPLEMENT IT
243	0433	3771	DCA	MODE	/SO A BASS IS MADE IN OPPOSITE MODE
244	0434	1771	TAD	MODE	/GET MODE AND SEE IF ITS A MODE
245	0435	7640	SEA CLA		/INDICATING EXECUTION OF BOTH MODES
246	0436	9200	JMP	MOSEQ	/EXECUTE IN "B"
247	0437	5772	JMP	RUN+4	/
248					
249	0440	0000	PROB, OPEN		/ A+B/B+B/A+A/B+B/A+B
250	0441	3770	DCA	CODE	/
251	0442	1775	TAD	A	/CHECK A FOR 0
252	0443	7600	SNA	CLA	/A IS OK
253	0444	0640	JMP I	PROB	/A IS 0 SO EXIT
254	0445	1776	TAD	B	/CHECK B FOR 0
255	0446	7600	SNA CLA		/B IS OK
256	0447	0640	JMP I	PROB	/B IS 0 SO EXIT
257	0450	1771	TAD	MODE	/FIND OUT MODE TO BE EXECUTED
258	0451	7640	SEA	CLA	/TEST CONDITION
259	0452	0261	JMP	+7	/SET UP FOR B MODE
260	0453	1775	TAD	A	/GET A OPERAND
261	0454	3353	DCA	AOPER	/
262	0455	1776	TAD	B	/GET B OPERAND
263	0456	3354	DCA	BOPER	/
264	0457	7447	XINST, SWBA		/GO TO MODE A, IF IN A NON SE THIS WILL BE A "NOP"
265	0460	9267	JMP	+7	
266	0461	1375	TAD	IA	/GET A OPERAND ADDRESS
267	0462	3353	DCA	AOPER	
268	0463	1376	TAD	IB	/GET B OPERAND ADDRESS
269	0464	3354	DCA	BOPER	/
270	0465	7447	SWBA		/ZERO OF FLAG
271	0466	7431	SWAB		/GO TO MODE B
272	0467	7021	CAN		/CLEAN AC AND NO
273	0470	1353	TAD	AOPER	
274	0471	3320	DCA	A2	
275	0472	1353	TAD	AOPER	
276	0473	3322	DCA	A3	
277	0474	1353	TAD	AOPER	
278	0475	3330	DCA	A4	
279	0476	1354	TAD	BOPER	
280	0477	3312	DCA	B1	

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281 0500 1354 TAD BOPER
282 0501 3314 DCA B2
283 0502 1354 TAD BOPER
284 0503 3316 DCA B3
285 0504 1354 TAD BOPER
286 0505 3324 DCA B4
287 0506 1354 TAD BOPER
288 0507 3326 DCA B5
289 0510 1775' A1, TAD A
290 0511 7425 MQL MUY
291 0512 0241 B1, B
292 0513 7407 DVI
293 0514 0241 B2, B
294 0515 7405 MUY
295 0516 0241 B3, B
296 0517 7407 DVI
297 0520 0240 A2, A
298 0521 7405 MUY
299 0522 0240 A3, A
300 0523 7407 DVI
301 0524 0241 B4, B
302 0525 7405 MUY
303 0526 0241 B5, B
304 0527 7407 DVI
305 0530 0240 A4, A
306 0531 4767' JMS SAVREG
307 0532 1352 TAD M15
308 0533 7041 CMA IAC
309 0534 3766' DCA SIMSC
310 0535 3765' DCA SIMGT
311 0536 3764' DCA SIML
312 0537 3763' DCA SIMAC
313 0540 1776' TAD B
314 0541 3762' DCA SIMMO
315 0542 4761' JMS CHECK
316 0543 5640 JMP I PROG
317
318 /ROUTINE TO LOAD AC+MO FOR NMI TEST.
319
320 0544 0000 LMOAC, OPEN
321 0545 1776' TAD B
322 0546 7421 MQL
323 0547 1775' TAD A
324 0550 3744 JMP I LMOAC
325
326 0551 7770 K7770, 7770
327 0552 7763 M15, -15
328 0553 0000 AOPER, OPEN
329 0554 0000 BOPER, OPEN
330 0555 0001 TEST, 1
331
332 0556 *.
333
334
335 0561 0616

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/SAVE REGISTERS;
/SET UP THE-
/SIMULATED-
/STEP COUNTER
/8 TO SIMULATED BT;
/8 TO SIMULATED LINK;
/8 TO SIMULATED AG;
/
/8 TO SIMULATED MO;
/CHECK SIMULATED AGAINST ACTUAL.
/EXIT.

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/8MUY+DIV; 1=MUY,DVI, SHIFTS, AND NORMALISE.

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336 0562 0246
337 0563 0245
338 0564 0756
339 0565 0757
340 0566 0755
341 0567 0600
342 0570 0236
343 0571 0233
344 0572 0305
345 0573 0251
346 0574 0663
347 0575 0240
348 0576 0241
349 0577 0237
350 0600
351
352
353 0600 0000 SAVREG, OPEN
354 0601 3777' DCA BAC
355 0602 7001 MQA
356 0603 3776' DCA BMO
357 0604 7441 SCA
358 0605 3017 AUA, DCA BSC
359 0606 7010 RAR
360 0607 3354 DCA BLINK
361 0610 1775' TAD MODE
362 0611 7640 SEA CLA
363 0612 0004 GTF
364 0613 0122 AND 2 K0000
365 0614 3353 DCA BGT
366 0615 5600 JMP I SAVREG
367
368
369 /ROUTINE TO CHECK AC, MO, L, BT, BG.
370
371 0616 0000 CHECK, OPEN
372 0617 4242 JMS COMERR
373 0620 7701 CLA MQA
374 0621 7041 CIA
375 0622 1774' TAD SIMMO
376 0623 7640 SEA CLA
377 0624 0240 JMP DATERR
378 0625 1777' TAD BAC
379 0626 7041 CIA
380 0627 1773' TAD SIMAC
381 0630 7640 SEA CLA
382 0631 0240 JMP DATERR
383 0632 1772' TAD SLOTS0
384 0633 7041 CIA
385 0634 1771' TAD SLOTS0
386 0635 7640 SEA CLA
387 0636 0240 JMP DATERR
388 0637 5616 JMP I CHECK
389 0640 4770' DATERR, JMS ERROR

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/SAVE THE AC;
/MO=>BAC;
/SAVE THE MO;
/BG=>BAC;
/SAVE THE STEP COUNTER;
/LINK=>BAC;
/SAVE THE LINK;
/CHECK THE MODE AND
/IF "A" MODE SKIP NEXT INSTRUCTION;
/PLAG=>BAC;
/SAVE ONLY THE GT FLAG;
/SAVE THE BT FLAG;
/EXIT, AG AND LINK0;

```

```

/COMBINE DATA
/
/MO CHECK OK?
/NO
/
/SIMULATED AG<ACTUAL AG?
/NO
/
/SIMULATED L.GT,SC<ACTUAL L.GT,SC?
/NO
/CHECK COMPLETE

```

```

390 0641 0616 JMP I CHECK /
391
392 /ROUTINE TO COMBINE ERROR DATA/
393
394 0642 0800 COMERR, OPEN
395 0643 1767 TAD CODE /SET CODE ACCORDING TO MODE AND TEST;
396 0644 0875 AND Z K7
397 0645 3767 DCA CODE //
398 0646 7330 CLA CLL CML RAR //
399 0647 0775 AND MODE //
400 0650 1767 TAD CODE //
401 0651 3767 DCA CODE //
402 0652 1354 TAD BLINK /COMBINE RAD/ LINK, GT, AND STEP COUNTER;
403 0653 1817 AUB, TAD BSC //
404 0654 1353 TAD BGT //
405 0655 3771 DCA BLGTSC //
406 0656 1356 TAD SIML /COMBINE SIMULATED/ LINK, GT, AND STEP COUNTER;
407 0657 1355 TAD SIMSC //
408 0658 1357 TAD SIMGT //
409 0661 3772 DCA BLGTSC //
410 0662 0642 JMP I COMERR /EXIT.
411
412 /TEST OF THE SHIFT LEFT INSTRUCTION
413 /ERROR CODE=X801.
414
415 0663 1360 SHLTST, TAD K7767 //
416 0664 3766 DCA CODE+1 //
417 0665 4321 JMS SETSIM //
418 0666 1774 TAD SIMMQ //
419 0667 7104 RAL CLL //
420 0670 3774 DCA SIMMQ //
421 0671 1773 TAD SIMAC //
422 0672 7804 RAL //
423 0673 3773 DCA SIMAC //
424 0674 7810 RAR //
425 0675 3386 DCA SIML //
426 0676 3397 DCA SIMGT //
427 0677 4765 JMS SHIFT //
428 0700 7413 SHL //
429 0701 0266 JMP SHLTST+3 //
430
431 /TEST OF THE LOGICAL SHIFT RIGHT INSTRUCTION
432 /ERROR CODE=X802.
433
434 0702 4321 LSRTST, JMS SETSIM //
435 0703 1773 TAD SIMAC //
436 0704 7110 CLL RAR //
437 0705 3773 DCA SIMAC //
438 0706 1774 TAD SIMMQ //
439 0707 7810 RAR //
440 0710 3774 DCA SIMMQ //
441 0711 7812 RTR //
442 0712 0775 AND MODE //
443 0713 3397 DCA SIMGT //
444 0714 3396 DCA SIML //

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445 0715 4765 JMS SHIFT //
446 0716 7417 LSR //
447 0717 0303 JMP LSRTST+1 //
448 0720 0764 JMP ASRTST //
449
450 /ROUTINE TO SET SIMULATED.
451
452 0721 0800 SETSIM, OPEN
453 0722 2767 ISE CODE //
454 0723 3763 DCA SHIFTS /S TO NUMBER OF SHIFTS;
455 0724 1762 TAD A //
456 0725 3773 DCA SIMAC /SET SIMULATED AC;
457 0726 1761 TAD B //
458 0727 3774 DCA SIMMQ /SET SIMULATED MQ;
459 0730 1775 TAD MODE //
460 0731 7690 SNA CLA /IF MODE "0"/ 0->BGT;
461 0732 0721 JMP I SETSIM //
462 0733 7447 SWBA //
463 0734 7431 SWAB //
464 0735 0721 JMP I SETSIM //
465
466 /ROUTINE TO SET "SIMAC AND "SIMMQ" FOR THE NMI TEST.
467
468 0736 0800 SENSIM, B
469 0737 7501 HQA //
470 0740 1352 TAD M4000 //
471 0741 7640 SNA CLA //
472 0742 0345 JMP ,+3 //
473 0743 1775 TAD MODE //
474 0744 7690 SNA CLA //
475 0745 1762 TAD A //
476 0746 3773 DCA SIMAC /SET SIMULATED AC;
477 0747 1761 TAD B //
478 0750 3774 DCA SIMMQ /SET SIMULATED MQ;
479 0751 0736 JMP I SENSIM //
480
481 0752 4000 M4000, 4000
482 0753 0800 BGT, OPEN
483 0754 0800 BLINK, OPEN
484 0755 0800 SIMSC, OPEN
485 0756 0800 SIML, OPEN
486 0757 0800 SIMGT, OPEN
487 0760 7767 K7767, 7767
488
489 0761 .,
490
491
492 0761 0241
493 0762 0240
494 0763 0346
495 0764 1000
496 0765 0326
497 0766 0237
498 0767 0236
499 0770 0222

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500 0771 0244
 501 0772 0247
 502 0773 0245
 503 0774 0246
 504 0775 0253
 505 0776 0243
 506 0777 0242
 1000

PAGE

507
 508 /TEST OF THE ARITHMETIC SHIFT RIGHT INSTRUCTION
 509 /ERROR CODE=X003,
 510 ASRTST, JMS SETSIM //
 511 CLL RAL //
 512 TAD SIMAC //
 513 SPA A //
 514 CML RAL //
 515 RAR RAL //
 516 DCA SIMAC //
 517 TAD SIMMQ //
 518 RAR RAL //
 519 DCA SIMMQ //
 520 RTR RAL //
 521 AND MODE //
 522 DCA SIMGT //
 523 TAD SIMAC //
 524 AND K4000 //
 525 DCA SIML //
 526 JMS SHIFT //
 527 ASR RAL //
 528 JMP ASRTST+1 //
 529

530 /TEST OF THE NORMALIZE INSTRUCTION
 531 /ERROR CODE=X004,
 532 NM11, ISB CODE //
 533 JMS LMQAC //LOAD MQ AND AC,
 534 JMS SENSIM //SET SIMAC AND SIMMQ, REGARDLESS,
 535 TAD A //LOAD AC,
 536 NM1, //NORMALIZE,
 537 JMS SAVREG //SAVE REGISTERS,
 538 TAD BAC
 539 CLL RAL
 540 SEL //AC0=1?
 541 JMP NM12 //AC0=1,
 542 SPA //AC1=1?
 543 JMP NM14 //AC0=0 AND AC1=1,
 544 MQA //AC0=AC1=0,
 545 SEA CLA //AC AND MQ 0?
 546 JMP NM1ERR //AC AND/OR MQ NOT 0,
 547 SCA
 548 SEA CLA //SC=0?
 549 JMP NM1ERR //SC NOT 0,
 550 JMS LMQAC //LOAD MQ AND AC,
 551 MQA //OR" MQ TO AC,
 552 SNA CLA //STARTING AC AND MQ=0?
 553 JMP SHFRET //EXIT

554 1051 1765' TAD A //GET STARTING AC,
 555 1052 7104' CLL RAL //
 556 1053 7501' MQA
 557 1054 7640' SEA CLA //STARTING AC AND MQ 4000 0000?
 558 1055 5347' JMP NM1ERR //
 559 1056 1774' TAD MODE
 560 1057 7690' SNA CLA //MODE "B"?
 561 1058 5347' JMP NM1ERR //
 562 1059 5762' NM12, JMP SHFRET //EXIT
 563 1060 7700' SNA CLA //AC1=0?
 564 1061 5272' JMP NM13 //YES, AC0=1 AND AC1=0,
 565 1062 7332' CLA CLL RTR //2000
 566 1063 1763' TAD BAC
 567 1064 7501' MQA
 568 1065 7640' SEA CLA //AC AND MQ=0000 0000?
 569 1066 5347' JMP NM1ERR //
 570 1067 5347' NM13, JMP NM14 //YES,
 571 1068 5347' JMS LMQAC //LOAD MQ AND AC,
 572 1069 7104' CLL RAL
 573 1070 7501' MQA
 574 1071 7640' SEA CLA //STARTING AC AND MQ=4000 0000?
 575 1072 5347' JMP NM14 //
 576 1073 1774' TAD MODE
 577 1074 7640' SNA CLA //MODE "A"?
 578 1075 5347' JMP NM1ERR //
 579 1076 7441' SCA
 580 1077 7640' SEA CLA //SC=0?
 581 1078 5347' JMP NM1ERR //
 582 1079 5340' NM14, JMP NM15 //NO,
 583 1080 7641' SNA CLA //YES,
 584 1081 7690' SNA CLA
 585 1082 5340' JMP NM15
 586 1083 1774' TAD MODE
 587 1084 7104' CLA CLL
 588 1085 1017' AUC, TAD BSC
 589 1086 3321' DCA NM1SHF
 590 1087 1761' TAD BSC
 591 1088 7421' MQL
 592 1089 1763' TAD BAC
 593 1090 7415' ASR
 594 1091 0000' NM1SHF, B
 595 1092 3776' DCA SIMAC //SAVE SHIFTED AC
 596 1093 7501' MQA //SHIFTED MQ=3AC
 597 1094 3775' DCA SIMMQ //SAVE SHIFTED MQ
 598 1095 1776' TAD SIMAC //RELOAD THE AC,
 599 1096 7041' CHA IAC
 600 1097 1765' TAD A
 601 1098 7640' SEA CLA //AC CHECK?
 602 1099 5347' JMP NM1ERR
 603 1100 7501' MQA
 604 1101 7041' CHA IAC
 605 1102 1760' TAD B
 606 1103 7640' SEA CLA //MQ CHECK?
 607 1104 5347' JMP NM1ERR
 608 1105 5762' JMP SHFRET //EXIT

609	1148	1763'	NM15,	TAD	BAC	/
610	1141	7841		CMA	TAC	
611	1142	1765'		TAD	A	
612	1143	7648		SEA	CLA	
613	1144	5347		JMP	NMIERR	/
614	1145	1761'		TAD	BMO	/
615	1146	5333		JMP	,=13	/
616						
617	1147	1136	NMIERR,	TAD	E	K7771
618	1158	3787'		DCA	CODE+1	/
619	1151	4756'		JMS	COMERR	/
620	1152	4755'		JMS	ERROR	/
621	1153	5762'		JMP	SHFRET	/
622						
623	1154	4888	K4888,	4888		
624						
625		1155		*		
626						
627	1155	8222				
628	1156	8642				
629	1157	8237				
630	1160	8241				
631	1161	8243				
632	1162	8425				
633	1163	8242				
634	1164	8688				
635	1165	8248				
636	1166	8736				
637	1167	8544				
638	1170	8236				
639	1171	8326				
640	1172	8756				
641	1173	8757				
642	1174	8253				
643	1175	8246				
644	1176	8245				
645	1177	8721				

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0200 11111111 11111111 11111111 11111111 11111111 11111111 11111111 11111111
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7700

646	0001	FIELD 1
647		/LOADER CALL
648		
649	1200 0254	INIT
650	1201 0301	RUN
651	1202 0000	0
652	1203 7775	-3
653	1204 0605	AUAIABIAUC
654	1205 0653	
655	1206 1113	
656	1207 0000	0
657	1210 0000	0
658	1211 0000	0
659		
660		S

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1200 11111111 11000000 00000000 00000000 00000000 00000000 00000000 00000000
1300 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

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7700

A	0240	K0	0066	KILL	0217	RLBUFF	0097
A1	0510	K10	0076	KILLED	0220	RUN	0301
A1432	0365	K100	0107	K107	0004	SAVREG	0000
A2	0520	K11	0077	KXXXX	0344	SCA	7441
A3	0522	K116	0071	L10N	4440	SENSIM	0736
A4	0530	K13	0100	L10P	0040	SERVEX	0004
ASPER	0553	K17	0101	LMOAC	0544	SETSIM	0721
ASBUFF	4400	K177	0130	LSR	7417	SGT	0000
ASBUFF	0000	K20	0102	LSRTST	0702	SHPRET	0400
ASR	7415	K200	0110	M13	0502	SHIFT	0320
ASRTST	1000	K2000	0122	M20	0135	SHIFTS	0346
AUA	0005	K212	0111	M200	0131	SHL	7413
AUB	0053	K215	0112	M240	0127	SHLTST	0063
AUC	1113	K240	0113	M240	0126	SIMAC	0240
AUTO	0017	K240	0114	M270	0129	SIMOT	0707
B	0241	K272	0115	M3	0141	SIML	0706
B1	0512	K277	0116	M30	0134	SIMMO	0246
B2	0514	K3	0072	M4	0140	SIMSC	0705
B3	0516	K30	0103	M40	0133	SLOTSC	0247
B4	0524	K301	0117	M4000	0702	SMODE	0201
B5	0526	K32	0067	M40	0132	SPACEZ	4455
BAC	0242	K323	0120	M5	0137	SPACEP	0055
BGT	0753	K37	0366	M7	0136	STSC	0250
BLOTSC	0244	K4	0073	MOBEQ	0000	SWAB	7431
BLINK	0754	K40	0104	MESSAGE	4444	SWBA	7447
BMO	0243	K400	0121	MESSAGEP	0044	SWP	7521
BOPER	0554	K4000	1154	MODE	0003	TEHPA	0232
BSC	0017	K5	0074	MGA	7001	TEST	0055
CAM	7021	K5000	0123	MGLA	7001	TEXT1	0201
CHECK	0016	K540	0124	MGL	7401	TMOOCP	0041
CNTR	0221	K5402	0003	MGNOP	7401	TMOOCT	4441
CODE	0236	K64	0070	MUL20P	0045	TYPE	4400
COMERR	0642	K7	0075	MUY	7409	TYPEP	0000
CRLF	4454	K70	0105	NM1	7411	XINST	0407
CRLFP	0054	K7510	0125	NM11	1003		
CATERR	0640	K7520	0126	NM12	1002		
CVI	7407	K7540	0127	NM13	1072		
EOP1	0307	K7600	0131	NM14	1106		
ERROR	0222	K77	0106	NM15	1140		
ERRP	0001	K7735	0132	NMIERR	1147		
EXINIT	0020	K7740	0133	NMISHF	1121		
EXSERV	0004	K7790	0134	ONEOCP	0042		
EXTMEM	0101	K7760	0135	ONEOCT	4442		
FOROCP	0043	K7767	0760	OPEN	0000		
FOROCT	4443	K7770	0951	PRNT1	4451		
GTF	0004	K7771	0136	PRNT1P	0001		
WOMEDF	0211	K7773	0137	PRNT2	4492		
IHRETP	0026	K7774	0140	PRNT2P	0002		
INIT	0254	K7775	0141	PRNT4	4493		
INITEX	0020	KCDF	0064	PRNT4P	0003		
INTACK	0214	KCIF	0003	PROB	0440		
IOFMSP	0056	KCIFDF	0020	RLBUFF	4497		

ERRORS DETECTED: 0
 LINKS GENERATED: 122
 RUN-TIME: 7 SECONDS
 3K CORE USED