

B01

EOF1DBKTCBSEQ

00010000

770323

PDP10 411

HDR1DBKTCBSEQ

00010000

770323

CO1

DBKTD-C KT11-D PROCESSORS STATES TEST MACY11 27(1006) 02-FEB-77 10:09 PAGE 2
DBKTDC.P11 02-FEB-77 09:11

.REM %

IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DBKTD-C-D
PRODUCT NAME: KT11-D PROCESSORS STATES TEST
DATE RELEASED: MARCH, 1977
MAINTAINER: DIAGNOSTIC GROUP

COPYRIGHT 1972, 1977 BY DIGITAL EQUIPMENT CORPORATION
THE INFORMATION IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT
NOTICE AND SHOULD NOT BE CONSTRUED AS A COMMITMENT BY DIGITAL
EQUIPMENT CORPORATION. DIGITAL EQUIPMENT CORPORATION ASSUMES
NO RESPONSIBILITY FOR ANY ERRORS THAT MAY APPEAR IN THIS
DOCUMENT.
THE SOFTWARE DESCRIBED IN THIS DOCUMENT IS FURNISHED UNDER A
LICENSE AND MAY ONLY BE USED OR COPIED IN ACCORDANCE WITH
THE TERMS OF SUCH LICENSE.
DIGITAL EQUIPMENT CORPORATION ASSUMES NO RESPONSIBILITY
FOR THE USE OR RELIABILITY OF ITS SOFTWARE ON EQUIPMENT
THAT IS NOT SUPPLIED BY DIGITAL.

1.0 ABSTRACT

THIS IS A TEST THAT UTILIZES THE KT11-D MEMORY MANAGEMENT OPTION AND TESTS THAT IN THE TWO PDP-11/40 STATES (KERNEL, USER) INSTRUCTIONS ARE EXECUTED PROPERLY. THIS TEST TESTS TRAPS FROM ONE STATE TO THE OTHER AND USES THE MFPI/MTPI INSTRUCTIONS.

2.0 REQUIREMENTS

2.1 EQUIPMENT

PDP-11/40 WITH KT11-D (MEM. MGMT.) INSTALLED.

2.2 STORAGE

UTILIZES 4K OF MEMORY

3.0 LOADING PROCEDURE

LOAD PROGRAM INTO MEMORY USING ABSOLUTE LOADER. PROGRAM MAY ALSO BE LOADED VIA XXDP OR ACT11.

4.0 STARTING PROCEDURE

LOAD ADDRESS 200. PRESS START, THE PROGRAM WILL LOOP AND RING BELL AND PRINT AN '*' ON PASS COMPLETION.

5.0 OPERATION PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

NONE

5.2 SUBROUTINE ABSTRACTS

5.2.1 SCOPE

SCOPE IS A MOV PC,R1 AND STORE THE PC+2 IN R1; THUS R1 MAY BE USED AS A REFERENCE TO DETERMINE THE LAST TEST SUCCESSFULLY COMPLETED.

5.2.2 HLT

HLT IS A HALT INSTRUCTION AND IS EXECUTED WHENEVER A HARDWARE MALFUNCTION IS DETECTED.

5.3 PROGRAM AND/OR OPERATOR ACTION

5.3.1 PASS COUNT (ICNT)

THE NUMBER OF PROGRAM PASSES COMPLETED IS CONTAINED IN ADDRESS ICNT (LOC. 1000). THIS ADDRESS MAY BE EXAMINED TO DETERMINE IN WHICH PASS THE ERROR OCCURED.

6.0 ERRORS

6.1 TEST ERROR WILL CAUSE A HALT

FALSE TRAP/INTERRUPT ERRORS - THE PROGRAM WILL HALT AT THE TRAP VECTOR ADDRESS +2. THE CONTENTS OF R6 CONTAINS THE ADDRESS WHERE THE PC OF THE INSTRUCTION THAT CAUSED THE TRAP IS STORED.

6.2 ERROR RECOVERY

TEST ERRORS - PRESS CONTINUE OR LOOP TEST (SEE 6.3)
TRAP ERRORS - DETERMINE WHERE ERROR OCCURED (SEE 6.1)

6.3 ERROR LOOPING

TO LOOP ON AN ERROR REPLACE THE HLT INSTRUCTION WITH A BRANCH BACK TO THE PREVIOUS SCOPE INSTRUCTION. NOTE THAT IF THE ERROR IS INTERMITTENT THE TEST WILL DROP THROUGH THE HLT AND PROCEED TO THE NEXT TEST. THEREFORE, TO LOOP THE TEST CONTINUOUSLY, REPLACE THE BEQ +4 INSTRUCTION PRECEEDING THE HLT WITH THE BRANCH BACK TO THE PREVIOUS SCOPE.

7.0 RESTRICTIONS

THIS PROGRAM MUST BE LOADED IN LOWER 4K.

7.1 STARTING RESTRICTION

ALL PROGRAMS MUST BE INITIALLY STARTED AT 200 AND MAY BE STARTED AT A SCOPE INSTRUCTION THEREAFTER.

7.2 OPERATIONAL RESTRICTIONS

NONE

8.1 EXECUTION TIME

ONE PASS TAKES APPROXIMATELY 10 SECONDS.

F01

DBKTD-C KT11-D PROCESSORS STATES TEST MACY11 27(1006) 02-FEB-77 10:09 PAGE 5
DBKTDC.P11 02-FEB-77 09:11

%

150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169

```

170
171 ; TEST DBKTD C TESTS FEATURES OF THE TWO PROCESSER STATES AND INCLUDES
172 ; TRAPS FROM ALL STATES TO ALL OTHER STATES, AND MFP/MTP INSTRUCTIONS IN ALL
173 ; STATES AND PREVIOUS STATES.
174 ; NOTE: ALL TESTS ARE ENTERED AND EXITED IN KERNEL MODE.
175
176 ; STARTING PROCEEDURE
177 ;     LOAD ADDRESS=200
178 ;     PRESS START
179 ;     KERNEL STACK POINTER IS AT 500
180 ;     USER STACK POINTER IS AT 700
181 ;     BELL WILL RING WHEN TEST IS COMPLETE
182
183 ; REGISTER ASSIGNMENTS
184         000000      R0=%0
185         000001      R1=%1
186         000002      R2=%2
187         000003      R3=%3
188         000004      R4=%4
189         000005      R5=%5
190         000007      PC=%7
191
192 ; STACK POINTERS
193         000006      KSP=%6          ; KERNEL STACK POINTER
194         000006      USP=%6          ; USER STACK POINTER
195         000000      HLT=HALT
196         010701      SCOPE=010701    ; MOVE PC TO R1
197         000003      TRT=3           ; TRACE TRAP
198         000140      PRTY3=140
199         000200      PRTY4=200
200         000340      PRTY7=340
201
202 ; VECTOR ADDRESSES
203         000004      ERRVEC=4         ; ADDRESS OF ERROR VECTOR
204         000010      RESVEC=10        ; ADDRESS OF RESERVED INST TRAP VECTOR
205         000030      EMTVEC=30        ; ADDRESS OF EMT VECTOR
206         000034      TRAPVEC=34       ; ADDRESS OF TRAP VECTOR
207         000020      IOTVEC=20        ; ADDRESS OF IOT VECTOR
208         000014      TBITVEC=14       ; ADDRESS OF 'T' BIT TRAP VECTOR
209         000014      TRTVEC=14        ; ADDRESS OF 'TRACE' TRAP
210         000064      TPVEC=64         ; ADDRESS OF TTY PRINTER INTERRUPT VECTOR
211
212 ; HARDWARE REGISTER ASSIGNMENTS
212         177776      PSW=177776       ; ADDRESS OF STATUS REGISTER
213         177774      SLR=177774       ; ADDRESS OF STACK LIMIT REGISTER
214         177560      TKS=177560       ; ADDRESS OF KEYBOARD CSR
215         177562      TKB=177562       ; ADDRESS OF KEYBOARD BUFFER
216         177564      TPS=177564       ; ADDRESS OF TELEPRINTER CSR
217         177566      TPB=177566       ; ADDRESS OF TELEPRINTER BUFFER
218         177570      SWR=177570       ; ADDRESS OF CONSOL SWITCH REGISTER
219
220 ; INITIAL STACK POINTER SETTIGS
220         000500      KPTR=500          ; KERNEL INITIAL STACK POINTER VALUE
221         000700      UPTR=700          ; USER INITIAL STACK POINTER VALUE
222         001000      YELPTR=1000       ; STACK POINTER VALUE FOR 'YELLOW' OVFLW
223         000736      REDPTR=736        ; STACK POINTER VALUE FOR 'RED' OVFLW
224
225 ; MISC. BIT ASSIGNMENTS
    
```


| | | | |
|-----|--------|--------|------|
| 282 | 000104 | 000106 | .+2 |
| 283 | 000106 | 000000 | HALT |
| 284 | 000110 | 000112 | .+2 |
| 285 | 000112 | 000000 | HALT |
| 286 | 000114 | 000116 | .+2 |
| 287 | 000116 | 000000 | HALT |
| 288 | 000120 | 000122 | .+2 |
| 289 | 000122 | 000000 | HALT |
| 290 | 000124 | 000126 | .+2 |
| 291 | 000126 | 000000 | HALT |
| 292 | 000130 | 000132 | .+2 |
| 293 | 000132 | 000000 | HALT |
| 294 | 000134 | 000136 | .+2 |
| 295 | 000136 | 000000 | HALT |
| 296 | 000140 | 000142 | .+2 |
| 297 | 000142 | 000000 | HALT |
| 298 | 000144 | 000146 | .+2 |
| 299 | 000146 | 000000 | HALT |
| 300 | 000150 | 000152 | .+2 |
| 301 | 000152 | 000000 | HALT |
| 302 | 000154 | 000156 | .+2 |
| 303 | 000156 | 000000 | HALT |
| 304 | 000160 | 000162 | .+2 |
| 305 | 000162 | 000000 | HALT |
| 306 | 000164 | 000166 | .+2 |
| 307 | 000166 | 000000 | HALT |
| 308 | 000170 | 000172 | .+2 |
| 309 | 000172 | 000000 | HALT |
| 310 | 000174 | 000176 | .+2 |
| 311 | 000176 | 000000 | HALT |
| 312 | 000200 | 000202 | .+2 |
| 313 | 000202 | 000000 | HALT |
| 314 | 000204 | 000206 | .+2 |
| 315 | 000206 | 000000 | HALT |
| 316 | 000210 | 000212 | .+2 |
| 317 | 000212 | 000000 | HALT |
| 318 | 000214 | 000216 | .+2 |
| 319 | 000216 | 000000 | HALT |
| 320 | 000220 | 000222 | .+2 |
| 321 | 000222 | 000000 | HALT |
| 322 | 000224 | 000226 | .+2 |
| 323 | 000226 | 000000 | HALT |
| 324 | 000230 | 000232 | .+2 |
| 325 | 000232 | 000000 | HALT |
| 326 | 000234 | 000236 | .+2 |
| 327 | 000236 | 000000 | HALT |
| 328 | 000240 | 000242 | .+2 |
| 329 | 000242 | 000000 | HALT |
| 330 | 000244 | 000246 | .+2 |
| 331 | 000246 | 000000 | HALT |
| 332 | 000250 | 000252 | .+2 |
| 333 | 000252 | 000000 | HALT |
| 334 | 000254 | 000256 | .+2 |
| 335 | 000256 | 000000 | HALT |
| 336 | 000260 | 000262 | .+2 |
| 337 | 000262 | 000000 | HALT |

| | | | | | | |
|-----|--------|--------|--------|-----------|-------|----------------------|
| 338 | 000264 | 000266 | | .+2 | | |
| 339 | 000266 | 000000 | | HALT | | |
| 340 | 000270 | 000272 | | .+2 | | |
| 341 | 000272 | 000000 | | HALT | | |
| 342 | 000274 | 000276 | | .+2 | | |
| 343 | 000276 | 000000 | | HALT | | |
| 344 | 000300 | 000302 | | .+2 | | |
| 345 | 000302 | 000000 | | HALT | | |
| 346 | 000304 | 000306 | | .+2 | | |
| 347 | 000306 | 000000 | | HALT | | |
| 348 | 000310 | 000312 | | .+2 | | |
| 349 | 000312 | 000000 | | HALT | | |
| 350 | 000314 | 000316 | | .+2 | | |
| 351 | 000316 | 000000 | | HALT | | |
| 352 | 000320 | 000322 | | .+2 | | |
| 353 | 000322 | 000000 | | HALT | | |
| 354 | 000324 | 000326 | | .+2 | | |
| 355 | 000326 | 000000 | | HALT | | |
| 356 | 000330 | 000332 | | .+2 | | |
| 357 | 000332 | 000000 | | HALT | | |
| 358 | 000334 | 000336 | | .+2 | | |
| 359 | 000336 | 000000 | | HALT | | |
| 360 | 000340 | 000342 | | .+2 | | |
| 361 | 000342 | 000000 | | HALT | | |
| 362 | 000344 | 000346 | | .+2 | | |
| 363 | 000346 | 000000 | | HALT | | |
| 364 | 000350 | 000352 | | .+2 | | |
| 365 | 000352 | 000000 | | HALT | | |
| 366 | 000354 | 000356 | | .+2 | | |
| 367 | 000356 | 000000 | | HALT | | |
| 368 | 000360 | 000362 | | .+2 | | |
| 369 | 000362 | 000000 | | HALT | | |
| 370 | 000364 | 000366 | | .+2 | | |
| 371 | 000366 | 000000 | | HALT | | |
| 372 | 000370 | 000372 | | .+2 | | |
| 373 | 000372 | 000000 | | HALT | | |
| 374 | 000374 | 000376 | | .+2 | | |
| 375 | 000376 | 000000 | | HALT | | |
| 376 | | 000046 | | .=46 | | |
| 377 | 000046 | 006624 | | \$ENDAD | | |
| 378 | | 000052 | | .=52 | | |
| 379 | 000052 | 000000 | | 000000 | | |
| 380 | | | | | | |
| 381 | | 000200 | | .=200 | | |
| 382 | 000200 | 000167 | 000612 | JMP | START | ;GO START |
| 383 | | | | | | |
| 384 | | 001000 | | .=1000 | | |
| 385 | | | | | | |
| 386 | | | | | | |
| 387 | 001000 | 000000 | | | | |
| 388 | 001002 | 000000 | | | | ;CONTAINS PASS COUNT |
| 389 | | 001012 | | | | |
| 390 | 001012 | 000000 | | .=.+6 | | |
| 391 | 001014 | 000000 | | FTITLE: 0 | | ;TITLE FLAG |
| | | | | PASCNT: 0 | | |

```

392
393 001016 012706 000500      START:  MOV      #KPTR,KSP
394 001022 005067 177752      CLR      ICNT
395 001026 005767 177760      TST     FTITLE      ;HAS TITLE BEEN PRINTED YET?
396 001032 001050      BNE     PWRUP      ;YES, SKIP TITLE
397 001034 023737 000042 000046      CMP     @#42,@#46  ;ARE WE IN ACT11 AUTOMATIC MODE?
398 001042 001444      BEQ     PWRUP      ;YES, SKIP TITLE
399 001044 012700 001076      MOV     #TITLE,RO  ;GET MESSAGE ADDRESS
400 001050 012767 000001 177734      MOV     #1,FTITLE  ;SET FLAG
401 001056 105767 176502      1$:    TSTB    TPS
402 001062 100375      BPL     1$
403 001064 105710      TSTB    (0)        ;END OF MESSAGE?
404 001066 001432      BEQ     PWRUP      ;YES, GET OVER THE ASCII
405 001070 112067 176472      MOV     (0)+,TPB   ;PRINT CHARACTER
406 001074 000770      BR     1$          ;GO DO THE NEXT ONE
407 001076 005015 042120 030520      TITLE: .ASCIZ <15><12>@PDP11/40 PROCESSOR STATES TEST, DBKTD-C@<15><12><177>
408 001104 027461 030064 050040
409 001112 047522 042503 051523
410 001120 051117 051440 040524
411 001126 042524 020123 042524
412 001134 052123 020054 041104
413 001142 052113 026504 006503
414 001150 077412      000
415      001154
416      .EVEN
417 001154 032737 000000 177776      PWRUP: BIT     #KM+PKM,@#PSW ;TEST THAT PROCESSOR POWERED UP OK FOR THE TEST
418 001162 001377      BNE     .          ;IS STATUS CORRECT
419      ;LOOP HERE IF NOT
420 001164 012706 000500      BEGIN: MOV     #KPTR,KSP ;INITIALIZE THE STACK POINTER
421
422      ;CHECK THAT THE NOP INSTRUCTION IS A 'NOP' IN USER MODE.
423 001170 010701      †1:   SCOPE
424 001172 012737 140000 177776      MOV     #UM,@#PSW ;USER MODE,PRIORITY LEVEL 0
425 001200 000240      NOP
426 001202 013700 177776      MOV     @#PSW,RO  ;GET @#PSW
427 001206 005037 177776      CLR     @#PSW     ;KERNEL MODE!!!
428 001212 022700 140000      CMP     #UM,RO    ;TEST THAT NOP DID NOT ALTER @#PSW
429 001216 001401      BEQ     .+4
430 001220 000000      HLT
431      ;ERROR! NOP CHANGED STATUS WORD
432
433      ;TEST TRAP FROM USER MODE TO KERNEL MODE
434 001222 010701      †5:   SCOPE
435 001224 012706 000500      MOV     #KPTR,KSP
436 001230 012737 001266 000020      MOV     #T5A,@#IOTVEC
437 001236 005067 176560      CLR     IOTVEC+2
438 001242 012737 140340 177776      MOV     #UM+PRTY7,@#PSW ;USER MODE!!!
439 001250 012706 000700      MOV     #UPTR,USP
440 001254 000277      SCC
441 001256 000004      IOT
442 001260 005037 177776      T5AA: CLR     @#PSW
443 001264 000000      HLT
444 001266 013700 177776      T5A:  MOV     @#PSW,RO
445 001272 005037 177776      CLR     @#PSW
446 001276 022700 030000      CMP     #KM+PUM,RO
447 001302 001401      BEQ     .+4
    
```

| | | | | | | |
|-----|--------|--------|--------|--------|--------|--|
| 448 | 001304 | 000000 | | | HLT | |
| 449 | 001306 | 022767 | 001260 | 177160 | CMP | #T5AA, KPTR-4 |
| 450 | 001314 | 001401 | | | BEQ | .+4 |
| 451 | 001316 | 000000 | | | HLT | |
| 452 | 001320 | 022767 | 140357 | 177150 | CMP | #UM+PRTY7+17, KPTR-2 |
| 453 | 001326 | 001401 | | | BEQ | .+4 |
| 454 | 001330 | 000000 | | | HLT | |
| 455 | 001332 | 022706 | 000474 | | CMP | #KPTR-4, KSP |
| 456 | 001336 | 001401 | | | BEQ | .+4 |
| 457 | 001340 | 000000 | | | HLT | |
| 458 | 001342 | 012737 | 140000 | 177776 | MOV | #UM, @PSW |
| 459 | 001350 | 010600 | | | MOV | USP, R0 |
| 460 | 001352 | 005037 | 177776 | | CLR | @PSW |
| 461 | 001356 | 022700 | 000700 | | CMP | #UPTR, R0 |
| 462 | 001362 | 001401 | | | BEQ | .+4 |
| 463 | 001364 | 000000 | | | HLT | |
| 464 | 001366 | 012737 | 000022 | 000020 | MOV | #IOTVEC+2, @IOTVEC |
| 465 | | | | | | |
| 466 | | | | | | : TEST TRAP FROM USER TO USER MODE (VIA TRACE TRAP) |
| 467 | 001374 | 010701 | | | T7: | SCOPE |
| 468 | 001376 | 012767 | 001434 | 176410 | MOV | #T7A, TRTVEC |
| 469 | 001404 | 012767 | 140000 | 176404 | MOV | #UM, TRTVEC+2 ;USER MODE ON TRAP |
| 470 | 001412 | 012737 | 140000 | 177776 | MOV | #UM, @PSW |
| 471 | 001420 | 012706 | 000700 | | MOV | #UPTR, USP |
| 472 | 001424 | 000003 | | | TRT | |
| 473 | 001426 | 005037 | 177776 | | T7AA: | CLR @PSW |
| 474 | 001432 | 000000 | | | | HLT |
| 475 | 001434 | 013700 | 177776 | | T7A: | MOV @PSW, R0 |
| 476 | 001440 | 010602 | | | | MOV USP, R2 |
| 477 | 001442 | 042737 | 140000 | 177776 | | BIC #UM, @PSW |
| 478 | 001450 | 022767 | 001426 | 177216 | | CMP #T7AA, UPTR-4 |
| 479 | 001456 | 001401 | | | | BEQ .+4 |
| 480 | 001460 | 000000 | | | | HLT |
| 481 | 001462 | 022700 | 170000 | | | CMP #UM+PUM, R0 |
| 482 | 001466 | 001401 | | | | BEQ .+4 |
| 483 | 001470 | 000000 | | | | HLT |
| 484 | 001472 | 012767 | 000016 | 176314 | | MOV #TRTVEC+2, TRTVEC |
| 485 | 001500 | 005067 | 176312 | | | CLR TRTVEC+2 |
| 486 | | | | | | |
| 487 | | | | | | : TEST THAT THE 'HALT' INSTRUCTION TRAPS TO LOCATION 10 IN |
| 488 | | | | | | : USER MODE. |
| 489 | 001504 | 010701 | | | T12: | SCOPE |
| 490 | 001506 | 012737 | 001542 | 000010 | | MOV #T12A, @RESVEC |
| 491 | 001514 | 005037 | 000012 | | | CLR @RESVEC+2 |
| 492 | 001520 | 012706 | 000500 | | | MOV #KPTR, KSP |
| 493 | 001524 | 012737 | 140000 | 177776 | | MOV #UM, @PSW ;USER MODE!!! |
| 494 | 001532 | 000000 | | | | ;HALT TRAPS IN USER MODE |
| 495 | 001534 | 005037 | 177776 | | T12AA: | CLR @PSW |
| 496 | 001540 | 000000 | | | | HLT ;ERROR! HALT DID NOT TRAP |
| 497 | 001542 | 013700 | 177776 | | T12A: | MOV @PSW, R0 |
| 498 | 001546 | 005037 | 177776 | | | CLR @PSW |
| 499 | 001552 | 022700 | 030000 | | | CMP #KM+PUM, R0 |
| 500 | 001556 | 001401 | | | | BEQ .+4 |
| 501 | 001560 | 000000 | | | | HLT |
| 502 | 001562 | 022767 | 001534 | 176704 | | CMP #T12AA, KPTR-4 |
| 503 | 001570 | 001401 | | | | BEQ .+4 |

```

504 001572 000000          HLT
505
506          :CHECK THAT SPL TRAPS TO 10 IN USER MODE.
507 001574 010701          †13: SCOPE
508 001576 012737 001626 000010      MOV      @T13A,@RESVEC
509 001604 012706 000500          MOV      @KPTR,KSP          ;SET KERNEL STACK PTR
510 001610 012737 140000 177776      MOV      @UM,@PSW          ;USER MODE!!!
511 001616 000237          SPL      7          ;SPL TRAPS IN USER MODE
512 001620 005037 177776      T13AA: CLR      @PSW          ;KERNEL MODE!!!
513 001624 000000          HLT          ;ERROR! SPL FAILED TO TRAP IN USER MODE
514 001626 013700 177776      T13A:  MOV      @PSW,RO
515 001632 005037 177776          CLR      @PSW
516 001636 022700 030000          CMP      @KM+PUM,RO
517 001642 001401          BEQ      .+4
518 001644 000000          HLT
519 001646 022767 001620 176620      CMP      @T13AA,KPTR-4
520 001654 001401          BEQ      .+4
521 001656 000000          HLT
522 001660 012737 000012 000010      MOV      @RESVEC+2,@RESVEC
523
524          :TEST THAT "RESET" RESETS IN KERNEL MODE
525 001666 010701          †18: SCOPE
526 001670 005037 177776          CLR      @PSW
527 001674 012737 000340 177776      MOV      @PTY7,@PSW          ;PRIORITY TO 7
528 001702 012767 000100 175654      MOV      @100,177564          ;SET "IE" IN TPS
529 001710 000005          RESET          ;CLEAR "IE"
530 001712 005037 177776          CLR      @PSW
531 001716 032767 000100 175640      BIT      @100,177564
532 001724 001401          BEQ      .+4
533 001726 000000          HLT          ;RESET DID NOT
534          ;CLEAR "IE"
535
536          :TEST THAT "RESET" NOP'S IN USER MODE
537 001730 010701          †19: SCOPE
538 001732 012737 140340 177776      MOV      @UM+PTY7,@PSW          ;USER MODE!!!
539 001740 012767 000100 175616      MOV      @100,177564          ;SET "IE"
540 001746 000005          RESET          ;SHOULD NOP
541 001750 032767 000100 175606      BIT      @100,177564
542 001756 001001          BNE      .+4
543 001760 000000          HLT          ;"IE" CLEARED
544 001762 005067 175576          CLR      177564
545 001766 005037 177776          CLR      @PSW
546
547          :TEST INTERRUPT SEQUENCE USER TO KERNEL MODE
548 001772 010701          †15: SCOPE
549 001774 012706 000500          MOV      @KPTR,KSP          ;SET KERNEL STACK POINTER
550 002000 012737 170340 177776      MOV      @UM+PUM+PTY7,@PSW          ;USER MODE!!!
551 002006 012767 002052 176050      MOV      @T15A,64          ;INTERRUPT VEC.
552 002014 012767 000200 176044      MOV      @KM+PTY4,66
553 002022 012706 000700          MOV      @UPTR,USP          ;SET USER STACK POINTER
554 002026 042737 000200 177776      BIC      @PTY4,@PSW          ;SET PRIORITY LEVEL=3
555 002034 012767 000100 175522      MOV      @100,177564          ;REQUEST AN INTERRUPT AT LEVEL 4
556 002042 000240          NOP
557 002044 005037 177776      T15AA: CLR      @PSW          ;KERNEL MODE!!!
558 002050 000000          HLT          ;ERROR! NO INTERRUPT REQUEST
559 002052 013700 177776      T15A:  MOV      @PSW,RO          ;GET 'NEW' @PSW

```

```

560 002056 005067 175502 CLR 177564 ;DISABLE REQUEST
561 002062 005037 177776 CLR @#PSW
562 002066 022700 030200 CMP #KM+PUM+PTY4,RO ;TEST THAT 'NEW' @#PSW IS CORRECT
563 002072 001401 BEQ .+4 ;(PIRVEC+2)
564 002074 000000 HLT ;ERROR! 'NEW' @#PSW NOT = TO (PIRVEC+2)
565 002076 022767 002044 176370 CMP #T15AA,KPTR-4 ;IS RETURN ADDRESS ON KERNEL STACK
566 002104 001401 BEQ .+4
567 002106 000000 HLT ;ERROR! RETURN ADDRESS NOT ON KERNEL STACK
568 002110 022767 170140 176360 CMP #UM+PUM+PTY3,KPTR-2 ;TEST THAT 'OLD' @#PSW WAS SAVED ON
569 002116 001401 BEQ .+4 ;KERNEL STACK
570 002120 000000 HLT ;ERROR!
571 002122 012767 000066 175734 MOV #66,64
572 002130 005067 175732 CLR 66
573
574 ;TEST THAT THERE IS NO STACK OVERFLOW IN USER MODE.
575 002134 010701 T17: SCOPE
576 002136 012737 000400 177774 MOV #400,@#SLR ;SET STACK LIMIT =1000
577 002144 012737 140000 177776 MOV #UM,@#PSW ;USER MODE!!!
578 002152 012737 002402 000004 MOV #T17ERR,@#ERRVEC
579 002160 012706 000700 MOV #UPTR,USP ;SET USER STACK POINTER
580 002164 005067 176612 CLR TEMP ;CLEAR INDICATOR LOCATION
581 002170 004767 000006 T17A: JSR 7,T17B ;PUSH ONTO USER STACK
582 002174 052767 000400 176600 BIS #400,TEMP ;SET ERROR INDICATOR BIT
583 002202 052767 000001 176572 T17B: BIS #1,TEMP ;SET INDICATOR BIT
584 002210 004567 000006 JSR 5,T17C ;PUSH ONTO USER STACK
585 002214 052767 001000 176560 BIS #1000,TEMP ;SET ERROR INDICATOR BIT
586 002222 052767 000002 176552 T17C: BIS #2,TEMP ;SET INDICATOR BIT
587 002230 050546 BIS R5,-(USP) ;PUSH ONTO USER STACK
588 002232 052767 000004 176542 BIS #4,TEMP ;SET INDICATOR BIT
589 002240 052737 000000 177776 BIS #REG,@#PSW ;SELECT R0-R5
590 002246 004767 000006 JSR 7,T17D ;PUSH ONTO USER STACK
591 002252 052767 002000 176522 BIS #2000,TEMP ;SET ERROR INDICATOR BIT
592 002260 052767 000010 176514 T17D: BIS #10,TEMP
593 002266 012702 002302 MOV #T17E,R2 ;SET UP RETURN FOR RTS
594 002272 000202 RTS R2 ;GO TO T17E
595 002274 052767 004000 176500 BIS #4000,TEMP ;SET INDICATOR TO SHOW ERROR
596 002302 052767 000020 176472 T17E: BIS #20,TEMP
597 002310 004567 000006 JSR R5,T17F
598 002314 052767 010000 176460 BIS #10000,TEMP ;SET ERROR INDICATOR BIT
599 002322 052767 000040 176452 T17F: BIS #40,TEMP
600 002330 012737 002354 000034 MOV #T17G,@#TRAPVEC ;SET UP TRAP VECTOR FOR TRAP
601 002336 012737 140000 000036 MOV #UM,@#TRAPVEC+2
602 002344 104400 TRAP
603 002346 052767 020000 176426 BIS #20000,TEMP
604 002354 052767 000100 176420 T17G: BIS #100,TEMP
605 002362 005037 177776 CLR @#PSW ;KERNEL MODE!!!
606 002366 022767 000177 176406 CMP #177,TEMP
607 002374 001401 BEQ .+4
608 002376 000000 HLT
609 002400 000403 BR T17X
610 002402 005037 177776 T17ERR: CLR @#PSW
611 002406 000000 HLT ;ERROR! OVERFLOW OCCURED
612 002410 005037 177774 T17X: CLR @#SLR
613 002414 012737 000036 000034 MOV #TRAPVEC+2,@#TRAPVEC
614 002422 005067 175410 CLR TRAPVEC+2
615

```

```

616                                     ;TEST THAT MTPD/I POPS WORD OFF THE THE APPROPRIATE STACK (AS
617                                     ;DETERMINED BY BITS 15&14 IN @#PSW.)
618                                     ;MTPD, KERNEL MODE
619 002426 010701                                     †21: SCOPE
620 002430 005037 177776                               CLR @#PSW
621 002434 012706 000500                               MOV #KPTR,KSP ;SET KERNEL STACK POINTER
622 002440 012700 177777                               MOV #-1,R0 ;PRE-SET R0
623 002444 005016                                     CLR (KSP) ;PUT 0 ON THE STACK
624 002446 012737 030011 177776                       MOV #PUM+N+C,@#PSW ;PRE SET STATUS
625 002454 006600                                     MTP I R0 ;R0<--(KSP)+
626
627 002456 013702 177776                               MOV @#PSW,R2 ;GET STATUS
628 002462 022702 030005                               CMP #PUM+Z+C,R2
629 002466 001401                                     BEQ .+4
630 002470 000000                                     HLT ;ERROR! INCORRECT STATUS
631 002472 022706 000502                               CMP #KPTR+2,KSP ;DID KSP INCREMENT BY 2
632 002476 001401                                     BEQ .+4
633 002500 000000                                     HLT ;ERROR! KSP DID NOT POP
634 002502 005700                                     TST R0 ;DID WORD ON STACK (0) GET TO R0?
635 002504 001401                                     BEQ .+4
636 002506 000000                                     HLT ;ERROR! MTPD DID NOT POP 0 OFF
637                                     ;KSP INTO R0
638
639                                     ;MTP I, KERNEL MODE
640 002510 010701                                     †22: SCOPE
641 002512 005037 177776                               CLR @#PSW
642 002516 012706 000500                               MOV #KPTR,KSP
643 002522 005002                                     CLR R2 ;PRESET R2
644 002524 012716 177777                               MOV #-1,(KSP)
645 002530 012737 030006 177776                       MOV #PUM+Z+V,@#PSW ;PRESET STATUS
646 002536 006602                                     MTP I R2 ;R2+(KSP)+
647
648 002540 013700 177776                               MOV @#PSW,R0 ;GET STATUS
649 002544 022700 030010                               CMP #PUM+N,R0
650 002550 001401                                     BEQ .+4
651 002552 000000                                     HLT ;ERROR! INCORRECT STATUS
652 002554 022706 000502                               CMP #KPTR+2,KSP
653 002560 001401                                     BEQ .+4
654 002562 000000                                     HLT ;ERROR!
655 002564 005202                                     INC R2
656 002566 001401                                     BEQ .+4
657 002570 000000                                     HLT ;ERROR!
658
659                                     ;MTPD, USER MODE
660 002572 010701                                     †25: SCOPE
661 002574 012737 140000 177776                       MOV #UM,@#PSW
662 002602 012706 000700                               MOV #UPTR,USP
663 002606 052716 177777                               BIS #-1,(USP)
664 002612 000261                                     SEC
665 002614 042705 177777                               BIC #-1,R5
666 002620 006605                                     MTP I R5 ;R5+(USP)+
667
668 002622 013700 177776                               MOV @#PSW,R0
669 002626 010602                                     MOV USP,R2
670 002630 005037 177776                               CLR @#PSW
671 002634 022700 140011                               CMP #UM+N+C,R0
    
```

| | | | | | | | |
|-----|--------|--------|--------|--------|------|--------------|----------------------------------|
| 672 | 002640 | 001401 | | | BEQ | .+4 | |
| 673 | 002642 | 000000 | | | HLT | | |
| 674 | 002644 | 022702 | 000702 | | CMP | #UPTR+2,R2 | |
| 675 | 002650 | 001401 | | | BEQ | .+4 | |
| 676 | 002652 | 000000 | | | HLT | | |
| 677 | 002654 | 005205 | | | INC | R5 | |
| 678 | 002656 | 001401 | | | BEQ | .+4 | |
| 679 | 002660 | 000000 | | | HLT | | |
| 680 | | | | | | | |
| 681 | | | | | | | |
| 682 | | | | | | | |
| 683 | 002662 | 010701 | | | | | |
| 684 | 002664 | 012737 | 140000 | 177776 | MOV | #UM,#PSW | |
| 685 | 002672 | 012706 | 000700 | | MOV | #UPTR,USP | |
| 686 | 002676 | 042716 | 177777 | | BIC | #-1,(USP) | |
| 687 | 002702 | 052700 | 177777 | | BIS | #-1,R0 | |
| 688 | 002706 | 000257 | | | CCC | | |
| 689 | 002710 | 006600 | | | MTPI | R0 | ;R0+(USP)+ |
| 690 | | | | | | | |
| 691 | 002712 | 013702 | 177776 | | MOV | #PSW,R2 | |
| 692 | 002716 | 010603 | | | MOV | USP,R3 | |
| 693 | | | | | | | |
| 694 | 002720 | 005037 | 177776 | | CLR | #PSW | |
| 695 | 002724 | 022702 | 140004 | | CMP | #UM+2,R2 | |
| 696 | 002730 | 001401 | | | BEQ | .+4 | |
| 697 | 002732 | 000000 | | | HLT | | |
| 698 | 002734 | 022703 | 000702 | | CMP | #UPTR+2,R3 | |
| 699 | 002740 | 001401 | | | BEQ | .+4 | |
| 700 | 002742 | 000000 | | | HLT | | |
| 701 | 002744 | 005700 | | | TST | R0 | |
| 702 | 002746 | 001401 | | | BEQ | .+4 | |
| 703 | 002750 | 000000 | | | HLT | | |
| 704 | | | | | | | |
| 705 | | | | | | | |
| 706 | | | | | | | |
| 707 | | | | | | | |
| 708 | 002752 | 010701 | | | | | |
| 709 | 002754 | 012737 | 140000 | 177776 | MOV | #UM,#PSW | ;USER MODE!!! |
| 710 | 002762 | 005006 | | | CLR | USP | ;PRESET USER STACK POINTER |
| 711 | 002764 | 012737 | 030000 | 177776 | MOV | #KM+PUM,#PSW | ;KERNEL MODE!!! PREV USER MODE!! |
| 712 | 002772 | 012706 | 000500 | | MOV | #KPTR,KSP | ;SET KERNEL STACK POINTER |
| 713 | 002776 | 012716 | 000700 | | MOV | #UPTR,(KSP) | |
| 714 | 003002 | 000277 | | | SCC | | ;PRESET CC'S |
| 715 | 003004 | 006606 | | | MTPI | USP | ;USP+(KSP)+ |
| 716 | | | | | | | |
| 717 | 003006 | 013702 | 177776 | | MOV | #PSW,R2 | ;SAVE CC'S |
| 718 | 003012 | 012737 | 140000 | 177776 | MOV | #UM,#PSW | ;USER MODE!!! |
| 719 | 003020 | 010600 | | | MOV | USP,R0 | ;GET USER STACK POINTER |
| 720 | 003022 | 005037 | 177776 | | CLR | #PSW | ;KERNEL MODE!!! |
| 721 | 003026 | 022700 | 000700 | | CMP | #UPTR,R0 | ;CHECK THAT MTPD SET USER STACK |
| 722 | 003032 | 001401 | | | BEQ | .+4 | ;POINTER PROPERLY |
| 723 | 003034 | 000000 | | | HLT | | ;ERROR! |
| 724 | 003036 | 022706 | 000502 | | CMP | #KPTR+2,KSP | ;CHECK KERNEL STACK POINTER |
| 725 | 003042 | 001401 | | | BEQ | .+4 | |
| 726 | 003044 | 000000 | | | HLT | | |
| 727 | | | | | | | |

;TEST THAT MTP D/I POPS WORD OFF STACK (AS DETERMINED BY BITS 15 & 14
 ;INTO STACK POINTER (AS DETERMINED BY BITS 13 & 12).
 ;USP+(KSP)+, MTPD

↑30: SCOPE
 ;USER MODE!!!
 ;PRESET USER STACK POINTER
 ;KERNEL MODE!!! PREV USER MODE!!
 ;SET KERNEL STACK POINTER
 ;PRESET CC'S
 ;USP+(KSP)+
 ;SAVE CC'S
 ;USER MODE!!!
 ;GET USER STACK POINTER
 ;KERNEL MODE!!!
 ;CHECK THAT MTPD SET USER STACK
 ;POINTER PROPERLY
 ;ERROR!
 ;CHECK KERNEL STACK POINTER


```

784
785 ;TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION
786 ;KERNEL MODE
787 003254 010701 T36: SCOPE
788 003256 005037 177776 CLR @#PSW
789 003262 012706 000500 MOV #KPTR,KSP
790 003266 012716 177777 MOV #-1,(KSP)
791 003272 012737 003312 000004 MOV #T36A,@#ERRVEC
792 003300 005067 174502 CLR ERRVEC+2
793 003304 006667 174467 MTPI -1 ;TRAPS ON ODD ADDRESS
794 003310 000000 T36AA: HLT ;ERROR! DID NOT TRAP
795 003312 022706 000476 T36A: CMP #KPTR-2,KSP ;IS KSP CORRECT?(1 POP AND 2
796 003316 001401 BEQ .+4 ;PUSHES)
797 003320 000000 HLT ;ERROR! INCORRECT VALUE IN KSP
798 003322 022767 003310 175146 CMP #T36AA,KPTR-2
799 003330 001401 BEQ .+4
800 003332 000000 HLT
801
802 ;USER MODE
803 003334 010701 T40: SCOPE
804 003336 012737 170000 177776 MOV #UM+PUM,@#PSW ;USER MODE!!!, PREV USER MODE!!
805 003344 012702 000001 MOV #1,R2
806 003350 012706 000700 MOV #UPTR,USP ;SET USER STACK POINTER
807 003354 012716 125252 MOV #125252,(USP) ;PRESET USER STACK
808 003360 012737 003404 000004 MOV #T40A,@#ERRVEC ;LOAD ERROR VECTOR
809 003366 012737 140000 000006 MOV #UM,@#ERRVEC+2
810 003374 006642 MTPI -(R2) ;-(R2)+(USP)+; SHOULD TRAP ON ODD ADRS
811 003376 005037 177776 T40AA: CLR @#PSW ;KERNEL MODE!!!
812 003402 000000 HLT ;ERROR DID NOT TRAP
813 003404 010600 T40A: MOV USP,R0 ;GET USERS STACK POINTER
814 003406 042737 140000 177776 BIC #UM,@#PSW ;KERNEL MODE!!!
815 003414 022700 000676 CMP #UPTR-2,R0 ;CHECK THAT USER STACK POINTER
816 003420 001401 BEQ .+4 ;PUSHED PROPERLY (1 POP 2 PUSHES)
817 003422 000000 HLT ;ERROR! INCORRECT USER STACK POINTER
818 003424 022737 170010 000700 CMP #UM+PUM+N,@#UPTR ;CHECK THAT CORRECT STATUS WAS
819 003432 001401 BEQ .+4 ;SAVED ON USER STACK ('N' IS DATA POPPED)
820 003434 000000 HLT ;ERROR! INCORRECT STATUS SAVED ON USER STACK
821 003436 022767 003376 175232 CMP #T40AA,UPTR-2 ;CHECK THAT RETURN ADDRESS WAS
822 003444 001401 BEQ .+4 ;SAVED ON USER STACK
823 003446 000000 HLT ;ERROR! RETURN PC NOT ON USER STACK
824 003450 022702 177777 CMP #-1,R2 ;DID R2 DECREMENT BY 2
825 003454 001401 BEQ .+4
826 003456 000000 HLT
827 ;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
828 ;KERNEL MODE
829 003460 010701 T41: SCOPE
830 003462 005037 177776 CLR @#PSW
831 003466 012700 177777 MOV #-1,R0
832 003472 012737 003526 000004 MOV #T41A,@#ERRVEC
833 003500 005067 174302 CLR ERRVEC+2
834 003504 052737 000000 177776 BIS #REG,@#PSW ;R0-R5
835 003512 005000 CLR R0
836 003514 012746 000002 MOV #2,-(KSP)
837 003520 000261 SEC
838 003522 006620 MTPI (R0)+ ;(R0)+(KSP)+
839 003524 000401 BR .+4

```

```

840 003526 000000          T41A:  HLT          ;ERROR! TRAPPED
841 003530 103401          BCS          .+4      ;MTP D/I SHOULD NOT AFFECT CARRY
842 003532 000000          HLT          ;BIT ERROR! CARRY BIT BUT CLEARED.
843 003534 022767 000002 174236  CMP          #2,0
844 003542 001401          BEQ          .+4
845 003544 000000          HLT
846
847
848 003546 010701          T41B:  SCOPE
849 003550 012737 003576 000004  MOV          #T41BB, @#ERRVEC ;LOAD ERROR VECTOR
850 003556 012706 000500          MOV          #KPTR, KSP    ;SET KERNEL STACK POINTER
851 003562 012716 177777          MOV          #-1, (KSP)    ;LOAD KERNEL STACK
852 003566 000257          CCC          ;PRESET CC'S
853 003570 006637 001002          MTPI        @#TEMP        ;@#TEMP←(KSP)+
854
855 003574 000401          T41BB:  BR          .+4
856 003576 000000          HLT          ;ERROR! TRAPPED
857 003600 013700 177776          MOV          @#PSW, R0      ;SAVE CC'S
858 003604 022700 000010          CMP          #REG+N, R0    ;CHECK RESULT STATUS
859 003610 001401          BEQ          .+4
860 003612 000000          HLT          ;ERROR! INCORRECT STATUS AFTER MTPD
861 003614 005237 001002          INC          @#TEMP        ;CHECK RESULT
862 003620 001401          BEQ          .+4
863 003622 000000          HLT          ;ERROR! MTPD FAILED
864
865          ;USER MODE
866 003624 010701          †43:  SCOPE
867 003626 005037 177776          CLR          @#PSW
868 003632 012703 177777          MOV          #-1, R3
869 003636 012737 003676 000004  MOV          #T43A, @#ERRVEC
870 003644 012737 140000 177776  MOV          #UM, @#PSW
871 003652 012703 001004          MOV          #TEMP+2, R3
872 003656 005067 175120          CLR          TEMP
873 003662 012706 000700          MOV          #UPTR, USP
874 003666 052716 177777          BIS          #-1, (USP)
875 003672 006643          MTPI        -(R3)          ;-(R3)←(USP)+
876 003674 000401          BR          .+4
877 003676 000000          T43A:  HLT          ;ERROR TRAPPED
878 003700 013700 177776          MOV          @#PSW, R0
879 003704 042737 140000 177776  BIC          #UM, @#PSW    ;KERNEL MODE!!!
880 003712 122700 000010          CMPB        #N, R0
881 003716 001401          BEQ          .+4
882 003720 000000          HLT
883 003722 005167 175054          COM          TEMP
884 003726 001401          BEQ          .+4
885 003730 000000          HLT
886 003732 012737 000006 000004  MOV          #ERRVEC+2, @#ERRVEC
887 003740 005067 174042          CLR          ERRVEC+2
888
889          ;TEST THAT MFP D/I PUSHES DESTINATION REGISTER DATA ONTO THE APPROPRIATE STACK
890          ; (AS DETERMINED BY @#PSW BITS 15 & 14)
891          ; KERNEL MODE MFPD
892 003744 010701          †44:  SCOPE
893 003746 012706 000500          MOV          #KPTR, KSP
894 003752 012716 125252          MOV          #125252, (KSP)
895 003756 012700 177777          MOV          #-1, R0
    
```

| Address | Instruction | PC | PSW | Comments |
|---------|-------------|--------|---------------|----------|
| 896 | SEC | 000261 | | |
| 897 | MFPI | 006500 | | |
| 898 | MOV | 013702 | 177776 | |
| 899 | MOV | 022702 | 000011 | |
| 900 | CMP | 001401 | | |
| 901 | BEQ | 000000 | | |
| 902 | HLT | 022706 | 000476 | |
| 903 | CMP | 001401 | | |
| 904 | BEQ | 000000 | | |
| 905 | HLT | 005116 | | |
| 906 | COM | 001401 | | |
| 907 | BEQ | 000000 | | |
| 908 | HLT | | | |
| 909 | MODE MFPI | 010701 | | |
| 910 | SCOPE | 012706 | 000500 | |
| 911 | MOV | 012716 | 052525 | |
| 912 | MOV | 005004 | | |
| 913 | CLR | 012737 | 000001 177776 | |
| 914 | MOV | 012704 | 125252 | |
| 915 | MOV | 006504 | | |
| 916 | MFPI | | | |
| 917 | MOV | 013700 | 177776 | |
| 918 | MOV | 022700 | 000011 | |
| 919 | CMP | 001401 | | |
| 920 | BEQ | 000000 | | |
| 921 | HLT | 022706 | 000476 | |
| 922 | CMP | 001401 | | |
| 923 | BEQ | 000000 | | |
| 924 | HLT | 004072 | | |
| 925 | COM | 022716 | 125252 | |
| 926 | CMP | 001401 | | |
| 927 | BEQ | 000000 | | |
| 928 | HLT | | | |
| 929 | | | | |
| 930 | | | | |
| 931 | MODE MFPD | 010701 | | |
| 932 | SCOPE | 005003 | | |
| 933 | CLR | 012737 | 140000 177776 | |
| 934 | MOV | 012706 | 000700 | |
| 935 | MOV | 012726 | 125252 | |
| 936 | MOV | 012703 | 177777 | |
| 937 | MOV | 000257 | | |
| 938 | CCC | 006503 | | |
| 939 | MFPI | | | |
| 940 | MOV | 013700 | 177776 | |
| 941 | MOV | 010604 | | |
| 942 | MOV | 042737 | 140000 177776 | |
| 943 | BIC | 022700 | 140010 | |
| 944 | CMP | 001401 | | |
| 945 | BEQ | 000000 | | |
| 946 | HLT | 022704 | 000700 | |
| 947 | CMP | 001401 | | |
| 948 | BEQ | 000000 | | |
| 949 | HLT | 005214 | | |
| 950 | INC | 001401 | | |
| 951 | BEQ | 000000 | | |
| | HLT | | | |

```

;-(KSP)+R0,(R0)=-1
;GET STATUS RESULT
;
;ERROR! INCORRECT STATUS RESULT
;DID KERNEL STACK POINTER GET
;PUSHED?
;ERROR!
;TEST THAT CORRECT DATA(-1) GOT
;PUSHED ONTO KERNEL STACK
;ERROR! -1NOT PUSHED ONTO KERNEL STACK

:KERNEL MODE MFPI
†45: SCOPE
MOV #KPTR,KSP
MOV #52525,(KSP)
CLR R4
MOV #REG+C,@#PSW
MOV #125252,R4
MFPI R4
;PRE SET STACK
;PRESET 'WRONG' REGISTER
;SELECT R0-R5,SET C
;LOAD DATA TO BE MOVED
;-(KSP)+R4,(R4)=125252

MOV @#PSW,R0
CMP #REG+N+C,R0
BEQ .+4
HLT
;CHECK STATUS RESULT
;ERROR! INCORRECT STATUS
;CHECK PUSH
;ERROR! KSP DID NOT PUSH DOWN
;CHECK DATA ON THE STACK

MOV @#PSW,R0
MOV USP,R4
BIC #UM,@#PSW
CMP #UM+N,R0
BEQ .+4
HLT
;ERROR! INCORRECT DATA ON THE STACK
;IF DATA=0 THEN INCORRECT REGISTER
;(R4), IF DATA=52525 NO DATA PUSHED
;ON THE STACK.

:USER MODE MFPD
†50: SCOPE
CLR R3
MOV #UM,@#PSW
MOV #UPTR,USP
MOV #125252,(USP)+
MOV #-1,R3
CCC
MFPI R3
;-(USP)+R3 (R3)=-1

MOV @#PSW,R0
MOV USP,R4
BIC #UM,@#PSW
CMP #UM+N,R0
BEQ .+4
HLT
;PRESET
;USER MODE, R0-R5
;SET USER'S STACK POINTER
;PRESET STACK

MOV #UPTR,R4
CMP #UPTR,R4
BEQ .+4
HLT
;-(R4)
BEQ .+4
HLT

```

```

952 004200 005037 177776          CLR      @#PSW
953                                :USER MODE MFPI
954 004204 010701          †51: SCOPE
955 004206 005005          CLR      R5
956 004210 012737 140000 177776  MOV      #UM,@#PSW      ;USER MODE!!!
957 004216 012706 000700      MOV      #UPTR,USP      ;SET USER STACK POINTER
958 004222 012716 177777      MOV      #-1,(USP)      ;PRESET USER STACK
959 004226 012705 000700      MOV      #UPTR,R5      ;PRESET R5
960 004232 000277          SCC      ;PRESET CONDITION CODES
961 004234 006505          MFPI     R5              ;-(USP)+R5
962
963 004236 013700 177776          MOV      @#PSW,R0      ;GET STATUS RESULT
964 004242 010602          MOV      USP,R2        ;GET USER STACK POINTER
965 004244 042737 140000 177776  BIC      #UM,@#PSW      ;KERNEL MODE!!!
966 004252 022700 140001      CMP      #UM+C,R0      ;CHECK STATUS RESULT AFTER MFPI INST
967 004256 001401          BEQ      .+4
968 004260 000000          HLT
969 004262 022702 000676      CMP      #UPTR-2,R2    ;ERROR! INCORRECT STATUS AFTER MFPI
970 004266 001401          BEQ      .+4
971 004270 000000          HLT
972 004272 022712 000700      CMP      #UPTR,(R2)
973 004276 001401          BEQ      .+4
974 004300 000000          HLT
975                                :TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
976                                :STACK.
977                                :KERNEL MODE,MFPD
978 004302 010701          †52: SCOPE
979 004304 005037 177776          CLR      @#PSW      ;KERNEL MODE!!!
980 004310 012700 001002      MOV      #TEMP,R0      ;PRESET R0
981 004314 052737 000000 177776  BIS      #REG,@#PSW      ;SELECT R0-R5
982 004322 012700 001004      MOV      #TEMP+2,R0    ;PRESET R0
983 004326 012767 177777 174446  MOV      #-1,TEMP
984 004334 005067 174444      CLR      TEMP+2
985 004340 012706 000500      MOV      #KPTR,KSP      ;SET KERNEL STACK POINTER
986 004344 012716 125252      MOV      #125252,(KSP) ;PRESET KERNEL STACK
987 004350 006520          MFPI     (R0)+         ;-(KSP)+(R0)+,R0=TEMP+2,TEMP+2=0
988
989 004352 013702 177776          MOV      @#PSW,R2
990 004356 022702 000004      CMP      #REG+2,R2
991 004362 001401          BEQ      .+4
992 004364 000000          HLT
993 004366 022706 000476      CMP      #KPTR-2,KSP
994 004372 001401          BEQ      .+4
995 004374 000000          HLT
996 004376 005716          TST      (KSP)
997 004400 001401          BEQ      .+4
998 004402 000000          HLT
999
1000                                :USER MODE MFPI
1001 004404 010701          †54: SCOPE
1002 004406 012737 140000 177776  MOV      #UM,@#PSW
1003 004414 012703 001004      MOV      #TEMP+2,R3
1004 004420 052737 000340 177776  BIS      #REG+PRTY7,@#PSW
1005 004426 012703 001006      MOV      #TEMP+4,R3
1006 004432 005067 174344      CLR      TEMP
1007 004436 012767 177777 174340  MOV      #-1,TEMP+2
    
```

| | | | | | | | |
|------|--------|--------|--------|--------|------------|-------------------|---|
| 1008 | 004444 | 012706 | 000700 | | MOV | #UPTR, USP | |
| 1009 | 004450 | 012716 | 125252 | | MOV | #125252, (USP) | |
| 1010 | 004454 | 006563 | 177776 | | MFPI | -2(R3) | ;- (USP+-2(R3), R3=#TEMP+4, TEMP+2=-1 |
| 1011 | | | | | | | |
| 1012 | 004460 | 013700 | 177776 | | MOV | @#PSW, R0 | |
| 1013 | 004464 | 010602 | | | MOV | USP, R2 | |
| 1014 | 004466 | 042737 | 140000 | 177776 | BIC | #UM, @#PSW | |
| 1015 | 004474 | 022700 | 140350 | | JMP | #UM+PRTY7+N, R0 | |
| 1016 | 004500 | 001401 | | | BEQ | .+4 | |
| 1017 | 004502 | 000000 | | | HLT | | |
| 1018 | 004504 | 022702 | 000676 | | CMP | #UPTR-2, R2 | |
| 1019 | 004510 | 001401 | | | BEQ | .+4 | |
| 1020 | 004512 | 000000 | | | HLT | | |
| 1021 | 004514 | 005112 | | | COM | (R2) | |
| 1022 | 004516 | 001401 | | | BEQ | .+4 | |
| 1023 | 004520 | 000000 | | | HLT | | |
| 1024 | | | | | | | |
| 1025 | 004522 | 010701 | | | | | : TEST OVERFLOW (YELLOW) USING MFPI INSTRUCTION |
| 1026 | 004524 | 012737 | 030000 | 177776 | T55: | SCOPE | |
| 1027 | 004532 | 012706 | 001000 | | MOV | #PUM, @#PSW | ; KERNEL MODE!!!, PREV USER MODE!! |
| 1028 | 004536 | 012767 | 177777 | 174236 | MOV | #YELPTR, KSP | ; SET STACK PTR AT TOP OF YELLOW ZONE |
| 1029 | 004544 | 005066 | 177776 | | MOV | #-1, TEMP | ; PRESET DATA |
| 1030 | 004550 | 012737 | 004576 | 000004 | CLR | -2(KSP) | ; PRESET STACK DATA |
| 1031 | 004556 | 005037 | 000006 | | MOV | #T55A, @#ERRVEC | ; LOAD ERROR TRAP VECTOR |
| 1032 | 004562 | 012737 | 000400 | 177774 | CLR | @#ERRVEC+2 | |
| 1033 | 004570 | 006567 | 174206 | | MOV | #400, @#SLR | ; SET STACK LIMIT =1000 |
| 1034 | | | | | MFPI | TEMP | ; PUSH TEMP ONTO KERNEL STACK |
| 1035 | 004574 | 000000 | | | | | ; SHOULD OVERFLOW STACK |
| 1036 | 004576 | 022767 | 177777 | 174172 | T55AA: HLT | | ; ERROR! FAILED TO TRAP ON OVERFLOW |
| 1037 | 004604 | 001401 | | | T55A: CMP | #-1, YELPTR-2 | ; CHECK THAT MFPI PUSHED DATA |
| 1038 | 004606 | 000000 | | | BEQ | .+4 | ; ONTO STACK |
| 1039 | 004610 | 022767 | 030010 | 174156 | HLT | | ; ERROR! MFPI FAILED TO PUSH DATA |
| 1040 | 004616 | 001401 | | | CMP | #PUM+N, YELPTR-4 | ; CHECK SAVED STATUS ON TRAP |
| 1041 | 004620 | 000000 | | | BEQ | .+4 | |
| 1042 | 004622 | 022767 | 004574 | 174142 | HLT | | ; ERROR! INCORRECT STATUS SAVED |
| 1043 | 004630 | 001401 | | | CMP | #T55AA, YELPTR-6 | ; CHECK SAVED PC ON STACK |
| 1044 | 004632 | 000000 | | | BEQ | .+4 | |
| 1045 | 004634 | 005037 | 177774 | | HLT | | ; ERROR! INCORRECT PC SAVED ON STACK |
| 1046 | | | | | CLR | @#SLR | ; CLEAR STACK LIMIT REGISTER |
| 1047 | | | | | | | |
| 1048 | 004640 | 010701 | | | | | : TEST OVERFLOW (RED) USING MFPI INSTRUCTION |
| 1049 | 004642 | 012737 | 004714 | 000004 | T56: | SCOPE | |
| 1050 | 004650 | 012737 | 030340 | 177776 | MOV | #T56A, @#ERRVEC | ; SET ERROR TRAP VECTOR |
| 1051 | 004656 | 012706 | 000736 | | MOV | #PUM+PRTY7, @#PSW | ; KERNEL MODE!!!, PREV USER MODE!! |
| 1052 | 004662 | 012766 | 177777 | 177776 | MOV | #REDPTR, KSP | ; SET STACK PTR TO TOP OF RED ZONE |
| 1053 | 004670 | 005067 | 174106 | | MOV | #-1, -2(KSP) | ; PRESET RED LOCATION=-1 |
| 1054 | | | | | CLR | TEMP | ; (TEMP) WILL BE THE DATA MOVED |
| 1055 | 004674 | 012703 | 001004 | | | | ; TO RED LOCATION |
| 1056 | 004700 | 012737 | 000400 | 177774 | MOV | #TEMP+2, R3 | ; LOAD INDEX REGISTER |
| 1057 | 004706 | 006563 | 177776 | | MOV | #400, @#SLR | ; SET STACK LIMIT=1000 |
| 1058 | | | | | MFPI | -2(R3) | ; -(KSP)+TEMP SHOULD OVER |
| 1059 | 004712 | 000000 | | | | | ; FLOW (RED) |
| 1060 | | | | | T56AA: HLT | | ; ERROR! FAILED TO TRAP ON 'RED' |
| 1061 | 004714 | 022737 | 177777 | 000734 | T56A: CMP | #-1, @#REDPTR-2 | ; OVERFLOW |
| 1062 | 004722 | 001401 | | | BEQ | .+4 | ; TEST THAT MFPI DID NOT WRITE |
| 1063 | 004724 | 000000 | | | HLT | | ; INTO 'RED' LOCATION |

| | | | | | | | | |
|------|--------|--------|--------|--------|--------|---------------------|-------------|--|
| 1064 | 004726 | 005706 | | | TST | KSP | | ;STACK SHOULD HAVE GONE TO 0 |
| 1065 | 004730 | 001401 | | | BEQ | .+4 | | |
| 1066 | 004732 | 000000 | | | HLT | | | |
| 1067 | 004734 | 022737 | 030344 | 000002 | CMP | #PUM+PRTY7+Z, @#2 | | ;OLD STATUS SHOULD BE IN 2 |
| 1068 | 004742 | 001401 | | | BEQ | .+4 | | |
| 1069 | 004744 | 000000 | | | HLT | | | ;ERROR! |
| 1070 | 004746 | 022737 | 004712 | 000000 | CMP | #T56AA, @#0 | | ;AND RETURN IN 0 |
| 1071 | 004754 | 001401 | | | BEQ | .+4 | | |
| 1072 | 004756 | 000000 | | | HLT | | | ;ERROR! INCORRECT PC IN 0 |
| 1073 | 004760 | 005037 | 177774 | | CLR | @#SLR | | |
| 1074 | 004764 | 012737 | 000006 | 000004 | MOV | #ERRVEC+2, @#ERRVEC | | ;RESTORE ERROR VECTOR |
| 1075 | | | | | | | | |
| 1076 | | | | | | | | |
| 1077 | 004772 | 010701 | | | | | | |
| 1078 | 004774 | 012706 | 000500 | | T57: | SCOPE | | |
| 1079 | 005000 | 012737 | 000340 | 000036 | MOV | #KPTR, KSP | | ;SET KERNEL STACK POINTER |
| 1080 | 005006 | 012737 | 005076 | 000034 | MOV | #PRTY7, @#TRAPVEC+2 | | |
| 1081 | 005014 | 012737 | 140000 | 177776 | MOV | #T57A, @#TRAPVEC | | |
| 1082 | 005022 | 005002 | | | MOV | #UM, @#PSW | | ;USER MODE!!! |
| 1083 | 005024 | 104400 | | | CLR | R2 | | |
| 1084 | 005026 | 013767 | 177776 | 173746 | TRAP | | | ;TRAP & ENTER KERNEL MODE |
| 1085 | 005034 | 042737 | 140000 | 177776 | T57AA: | MOV | @#PSW, TEMP | |
| 1086 | 005042 | 022767 | 005026 | 173424 | BIC | #UM, @#PSW | | ;KERNEL MODE!!! |
| 1087 | 005050 | 001401 | | | CMP | #T57AA, KPTR-4 | | ;CHECK THAT RETURN ADDRESS IS ON |
| 1088 | 005052 | 000000 | | | BEQ | .+4 | | ;KERNEL STACK |
| 1089 | 005054 | 022767 | 140004 | 173720 | HLT | | | ;ERROR! RETURN ADDRESS NOT ON STACK |
| 1090 | 005062 | 001401 | | | CMP | #UM+Z, TEMP | | ;CHECK THAT CORRECT @#PSW WAS |
| 1091 | 005064 | 000000 | | | BEQ | .+4 | | ;RESTORED ON THE RETURN |
| 1092 | | | | | HLT | | | ;ERROR! INCORRECT STATUS WAS RETURNED |
| 1093 | 005066 | 005102 | | | | | | ;BY KERNEL FROM TRAP |
| 1094 | 005070 | 001401 | | | COM | R2 | | ;CHECK THAT TRAP ROUTINE WAS EXECUTED |
| 1095 | 005072 | 000000 | | | BEQ | .+4 | | |
| 1096 | | | | | HLT | | | ;ERROR! KERNEL DID NOT DO COM R2 |
| 1097 | 005074 | 000402 | | | | | | ; (AT T57A) |
| 1098 | 005076 | 005102 | | | T57A: | BR | T57EX | ;EXIT TEST |
| 1099 | 005100 | 000002 | | | COM | R2 | | ;COMPLEMENT R2 |
| 1100 | 005102 | 000240 | | | RTI | | | ;AND EXIT |
| 1101 | | | | | T57EX: | NOP | | |
| 1102 | | | | | | | | |
| 1103 | | | | | | | | |
| 1104 | | | | | | | | |
| 1105 | 005104 | 010701 | | | | | | |
| 1106 | 005106 | 005037 | 177776 | | T60: | SCOPE | | |
| 1107 | 005112 | 012706 | 000500 | | CLR | @#PSW | | ;KERNEL MODE!!!, PREV KERNEL MODE!! |
| 1108 | 005116 | 006506 | | | MOV | #KPTR, KSP | | ;SET KERNEL STACK POINTER |
| 1109 | 005120 | 022767 | 000500 | 173350 | MFPI | KSP | | ;-(KSP)+KSP |
| 1110 | 005126 | 001401 | | | CMP | #KPTR, KPTR-2 | | ;TEST THAT VALUE OF KERNEL STACK POINTER |
| 1111 | 005130 | 000000 | | | BEQ | .+4 | | ;WAS PUSHED ONTO KERNEL STACK |
| 1112 | | | | | HLT | | | ;ERROR! |
| 1113 | | | | | | | | |
| 1114 | 005132 | 010701 | | | | | | |
| 1115 | 005134 | 012737 | 030000 | 177776 | T62: | -(KSP)+USP, MFPI | | |
| 1116 | 005142 | 012706 | 000500 | | SCOPE | | | |
| 1117 | 005146 | 012716 | 177777 | | MOV | #KM+PUM, @#PSW | | ;KERNEL MODE!!!, PREV USER MODE!! |
| 1118 | 005152 | 006606 | | | MOV | #KPTR, KSP | | ;SET KERNEL STACK POINTER |
| 1119 | 005154 | 005166 | 177776 | | MOV | #-1, (KSP) | | |
| | | | | | MTP | USP | | ;SET USER STACK POINTER USP+(KSP)+ |
| | | | | | COM | -2(KSP) | | ;PRESET KERNEL STACK |

| | | | | | | | |
|------|--------|--------|--------|--------|------------------|----------------|--|
| 1120 | 005160 | 006506 | | | MFPI | USP | ;(KSP)+USP |
| 1121 | 005162 | 022716 | 177777 | | CMP | #-1,(KSP) | ;CHECK THAT USER STACK POINTER WAS |
| 1122 | 005166 | 001401 | | | BEQ | .+4 | ;PUSHED ONTO KERNEL STACK |
| 1123 | 005170 | 000000 | | | HLT | | ;ERROR! |
| 1124 | | | | | | | |
| 1125 | | | | | ;(USP)+USP, MFPI | | |
| 1126 | 005172 | 010701 | | | ↑65: SCOPE | | |
| 1127 | 005174 | 012737 | 030000 | 177776 | MOV | #PUM, @#PSW | ;KERNEL MODE!!!, PREV USER MODE!! |
| 1128 | 005202 | 012706 | 000500 | | MOV | #KPTR, KSP | ;SET KERNEL STACK POINTER |
| 1129 | 005206 | 012716 | 000700 | | MOV | #UPTR, (KSP) | |
| 1130 | 005212 | 006606 | | | MTPI | USP | ;SET USER STACK POINTER |
| 1131 | 005214 | 005067 | 173456 | | CLR | UPTR-2 | |
| 1132 | 005220 | 052737 | 140000 | 177776 | BIS | #UM, @#PSW | ;USER MODE!!!, PREV USER MODE!!! |
| 1133 | 005226 | 006506 | | | MFPI | USP | ;PUSH USER STACK POINTER ONTO USER STACK |
| 1134 | 005230 | 042737 | 140000 | 177776 | BIC | #UM, @#PSW | ;KERNEL MODE!!!, PREV USER MODE!! |
| 1135 | 005236 | 006506 | | | MFPI | USP | ;PUSH USER STACK POINTER ONTO KERNEL STACK |
| 1136 | 005240 | 022716 | 000676 | | CMP | #UPTR-2, (KSP) | ;CHECK THAT USER STACK POINTER WAS |
| 1137 | 005244 | 001401 | | | BEQ | .+4 | ;PUSHED PROPERLY (ONCE) |
| 1138 | 005246 | 000000 | | | HLT | | ;ERROR! |
| 1139 | 005250 | 022767 | 000700 | 173420 | CMP | #UPTR, UPTR-2 | ;CHECK THAT USER STACK POINTER IS ON THE |
| 1140 | 005256 | 001401 | | | BEQ | .+4 | ;USERS STACK |
| 1141 | 005260 | 000000 | | | HLT | | ;ERROR! |
| 1142 | | | | | | | |
| 1143 | | | | | ;(KSP)+KSP, MFPI | | |
| 1144 | 005262 | 010701 | | | ↑66: SCOPE | | |
| 1145 | 005264 | 005037 | 177776 | | CLR | @#PSW | ;KERNEL MODE!!!, PREV KERNEL MODE!! |
| 1146 | 005270 | 012706 | 000500 | | MOV | #KPTR, KSP | ;SET KERNEL STACK POINTER |
| 1147 | 005274 | 006506 | | | MFPI | KSP | ;PUSH KERNEL STACK POINTER ONTO KERNEL |
| 1148 | | | | | | | ;STACK |
| 1149 | 005276 | 022767 | 000500 | 173172 | CMP | #KPTR, KPTR-2 | ;CHECK RESULT |
| 1150 | 005304 | 001401 | | | BEQ | .+4 | |
| 1151 | 005306 | 000000 | | | HLT | | ;ERROR! |
| 1152 | | | | | | | |
| 1153 | | | | | ;(KSP)+USP, MFPI | | |
| 1154 | 005310 | 010701 | | | ↑70: SCOPE | | |
| 1155 | 005312 | 012737 | 030000 | 177776 | MOV | #PUM, @#PSW | ;KERNEL MODE!!!, PREV USER MODE!! |
| 1156 | 005320 | 012706 | 000500 | | MOV | #KPTR, KSP | ;SET KERNEL STACK POINTER |
| 1157 | 005324 | 012716 | 177777 | | MOV | #-1, (KSP) | |
| 1158 | 005330 | 006606 | | | MTPI | USP | ;SET USER STACK POINTER |
| 1159 | 005332 | 005166 | 177776 | | COM | -2(KSP) | ;PRESET KERNEL STACK |
| 1160 | 005336 | 006506 | | | MFPI | USP | ;PUSH USER STACK POINTER ONTO KERNEL STACK |
| 1161 | 005340 | 022716 | 177777 | | CMP | #-1, (KSP) | ;CHECK RESULT |
| 1162 | 005344 | 001401 | | | BEQ | .+4 | |
| 1163 | 005346 | 000000 | | | HLT | | ;ERROR! USER STACK POINTER NOT ON KERNEL STACK |
| 1164 | | | | | | | |
| 1165 | | | | | ;(USP)+USP, MFPI | | |
| 1166 | 005350 | 010701 | | | ↑73: SCOPE | | |
| 1167 | 005352 | 012737 | 030000 | 177776 | MOV | #PUM, @#PSW | ;KERNEL MODE!!!, PREV USER MODE!! |
| 1168 | 005360 | 012706 | 000500 | | MOV | #KPTR, KSP | ;SET KERNEL STACK POINTER |
| 1169 | 005364 | 012716 | 000700 | | MOV | #UPTR, (KSP) | |
| 1170 | 005370 | 006606 | | | MTPI | USP | ;SET USER STACK POINTER |
| 1171 | 005372 | 005067 | 173300 | | CLR | UPTR-2 | ;PRESET USER STACK |
| 1172 | 005376 | 052737 | 140000 | 177776 | BIS | #UM, @#PSW | ;USER MODE!!!, PREV USER MODE!! |
| 1173 | 005404 | 006506 | | | MFPI | USP | ;(USP)+USP |
| 1174 | 005406 | 042737 | 140000 | 177776 | BIC | #UM, @#PSW | ;KERNEL MODE!!! |
| 1175 | 005414 | 006506 | | | MFPI | USP | ;GET USER STACK POINTER |

```

1176 005416 022716 000676      CMP      #UPTR-2,(KSP)  ;CHECK THAT USER STACK POINTER WAS
1177 005422 001401      BEQ      .+4          ;PUSHED ONCE
1178 005424 000000      HLT                      ;ERROR!
1179 005426 022767 000700 173242    CMP      #UPTR,UPTR-2 ;CHECK THAT USER STACK POINTER WAS PUSHED
1180 005434 001401      BEQ      .+4          ;ONTO USER STACK
1181 005436 000000      HLT                      ;ERROR!
1182
1183      ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
1184 005440 010701      SCOPE
1185 005442 012737 100000 177776    ↑74:  MOV      #IM, @#PSW      ; ILLEGAL MODE!!!
1186 005450 013700 177776      MOV      @#PSW,RO      ; GET ILLEGAL MODE
1187 005454 005037 177776      CLR      @#PSW          ; KERNEL MODE!!
1188 005460 022700 100000      CMP      #IM,RO        ; CHECK THAT ILLEGAL MODE WAS SET
1189 005464 001401      BEQ      .+4          ; INTO STATUS
1190 005466 000000      HLT
1191
1192      ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
1193 005470 010701      SCOPE
1194 005472 012737 040000 177776    ↑75:  MOV      #IM1, @#PSW    ; ILLEGAL MODE!!!
1195 005500 013700 177776      MOV      @#PSW,RO      ; GET ILLEGAL MODE
1196 005504 005037 177776      CLR      @#PSW          ; KERNEL MODE!!
1197 005510 022700 040000      CMP      #IM1,RO       ; CHECK THAT ILLEGAL MODE WAS SET
1198 005514 001401      BEQ      .+4          ; INTO STATUS
1199 005516 000000      HLT
1200
1201      ;TEST THAT KERNEL CAN GET DATA FROM USER STACK
1202 005520 010701      SCOPE
1203 005522 012737 030000 177776    ↑76:  MOV      #KM+PUM, @#PSW ; KERNEL MODE!!!, PREV USER MODE!!
1204 005530 012706 000500      MOV      #KPTR, KSP    ; SET KERNEL STACK POINTER
1205 005534 012716 000700      MOV      #UPTR, (KSP)
1206 005540 006606      MTPI     USP           ; SET USER STACK POINTER
1207 005542 005067 173132      CLR      UPTR          ; PRESET USER STACK
1208 005546 005016      CLR      (KSP)         ; PRESET KERNEL STACK
1209 005550 012766 177777 177776    MOV      #-1, -2(KSP)
1210 005556 006506      MFPI     USP           ; -(KSP)+USP
1211 005560 006576 000000      MFPI     @ (KSP)       ; LIKE MOV @ (6), -(6)
1212 005564 000240      NOP
1213 005566 013703 177776      MOV      @#PSW, R3     ; SAVE STATUS RESULT
1214 005572 022767 000700 172700    CMP      #UPTR, KPTR   ; CHECK THAT USER STACK POINTER WAS
1215 005600 001401      BEQ      .+4          ; PUSHED ONTO KERNEL STACK
1216 005602 000000      HLT                      ; ERROR!
1217 005604 022706 000476      CMP      #KPTR-2, KSP  ; CHECK THAT KERNEL STACK POINTER IS POS-
1218 005610 001401      BEQ      .+4          ; ITIONED PROPERLY
1219 005612 000000      HLT                      ; ERROR! INCORRECT KERNEL STACK POINTER
1220 005614 005716      TST      (KSP)         ; CHECK THAT CORRECT DATA
1221 005616 001401      BEQ      .+4          ; WAS PUSHED ONTO KERNEL STACK
1222 005620 000000      HLT                      ; ERROR!
1223 005622 022703 030004      CMP      #KM+PUM+2, R3 ; CHECK STATUS
1224 005626 001401      BEQ      .+4
1225 005630 000000      HLT                      ; ERROR! INCORRECT STATUS
1226
1227      ;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7, PC
1228 005632 010701      SCOPE
1229 005634 012737 030000 177776    ↑102: MOV      #KM+PUM, @#PSW ; KERNEL MODE!!!, PREV USER MODE!!
1230 005642 012706 000500      MOV      #KPTR, KSP    ; SET KERNEL STACK PTR
1231 005646 005016      CLR      (KSP)         ; PUT DATA ON STACK

```

| | | | | | | | |
|------|--------|--------|--------|--------|-------------|-----------------|--|
| 1232 | 005650 | 012737 | 001002 | 001004 | MOV | #TEMP, @#TEMP+2 | ; LOAD ADDRESS |
| 1233 | 005656 | 012767 | 177777 | 173116 | MOV | #-1, TEMP | ; PRESET DATA |
| 1234 | 005664 | 000277 | | | SCC | | ; PRESET CC'S |
| 1235 | 005666 | 006677 | 173112 | | MTP | @TEMP+2 | ; TEMP+(KSP)+ |
| 1236 | 005672 | 013703 | 177776 | | MOV | @#PSW, R3 | ; CHECK CC'S |
| 1237 | 005676 | 022703 | 030005 | | CMP | #PUM+2+C, R3 | ; CHECK CC'S |
| 1238 | 005702 | 001401 | | | BEQ | .+4 | |
| 1239 | 005704 | 000000 | | | HLT | | ; ERROR! INCORRECT CC'S AFTER MTPD |
| 1240 | 005706 | 005737 | 001002 | | TST | @#TEMP | ; CHECK RESULT |
| 1241 | 005712 | 001401 | | | BEQ | .+4 | |
| 1242 | 005714 | 000000 | | | HLT | | ; ERROR! INCORRECT RESULT |
| 1243 | | | | | | | |
| 1244 | | | | | | | ; CHECK THAT MTP |
| 1245 | 005716 | 010701 | | | T103: SCOPE | | |
| 1246 | 005720 | 012737 | 030000 | 177776 | MOV | #KM+PUM, @#PSW | ; KERNEL MODE!!! |
| 1247 | 005726 | 012706 | 000500 | | MOV | #KPTR, KSP | ; SET KERNEL STACK PTR |
| 1248 | 005732 | 012716 | 177777 | | MOV | #-1, (KSP) | ; LOAD DATA ONTO STACK |
| 1249 | 005736 | 012704 | 177776 | | MOV | #-2, R4 | ; LOAD INDEX REGISTER |
| 1250 | 005742 | 005067 | 173034 | | CLR | TEMP | ; PRESET DATA |
| 1251 | 005746 | 012767 | 001002 | 173030 | MOV | #TEMP, TEMP+2 | |
| 1252 | 005754 | 006674 | 001006 | | MTP | @TEMP+4(R4) | ; TEMP+(KSP)+ |
| 1253 | 005760 | 013703 | 177776 | | MOV | @#PSW, R3 | ; SAVE STATUS RESULT |
| 1254 | 005764 | 022706 | 000502 | | CMP | #KPTR+2, KSP | ; CHECK THAT KSP POPPED |
| 1255 | 005770 | 001401 | | | BEQ | .+4 | |
| 1256 | 005772 | 000000 | | | HLT | | ; ERROR! INCORRECT STACK PTR |
| 1257 | 005774 | 022703 | 030010 | | CMP | #PUM+N, R3 | ; CHECK STATUS RESULT |
| 1258 | 006000 | 001401 | | | BEQ | .+4 | |
| 1259 | 006002 | 000000 | | | HLT | | ; ERROR! INCORRECT STATUS |
| 1260 | 006004 | 005267 | 172772 | | INC | TEMP | ; CHECK RESULT |
| 1261 | 006010 | 001401 | | | BEQ | .+4 | |
| 1262 | 006012 | 000000 | | | HLT | | ; ERROR! INCORRECT RESULT |
| 1263 | | | | | | | |
| 1264 | | | | | | | ; TEST THAT MTPD/I CAN LOAD PC |
| 1265 | 006014 | 010701 | | | T104: SCOPE | | |
| 1266 | 006016 | 012737 | 000000 | 177776 | MOV | #KM, @#PSW | ; KERNEL MODE!!! |
| 1267 | 006024 | 012706 | 000500 | | MOV | #KPTR, KSP | ; SET KERNEL STACK PTR |
| 1268 | 006030 | 012716 | 006042 | | MOV | #T104A, (KSP) | ; PUT NEW PC ON STACK |
| 1269 | 006034 | 000277 | | | SCC | | ; PRESET CC'S |
| 1270 | 006036 | 006607 | | | MTP | PC | ; PC+(KSP)+ |
| 1271 | 006040 | 000000 | | | HLT | | ; ERROR! MTPD FAILED TO SET PC |
| 1272 | 006042 | 100001 | | | T104A: BPL | .+4 | |
| 1273 | 006044 | 000000 | | | HLT | | ; ERROR! 'N' FAILED TO CLEAR IN STATUS |
| 1274 | 006046 | 103401 | | | BCS | .+4 | |
| 1275 | 006050 | 000000 | | | HLT | | ; ERROR! 'C' WAS CLEARED BY MTPD |
| 1276 | | | | | | | |
| 1277 | | | | | | | ; USER MODE |
| 1278 | 006052 | 010701 | | | T106: SCOPE | | |
| 1279 | 006054 | 012737 | 170000 | 177776 | MOV | #UM+PUM, @#PSW | ; USER MODE!!! |
| 1280 | 006062 | 012706 | 000700 | | MOV | #UPTR, USP | ; SET USER STACK PTR |
| 1281 | 006066 | 012716 | 006104 | | MOV | #T106A, (USP) | ; PUT NEW PC ON STACK |
| 1282 | 006072 | 000277 | | | SCC | | ; PRESET CC'S |
| 1283 | 006074 | 006607 | | | MTP | PC | ; PC+(USP)+ |
| 1284 | 006076 | 005037 | 177776 | | CLR | @#PSW | ; KERNEL MODE!!! |
| 1285 | 006102 | 000000 | | | HLT | | ; ERROR! MTPD FAILED TOMLOAD PC |
| 1286 | 006104 | 013705 | 177776 | | T106A: MOV | @#PSW, R5 | ; SAVE STATUS |
| 1287 | 006110 | 005037 | 177776 | | CLR | @#PSW | ; KERNEL MODE!!! |

| | | | | | | | |
|------|--------|--------|--------|--------|--------------|-----------------|---|
| 1288 | 006114 | 022705 | 170001 | | CMP | #UM+PUM+C,R5 | ;CHECK STATUS |
| 1289 | 006120 | 001401 | | | BEQ | +.4 | |
| 1290 | 006122 | 000000 | | | HLT | | |
| 1291 | | | | | | | |
| 1292 | | | | | | | |
| 1293 | 006124 | 010701 | | | | | |
| 1294 | 006126 | 005037 | 177776 | | ↑T107: SCOPE | | |
| 1295 | 006132 | 012706 | 000500 | | CLR | @#PSW | ;KERNEL MODE!!! |
| 1296 | 006136 | 012737 | 006154 | 000004 | MOV | #KPTR,KSP | ;SET KERNEL STACK PTR |
| 1297 | 006144 | 000277 | | | MOV | #T107A,@#ERRVEC | ;LOAD ERROR VECTOR |
| 1298 | 006146 | 006567 | 171627 | | SCC | | ;PRESET CC'S |
| 1299 | 006152 | 000000 | | | MFPI | 1 | ;ODD ADDRESS SHOULD TRAP |
| 1300 | 006154 | 022706 | 000474 | | T107AA: HLT | | ;ERROR! FAILED TO TRAP ON ODD ADDRESS |
| 1301 | 006160 | 001401 | | | T107A: CMP | #KPTR-4,KSP | ;CHECK THAT STACK PTR WAS PUSHED |
| 1302 | 006162 | 000000 | | | BEQ | +.4 | ;PROPERLY (2 PUSHES) |
| 1303 | 006164 | 022726 | 006152 | | HLT | | ;ERROR! INCORRECT STACK PTR AFTER ERROR |
| 1304 | 006170 | 001401 | | | CMP | #T107AA,(KSP)+ | ;CHECK RETURN PC ON STACK |
| 1305 | 006172 | 000000 | | | BEQ | +.4 | |
| 1306 | 006174 | 022716 | 000017 | | HLT | | ;ERROR! RETURN PC NOT ON STACK |
| 1307 | 006200 | 001401 | | | CMP | #17,(KSP) | ;CHECK SAVED STATUS ON STACK |
| 1308 | 006202 | 000000 | | | BEQ | +.4 | |
| 1309 | | | | | HLT | | ;ERROR! INCORRECT STATUS SAVED ON STACK |
| 1310 | 006204 | 010701 | | | | | |
| 1311 | 006206 | 012737 | 140000 | 177776 | ↑T110: SCOPE | | |
| 1312 | 006214 | 012706 | 000700 | | MOV | #UM,@#PSW | ;USER MODE!!! |
| 1313 | 006220 | 012737 | 140000 | 000006 | MOV | #UPTR,USP | ;SET USER STACK |
| 1314 | 006226 | 012737 | 006246 | 000004 | MOV | #UM,@#ERRVEC+2 | ;LOAD 'NEW' STATUS |
| 1315 | 006234 | 006537 | 177702 | | MOV | #T110A,@#ERRVEC | ;AND PC |
| 1316 | 006240 | 005037 | 177776 | | MFPI | @#177702 | ;177702 IS NON-EXISTANT ADRS |
| 1317 | 006244 | 000000 | | | T110AA: CLR | @#PSW | ;KERNEL MODE!!! |
| 1318 | 006246 | 010603 | | | HLT | | ;ERROR! DID NOT TRAP ON NON ADRS |
| 1319 | 006250 | 042737 | 140000 | 177776 | T110A: MOV | USP,R3 | ;SAVE USER STACK PTR |
| 1320 | 006256 | 022703 | 000674 | | BIC | #UM,@#PSW | ;KERNEL MODE!!! |
| 1321 | 006262 | 001401 | | | CMP | #UPTR-4,R3 | ;CHECK USER STACK PTR |
| 1322 | 006264 | 000000 | | | BEQ | +.4 | |
| 1323 | 006266 | 022723 | 006240 | | HLT | | ;ERROR! INCORRECT USP AFTER ERROR TRAP |
| 1324 | 006272 | 001401 | | | CMP | #T110AA,(R3)+ | ;CHECK RETURN PC ON USER STACK |
| 1325 | 006274 | 000000 | | | BEQ | +.4 | |
| 1326 | 006276 | 022713 | 140000 | | HLT | | ;ERROR! RETURN PC NOT ON USER STACK |
| 1327 | 006302 | 001401 | | | CMP | #UM,(R3) | ;CHECK SAVED STATUS |
| 1328 | 006304 | 000000 | | | BEQ | +.4 | |
| 1329 | | | | | HLT | | ;ERROR! INCORRECT STATUS SAVED ON STACK |
| 1330 | | | | | | | |
| 1331 | 006306 | 010701 | | | | | |
| 1332 | 006310 | 012737 | 140000 | 177776 | ↑T111: SCOPE | | |
| 1333 | 006316 | 012706 | 000700 | | MOV | #UM,@#PSW | ;USER MODE!!! |
| 1334 | 006322 | 012737 | 006350 | 000004 | MOV | #UPTR,USP | ;SET USER STACK PTR |
| 1335 | 006330 | 012737 | 140000 | 000006 | MOV | #T111A,@#ERRVEC | ;LOAD ERROR TRAP VECTOR |
| 1336 | 006336 | 006567 | 171435 | | MOV | #UM,@#ERRVEC+2 | |
| 1337 | 006342 | 005037 | 177776 | | MFPI | -1 | ;ODD ADDRESS SHOULD TRAP |
| 1338 | 006346 | 000000 | | | T111AA: CLR | @#PSW | ;KERNEL MODE!!! |
| 1339 | 006350 | 010603 | | | HLT | | ;ERROR! FAILED TO TRAP |
| 1340 | 006352 | 042737 | 140000 | 177776 | T111A: MOV | USP,R3 | ;SAVE USER STACK PTR |
| 1341 | 006360 | 022703 | 000674 | | BIC | #UM,@#PSW | ;KERNEL MODE!!! |
| 1342 | 006364 | 001401 | | | CMP | #UPTR-4,R3 | ;CHECK USER STACK PTR |
| 1343 | 006366 | 000000 | | | BEQ | +.4 | |
| | | | | | HLT | | ;ERROR! INCORRECT USER STACK POINTER |

```

1344 006370 022713 006342          CMP      #T111AA, (R3)      ;CHECK RETURN SDDRESS ON USER STACK
1345 006374 001401          BEQ      .+4
1346 006376 000000          HLT
1347 006400 012737 000006 000004      MOV      #ERRVEC+2, @#ERRVEC;RESTORE ERROR TRAP TO HALT
1348 006406 005067 171374          CLR      ERRVEC+2
1349
1350                                     ;TEST THAT MTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
1351                                     ;KERNEL MODE, PREVIOUS USER MODE
1352                                     †112: SCOPE
1352 006412 010701          MOV      #KM+PUM, @#PSW      ;KERNEL MODE!!! PREV USER MODE!!
1353 006414 012737 030000 177776      MOV      #KPTR, KSP          ;SET KERNEL STACK PTR
1354 006422 012706 000500          MOV      #UPTR, -(KSP)
1355 006426 012746 000700          MTPI    USP                  ;SET USER STACK PTR
1356 006432 006606          MOV      #TEMP, -(KSP)      ;PUT ADDRESS ON THE STACK
1357 006434 012746 001002          MOV      #-1, -(KSP)       ;PUT DATA ON THE STAK
1358 006440 012746 177777          CLR      @#TEMP             ;PRESET DATA
1359 006444 005037 001002          MTPI    @#TEMP              ;MOVE #-1 TO TEMP
1360 006450 006636          CMP      #KPTR, KSP        ;CHECK STACK PTR AFTER MTPD
1361 006452 022706 000500          BEQ      .+4
1362 006456 001401          HLT
1363 006460 000000          INC      TEMP              ;ERROR! INCORRECT STACK PTR AFTER MTPD
1364 006462 005267 172314          BEQ      .+4                ;CHECK THAT DATA WAS MOVED TO TEMP
1365 006466 001401          HLT
1366 006470 000000          MFPI    USP                ;ERROR! DATA NOT IN TEMP
1367 006472 006506          CMP      #UPTR, (KSP)      ;GET USER STACK PTR
1368 006474 022716 000700          BEQ      .+4                ;CHECK THAT USER STACK PTR NOT CHANGED
1369 006500 001401          HLT                          ;BY MTPD INSTRUCTION
1370 006502 000000          HLT                          ;ERROR! USP WAS CHANGED BY MTPD INST.
1371
1372 006504 005767 172304          END:    TST      PASCNT      ;FIRST PASS?
1373 006510 001410          BEQ      DONE              ;YES, SKIP ITERATIONS THIS TIME
1374 006512 005267 172262          INC      ICNT              ;INCREMENT PASS COUNT
1375 006516 026727 172256 000144      CMP      ICNT, #100.        ;100 PASSES COMPLETED?
1376 006524 001402          BEQ      DONE
1377 006526 000167 172432          JMP      BEGIN
1378 006532 005267 172256          DONE:  INC      PASCNT      ;TO ENABLE ITERATIONS ON LATER PASSES
1379 006536 032767 010000 171024      BIT      #10000, SWR        ;INHIBIT BELL AND '*'?
1380 006544 001401          BEQ      .+4
1381 006546 000422          BR      LOGICT
1382 006550 012767 000007 171010      MOV      #7, TPB           ;RING BELL
1383 006556 105767 171002          TSTB    TPS
1384 006562 100375          BPL     .-4
1385 006564 012767 000052 170774      MOV      #52, TPB         ;PRINT '*' FOR PASS INDICATION
1386 006572 105767 170766          TSTB    TPS
1387 006576 100375          BPL     .-4
1388 006600 012767 000177 170760      MOV      #177, TPB
1389 006606 105767 170752          TSTB    TPS
1390 006612 100375          BPL     .-4
1391 006614 013701 000042          LOGICT: MOV      @#42, %1      ;RETURN TO MONITOR?
1392 006620 001405          BEQ     LOGICE
1393 006622 000005          RESET
1394 006624 004711          SENDAD: JSR     7, (1)      ;RETURN!
1395 006626 000240          NOP
1396 006630 000240          NOP
1397 006632 000240          NOP
1398 006634 005000          LOGICE: CLR     RO          ;DELAY FOR ACT11
1399 006636 005200          INC     RO

```

C03

DBKTD-C KT11-D PROCESSORS STATES TEST MACY11 27(1006) 02-FEB-77 10:09 PAGE 28
DBKTDC.P11 02-FEB-77 09:11

1400 006640 001376
1401 006642 000167 172150
1402 000001

BNE -2
JMP START
.END

| | | | | | | | | | |
|---------|---------|---------|--------|--------|--------|-------|--------|---------|-----------|
| BEGIN | 001164 | REDPTR= | 000736 | T110A | 006246 | T26 | 002662 | T56 | 004640 |
| BIT13 = | 020000 | REG = | 000000 | T110AA | 006240 | T30 | 002752 | T56A | 004714 |
| BIT14 = | 040000 | RESVEC= | 000010 | T111 | 006306 | T31 | 003046 | T56AA | 004712 |
| BIT15 = | 100000 | SCOPE = | 010701 | T111A | 006350 | T31C | 003072 | T57 | 004772 |
| BIT6 = | 000100 | SLR = | 177774 | T111AA | 006342 | T32A | 003144 | T57A | 005076 |
| C = | 000001 | START | 001016 | T112 | 006412 | T35 | 003214 | T57AA | 005026 |
| DONE | 006532 | SWR = | 177570 | T12 | 001504 | T36 | 003254 | T57EX | 005102 |
| EMTVEC= | 000030 | TBIT = | 000020 | T12A | 001542 | T36A | 003312 | T60 | 005104 |
| END | 006504 | TBITVE= | 000014 | T12AA | 001534 | T36AA | 003310 | T62 | 005132 |
| ERRVEC= | 000004 | TEMP | 001002 | T13 | 001574 | T40 | 003334 | T65 | 005172 |
| FTITLE | 001012 | TITLE | 001076 | T13A | 001626 | T40A | 003404 | T66 | 005262 |
| HLT = | 000000 | TKB = | 177562 | T13AA | 001620 | T40AA | 003376 | T7 | 001374 |
| ICNT | 001000 | TKS = | 177560 | T15 | 001772 | T41 | 003460 | T7A | 001434 |
| IM = | 100000 | TPB = | 177566 | T15A | 002052 | T41A | 003526 | T7AA | 001426 |
| IM1 = | 040000 | TPS = | 177564 | T15AA | 002044 | T41B | 003546 | T70 | 005310 |
| IOTVEC= | 000020 | TPVEC = | 000064 | T17 | 002134 | T41BB | 003576 | T73 | 005350 |
| KM = | 000000 | TRAPVE= | 000034 | T17A | 002170 | T43 | 003624 | T74 | 005440 |
| KPTR = | 000500 | TRT = | 000003 | T17B | 002202 | T43A | 003676 | T75 | 005470 |
| KSP = | %000006 | TRTVEC= | 000014 | T17C | 002222 | T44 | 003744 | T76 | 005520 |
| LOGICE | 006634 | T1 | 001170 | T17D | 002260 | T45 | 004020 | UM | = 140000 |
| LOGICT | 006614 | T102 | 005632 | T17E | 002302 | T5 | 001222 | UPTR | = 000700 |
| N = | 000010 | T103 | 005716 | T17ERR | 002402 | T5A | 001266 | USP | = %000006 |
| PASCNT | 001014 | T104 | 006014 | T17F | 002322 | T5AA | 001260 | V | = 000002 |
| PKM = | 000000 | T104A | 006042 | T17G | 002354 | T50 | 004104 | YELPTR= | 001000 |
| PRTY3 = | 000140 | T106 | 006052 | T17X | 002410 | T51 | 004204 | Z | = 000004 |
| PRTY4 = | 000200 | T106A | 006104 | T18 | 001666 | T52 | 004302 | \$ENDAD | 006624 |
| PRTY7 = | 000340 | T107 | 006124 | T19 | 001730 | T54 | 004404 | . | = 006646 |
| PSW = | 177776 | T107A | 006154 | T21 | 002426 | T55 | 004522 | | |
| PUM = | 030000 | T107AA | 006152 | T22 | 002510 | T55A | 004576 | | |
| PWRUP | 001154 | T110 | 006204 | T25 | 002572 | T55AA | 004574 | | |

. ABS. 006646 000

ERRORS DETECTED: 0
DEFAULT GLOBALS GENERATED: 0

MULE:DBKTDC,MULE:DBKTDC/SOL=DSKZ:SYSMAC.SML,MULE:DBKTDC.P11
RUN-TIME: 7'8.1 SECONDS
RUN-TIME RATIO: 251/15=16.0
CORE USED: 31K (61 PAGES)