

PDP11/45

STATES 11/45

MD-11-DCKBO-A

EP DCKBO A DL A

OCT 1976

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FICHE 1 OF 1

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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DCKB0-A1-D

PRODUCT NAME: 11/45 STATES TEST

DATE CREATED: 15 MAR 1972

MAINTAINER: DIAGNOSTIC GROUP

AUTHOR: JOHN ADAMS

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MAYNARD, MASS

MAINDEC-11-DCKB0-A PROCESSER STATES TEST
DCKB0A.P11

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- 1.0 ABSTRACT
THIS PROGRAM TESTS THAT 11/45 INSTRUCTIONS ARE EXECUTED PROPERLY IN THE THREE 11/45 STATES. (KERNEL, SUPERVISOR, AND USER) THE MTPD/I AND MFPD/I INSTRUCTIONS ARE ALSO TESTED. CONDITIONS ARE ALSO TESTED.
- 2.0 REQUIREMENTS
 - 2.1 EQUIPMENT
BASIC 11/45 SYSTEM
 - 2.2 STORAGE
THIS PROGRAM USES 0 THRU 17500
 - 2.3 PRELIMINARY PROGRAMS
DORA THRU DORA
- 3.0 LOADING PROCEDURE
LOAD PROGRAM USING ABS LOADER
- 4.0 STARTING PROCEDURE
LOAD ADDRESS 200. PRESS START. THE PROGRAM WILL LOOP AND RING BELL ON PASS COMPLETION.
- 5.0 OPERATING PROCEDURE
 - 5.1 SWITCH SETTINGS
NONE
 - 5.2 SUBROUTINE ABSTRACTS
 - 5.2.1 SCOPE
SCOPE IS A MOVE PC,R1 AND STORES THE PC+2 IN R1.
 - 5.2.2 HLT
HLT IS A HALT INSTRUCTION.
- 6.0 ERRORS
ALL ERRORS WILL CAUSE A HALT TRAP AND INTERRUPT ERRORS WILL CAUSE A HALT AT VECTOR+2.
- 6.1 ERROR RECOVERY
PRESS CONTINUE TO PROCEED TO NEXT TEST
- 6.2 ERROR LOOPING
TO LOOP ON AN ERROR, PLACE A BRANCH TO THE PREVIOUS SCOPE INSTRUCTION IN PLACE OF THE HALT INSTRUCTION.
NOTE THAT IF THE ERROR IS INTERMITTANT THAT THE TEST WILL DROP THRU THE HALT AND PROCEED TO THE NEXT TEST.
THEREFORE, TO LOOP THE TEST CONTINUOUSLY REPLACE THE BEQ .+4 INSTRUCTION IMMEDIATELY PRECEDING THE HALT WITH A BRANCH BACK TO THE PREVIOUS SCOPE.

TO LOOP ON TRAP FAILURES, PATCH IN THE FOLLOWING ROUTINE AT THE ADDRESS OF THE TRAP VECTOR.

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 110413

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TRAPVEC:          TRAPVEC+4
TRAPVEC+2:        0
TRAPVEC+4:        012716 ;MOVE SCOPE ADDRESS TO STACK
TRAPVEC+6:        ADDRESS ;ADDRESS OF PREVIOUS SCOPE
TRAPVEC+10:       000006 ;RETURN TO TEST AT SCOPE
```

RESTORE ALL LOCATIONS BEFORE PROCEEDING TO NEXT TEST.

- 7.0 RESTRICTIONS
NONE
- 8.0 MISCELLANEOUS
ON TESTER AS THE STACK POINTER(R6) WILL CONTAIN THE ADDRESS WHERE THE TRAP OCCURED.
- 8.1 EXECUTION TIME
THIS PROGRAM TAKES ABOUT 1 MINUTE.
- 8.2 STACK POINTER
THIS PROGRAM INITIALLY SETS THE STACK POINTER AT 500.
 *
 .TITLE MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
 .MLIST MC,MD,SEQ
 .ABS

;TEST DCKBOA THIS TEST TESTS FEATURES OF THE THREE PROCESSOR STATES AND INCLUDES
 ;TRAPS FROM ALL STATES TO ALL OTHER STATES, AND MFP/ATP INSTRUCTIONS IN ALL
 ;STATES AND PREVIOUS STATES.
 ;NOTE: ALL TESTS ARE ENTERED AND EXITED IN KERNEL MODE.

```
;STARTING PROCEEDURE
LOAD AC,=55=200
PC=5 START
KERNEL STACK POINTER IS AT 500
SUPER STACK POINTER IS AT 600
USER STACK POINTER IS AT 700
BELL WILL RING WHEN TEST IS COMPLETE
```

.REGISTER ASSIGNMENTS

```
000000 R0=%0
000001 R1=%1
000002 R2=%2
000003 R3=%3
000004 R4=%4
000005 R5=%5
000007 PC=%7
000000 R10=%10
000001 R11=%11
000002 R12=%12
000003 R13=%13
000004 R14=%14
000005 R15=%15
```

```
;STACK POINTERS
KSP=%6
SSP=%6
```

```
;KERNEL STACK POINTER
;SUPERVISOR STACK POINTER
```

```
000006
000006
```

000006
000000
010701
000003
000140
000200
000340

USP=x6
HLT=HALT
SCOPE=010701
TRT=3
PTY3=140
PTY4=200
PTY7=340

;USER STACK POINTER
;MOVE PC TO R1
;TRACE TRAP

000004
000030
000034
000020
000014
000014
000064
000240

;VECTOR ADDRESSES
ERRVEC=4
EMTVEC=30
TRAPVEC=34
IOTVEC=20
TBITVEC=14
TRTVEC=14
TPVEC=64
PIRVEC=240

;ADDRESS OF ERROR VECTOR
;R1 OF EMT VECTOR
;R1 OF TRAP VECTOR
;R1 OF IOT VECTOR
;R1 OF 'T' BIT TRAP VECTOR
;R1 OF 'TRACE' TRAP
;ADDRESS OF TTY PRINTER INTERRUPT VECTOR
;ADDRESS OF PIRG VECTOR

177776
177774
177772
177770
177560
177562
177564
177566
177570
177570

;HARDWARE REGISTER ASSIGNMENTS
PSW=177776
SLR=177774
PIR=177772
URBREAK=177770
TKS=177560
TKB=177562
TPS=177564
TPB=177566
SWR=177570
DISPLAY=177570

;ADDRESS OF STATUS REGISTER
;ADDRESS OF STACK LIMIT REGISTER
;ADDRESS OF PROGRAM INTERRUPT REQUEST
;ADDRESS OF MICRO BREAK REGISTER
;ADDRESS OF KEYBOARD CSR
;ADDRESS OF KEYBOARD BUFFER
;ADDRESS OF TELEPRINTER CSR
;ADDRESS OF TELEPRINTER BUFFER
;ADDRESS OF CONSOL SWITCH REGISTER
;ADDRESS OF CONSOL DISPLAY REGISTER

000500
000600
000700
001000
000736

;INITIAL STACK POINTER SETTINGS
KPTR=500
SPTR=600
UPTR=700
YELPTR=1000
REDPTR=736

;KERNEL INITIAL STACK POINTER VALUE
;SUPERVISOR INITIAL STACK POINTER VALUE
;USER INITIAL STACK POINTER VALUE
;STACK POINTER VALUE FOR 'YELLOW' OVFLW
;STACK POINTER VALUE FOR 'RED' OVFLW

100000
040000
020000
000100

;MISC. BIT ASSIGNMENTS
BIT15=100000
BIT14=40000
BIT13=20000
BIT6=100

140000
100000
040000
000000
030000
010000
000000
004000
000020
000001
000002
000004
000010

;STATUS REGISTER BIT ASSIGNMENTS
UM=140000
IM=100000
SM=040000
KM=0
PUM=030000
PSM=010000
PKM=0
REG=004000
TBIT=20
C=1
V=2
Z=4
N=10

;USER MODE
;ILLEGAL MODE
;SUPERVISOR MODE
;KERNEL MODE
;PREVIOUS USER MODE
;PREVIOUS SUPERVISOR MODE
;PREVIOUS KERNEL MODE
;REGISTER BIT
; 'T' BIT IN PSW
; 'C' BIT IN PS
; 'V' BIT IN PS
; 'Z' BIT IN PS
; 'N' BIT IN PS

F01

MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
DCKBOA.P11

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	010000		PIR4=10000		;LEVEL 4 REQUEST IN PIR0
	000000		.=0		
000200	000200 000167	000606	.=200 JMP	START	;GO START
	001000		.=1000		
		;TAGS			
001000 001002	000000 000000 001012	ICNT: TEMP:	0 0 .=.+6		;CONTAINS PASS COUNT

```

001012 012706 000500      START:  MOV    @KPTR,KSP
001016 005067 177756      CLR    ICNT
:TEST THAT PROCESSOR POWERED UP OK FOR THE TEST
001022 032737 174000 177776  PWRUP:  BIT    @UM+PUM+REG,@PSW ;IS STATUS CORRECT
001030 001377      BNE    . ;LOOP HERE IF NOT

001032 012706 000500      BEGIN:  MOV    @KPTR,KSP ;INITIALIZE THE STACK POINTER
001036 016737 177736 177570  MOV    ICNT,@DISPLAY ;DISPLAY PASS COUNT IN LIGHT REGISTER
001044 032737 000400 177570  BIT    @400,@SWR ;LOAD MICRO BREAK REGISTER
001052 001403      BEQ    .+10
001054 113737 177570 177770  MOVB  @SWR,@SUBBREAK ;LOAD MICRO BREAK REG WITH SR0-7

;CHECK THAT THE SPL INSTRUCTION IS A 'NOP' IN SUPERVISORY/USER MODE.
;SUPERVISORY MODE.
001062 010701      TO:    SCOPE
001064 012737 040340 177776  MOV    @SM+PRTY7,@PSW ;SUPERVISORY MODE, PRIORITY LEVEL 7
001072 000230      SPL    0 ;TRY TO SET PRIORITY LEVEL =0
001074 013700 177776      MOV    @PSW,R0 ;GET PSM
001100 005037 177776      CLR    @PSW
001104 022700 040340      CMP    @SM+PRTY7,R0
001110 001401      BEQ    .+4
001112 000000      HLT    ;ERROR! INCORRECT STATUS AFTER SPL

;USER MODE
001114 010701      †1:   SCOPE
001116 012737 140000 177776  MOV    @UM,@PSW ;USER MODE, PRIORITY LEVEL 0
001124 000237      SPL    7 ;TRY TO SET PRIORITY LEVEL 7
001126 013700 177776      MOV    @PSW,R0 ;GET PSM
001132 005037 177776      CLR    @PSW ;KERNEL MODE!!!
001136 022700 140000      CMP    @UM,R0 ;TEST THAT SPL DID NOT ALTER PSM
001142 001401      BEQ    .+4
001144 000000      HLT    ;ERROR! SPL CHANGED STATUS WORD

;CHECK THAT RESET IS A 'NOP' IN SUPERVISORY/USER MODE
;SUPERVISORY MODE
001146 010701      †2:   SCOPE
001150 012737 070340 177776  MOV    @SM+PUM+PRTY7,@PSW ;PRESET STATUS
001156 052767 000100 176374  BIS    @BIT6,TKS ;SET IE BIT IN TKS
001164 000005      RESET ;RESET
001166 013700 177776      MOV    @PSW,R0 ;GET STATUS WORD
001172 016702 176352      MOV    TKS,R2 ;GET TKS
001176 005037 177776      CLR    @PSW ;KERNEL MODE !!!
001202 005037 176352      CLR    TKS ;CLEAR IE BIT
001206 022700 070340      CMP    @SM+PUM+PRTY7,R0 ;TEST THAT STATUS DID NOT CHANGE
001212 001401      BEQ    .+4
001214 000000      HLT    ;ERROR! STATUS CHANGED BY RESET
001216 032702 000100      BIT    @BIT6,R2 ;TEST THAT IE BIT DID NOT CLEAR
001222 001001      BNE    .+4
001224 000000      HLT    ;ERROR! RESET CLEARED IE BIT IN TKS

;USER MODE
001226 010701      †3:   SCOPE
001230 012737 154340 177776  MOV    @UM+PSM+REG+PRTY7,@PSW ;PRESET STATUS
001236 052767 000100 176314  BIS    @BIT6,TKS ;SET IE BIT IN TKS
001244 000005      RESET ;RESET

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MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
DCKBOA.P11

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001246 013700 177776      MOV      @@PSW,R10      ;GET STATUS WORD
001252 016702 176302      MOV      TKS,R12      ;GET TKS
001256 005067 176276      CLR      TKS          ;CLEAR IE BIT
001262 042737 140000 177776      BIC      @UM,@@PSW     ;KERNEL MODE!!!
001270 022700 154340      CMP      @UM+@PSW+REG+@PTY7,R10 ;CHECK STATUS AFTER RESET
001274 001401      BEQ      .+4
001276 000000      HLT
001300 032702 000100      BIT      @BIT6,R12    ;ERROR! INCORRECT STATUS AFTER RESET
001304 001001      BNE      .+4          ;CHECK IE BIT AFTER RESET
001306 000000      HLT
001310 005037 177776      CLR      @@PSW        ;ERROR! IE BIT WAS CLEARED BY RESET

;TEST A TRAP FROM SUPERVISOR TO KERNEL MODE
T4: SCOPE
001314 C10701      MOV      @KPTR,KSP    ;SET KERNEL STACK POINTER
001316 012706 000500      MOV      @T4A,TRAPVEC
001322 012767 001362 176504      MOV      @PTY7+17,TRAPVEC+2
001330 012767 000357 176500      MOV      @SM,@@PSW    ;SUPERVISORY MODE!!!
001336 012737 040000 177776      MOV      @SPTR,SSP    ;SET SUPERVISORS STACK POINTER
001344 012706 000600      CCC      ;CLEAR CONDITION CODES
001352 104400      TRAP
001354 005037 177776      T4AA: CLR      @@PSW
001360 000000      HLT          ;ERROR! DID NOT TRAP
001362 013700 177776      T4A:  MOV      @@PSW,R0
001366 005037 177776      CLR      @@PSW
001372 022700 010357      CMP      @UM+@PSW+@PTY7+17,R0 ;IS NEW STATUS CORRECT?
001376 001401      BEQ      .+4
001400 000000      HLT          ;ERROR! INCORRECT NEW STATUS
001402 022767 001354 177064      CMP      @T4AA,KPTR-4 ;WAS RETURN ADDRESS SAVED ON KERNEL'S
001410 001401      BEQ      .+4          ;STACK?
001412 000000      HLT
001414 022767 040000 177054      CMP      @SM,KPTR-2   ;WAS OLD STATUS SAVED ON KERNEL'S
001422 001401      BEQ      .+4          ;STACK?
001424 000000      HLT
001426 022706 000474      CMP      @KPTR-4,KSP
001432 001401      BEQ      .+4
001434 000000      HLT
001436 012737 040000 177776      MOV      @SM,@@PSW   ;ENTER SUPERVISORY MODE TO GET
001444 010600      MOV      SSP,R0      ;SUPERVISOR STACK POINTER
001446 005037 177776      CLR      @@PSW
001452 022700 000600      CMP      @SPTR,R0
001456 001401      BEQ      .+4
001460 000000      HLT
001462 012767 000036 176344      MOV      @TRAPVEC+2,TRAPVEC
001470 005067 176342      CLR      TRAPVEC+2

;TEST TRAP FROM USER MODE TO KERNEL MODE
T5: SCOPE
001474 010701      MOV      @KPTR,KSP    ;SET KERNEL STACK PTR
001476 012706 000500      MOV      @T5A,@IOTVEC ;SET IOT TRAP VECTOR
001502 012737 001540 000020      CLR      IOTVEC+2    ;KERNEL MODE AFTER IOT
001510 005067 176306      MOV      @UM+@PSW+@PTY7,@@PSW ;USER MODE!!!
001514 012737 150340 177776      MOV      @UPTR,USP   ;SET USER STACK PTR
001522 012706 000700      SCC      ;PRESET CONDITION CODES
001526 000277      IOT
001530 000004      IOT
001532 005037 177776      T5AA: CLR      @@PSW   ;TRAP USER MODE TO KERNEL MODE
                                ;KERNEL MODE!!!
```


I01

MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
DCKBOA.P11

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001536	000000				HLT				;ERROR! FAILED TO TRAP
001540	013700	177776		TSA:	MOV	@#PSW,RO			;SAVE STATUS
001544	005037	177776			CLR	@#PSW			;KERNEL MODE!!!
001550	022700	030000			CMP	#K1+PUM,RO			;CHECK STATUS AFTER IOT
001554	001401				BEQ	.+4			
001556	000000				HLT				;ERROR! INCORRECT STATUS AFTER IOT
001560	022767	001532	176706		CMP	@T5AA,KPTR-4			;CHECK KERNEL STACK PTR
001566	001401				BEQ	.+4			
001570	000000				HLT				;ERROR! INCORRECT KSP AFTER IOT
001572	022767	150357	176676		CMP	#UM+PSW+PRTY7+17,KPTR-2			;CHECK SAVED STATUS ON IOT
001600	001401				BEQ	.+4			
001602	000000				HLT				;ERROR! INCORRECT STATUS SAVED ON STACK AFTER IOT
001604	022706	000474			CMP	#KPTR-4,KSP			;CHECK RETURN PC ON IOT
001610	001401				BEQ	.+4			
001612	000000				HLT				;INCORRECT RETURN PC SAVED ON STACK
001614	012737	140000	177776		MOV	#UM,@#PSW			;USER MODE!!!
001622	010600				MOV	USP,RO			
001624	012737	177776			CLR	@#PSW			;KERNEL MODE!!!
001630	010700	000700			CMP	#UPTR,RO			;CHECK THAT USER STACK PTR
001634	001401				BEQ	.+4			;WAS NOT AFFECTED BY IOT TRAP
001636	000000				HLT				;ERROR! USP WAS CHANGED ON IOT
001640	012737	000022	000020		MOV	@IOTVEC+2,@#IOTVEC			
;TEST TRAP FROM USER MODE TO SUPERVISOR MODE									
001646	010701			T6:	SCOPE				
001650	012737	001720	000030		MOV	@T6A,@#EHTVEC			;SET EHT TRAP VECTOR
001656	012737	040000	000032		MOV	#SM,@#EHTVEC+2			;SUPER MODE AFTER EHT
001664	012737	044000	177776		MOV	#SM+REG,@#PSW			;SUPER MODE!!!
001672	012706	000600			MOV	#SPTR,SSP			;SET SUPER STACK PTR
001676	012737	144000	177776		MOV	#UM+REG,@#PSW			;USER MODE!!!
001704	012706	000700			MOV	#UPTR,USP			;SET USER STACK POINTER
001710	104000				EHT				;TRAP USER TO SUPERVISOR
001712	005037	177776		T6AA:	CLR	@#PSW			;KERNEL MODE!!!
001716	000000				HLT				;ERROR! EHT FAILED TO TRAP
001720	013700	177776		T6A:	MOV	@#PSW,RO			;SAVE STATUS AFTER EHT TRAP
001724	010602				MOV	SSP,R2			;SAVE SUPER STACK PTR
001726	005037	177776			CLR	@#PSW			;KERNEL MODE!!!
001732	022700	070000			CMP	#SM+PUM,RO			;CHECK STATUS AFTER EHT TRAP
001736	001401				BEQ	.+4			
001740	000000				HLT				;ERROR! INCORRECT STATUS AFTER EHT TRAP
001742	022767	001712	176624		CMP	@T6AA,SPTR-4			;CHECK RETURN PC ON SUPER STACK
001750	001401				BEQ	.+4			
001752	000000				HLT				;ERROR! INCORRECT RETURN PC ON SUPER STACK AFTER EHT
001754	022767	144000	176614		CMP	#UM+REG,SPTR-2			;CHECK STATUS SAVED ON SUPER STACK
001762	001401				BEQ	.+4			
001764	000000				HLT				;ERROR! INCORRECT STATUS SAVED ON STACK HLT
001766	022702	000574			CMP	#SPTR-4,R2			;CHECK SUPER STACK PTR AFTER EHT
001772	001401				BEQ	.+4			
001774	000000				HLT				;ERROR! INCORRECT SSP AFTER EHT TRAP
001776	012737	140000	177776		MOV	#UM,@#PSW			;USER MODE!!!
002004	010600				MOV	USP,RO			;SAVE USER STACK PTR
002006	005037	177776			CLR	@#PSW			;KERNEL MODE!!!
002012	022700	000700			CMP	#UPTR,RO			;CHECK THAT USP WAS NOT CHANGED ON TRAP
002016	001401				BEQ	.+4			
002020	000000				HLT				;ERROR! INCORRECT USP AFTER EHT TRAP

```

:TEST TRAP FROM USER TO USER MODE
↑7: SCOPE
MOV @T7A,@TRTVEC ;SET TRACE TRAP VECTOR
MOV @UM+PC,@TRTVEC+2 ;USER MODE AFTER TRAP
MOV @UM,@PSW ;USER MODE!!!
MOV @UPTR,USP ;SET USER STACK PTR
TRT ;TRACE TRAP
T7AA: CLR @PSW ;KERNEL MODE!!!
HLT ;ERROR! TRT FAILED TO TRAP
T7A: MOV @PSW,R10 ;SAVE STATUS AFTER TRAP
MOV USP,R12 ;SAVE USER STACK PTR
BIC @UM,@PSW ;KERNEL MODE!!!
CMP @T7AA,UPTR-4 ;CHECK RETURN PC ON USER STACK
BEQ .+4
HLT ;ERROR! INCORRECT RETURN PC ON USER STACK
CMP @UM+PUM+REG,R10 ;CHECK STATUS AFTER TRT TRAP
BEQ .+4
HLT ;ERROR! INCORRECT STATUS AFTER TRT TRAP
MOV @TRTVEC+2,TRTVEC
CLR TRTVEC+2

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:TEST TRAP SEQUENCE FROM SUPERVISOR TO SUPERVISOR
↑10: SCOPE
MOV @T10A,@EMTVEC ;SET EMT TRAP VECTOR
MOV @SM,@EMTVEC+2 ;SUPER MODE AFTER EMT
MOV @SM,@PSW ;SUPER MODE!!!
MOV @SPTR,SSP ;SET SUPER STACK PTR
EMT+377 ;TRAP SUPER TO SUPER
T10AA: CLR @PSW ;KERNEL MODE!!!
HLT ;ERROR! EMT FAILED TO TRAP
T10A: MOV @PSW,R0 ;SAVE STATUS AFTER EMT TRAP
CLR @PSW ;KERNEL MODE!!!
CMP @T10AA,SPTR-4 ;CHECK RETURN PC ON SUPER STACK
BEQ .+4
HLT ;ERROR! INCORRECT RETURN PC ON SUPER STACK AFTER TRAP
CMP @SM+PSW,R0 ;CHECK STATUS AFTER TRAP
BEQ .+4
HLT ;ERROR! INCORRECT STATUS AFTER TRAP
MOV @EMTVEC+2,@EMTVEC
CLR @EMTVEC+2

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:TEST TRAP SEQUENCE SUPERVISOR TO USER
↑11: SCOPE
MOV @T11A,TRAPVEC ;SET TRAP TRAP VECTOR
MOV @UM,TRAPVEC+2 ;USER MODE AFTER TRAP
MOV @UM,@PSW ;USER MODE
MOV @UPTR,USP ;SET USER STACK PTR
MOV @SM,@PSW ;SUPERVISORY MODE!!!
SCC ;PRE SET CONDITION CODES
TRAP+377 ;TRAP SUPER TO USER
T11AA: CLR @PSW ;KERNEL MODE!!!
HLT ;ERROR! TRAP FAILED TO TRAP
T11A: MOV @PSW,R0 ;SAVE STATUS AFTER TRAP
MOV USP,R2 ;SAVE USER STACK PTR
CLR @PSW ;KERNEL MODE!!!
CMP @T11AA,(R2)+ ;CHECK RETURN PC ON USER STACK

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002324	001401			BEQ	.+4	
002326	000000			HLT		; ERROR! INCORRECT RETURN PC ON USER STACK
002330	022712	040017		CMP	#SM+17,(R2)	; CHECK SAVED STATUS
002334	001401			BEQ	.+4	
002336	000000			HLT		; ERROR! SAVED STATUS ON USER STACK INCORRECT
002340	022700	150000		CMP	#UM+PSW,R0	; CHECK STATUS AFTER TRAP
002344	001401			BEQ	.+4	
002346	000000			HLT		; ERROR! STATUS AFTER TRAP INCORRECT
002350	012767	000036	175456	MOV	#TRAPVEC+2,TRAPVEC	
002356	005067	175454		CLR	TRAPVEC+2	

; TEST THAT THE 'HALT' INSTRUCTION CAUSES A TRAP TO LOCATION 4 IN
; SUPERVISORY MODE.

002362	010701			T12: SCOPE		
002364	012737	002420	000004	MOV	#T12A,#ERRVEC	; SET ERROR TRAP VECTOR
002372	005067	175410		CLR	ERRVEC+2	; KERNEL MODE ON TRAP
002376	012706	000577		MOV	#KPTR,KSP	; SET KERNEL STACK PTR
002402	012737	040000	177776	MOV	#SM,#PSW	; SUPER MODE!!!
002410	000000			HLT		; HALT TRAPS IN SUPERVISORY MODE
002412	005037	177776		T12AA: CLR	#PSW	; KERNEL MODE!!!
002416	000000			HLT		; ERROR! HALT DID NOT TRAP
002420	013700	177776		T12A: MOV	#PSW,R0	; SAVE STATUS AFTER TRAP
002424	005037	177776		CLR	#PSW	; KERNEL MODE!!!
002430	022700	010000		CMP	#KH+PSW,R0	; CHECK STATUS AFTER TRAP
002434	001401			BEQ	.+4	
002436	000000			HLT		; ERROR! INCORRECT STATUS AFTER TRAP
002440	022767	002412	176026	CMP	#T12AA,KPTR-4	; CHECK RETURN PC
002446	001401			BEQ	.+4	
002450	000000			HLT		; ERROR! INCORRECT RETURN PC ON KERNEL STACK

; USER MODE

002452	010701			T13: SCOPE		
002454	012737	002504	000004	MOV	#T13A,#ERRVEC	; SET ERROR TRAP VECTOR
002462	012706	000500		MOV	#KPTR,KSP	; SET KERNEL STACK PTR
002466	012737	140000	177776	MOV	#UM,#PSW	; USER MODE!!!
002474	000000			HLT		; HALT TRAP TO 4 IN USER MODE
002476	005037	177776		T13AA: CLR	#PSW	
002502	000000			HLT		
002504	013700	177776		T13A: MOV	#PSW,R0	
002510	005037	177776		CLR	#PSW	
002514	022700	030000		CMP	#KH+PSW,R0	
002520	001401			BEQ	.+4	
002522	000000			HLT		
002524	022767	002476	175742	CMP	#T13AA,KPTR-4	
002532	001401			BEQ	.+4	
002534	000000			HLT		
002536	012737	000006	000004	MOV	#ERRVEC+2,#ERRVEC	

; TEST INTERRUPT SEQUENCE SUPERVISOR TO KERNEL MODE

002544	010701			T14: SCOPE		
002546	000237			SPL	7	; SET PROCESSOR PRIORITY LEVEL 7
002550	012767	002624	175306	MOV	#T14A,TPVEC	; LOAD TELEPRINTER
002556	012767	004200	175302	MOV	#REG+PTY4,TPVEC+2	; VECTOR ADDRESSES
002564	012706	000500		MOV	#KPTR,KSP	; SET KERNEL STACK
002570	052737	070000	177776	BIS	#SM+PSW,#PSW	; SUPERVISORY MODE, PREVIOUS USER MODE
002576	012706	000600		MOV	#SPTR,SSP	

```

002602 052737 000100 177564      BIS      @BIT6,@TPS      ;SET IE BIT IN TELEPRINTER
002610 042737 000340 177776      BIC      @PTY7,@PSW     ;ALLOW INTERRUPT
002616 005037 177776      CLR      @PSW           ;KERNEL MODE
002622 000000      HLT                               ;ERROR NO INTERRUPT
002624 013700 177776      MOV      @PSW,R10
002630 042737 140000 177776      BIC      @UM,@PSW
002636 042737 000100 177564      BIC      @BIT6,@TPS     ;CLEAR IE BIT IN TELEPRINTER
002644 022700 014200      CMP      @KM+PSW+REG+PTY4,R10 ;CHECK 'NEW' STATUS
002650 001401      BEQ      .+4
002652 000000      HLT                               ;ERROR! 'NEW' STATUS IS INCORRECT
002654 022706 000474      CMP      @KPTR-4,KSP
002660 001401      BEQ      .+4
002662 000000      HLT
002664 022767 002616 175602      CMP      @T14AA,KPTR-4
002672 001401      BEQ      .+4
002674 000000      HLT
002676 022767 070000 175572      CMP      @SM+PUM,KPTR-2
002704 001401      BEQ      .+4
002706 000000      HLT
002710 012767 000066 175146      MOV      @TPVEC+2,TPVEC
002716 005067 175144      CLR      TPVEC+2

```

:TEST INTERRUPT SEQUENCE USER TO KERNEL MODE

```

†15: SCOPE
002722 010701      MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
002724 012706 000500      MOV      @UM+PUM+PTY7,@PSW ;USER MODE!!!
002730 012737 170340 177776      MOV      @T15A,@PIRVEC  ;LOAD PROGRAM INTERRUPT ROST VEC.
002736 012737 003000 000240      MOV      @KM+PSW+PTY4,@PIRVEC+2
002744 012737 010200 000242      MOV      @UPTR,USP     ;SET USER STACK POINTER
002752 012706 060700      BIC      @PTY4,@PSW     ;SET PRIORITY LEVEL=3
002756 042737 000200 177776      MOV      @PIR4,@PIRQ   ;REQUEST AN INTERRUPT AT LEVEL 4
002764 012737 010000 177772      CLR      @PSW          ;KERNEL MODE!!!
002772 005037 177776      HLT                               ;ERROR! NO INTERRUPT REQUEST
002776 000000      HLT
003000 013700 177776      MOV      @PSW,R0       ;GET 'NEW' PSW
003004 005067 174762      CLR      PIRQ          ;DISABLE REQUEST
003010 005037 177776      CLR      @PSW
003014 022700 030200      CMP      @KM+PUM+PTY4,R0 ;TEST THAT 'NEW' PSW IS CORRECT
003020 001401      BEQ      .+4           ;(@PIRVEC+2)
003022 000000      HLT                               ;ERROR! 'NEW' PSW NOT = TO (@PIRVEC+2)
003024 022767 002772 175442      CMP      @T15AA,KPTR-4 ;IS RETURN ADDRESS ON KERNEL STACK
003032 001401      BEQ      .+4
003034 000000      HLT                               ;ERROR! RETURN ADDRESS NOT ON KERNEL STACK
003036 022767 170140 175432      CMP      @UM+PUM+PTY3,KPTR-2 ;TEST THAT 'OLD' PSW WAS SAVED ON
003044 001401      BEQ      .+4           ;KERNEL STACK
003046 000000      HLT                               ;ERROR!
003050 012737 000242 000240      MOV      @PIRVEC+2,@PIRVEC
003056 005037 000242      CLR      @PIRVEC+2

```

:TEST THAT THERE IS NO STACK OVERFLOW IN SUPERVISORY MODE.

```

†16: SCOPE
003062 010701      MOV      @1000,@SLR    ;SET STACK LIMIT=1400
003064 012737 001000 177774      MOV      @SM+PUM,@PSW  ;SUPERVISORY MODE
003072 012737 070000 177776      MOV      @SPTR,SSP     ;SET SUPERVISOR STACK
003100 012706 000600      MOV      @125252(SSP) ;PRE SET STACK
003104 012716 125252      MOV      @T16G,@EMTVEC
003110 012737 003302 000030      MOV      @SM,@EMTVEC+2 ;ENTER SUPERVISORY MODE ON EMT
003116 012737 040000 000032

```

MO1

MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
DCKBOA.P11

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003124 012737 003330 000004  MOV    #T16ERR,#ERRVEC
003132 005067 175644  CLR    TEMP                    ;CLEAR INDICATOR LOCATION
003136 004767 000000  T16A: JSR    7,T16B             ;GO TO T16B
003142 052767 070001 175632 T16B: BIS    #1,TEMP             ;SET INDICATOR BIT
003150 004567 000000  JSR    5,T16C
003154 052767 000002 175620 T16C: BIS    #2,TEMP             ;SET INDICATOR BIT
003162 052737 004000 177776  BIS    #REG,#PSW              ;SELECT R10-R15
003170 004767 000000  JSR    7,T16D
003174 052767 00L704 175600 T16D: BIS    #4,TEMP             ;SET INDICATOR BIT
003202 004567 000000  JSR    R15,T16E
003206 052767 000010 175566 T16E: BIS    #10,TEMP            ;SET INDICATOR BIT
003214 014616  MOV    -(SSP),SSP
003216 052767 000020 175556  BIS    #20,TEMP              ;SET INDICATOR BIT
003224 012767 003250 174632  MOV    #T16F,TPVEC           ;LOAD TELEPRINTER VECTOR
003232 012767 044000 174626  MOV    #SM+REG,TPVEC+2       ;AND 'NEW' STATUS
003240 052737 000100 177564  BIS    #BIT6,#TPS            ;GENERATE AN INTERRUPT (VIA TELEPRINTER)
003246 000001  WAIT
003250 042737 000100 177564 T16F: BIC    #BIT6,#TPS
003256 012767 000066 174600  MOV    #TPVEC+2,TPVEC
003264 005067 174576  CLR    TPVEC+2
003270 052767 000040 175504  BIS    #40,TEMP              ;SET INDICATOR BIT
003276 104377  EMT+377
003300 000000  HLT
003302 052767 000100 175472 T16G: BIS    #100,TEMP          ;SET INDICATOR BIT
003310 005037 177776  CLR    #PSW                  ;KERNEL MODE!!!
003314 022767 000177 175460  CMP    #177,TEMP             ;TEST THAT ALL INSTRUCTIONS WHICH COULD
003322 001401  BEQ
003324 000000  HLT                          ;CAUSE OVERFLOW DID NOT OVERFLOW.
003326 000403  BR    T16X                    ;ERROR!
003330 005037 177776  T16ERR: CLR #PSW
003334 000000  HLT                            ;EXIT TEST

003336 005037 177774  T16X: CLR #SLR
003342 012737 000032 000030  MOV    #EMTVEC+2,#EMTVEC
003350 005037 000032  CLR    #EMTVEC+2
;USER MODE
003354 010701  SCOPE
003356 012737 000400 177774  #17:  MOV    #400,#SLR           ;SET STACK LIMIT =1000
003364 012737 150000 177776  MOV    #UM+PSW,#PSW          ;USER MODE!!!
003372 012737 003622 000004  MOV    #T17ERR,#ERRVEC
003400 012706 000700  MOV    #UPTA,USP             ;SET USER STACK POINTER
003404 005067 175372  CLR    TEMP                   ;CLEAR INDICATOR LOCATION
003410 004767 000006  T17A: JSR    7,T17B             ;PUSH ONTO USER STACK
003414 052767 000400 175360  BIS    #400,TEMP             ;SET ERROR INDICATOR BIT
003422 052767 000001 175352 T17B: BIS    #1,TEMP             ;SET INDICATOR BIT
003430 004567 000006  JSR    5,T17C                 ;PUSH ONTO USER STACK
003434 052767 001000 175340  BIS    #1000,TEMP            ;SET ERROR INDICATOR BIT
003442 052767 000002 175332 T17C: BIS    #2,TEMP             ;SET INDICATOR BIT
003450 050546  BIS    RS,-(SSP)              ;PUSH ONTO USER STACK
003452 052767 000004 175322  BIS    #4,TEMP             ;SET INDICATOR BIT
003460 052737 004000 177776  BIS    #REG,#PSW              ;SELECT R10-R15
003466 004767 000006  JSR    7,T17D
003472 052767 002000 175302  BIS    #2000,TEMP            ;PUSH ONTO USER STACK
003500 052767 000010 175274 T17D: BIS    #10,TEMP            ;SET ERROR INDICATOR BIT

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003506 012702 003522      MOV      @T17E,R12      ;SET UP RETURN FOR RTS
003512 000202      RTS      R12          ;GO TO T16E
003514 052767 004000 175260  T17E:  BIS      @4000,TEMP    ;SET INDICATOR TO SHOW ERROR
003522 052767 000020 175252  BIS      @20,TEMP
003530 004567 000006  JSR      R15,T17F
003534 052767 010700 175240  T17F:  BIS      @10000,TEMP   ;SET ERROR INDICATOR BIT
003542 052767 000140 175232  BIS      @40,TEMP
003550 012767 003574 174256  MOV      @T17G,TRAPVEC ;SET UP TRAP VECTOR FOR TRAP
003556 012767 144000 174252  MOV      @UM+REG,TRAPVEC+2
003564 104400      TRAP
003566 052767 020000 175206  T17G:  BIS      @20000,TEMP
003574 052767 000100 175200  BIS      @100,TEMP
003602 005037 177776      CLR      @PSW          ;KERNEL MODE!!!
003606 022767 000177 175166  CMP      @177,TEMP
003614 001401      BEQ     .+4
003616 000000      HLT
003620 000403      BR
003622 005037 177776  T17ERR: CLR      @PSW
003626 000000      HLT          ;ERROR! OVERFLOW OCCURED
003630 005037 177774  T17X:  CLR      @SLR
003634 012767 000036 174172  MOV      @TRAPVEC+2,TRAPVEC
003642 005067 174170  CLR      TRAPVEC+2

;TEST TRAP & RETURN SUPERVISOR-KERNEL-SUPERVISOR
T20:  SCOPE
003646 010701      MOV      @KPTR,KSP
003650 012706 000500      MOV      @REG,@IOTVEC+2
003654 012737 004000 000022  MOV      @T20A,@IOTVEC
003662 012737 003764 000020  MOV      @SM+REG+PTY4,@PSW
003670 012737 044200 177776  CLR      R10
003676 005000      IOT
003700 000004  T20AA: MOV      @PSW,TEMP      ;GET RETURN STATUS FROM IOT TRAP
003702 013767 177776 175072  BIC      @UM,@PSW      ;KERNEL MODE!!!
003710 042737 140000 177776  CMP      @T20AA,KPTR-4 ;CHECK THAT RETURN ADDRESS WAS
003716 022767 003702 174550  BEQ     .+4           ;SAVED ON KERNEL STACK ON IOT TRAP
003724 001401      HLT          ;ERROR!
003726 000000      CMP      @SM+REG+PTY4+Z,KPTR-2 ;CHECK THAT STATUS WAS SAVED
003730 022767 044204 174540  BEQ     .+4           ;CORRECTLY ON KERNEL STACK
003736 001401      HLT          ;ERROR! INCORRECT STATUS SAVED
003740 000000      CMP      @SM+REG+PTY4+Z,TEMP ;CHECK STATUS RETURNED BY RTT
003742 022767 044204 175032  BEQ     .+4
003750 001401      HLT          ;ERROR
003752 000000      INC      R10          ;CHECK THAT COM R10 WAS EXECUTED
003754 005200      BEQ     T21
003756 001404      HLT          ;ERROR! COM R10 NOT EXECUTED AT T20A
003760 000000      BR      T21          ;GO TO NEXT TEST
003762 000402  T20A:  COM      R10
003764 005100      RTT
003766 000006

;TEST THAT MTPD/I POPS WORD OFF THE THE APPROPRIATE STACK (AS
;DETERMINED BY BITS 15&14 IN PSW.)
;MTPD, KERNEL MODE
T21:  SCOPE
003770 010701      CLR      @PSW
003772 005037 177776      MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
003776 012706 000500      MOV      #-1,R0        ;PRE-SET R0
004002 012700 177777

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004006	005016			CLR	(KSP)	: PUT 0 ON THE STACK
004010	012737	010011	177776	MOV	#PSH+N+C, @PSH	: PRE SET STATUS
004014	106600			MTPD	R0	: R0+(KSP)+
004018	013702	177776		MOV	@PSH, R2	: GET STATUS
004022	012702	010005		CHP	#PSH+Z+C, R2	: CHECK STATUS AFTER MTPD
004026	011401			BEQ	.+4	
004030	012706	000502		HLT		: ERROR! INCORRECT STATUS
004034	011401			CHP	#KPTR+2, KSP	: DID KSP INCREMENT BY 2
004038	011401			BEQ	.+4	
004042	012700			HLT		: ERROR! KSP DID NOT POP
004046	011401			TST	R0	: DID WORD ON STACK (0) GET TO R0?
004050	000000			BEQ	.+4	
				HLT		: ERROR! MTPD DID NOT POP 0 OFF : KSP INTO R0

: MTPD, KERNEL MODE

004054	010701			↑22: SCOPE		
004058	012737	177776		CLR	@PSH	: KERNEL MODE!!!
004062	000500			MOV	#KPTR, KSP	: SET KERNEL STACK PTR
004066	012702			CLR	R2	: F-RESET R2
004070	012716	177777		MOV	#-1, (KSP)	: PRESET DATA ON THE STACK
004074	012737	030006	177776	MOV	#PUM+Z+V, @PSH	: PRESET STATUS
004078	012702			MTPD	R2	: R2+(KSP)+
004082	012700	030010		MOV	@PSH, R0	: GET STATUS
004086	011401			CHP	#PUM+N, R0	: CHECK STATUS
004090	011401			BEQ	.+4	
004094	012706	000502		HLT		: ERROR! INCORRECT STATUS
004098	011401			CHP	#KPTR+2, KSP	: CHECK STACK PTR AFTER MTPD
004102	011401			BEQ	.+4	
004106	000000			HLT		: ERROR! INCORRECT STACK PTR
004110	005202			INC	R2	: CHECK THAT MTPD MOVED DATA
004114	001401			BEQ	.+4	: FROM STACK TO R2
004118	000000			HLT		: ERROR!

: MTPD, SUPERVISORY MODE

004134	010701			↑23: SCOPE		
004138	005003			CLR	R3	: PRESET R3
004142	012737	044000	177776	MOV	#SM+REG, @PSH	: SUPER MODE!!!
004146	012706	000600		MOV	#SPTR, SSP	: SET SUPER STACK PTR
004150	052716	177777		BIS	#-1, (SSP)	: PRESET DATA ON SUPER STACK
004154	005003			CLR	R13	: PRESET R13
004158	000261			SEC		: SET 'C'
004162	106603			MTPD	R13	: R13+(SSP)+
004166	013700	177776		MOV	@PSH, R10	: SAVE STATUS
004170	010602			MOV	SSP, R12	: SAVE SUPER STACK POINTER
004174	042737	140000	177776	BIC	#UM, @PSH	: KERNEL MODE!!!
004200	022700	044011		CHP	#SM+REG+N+C, R10	: CHECK STATUS RESULT
004204	001401			BEQ	.+4	
004206	000000			HLT		: ERROR! INCORRECT STATUS AFTER MTPD
004210	022702	000602		CHP	#SPTR+2, R12	: CHECK SUPER STACK POINTER
004214	001401			BEQ	.+4	
004216	000000			HLT		: ERROR! INCORRECT SUPER STACK POINTER
004220	005203			INC	R13	: CHECK RESULT OF MTPD
004222	001401			BEQ	.+4	
004224	000000			HLT		: ERROR! MTPD FAILED TO LOAD R13

004226	005037	177776		CLR	2#PSW	:KERNEL MODE!!!, R0-R5	
004232	005703			TST	R3	:CHECK THAT R3 WAS NOT CHANGED	
004234	001401			BEQ	.+4		
004236	000000			HLT		:ERROR! MTPD CHANGED INCORRECT REGISTER	
:MTPD, SUPERVISORY MODE							
↑24:							
004240	010701			SCOPE			
004242	012737	070000	177776	MOV	#SM+PUM, 2#PSW	:SUPER MODE!!!, PREV USER MODE!!	
004250	012706	000600		MOV	#SPTR, SSP	:SET SUPER STACK PTR	
004254	005016			CLR	(SSP)	:PRESET DATA ON SUPER STACK	
004256	012704	177777		MOV	0-1, R4	:PRESET R4	
004262	012762			SEV		:SET 'V'	
004264	012734			MTPD	R4	:R4+(SSP)+	
004266	012730	177776		MOV	2#PSW, R0	:SAVE STATUS	
004272	012732			MOV	SSP, R2	:SAVE SUPER STACK PTR	
004274	012737	177776		CLR	2#PSW	:KERNEL MODE!!!	
004276	012730	070004		CMP	#SM+PUM+2, R0	:CHECK STATUS AFTER MTPD	
004278	001401			BEQ	.+4		
004280	000000			HLT		:ERROR! INCORRECT STATUS AFTER MTPD	
004310	022702	000602		CMP	#SPTR+2, R2	:CHECK SUPER STACK PTR AFTER MTPD	
004314	001401			BEQ	.+4		
004316	012730			HLT		:ERROR! INCORRECT SUPER STACK PTR AFTER MTPD	
004320	005704			TST	R4	:CHECK THAT DATA WAS MOVED	
004322	001401			BEQ	.+4	:FROM SUPER STACK TO R4	
004324	000000			HLT		:ERROR! MTPD FAILED TO MOVE DATA TO R4	
:MTPD, USER MODE							
↑25:							
004326	010701			SCOPE			
004330	012737	150000	177776	MOV	#UM+PSM, 2#PSW	:USER MODE!!!	
004336	012706	000700		MOV	#UPTR, USP	:SET USER STACK PTR	
004342	052716	177777		BIS	0-1, (USP)	:PRESET DATA ON USER STACK	
004346	000261			SEC		:SET 'C'	
004350	042705	177777		BIC	0-1, RS	:PRESET RS	
004354	102705			MTPD	RS	:RS+(USP)+	
004356	013700	177776		MOV	2#PSW, R0	:SAVE STATUS AFTER MTPD	
004362	010602			MOV	USP, R2	:SAVE USER STACK PTR	
004364	012737	177776		CLR	2#PSW	:KERNEL MODE!!!	
004370	012700	150011		CMP	#UM+PSM+M+C, R0	:CHECK STATUS AFTER MTPD	
004374	001401			BEQ	.+4		
004376	000000			HLT		:ERROR! INCORRECT STATUS AFTER MTPD	
004400	022702	000702		CMP	#UPTR+2, R2	:CHECK USER STACK PTR AFTER MTPD	
004404	001401			BEQ	.+4		
004406	000000			HLT		:ERROR! INCORRECT USP AFTER MTPD	
004410	005205			INC	RS	:CHECK THAT MTPD MOVED DATA FROM	
004412	001401			BEQ	.+4	:USER STACK TO RS	
004414	000000			HLT		:ERROR! MTPD FAILED	
:MTPD, USER MODE							
↑26:							
004416	010701			SCOPE			
004420	012737	140000	177776	MOV	#UM, 2#PSW	:USER MODE!!!	
004426	012706	000700		MOV	#UPTR, USP	:SET USER STACK PTR	
004432	042716	177777		BIC	0-1, (USP)	:PRESET DATA ON USER STACK	
004436	052700	177777		BIS	0-1, R0 ;PRESET R0		
004442	000257			CCC		:PRESET STATUS (ALL CC'S=0)	
004444	006600			MTPD	R0	:R0+(USP)+	


```

004446 013702 177776
004448 012737 177776
004450 012737 140004
004452 012737 000702
004454 012737 001401
004456 012737 001401
004458 012737 001401
004460 012737 001401
004462 012737 001401
004464 012737 001401
004466 012737 001401
004468 012737 001401
004470 012737 001401
004472 012737 001401
004474 012737 001401
004476 012737 001401
004478 012737 001401
004480 012737 001401
004482 012737 001401
004484 012737 001401
004486 012737 001401
004488 012737 001401
004490 012737 001401
004492 012737 001401
004494 012737 001401
004496 012737 001401
004498 012737 001401
004500 012737 001401
004502 012737 001401
004504 012737 001401
004506 012737 001401
004508 012737 001401
004510 012737 001401
004512 012737 001401
004514 012737 001401
004516 012737 001401
004518 012737 001401
004520 012737 001401
004522 012737 001401
004524 012737 001401
004526 012737 001401
004528 012737 001401
004530 012737 001401
004532 012737 001401
004534 012737 001401
004536 012737 001401
004538 012737 001401
004540 012737 001401
004542 012737 001401
004544 012737 001401
004546 012737 001401
004548 012737 001401
004550 012737 001401
004552 012737 001401
004554 012737 001401
004556 012737 001401
004558 012737 001401
004560 012737 001401
004562 012737 001401
004564 012737 001401
004566 012737 001401
004568 012737 001401
004570 012737 001401
004572 012737 001401
004574 012737 001401
004576 012737 001401
004578 012737 001401
004580 012737 001401
004582 012737 001401
004584 012737 001401
004586 012737 001401
004588 012737 001401
004590 012737 001401
004592 012737 001401
004594 012737 001401
004596 012737 001401
004598 012737 001401
004600 012737 001401

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```

MOV @PSW,R2 ;SAVE STATUS AFTER MTPD
MOV USP,R3 ;SAVE USP AFTER MTPD
CLR @PSW ;KERNEL MODE!!!
BUN+2,R2 ;CHECK STATUS AFTER MTPD
;+4
HLT ;ERROR! INCORRECT STATUS AFTER MTPD
CMP BUPTR+2,R3 ;CHECK USP AFTER MTPD
;+4
HLT ;ERROR! INCORRECT USP AFTER MTPD
TST R0 ;CHECK THAT MTPD MOVED DATA ON
BEQ R0 ;UPR STACK TO R0
HLT ;ERROR! MTPD FAILED

```

TEST THAT MTPD POPS WORD OFF STACK (AS DETERMINED BY BITS 15 & 14 INTO STACK POINTER (AS DETERMINED BY BITS 13 & 12)).
SSP+(KSP)+MTPD

```

004506 010701
004508 012737 040000 177776
004510 012737 010000 177776
004512 012706 000500
004514 012716 000600
004516 000277
004518 10 06
004520 013702 177776
004522 012737 040000 177776
004524 012737 000500
004526 012737 000600
004528 012737 000600
004530 012737 000600
004532 012737 000600
004534 012737 000600
004536 012737 000600
004538 012737 000600
004540 012737 000600
004542 012737 000600
004544 012737 000600
004546 012737 000600
004548 012737 000600
004550 012737 000600
004552 012737 000600
004554 012737 000600
004556 012737 000600
004558 012737 000600
004560 012737 000600
004562 012737 000600
004564 012737 000600
004566 012737 000600
004568 012737 000600
004570 012737 000600
004572 012737 000600
004574 012737 000600
004576 012737 000600
004578 012737 000600
004580 012737 000600
004582 012737 000600
004584 012737 000600
004586 012737 000600
004588 012737 000600
004590 012737 000600
004592 012737 000600
004594 012737 000600
004596 012737 000600
004598 012737 000600
004600 012737 000600

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↑27: SCOPE
MOV @PSW,@PSW ;SUPER MODE!!!
CLR SSP ;PRE SET SUPERVISORS STACK POINTER
BUN+PSW,@PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
MOV @PTR,KSP ;SET KERNEL STACK POINTER
MOV @SPTR,(KSP)
SCC ;PRESET CC'S
MTPD SSP ;SSP+(KSP)+
MOV @PSW,R2 ;SAVE STATUS
MOV @PSW,@PSW ;SUPER MODE!!!
MOV SSP,R0 ;GET SUPER STACK POINTER
CLR @PSW ;KERNEL MODE!!!
CMP @SPTR,R0 ;CHECK THAT SUPER STACK POINTER WAS
BEQ .+4 ;SET BY MTPD INST.
HLT ;ERROR! MTPD FAILED TO SET SUPER STACK POINTER
CMP @PSW+C,R2 ;CHECK STATUS AFTER MTPD
BEQ .+4
HLT ;ERROR! INCORRECT STATUS AFTER MTPD

```

```

004600 010701
004602 012737 140000 177776
004604 012737 030000 177776
004606 012706 000500
004608 012716 000700
004610 000277
004612 10 06
004614 013702 177776
004616 012737 140000 177776
004618 010600
004620 012737 177776
004622 012706 000700
004624 012716 000700
004626 012716 000700
004628 012716 000700
004630 012716 000700
004632 012716 000700
004634 012716 000700
004636 012716 000700
004638 012716 000700
004640 012716 000700
004642 012716 000700
004644 012716 000700
004646 012716 000700
004648 012716 000700
004650 012716 000700
004652 012716 000700
004654 012716 000700
004656 012716 000700
004658 012716 000700
004660 012716 000700
004662 012716 000700
004664 012716 000700
004666 012716 000700
004668 012716 000700
004670 012716 000700
004672 012716 000700
004674 012716 000700
004676 012716 000700
004678 012716 000700
004680 012716 000700
004682 012716 000700
004684 012716 000700
004686 012716 000700
004688 012716 000700
004690 012716 000700
004692 012716 000700
004694 012716 000700
004696 012716 000700
004698 012716 000700
004700 012716 000700

```

```

↑30: SCOPE
MOV @PSW,@PSW ;USER MODE!!!
CLR USP ;PRE SET USER STACK POINTER
BUN+PSW,@PSW ;KERNEL MODE!!!, PREV USER MODE!!
MOV @PTR,KSP ;SET KERNEL STACK POINTER
MOV BUPTR,(KSP)
SCC ;PRESET CC'S
MTPD USP ;USP+(KSP)+
MOV @PSW,R2 ;SAVE CC'S
MOV @PSW,@PSW ;USER MODE!!!
MOV USP,R0 ;GET USER STACK POINTER
CLR @PSW ;KERNEL MODE!!!
CMP BUPTR,R0 ;CHECK THAT MTPD SET USER STACK
BEQ .+4 ;POINTER PROPERLY
HLT ;ERROR!
CMP @KPTR+2,KSP ;CHECK KERNEL STACK POINTER
BEQ .+4
HLT

```

Address	PC	PSW	SP	Instruction	Comments
004676	010701			:KSP+(KSP)+, MTPD	
004700	012706	000500		↑31: SCOPE	
004704	012716	000736		MOV #KPTR, KSP	
004710	106606			MOV #REDPTR, (KSP)	:PRESET DATA ON KERNEL STACK
004712	022706	00073E		MTPD KSP	:KSP+(KSP)+
004716	001401			CMP #REDPTR, KSP	:CHECK THAT MTPD MOVED DATA ON
004720	000000			BEQ .+4	:KERNEL STACK TO KERNEL STACK PTR
				HLT	:ERROR! MTPD FAILED
004722	010701			:SSP+(SSP)+	
004724	012737	050000	177776	↑31A: SCOPE	
004732	005006			MOV #SM+PSM, @PSW	:SUPER MODE!!! PREV SUPER MODE!!
004734	012737	000600	000000	CLR SSP	:SET SUPER STACK POINTER
004742	000277			MOV #SPTR, @0	:PUT NEW STACK POINTER VALUE ON STACK
004744	106606			SCC	:PRESET CC'S
004746	010702	177776		MTPD SSP	:SSP+(SSP)+
004752	010702			MOV @PSW, R2	:SAVE RESULT STATUS
004754	010702	177776		MOV SSP, R0	:SAVE NEW SUPER STACK POINTER
004760	010702	000600		CLR @PSW	:KERNEL MODE!!!
004764	010702			CMP #SPTR, R0	:CHECK THAT MTPD SET SUPER STACK
004766	010702			BEQ .+4	:POINTER PROPERLY
004770	010702	050001		HLT	:ERROR!
004774	001401			CMP #SM+PSM+C, R2	:CHECK STATUS RESULT
004776	000000			BEQ .+4	:ERROR! INCORRECT STATUS AFTER MTPD
005000	010701			:USP+(SSP)+, MTPD	
005002	012737	140000	177776	↑31B: SCOPE	
005010	012706	000700		MOV #UM, @PSW	:USER MODE!!!
005014	012737	070000	177776	MOV #UPTR, USP	:SET USER STACK POINTER
005022	012706	000600		MOV #SM+PUM, @PSW	:SUPER MODE!!! PREV USER MODE!!
005026	005046			MOV #SPTR, SSP	:SET SUPER STACK POINTER
				CLR -(SSP)	:PUSH NEW USER STACK POINTER ONTO
					:SUPER STACK
					:PRESET CC'C
005030	000277			SCC	
005032	000244			CLZ	
005034	106606			MTPD USP	:USP+(SSP)+
005036	013702	177776		MOV @PSW, R2	:SAVE RESULT STATUS
005042	010600			MOV SSP, R0	:SAVE SUPER STACK POINTER
005044	052737	140000	177776	BIS #UM, @PSW	:USER MODE!!!
005052	010603			MOV USP, R3	:GET USER STACK POINTER
005054	005037	177776		CLR @PSW	:KERNEL MODE!!!
005060	022702	070005		CMP #SM+PUM+Z+C, R2	:CHECK RESULT STATUS
005064	001401			BEQ .+4	
005066	000000			HLT	:ERROR! INCORRECT STATUS AFTER MTPD
005070	022700	000600		CMP #SPTR, R0	:CHECK SUPER STACK POINTER
005074	001401			BEQ .+4	
005076	000000			HLT	:ERROR! INCORRECT SUPER STACK PINTER
005100	005703			TST R3	:CHECK USER STACK POINTER
005102	001401			BEQ .+4	
005104	000000			HLT	:ERROR! MTPD FAILED TO SET USER STACK POINTER
005106	010701			:USP+(USP)+, MTPD	
005110	012737	170000	177776	↑31C: SCOPE	
005116	012706	000700		MOV #UM+PUM, @PSW	:USER MODE!!! PREV USER MODE!!
				MOV #UPTR, USP	:SET USER STACK POINTER

005122	005016			CLR	(USP)	:PUT NEW STACK VALUE ON STACK
005124	000257			CCC		:PRESET CC'S
005126	106606			MTPD	USP	:USP+(USP)+
005130	013700	177776		MOV	@#PSW,RO	:SAVE CC'S
005134	010602			MOV	USP,R2	:SAVE USER STACK POINTER
005136	005037	177776		CLR	@#PSW	:KERNEL MODE!!!
005140	022700	170004		CMP	#UM+PUM+Z,RO	:CHECK STATUS
005146	001401			BEQ	.+4	
005150	000000			HLT		:ERROR! INCORRECT STATUS AFTER MTPD
005152	005702			TST	R2	:CHECK NEW STACK POINTER VALUE
005154	001401			BEQ	.+4	
005156	000000			HLT		:ERROR! MTPD FAILED TO SET USER STACK POINTER
:SSP~(KSP)+, MTPD						
005160	010701			↑32: SCOPE		
005162	012737	040000	177776	MOV	#SM,@#PSW	:SUPERVISORY MODE!!!
005170	000005			CLR	SSP	:PRESET SUPER STACK POINTER
005172	000237	177776		RSR	@#PSW	
005176	000237	177776		RSR	@#PSW	:KERNEL MODE!!!, PREV SUPER MODE!!
005182	012716	000600		MOV	@SPTR,(KSP)	
005186	000606			MTPD	SSP	:SSP+(KSP)+
005190	006337	177776		RSL	@#PSW	
005194	006337	177776		RSL	@#PSW	:SUPERVISORY MODE!!!
005198	010667	173556		MOV	SSP,TEMP	:GET SUPER STACK POINTER
005202	000637	177776		CLR	@#PSW	:KERNEL MODE!!!
005230	002767	000600	173544	CMP	@SPTR,TEMP	:CHECK THAT TOP WORD ON KSP (@SPTR)
005236	001401			BEQ	.+4	:WAS SET INTO SUPER STACK POINTER (SSP)
005240	000000			HLT		:ERROR!
:USP+(KSP)+, MTPD						
005242	010701			↑32A: SCOPE		
005244	012737	140000	177776	MOV	#UM,@#PSW	:USER MODE
005248	012706	177777		MOV	#-1,USP	:PRESET USER STACK POINTER
005252	012737	030000	177776	MOV	#UM+PUM,@#PSW	:CURRENT KERNEL, PREVIOUS USER
005256	005046			CLR	-(KSP)	:PRESET DATA ON KERNEL STACK
005260	006606			MTPD	USP	:USP+(KSP)+
005270	012737	140000	177776	MOV	#UM,@#PSW	:USER MODE!!!
005276	010600			MOV	USP,RO	:GET USER STACK POINTER
005300	005037	177776		CLR	@#PSW	:KERNEL MODE!!!
005304	005700			TST	RO	:CHECK THAT DATA ON KERNEL STACK
005306	001401			BEQ	.+4	:WAS MOVED TO USER STACK PTR
005310	000600			HLT		:ERROR! MTPD FAILED
:USP+(SSP)+, MTPD						
005312	010701			↑33: SCOPE		
005314	012737	140000	177776	MOV	#UM,@#PSW	:USER MODE!!!
005322	005006			CLR	USP	:PRESET USER STACK POINTER
005324	012737	070000	177776	MOV	#SM+PUM,@#PSW	:CURRENT SUPERVISOR, PREVIOUS USER
005332	012746	000700		MOV	#UPTR,-(SSP)	:PRESET DATA ON SUPER STACK
005336	006606			MTPD	USP	:USP+(SSP)+
005340	012737	140000	177776	MOV	#UM,@#PSW	:USER MODE!!!
005346	010600			MOV	USP,RO	:SAVE USER STACK PTR
005350	005037	177776		CLR	@#PSW	:KERNEL MODE!!!
005354	022700	000700		CMP	#UPTR,RO	:CHECK THAT MTPD MOVED DATA FROM
005360	001401			BEQ	.+4	:SUPER STACK TO USER STACK PTR

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005362 000000          HLT          ;ERROR! MTP1 FAILED

:SSP+(SSP)+ MTP1
↑34: SCOPE
005364 010701          MOV      @SM+PSM,@#PSW      ;SUPER MODE!!! PREV SUPER MODE!!
005366 012737 050000 177776      CLR      SSP              ;SET SUPER STACK PTR
005374 005006          MOV      @SPTR,(SSP)      ;PRESET DATA ON SUPER STAC
005376 012716 000600          MTP1     SSP              ;SSP+(SSP)+
005402 006606          MOV      SSP RC          ;GET SUPER STACK PTR
005404 010600          CLR      @#PSW          ;KERNEL MODE!!!
005406 005037 177776      CMP      @SPTR,RO        ;CHECK THAT MTP1 MOVED DATA ON
005412 022700 000600          BEQ     .+4              ;SUPER STACK TO SUPER STACK PTR
005416 001401          HLT
005420 000000          HLT          ;ERROR! MTP1 FAILED

:USP+(USP)+
↑35: SCOPE
005422 010701          MOV      @UM+PUM,@#PSW    ;USER MODE!!!, PREV USER MODE!!
005424 012737 170000 177776      MOV      @SPTR,USP        ;SET USER STACK PTR
005432 012706 000600          MOV      @UPTR,(USP)     ;PRESET DATA ON USER STACK
005436 012716 000700          MTP1     USP              ;USP+(USP)+
005442 006606          MOV      USP RO          ;SAVE USER STACK PTR IN RO
005444 010600          CLR      @#PSW          ;KE-UEL MODE!!!
005446 005037 177776      CMP      @UPTR,RO        ;CHECK THAT MTP1 MOVED DATA ON
005452 022700 000700          BEQ     .+4              ;USER STACK TO USER STACK PTR
005456 001401          HLT          ;ERROR! MTP1 FAILED

:TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION
:KERNEL MODE
↑36: SCOPE
005462 010701          CLR      @#PSW
005464 005037 177776      MOV      @KPTR,KSP
005470 012706 000500          MOV      @-1,(KSP)
005474 012716 177777          MOV      @T36A,@#ERRVEC
005500 012737 005520 000004      CLR      ERRVEC+2
005506 005067 172274          MTPD    -1              ;TRAPS ON ODD ADDRESS
005512 106667 172261          HLT          ;ERROR! DID NOT TRAP
005516 000000          T36AA: HLT
005520 022706 000476          T36A:  CMP      @KPTR-2,KSP ;IS KSP CORRECT?(1 POP AND 2
005524 001401          BEQ     .+4              ;PUSHES)
005526 000000          HLT          ;ERROR! INCORRECT VALUE IN KSP
005530 022767 005516 172740      CMP      @T36AA,KPTR-2 ;CHECK RETURN PC ON STACK
005536 001401          BEQ     .+4
005540 000000          HLT          ;ERROR! RETURN PC NOT ON STACK

:SUPERVISORY MODE
↑37: SCOPE
005542 010701          MOV      @SM+REG,@#PSW
005544 012737 044000 177776      CLR      R10              ;PRESET R10
005552 005000          BIC     @REG,@#PSW        ;RO-R5
005554 042737 004000 177776      MOV      @-1,R0          ;RO CONTAINS AN ODD ADDRESS
005562 012700 000001          MOV      @SPTR,SSP      ;SET SUPERVISOR'S STACK POINTER
005566 012706 000600          MOV      @-1,(SSP)      ;-1 IS THE DATA TO BE MOVED
005572 012716 177777          MOV      @T37A,@#ERRVEC ;LOAD ERROR VECTOR
005576 012737 005622 000004      MOV      @SM,@#ERRVEC+2
005604 012737 040000 000006      MTPD    (R0)+
005612 106620          HLT          ;TRAPS ON ODD ADDRESS
005614 005037 177776          T37AA: CLR      @#PSW
005620 000000          HLT          ;ERROR! DID NOT TRAP

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005622 010602 T37A: MOV SSP,R2 ;GET SUPERVISOR STACK POINTER
005624 005037 177776 CLR @#PSW ;KERNEL MODE!!!
005630 022702 000576 CMP @SPTR-2,R2 ;CHECK SUPER STACK PTR AFTER
005634 001401 BEQ .+4 ;MTPD AND TRAP
005636 000000 HLT ;ERROR! INCORRECT SSP
005640 022767 005614 172730 CMP @T37AA,SPTR-2 ;CHECK RETURN PC ON SUPER STACK
005646 001401 BEQ .+4
005650 000000 HLT ;ERROR! INCORRECT RETURN PC ON STACK
005652 022700 000003 CMP #3,R0 ;CHECK AUTO-INC OF R0
005656 001401 BEQ .+4
005660 000000 HLT ;ERROR! R0 FAILED TO AUTO-INC

;USER MODE
T40: SCOPE
005662 010701 MOV #UM+PUM,@#PSW ;USER MODE!!!, PREV USER MODE!!
005664 010737 170000 177776 CLR R2 ;SELECT R10-R15
005672 010702 004000 177776 BIS #REG,@#PSW
005674 010737 000000 177776 MOV #1,R12 ;SET USER STACK POINTER
005676 010702 000001 MOV #UPTR,USP ;PRESET USER STACK
005678 010706 010700 1 MOV #125252,(USP) ;LOAD ERROR VECTOR
005679 010716 010737 000004 MOV @T40A,@ERRVEC
005680 010737 144000 000006 MOV #UM+REG,@ERRVEC+2
005682 010742 HTPD ;-(R12)+((USP)+; SHOULD TRAP ON ODD ADDS
005684 010737 177776 T40AA: CLR @#PSW ;KERNEL MODE!!!
005686 010700 HLT ;ERROR DID NOT TRAP
005688 010700 T40A: MOV USP,R10 ;GET USERS STACK POINTER
005690 040737 140000 177776 BIC #UM,@#PSW ;KERNEL MODE!!!
005692 010700 000676 CMP #UPTR-2,R10 ;CHECK THAT USER STACK POINTER
005694 010701 BEQ .+4 ;PUSHED PROPERLY (1 POP 2 PUSHES)
005696 010700 HLT ;ERROR! INCORRECT USER STACK POINTER
005698 010737 174010 000700 CMP #UM+PUM+REG+N,@#UPTR ;CHECK THAT CORRECT STATUS WAS
005700 010701 BEQ .+4 ;SAVED ON USER STACK ('N' IS DATA POPPED)
005702 010700 HLT ;ERROR! INCORRECT STATUS SAVED ON USER STACK
005704 010767 005734 172674 CMP @T40AA,UPTR-2 ;CHECK THAT RETURN ADDRESS WAS
005706 001401 BEQ .+4 ;SAVED ON USER STACK
005708 010700 HLT ;ERROR! RETURN PC NOT ON USER STACK
005710 010702 177777 CMP #-1,R12 ;DID R12 DECREMENT BY 2
005712 001401 BEQ .+4
005714 000000 HLT ;ERROR! AUTO-DEC FAILED
005716 005037 177776 CLR @#PSW

;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
;KERNEL MODE
T41: SCOPE
006022 010701 MOV @#PSW ;KERNEL MODE!!!
006024 005037 177776 CLR #-1,R0 ;PRESET R0
006030 012700 177777 MOV @T41A,@ERRVEC ;SET ERROR VECTOR
006034 012737 006070 000004 CLR ERRVEC+2
006042 005067 171740 BIS #REG,@#PSW ;R10-R15
006046 052737 004000 177776 CLR R10 ;PRESET R10
006054 005000 MOV #2,-(KSP) ;PRESET DATA ON STACK
006056 012746 000002 SEC ;SET 'C'
006062 000261 MTPD (R10)+ ;(R10)++(KSP)+
006064 100820 BR .+4
006066 000401 T41A: HLT ;ERROR! TRAPPED
006070 000000 BCS .+4 ;MTP D/I SHOULD NOT AFFECT CARRY
006072 103401

```

```

006074 000000          HLT                               ;BIT ERROR! CARRY BIT BUT CLEARED.
006076 022767 000002 171674  CMP      #2,0                    ;CHECK THAT DATA WAS MOVED
006104 001401          BEQ      .+4                          ;FROM KERNEL STACK TO MEM ADDRESS
006106 000000          HLT

006110 010701          T41B: SCOPE
006112 012737 004000 177776  MOV      @REG,@#PSW                ;KERNEL MODE!!!
006120 012737 006146 000004  MOV      @T41B,@#ERRVEC           ;LOAD ERROR VECTOR
006126 012706 000500          MOV      @KPTR,KSP                ;SET KERNEL STACK POINTER
006132 012716 177777          MOV      @-1,(KSP)                ;LOAD KERNEL STACK
006136 000257          CCC                               ;PRESET CC'S
006140 106637 001002          MTPD      @#TEMP                    ;@#TEMP+(KSP)+

006144 000401          BR      .+4
006146 000000          T41B8: HLT                          ;ERROR! TRAPPED
006150 013700 177776          MOV      @#PSW,R10                ;SAVE CC'S
006154 012700 004010          CMP      @REG+@N,R10              ;CHECK RESULT STATUS
006160 001401          BEQ      .+4
006162 000000          HLT                          ;ERROR! INCORRECT STATUS AFTER MTPD
006164 015237 001002          INC      @#TEMP                    ;CHECK RESULT
006170 001401          BEQ      .+4
006172 000000          HLT                          ;ERROR! MTPD FAILED

;SUPERVISORY MODE
006174 010701          T42: SCOPE
006176 005037 177776          CLR      @#PSW
006202 012702 052525          MOV      @52525,R2
006206 012737 001250 000004  MOV      @T42A,@#ERRVEC           ;LOAD ERROR VECTOR
006214 052737 044000 177776  BIS      @SM+REG,@#PSW
006222 012702 001002          MOV      @TEMP,R12
006226 012767 177777 172546  MOV      @-1,TEMP
006234 012706 000600          MOV      @SPTR,SSP

006240 005016          CLR      (SSP)
006242 010262          SEV
006244 010622          MTPD      (R12)+                    ;(R12)++(SSP)+
006246 010401          BR      .+4
006250 010000          T42A: HLT                          ;ERROR TRAPPED ON 000 ADDRESS
006252 013700 177776          MOV      @#PSW,R10                ;GET CC'S
006256 042737 140000 177776  BIC      @UM,@#PSW
006264 022700 044004          CMP      @SM+REG+2,R10
006270 001401          BEQ      .+4
006272 000000          HLT
006274 005767 172502          TST      TEMP
006300 001401          BEQ      .+4
006302 000000          HLT

006304 010701          T43B: SCOPE
006306 012767 177777 172466  MOV      @-1,TEMP                    ;PRESET TEMP
006314 012737 006346 000004  MOV      @T43B,@#ERRVEC           ;LOAD ERROR VECTOR
006322 012737 074000 177776  MOV      @SM+PUM+REG,@#PSW        ;SUPERVISORY MODE!!!, PREV USER MODE!!
006330 012706 000600          MOV      @SPTR,SSP                ;SET SUPER STACK POINTER
006334 005046          CLR      -(SSP)                    ;PRESET SUPER STACK
006336 000257          CCC                               ;PRESET CC'S
006340 106667 172436          MTPD      TEMP                    ;TEMP+(SSP)+

```

```

006344 000401
006346 000000
006350 013702 177776
006354 010600
006356 022702 074004
006362 001401
006364 000000
006366 022700 000600
006372 001401
006374 000000

```

```

T4388: BR .+4
HLT ;ERROR! TRAPPED
MOV @#PSW,R12 ;SAVE CC'S
MOV SSP,R10 ;SAVE SUPER STACK POINTER
CMP @#N+@#P+@#R+2,R12 ;CHECK STATUS RESULT
BEQ .+4
HLT ;ERROR! INCORRECT STATUS
CMP @#SPTR,R10 ;CHECK SUPER STACK POINTER
BEQ .+4
HLT ;ERROR! INCORRECT SUPER STACK POINTER

```

```

006376 010701
006400 005037 177776
006404 012703 177777
006410 012737 006450 000004
006416 012737 144000 177776
006424 012703 001004
006430 005067 172346
006434 012706 000700
006440 052716 177777
006444 006643
006446 001401
006450 001000
006452 013000 177776
006456 042737 140000 177776
006464 122700 000010
006470 001401
006472 000000
006474 005167 172302
006500 001401
006502 000000
006504 012737 000006 000004
006512 005067 171270

```

```

:USER MODE
T43: SCOPE
CLR @#PSW
MOV @-1,R3
MOV @T43A,@#ERRVEC
MOV @#N+@#R,@#PSW
MOV @#TEMP+2,R13
CLR TEMP
MOV @#UPTR,USP
BIS @-1,(USP)
MTP @#N,-(R13) ;-(R13)+(USP)+
BR .+4
T43A: HLT ;ERROR TRAPPED
MOV @#PSW,R10
BIC @#N,@#PSW ;KERNEL MODE!!!
CMPB @#N,R10
BEQ .+4
HLT
COM TEMP
BEQ .+4
HLT
MOV @#ERRVEC+2,@#ERRVEC
CLR @#ERRVEC+2

```

```

:TEST THAT MFP D/I PUSHES DESTINATION REGISTER DATA ONTO THE APPROPRIATE STACK
:(AS DETERMINED BY PSW BITS 15 & 14)
:KERNEL MODE MFPD

```

```

006516 010701
006520 012706 000500
006524 012716 125252
006530 005027 000000
006534 012737 004000 177776
006542 012700 177777
006546 000261
006550 106500

```

```

T44: SCOPE
MOV @#KPTR,KSP
MOV @125252,(KSP)
CLR @#R0
MOV @#REG,@#PSW
MOV @-1,R10
SEC
MFPD R10 ;-(KSP)+R10,(R10)=-1

```

```

006552 013702 177776
006556 022702 004011
006562 001401
006564 000000
006566 022706 000476
006572 001401
006574 000000
006576 005116
006600 001401

```

```

MOV @#PSW,R12 ;GET STATUS RESULT
CMP @#REG+@#N+@#C,R12 ;
BEQ .+4
HLT ;ERROR! INCORRECT STATUS RESULT
CMP @#KPTR-2,KSP ;DID KERNEL STACK POINTER GET
BEQ .+4 ;PUSHED?
HLT ;ERROR!
COM (KSP) ;TEST THAT CORRECT DATA(-1) GOT
BEQ .+4 ;PUSHED ONTO KERNEL STACK

```

K02

MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
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006602	000000		HLT		;ERROR! -INOT PUSHED ONTO KERNEL STACK
006604	010701		MODE MFPI		
006606	012706	000500	SCOPE		
006612	012716	052525	MOV	#KPTR, KSP	
006616	005004		MOV	#52525, (KSP)	;PRE SET STACK
006620	012737	004001	CLR	R4	;PRESET 'WRONG' REGISTER
006626	012704	125252	MOV	#REG+C, #PSW	;SELECT R10-R15, SET C
006632	006504		MOV	#125252, R14	;LOAD DATA TO BE MOVED
			MFPI	R14	;-(KSP)+R14, (R14)=125252
006634	013700	177776	MOV	#PSW, R10	
006640	022700	004011	CMP	#REG+N+C, R10	;CHECK STATUS RESULT
006644	001401		BEQ	.+4	
006646	000000		HLT		;ERROR! INCORRECT STATUS
006650	022706	000476	CMP	#KPTR-2, KSP	;CHECK PUSH
006654	001401		BEQ	.+4	
006656	000000		HLT		;ERROR! KSP DID NOT PUSH DOWN
006660	022716	125252	CMP	#125252, (KSP)	;CHECK DATA ON THE STACK
006664	001401		BEQ	.+4	
006666	000000		HLT		;ERROR! INCORRECT DATA ON THE STACK
					;IF DATA=0 THEN INCORRECT REGISTER
					;(R4), IF DATA=52525 NO DATA PUSHED
					;ON THE STACK.

:KERNEL
↑45:


```

: SUPERVISORY MODE, MFPD
†46: SCOPE
006670 010701
006672 012737 040340 177776 MOV #SM+PRTY7, @PSW
006700 012706 000600 MOV #SPTR, SSP
006704 012702 177777 MOV #-1, R2
006710 012716 052525 MOV #52525, (SSP)
006714 052737 004000 177776 BIS #REG, @PSW
006722 005002 CLR R12
006724 000262 SEV
006726 106502 MFPD R12 ;-(SSP)+R12, (R12)=0

006730 013700 177776 MOV @PSW, R10
006734 010603 MOV SSP, R13
006736 042737 140000 177776 BIC #UM, @PSW
006744 022 044344 CMP #SM+REG+PRTY7+Z, R10 ;CHECK STATUS RESULT
006750 001401 BEQ .+4
006752 000300 HLT
006754 022703 000576 CMP #SPTR-2, R13
006760 001401 BEQ .+4
006762 000000 HLT
006764 005713 TST (R13)
006766 001401 BEQ .+4
006770 000000 HLT

: SUPERVISORY MODE, MFP1
†47: SCOPE
006772 010701
006774 012737 040200 177776 MOV #SM+PRTY4, @PSW
007002 012706 000600 MOV #SPTR, SSP
007006 012705 177777 MOV #-1, R5
007012 012716 125752 MOV #125252, (SSP)
007016 052737 004000 177776 BIS #REG, @PSW
007024 012705 052525 MOV #52525, R15
007030 000277 SCC
007032 006505 MFP1 R15 ;-(SSP)+R15, (R15)=52525

007034 013700 177776 MOV @PSW, R10
007040 010604 MOV SSP, R14
007042 042737 140000 177776 BIC #UM, @PSW
007050 022700 044201 CMP #SM+REG+PRTY4+C, R10 ;CHECK STATUS RESULT
007054 001401 BEQ .+4
007056 000000 HLT
007060 022704 000576 CMP #SPTR-2, R14
007064 001401 BEQ .+4
007066 000000 HLT
007070 022767 052525 171500 CMP #52525, SPTR-2
007076 001401 BEQ .+4
007100 000000 HLT

```


: TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
: STACK.

```

: KERNEL MODE, MFPD
↑52: SCOPE
007300 010701 177776 CLR @PSW ; KERNEL MODE!!!
007302 005037 177776 MOV @TEMP,R0 ; PRESET R0
007306 012700 001002 177776 BIS @REG,@PSW ; SELECT R10-R15
007312 052737 004000 177776 MOV @TEMP+2,R10 ; PRESET R10
007320 012700 001004 171450 MOV @-1,TEMP
007324 012767 177777 171450 CLR TEMP+2
007332 005067 171446 MOV @KPTR,KSP ; SET KERNEL STACK POINTER
007336 012706 000500 MOV @12525,(KSP) ; PRESET KERNEL STACK
007342 012716 125252 MFPD (R10)+ ; -(KSP)+(R10)+,R10=TEMP+2,TEMP+2=0
007346 106520

007350 013702 177776 MOV @PSW,R12
007354 022702 004004 CMP @REG+2,R12
007360 001401 BEQ .+4
007362 000000 HLT
007364 022706 000476 CMP @KPTR-2,KSP
007370 001401 BEQ .+4
007372 000000 HLT
007374 005716 TST (KSP)
007376 001401 BEQ .+4
007400 000000 HLT

: SUPERVISORY MODE, MFPI
↑53: SCOPE
007402 010701 070000 177776 MOV @SM+PUM,@PSW ; SUPERVISORY MODE!!!
007404 012737 001004 177776 MOV @TEMP+2,R2 ; PRESET R2
007412 012702 004000 177776 BIS @REG,@PSW ; SELECT R10-R15
007416 052737 001006 177776 MOV @TEMP+4,R12 ; PRESET R12
007424 012702 001006 171342 CLR TEMP
007430 005067 171346 MOV @TEMP+2,TEMP+2
007434 012767 001004 171342 MOV @SPTR,SSP ; SET SUPERVISORY STACK POINTER
007442 012706 000600 MOV @52525,(SSP) ; PRESET SUPER STACK
007446 012716 052525 MFPI @-(R12) ; -(SSP)+(R12),R12=TEMP+4,TEMP+2=TEMP+2
007452 006552

007454 013700 177776 MOV @PSW,R10 ; GET CONDITION CODE RESULTS
007460 010603 MOV SSP,R13
007462 042737 140000 177776 BIC @UM,@PSW
007470 022700 074000 CMP @SM+PUM+REG,R10 ; CHECK STATUS AFTER MFPI INST.
007474 001401 BEQ .+4
007476 000000 HLT ; ERROR! INCORRECT STATUS AFTER MFPI
007500 022703 000576 CMP @SPTR-2,R13 ; CHECK SUPER STACK POINTER
007504 001401 BEQ .+4
007506 000000 HLT ; ERROR! INCORRECT SSP AFTER MFPI
007510 022713 001004 CMP @TEMP+2,(R13) ; CHECK THAT PROPER DATA WAS PUSHED
007514 001401 BEQ .+4 ; ONTO SUPERVISORY STACK
007516 000000 HLT ; ERROR! INCORRECT DATA ON SUPER STACK

```



```

:TEST1 OVERFLOW (RED) USING MFPI INSTRUCTION
T56: SCOPE
007754 010701          MOV      @T56A,@ERRVEC ;SET ERROR TRAP VECTOR
007756 012737 010030 000004  MOV      @PUM+REG+PRTY7,@PSW ;KERNEL MODE!!!  PREV USER MODE!!
007764 012737 034340 177776  MOV      @REDPTR,KSP ;SET STACK PTR TO TOP OF RED ZONE
007772 012706 000736          MOV      @-1,-2(KSP) ;PRESET RED LOCATION=-1
007776 012766 177777 177776  MOV      TEMP ;(TEMP)WILL BE THE DATA MOVED
010004 005067 170772          CLR      TEMP ;TO RED LOCATION
010010 012703 001004          MOV      @TEMP+2,R13 ;LOAD INDEX REGISTER
010014 012737 000400 177774  MOV      @400,@SLR ;SET STACK LIMIT=1000
010022 006563 177776          MFPI    -2(R13) ;-(KSP)+TEMP SHOULD OVER
                                FLOW (RED)
010026 000000          T56AA:  HLT ;ERROR! FAILED TO TRAP ON 'RED'
                                OVERFLOW
010030 022737 177777 000734  T56A:  CMP      @-1,@REDPTR-2 ;TEST THAT MFPI DID NOT WRITE
010036 001401          BEQ     .+4 ;INTO 'RED' LOCATION
010040 000000          HLT ;ERROR!
010042 005706          TST     KSP ;STACK SHOULD HAVE GONE TO 0
010044 001401          BEQ     .+4
010046 000000          HLT
010050 002737 034344 000002  CMP      @PUM+REG+PRTY7+2,@@2 ;OLD STATUS SHOULD BE IN 2
010056 001401          BEQ     .+4
010060 000000          HLT ;ERROR!
010062 022737 010026 000000  CMP      @T56AA,@@0 ;AND RETURN IN 0
010070 001401          BEQ     .+4
010072 000000          HLT ;ERROR! INCORRECT PC IN 0
010074 005037 177774          CLR     @SLR
010100 012737 000006 000004  MOV      @ERRVEC+2,@ERRVEC;RESTORE ERROR VECTOR

:TEST TRAP & RETURN USER-KERNEL-USER
T57: SCOPE
010106 010701          MOV      @KPTR,KSP ;SET KERNEL STACK POINTER
010110 012706 000500          MOV      @REG,@TRAPVEC+2
010114 012767 004000 167714  MOV      @T57A,@TRAPVEC
010122 012767 010212 167704  MOV      @PUM+REG,@PSW ;USER MODE!!!
010130 012737 144000 177776  MOV      R12
010136 005002          CLR     R12 ;TRAP & ENTER KERNEL MODE
010140 104400          TRAP
010142 013767 177776 170632  T57AA:  MOV      @PSW,TEMP ;KERNEL MODE!!!
010150 042737 140000 177776  BIC     @1,@PSW
010156 022767 010142 170310  CMP      @T57AA,KPTR-4 ;CHECK THAT RETURN ADDRESS IS ON
010164 001401          BEQ     .+4 ;KERNEL STACK
010166 000000          HLT ;ERROR! RETURN ADDRESS NOT ON STACK
010170 022767 144004 170604  CMP      @PUM+REG+Z,TEMP ;CHECK THAT CORRECT PSW WAS
010176 001401          BEQ     .+4 ;RESTORED ON THE RETURN
010200 000000          HLT ;ERROR! INCORRECT STATUS WAS RETURNED
                                BY KERNEL FROM TRAP
010202 005102          COM     R12 ;CHECK THAT TRAP ROUTINE WAS EXECUTED
010204 001401          BEQ     .+4
010206 000000          HLT ;ERROR! KERNEL DID NOT DO COM R12
                                (AT T57A)
010210 000402          BR      T57EX ;EXIT TEST
010212 005102          T57A:  COM     R12 ;COMPLEMENT R12
010214 000002          RTI ;AND EXIT
010216 000240          T57EX:  NOP

```

```

;TEST THAT MFPD/I CAN PUSH ONTO CURRENT STACK (AS DETERMINED BY PS15 &
;PS14) THE PREVIOUS MODES STACK POINTER (AS DETERMINED BY PS13 &PS12)
;-(KSP)+KSP,MFPD
†60: SCOPE
010220 010701
010222 005037 177776 CLR @#PSW ;KERNEL MODE!!! PREV KERNEL MODE!!
010226 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
010232 106506 MFPD KSP ;-(KSP)+KSP
010234 022767 000500 170234 CMP #KPTR,KPTR-2 ;TEST THAT VALUE OF KERNEL STACK POINTER
010242 001401 BEQ .+4 ;WAS PUSHED ONTO KERNEL STACK
010244 000000 HLT ;ERROR!

;-(KSP)+SSP,MFPD
†61: SCOPE
010246 010701
010250 012737 014000 177776 MOV #KH+PSH+REG,@#PSW ;KERNEL MODE!!! PREV SUPER MODE!!
010256 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
010262 005016 CLR (KSP)
010264 006606 MTPD SSP ;SET SUPER STACK POINTER SSP+(KSP)+
010266 005166 177776 COM -2(KSP) ;PRESET KERNEL STACK
010272 106506 MFPD SSP ;-(KSP)+SSP
010274 022706 000500 CMP #KPTR,KSP ;CHECK THAT KERNEL STACK POINTER
010300 001401 BEQ .+4 ;IS CORRECT
010302 000000 HLT ;ERROR! INCORRECT KERNEL STACK POINTER
010304 005716 TST (KSP) ;CHECK THAT VALUE OF SUPER STACK POINTER
010306 001401 BEQ .+4 ;WAS PUSHED ONTO KERNEL STACK
010310 000000 HLT ;ERROR!

;-(KSP)+USP,MFPD
†62: SCOPE
010312 010701
010314 012737 034000 177776 MOV #KH+PUH+REG,@#PSW ;KERNEL MODE!!! PREV USER MODE!!
010322 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
010326 012716 177777 MOV #1,(KSP)
010332 106606 MTPD USP ;SET USER STACK POINTER USP+(KSP)+
010334 005166 177776 COM -2(KSP) ;PRESET KERNEL STACK
010340 106506 MFPD USP ;-(KSP)+USP
010342 022716 177777 CMP #1,(KSP) ;CHECK THAT USER STACK POINTER WAS
010346 001401 BEQ .+4 ;PUSHED ONTO KERNEL STACK
010350 000000 HLT ;ERROR!

;-(SSP)+SSP,MFPD
†63: SCOPE
010352 010701
010354 012737 014000 177776 MOV #KH+PSH+REG,@#PSW ;KERNEL MODE!!! PREV SUPER MODE!!
010362 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK POINTER
010366 012716 000600 MOV #SPTR,(KSP) ;SET KERNEL STACK
010372 106606 MTPD SSP ;PUSH TOP WORD ON KERNEL STACK (#SPTR)
;INTO SUPER STACK POINTER SSP+(KSP)+
;SUPER MODE!!!, PREV SUPER MODE!!
010374 052737 040000 177776 BIS #SH,@#PSW
010382 106506 MFPD SSP ;-(SSP)+SSP
010404 042737 140000 177776 BIC #UH,@#PSW ;KERNEL MODE!!! PREV SUPER MODE!!
010412 106506 MFPD SSP ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
010414 022716 000576 CMP #SPTR-2,(KSP) ;CHECK THAT SUPER STACK POINTER WAS
010420 001401 BEQ .+4 ;PUSHED PROPERLY (ONCE)
010422 000000 HLT ;ERROR!
010424 022767 000600 170144 CMP #SPTR,SPTR-2 ;CHECK THAT VALUE OF SUPER STACK PONTER
010432 001401 BEQ .+4 ;WAS PUSHED ONTO SUPER STACK
010434 000000 HLT ;ERROR!

```

E03

Address	PC	PSW	SP	Instruction	Comments
:-(SSP)+USP MFPO					
↑64:				SCOPE	
010436	010701			MOV @PSW+REG,@PSW	:KERNEL MODE!!! PREV SUPER MODE!!
010440	012737	014000	177776	MOV @KPTR,KSP	:SET KERNEL STACK POINTER
010446	012706	000500		MOV @SPTR,(KSP)	
010452	012716	000600		MTPD SSP	:SET SUPER STACK POINTER
010456	106606			BIS @PUM,@PSW	:KERNEL MODE!!!, PREV USER MODE!!
010460	052737	030000	177776	CLR (KSP)	
010466	005016			MTPD USP	:SET USER STACK POINTER=0
010470	106606			BIS @SM,@PSW	:SUPER MODE!!!, PREV USER MODE!!
010472	052737	040000	177776	MOV @-1,SPTR-2	:PRESET SUPER STACK
010477	012767	177777	170070	MFPD USP	:PUSH USER STACK POINTER ONTO SUPER STACK
010506	106506			BIC @UM+BIT15,@PSW	:KERNEL MODE!!!, PREV SUPER MODE!!
010510	042737	160000	177776	MFPD SSP	:PUSH SUPER STACK POINTER ONTO KERNEL STACK
010516	106506			CMP @SPTR-2,(KSP)	:CHECK THAT SUPER STACK POINTER WAS
010520	022716	000576		BEQ .+4	:PUSHED ONCE
010524	001401			HLT	:ERROR!
010526	000000				
010530	005767	170042		TST SPTR-2	:CHECK THAT USER STACK POINTER
010534	001401			BEQ .+4	:WAS PUSHED ONTO SUPER STACK
010536	000000			HLT	:ERROR!
:-(USP)+USP MFPO					
↑65:				SCOPE	
010540	010701			MOV @PUM,@PSW	:KERNEL MODE!!!, PREV USER MODE!!
010542	012737	030000	177776	MOV @KPTR,KSP	:SET KERNEL STACK POINTER
010550	012706	000500		MOV @UPTR,(KSP)	
010554	012716	000700		MTPD USP	:SET USER STACK POINTER
010560	106606			CLR UPTR-2	
010562	0067	170110		BIS @UM,@PSW	:USER MODE!!!, PREV USER MODE!!!
010566	052737	140000	177776	MFPD USP	:PUSH USER STACK POINTER ONTO USER STACK
010574	106506			BIC @UM,@PSW	:KERNEL MODE!!!, PREV USER MODE!!
010576	042737	140000	177776	MFPD USP	:PUSH USER STACK POINTER ONTO KERNEL STACK
010604	106506			CMP @UPTR-2,(KSP)	:CHECK THAT USER STACK POINTER WAS
010606	022716	000676		BEQ .+4	:PUSHED PROPERLY (ONCE)
010612	001401			HLT	:ERROR!
010614	000000				
010616	022767	000700	170052	CMP @UPTR,UPTR-2	:CHECK THAT USER STACK POINTER IS ON THE
010624	001401			BEQ .+4	:USERS STACK
010626	000000			HLT	:ERROR!
:-(KSP)+KSP MFPI					
↑66:				SCOPE	
010630	010701			CLR @PSW	:KERNEL MODE!!!, PREV KERNEL MODE!!
010632	005037	177776		MOV @KPTR,KSP	:SET KERNEL STACK POINTER
010636	012706	000500		MFPD KSP	:PUSH KERNEL STACK POINTER ONTO KERNEL
010642	006506				:STACK
010644	022767	000500	167624	CMP @KPTR,KPTR-2	:CHECK RESULT
010652	001401			BEQ .+4	
010654	000000			HLT	:ERROR!
:-(KSP)+SSP MFPI					
↑67:				SCOPE	
010656	010701			MOV @PSW+REG,@PSW	:KERNEL MODE!!!, PREV SUPER MODE!!
010660	012737	014000	177776	MOV @KPTR,KSP	:SET KERNEL STACK POINTER
010666	012706	000500		CLR (KSP)	
010672	005016			MTPD SSP	:SET SUPER STACK POINTER
010674	006606			COM -2(KSP)	:PRESET KERNEL STACK
010676	005166	177776			

F03

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010702	005506			MFPI	SSP	: PUSH SUPER STACK POINTER ONTO KERNEL STACK
010704	005706	000500		CMP	#KPTR, KSP	: CHECK THAT KERNEL STACK POINTER IS CORRECT
010710	001401			BEQ	.+4	
010712	005706			HLT		: ERROR! INCORRECT KERNEL STACK POINTER
010714	005716			TST	(KSP)	: CHECK THAT SUPER STACK POINTER
010716	001401			BEQ	.+4	: WAS PUSHED ONTO KERNEL STACK
010720	000000			HLT		: ERROR!
:-(KSP)+USP MFPI						
010722	010701			↑70: SCOPE		
010724	012737	034000	177776	MOV	#PUM+REG, @#PSW	: KERNEL MODE!!! PREV USER MODE!!
010732	012706	000500		MOV	#KPTR, KSP	: SET KERNEL STACK POINTER
010736	012716	177777		MOV	#-1, (KSP)	
010742	005506			HTPI	USP	: SET USER STACK POINTER
010744	005166	177776		COM	-2(KSP)	: PRESET KERNEL STACK
010750	005506			MFPI	USP	: PUSH USER STACK POINTER ONTO KERNEL STACK
010752	022716	177777		CMP	#-1, (KSP)	: CHECK RESULT
010756	001401			BEQ	.+4	
010760	000000			HLT		: ERROR! USER STACK POINTER NOT ON KERNEL STACK
:-(SSP)+SSP MFPI						
010762	010701			↑71: SCOPE		
010764	012737	014000	177776	MOV	#PSW+REG, @#PSW	: KERNEL MODE!!! PREV SUPER MODE!!
010772	012706	000500		MOV	#KPTR, KSP	: SET KERNEL STACK POINTER
010776	012716	000600		MOV	#SPTR, (KSP)	
011002	005506			HTPI	SSP	: SET SUPER STACK
011004	012737	040000	177776	BIS	#SH, @#PSW	: SUPER MODE!!! PREV SUPER MODE!!
011012	005506			MFPI	SSP	: PUSH SUPER STACK POINTER ONTO SUPER STACK
011014	042737	140000	177776	BIC	#UM, @#PSW	: KERNEL MODE!!! PREV SUPER MODE!!
011022	005506			MFPI	SSP	: GET SUPER STACK POINTER
011024	022716	000576		CMP	#SPTR-2, (KSP)	: CHECK THAT SUPER STACK POINTER WAS
011030	001401			BEQ	.+4	: PUSHED PROPERLY (ONCE)
011032	000000			HLT		: ERROR! INCORRECT SUPER STACK POINTER
011034	022767	000600	167534	CMP	#SPTR, SPTR-2	: CHECK THAT SUPER STACK POINTER WAS
011042	001401			BEQ	.+4	: PUSHED ONTO SUPER STACK
011044	000000			HLT		: ERROR!
:-(SSP)+USP MFPI						
011046	010701			↑72: SCOPE		
011050	012737	014000	177776	MOV	#PSW+REG, @#PSW	: KERNEL MODE!!! PREV SUPER MODE!!
011056	012706	000500		MOV	#KPTR, KSP	: SET KERNEL STACK POINTER
011062	012716	000600		MOV	#SPTR, (KSP)	
011066	005506			HTPI	SSP	: SET SUPER STACK POINTER
011070	022737	030000	177776	BIS	#PUM, @#PSW	: KERNEL MODE!!!, PREV USER MODE!!
011076	005016			CLR	(KSP)	
011100	005506			HTPI	USP	: SET USER STACK POINTER = 0
011102	012737	040000	177776	BIS	#SH, @#PSW	: SUPER MODE!!!, PREV SUPER MODE!!
011110	005506			MFPI	USP	: PUSH USER STACK POINTER ONTO SUPER STACK
011112	042737	160000	177776	BIC	#UM+BIT13, @#PSW	: KERNEL MODE!!!, PREV SUPER MODE!!!
011120	005506			MFPI	SSP	: PUSH SUPER STACK POINTER ONTO KERNEL STACK
011122	022716	000576		CMP	#SPTR-2, (KSP)	: CHECK THAT SUPER STACK POINTER IS
011126	001401			BEQ	.+4	: CORRECT
011130	000000			HLT		: ERROR!
011132	005767	167440		TST	SPTR-2	: CHECK THAT USER STACK POINTER IS ON
011136	001401			BEQ	.+4	: SUPER STACK


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011140 000000          HLT          ;ERROR!

;-(USP)+USP,MFPI
↑73:  SCOPE
011142 010701          MOV      @PUM+REG,@PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
011144 012737 004000 177776  MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
011152 012706 000500          MOV      @UPTR,(KSP)
011156 012716 000700          MTPU    USP            ;SET USER STACK POINTER
011162 006606          CLR      UPTR-2        ;PRESET USER STACK
011164 005067 167506          BIS      @UM,@PSW      ;USER MODE!!!,PREV USER MODE!!
011170 022737 140000 177776  MFPI    USP            ;-(USP)+USP
011176 005506          BIC      @UM,@PSW      ;KERNEL MODE!!!
011200 042737 140000 177776  MFPI    USP            ;GET USER STACK POINTER
011206 006506          CMP      @UPTR-2,(KSP) ;CHECK THAT USER STACK POINTER WAS
011210 022716 000676          BEQ     .+4            ;PUSHED ONCE
011214 001401          HLT
011216 000000          HLT
011220 022767 000700 167450  CMP      @UPTR,UPTR-2 ;CHECK THAT USER STACK POINTER WAS PUSHED
011226 001401          BEQ     .+4            ;ONTO USER STACK
011230 000000          HLT          ;ERROR!

;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
↑74:  SCOPE
011232 010701          MOV      @IM,@PSW      ;ILLEGAL MODE!!!
011234 012737 100000 177776  MOV      @PSW,R0        ;GET ILLEGAL MODE
011242 013700 177776          CLR      @PSW
011246 005037 177776          CMP      @IM,R0        ;KERNEL MODE!!
011252 022700 100000          BEQ     .+4            ;CHECK THAT ILLEGAL MODE WAS SET
011256 001401          HLT
011260 000000          HLT          ;INTO STATUS

;TEST THAT KERNEL CAN GET DATA FROM SUPER STACK
↑75:  SCOPE
011262 010701          MOV      @KM+PSW+REG,@PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
011264 012737 014000 177776  MOV      @KPTR,KSP      ;SET KERNEL STACK POINTER
011272 012706 000500          MOV      @SPTR,(KSP)
011276 012716 000600          MTPD    SSP            ;SET SUPER STACK POINTER
011302 106606          MOV      @-1,SPTR      ;PRESET SUPER STACK
011304 012767 177777 167266  CLR      (KSP)         ;PRESET KERNEL
011312 005016          CLR      -2(KSP)       ;STACK
011314 000366 177776          SCC
011320 000277          MFPO    SSP            ;PRESET CONDITION CODES
011322 100706          MFPO    @2(KSP)        ;GET SUPER STACK POINTER
011324 106576 000000          NOP                    ;LIKE MOV @2(6),-(6)
011330 000240          MOV      @PSW,R12      ;SAVE STATUS RESULT
011332 013702 177776          CMP      @SPTR,KPTR    ;TEST THAT SUPER STACK POINTER WAS PUSH-
011336 022767 000600 167134  BEQ     .+4            ;ONTO KERNEL STACK BY MFPO SSP INST.
011344 001401          HLT          ;ERROR!
011346 000000          HLT
011350 022706 000476          CMP      @KPTR-2,KSP   ;TEST THAT KERNEL STACK POINTER IS
011354 001401          BEQ     .+4            ;POSITIONED PROPERLY
011356 000000          HLT          ;ERROR! INCORRECT KERNEL STACK POINTER
011360 005216          INC      (KSP)         ;CHECK THAT DATA WAS MOVED TO KERNEL
011362 001401          BEQ     .+4            ;STACK
011364 000000          HLT          ;ERROR! INCORRECT DATA MOVED TO STACK
011366 022702 014011          CMP      @KM+PSW+REG+N+C,R12 ;CHECK STATUS RESULT
011372 001401          BEQ     .+4
011374 000000          HLT          ;ERROR! INCORRECT STATUS

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:TEST THAT KERNEL CAN GET DATA FROM USER STACK
†76: SCOPE
011376 010701          MOV      #KH+PUM+REG, @#PSW      ;KERNEL MODE!!!  PREV SUPER MODE!!
011400 012737 034000 177776  MOV      #KPTR, KSP              ;SET KERNEL STACK POINTER
011406 012706 000500          MOV      #UPTR, (KSP)
011412 012716 000700          MTPD    USP                      ;SET USER STACK POINTER
011416 106606          CLR      UPTR                    ;PRESET USER STACK
011420 000000 167254          CLR      (KSP)                  ;PRESET KERNEL STACK
011424 000000 177777 177776  MOV      @-1, -2(KSP)
011426 012766          MFPD    USP                      ;-(KSP)+USP
011434 106506          MFPD    @ (KSP)                 ;LIKE MOV @ (6), -(6)
011436 100000 000000          NOP
011442 000000 177776          MOV      @#PSW, R13              ;SAVE STATUS RESULT
011444 013703 167022          CMP      #UPTR, KPTR            ;CHECK THAT USER STACK POINTER WAS
011450 002767          BEQ     .+4                      ;PUSHED ONTO KERNEL STACK
011456 001401          HLT
011460 000000          CMP      #KPTR-2, KSP           ;CHECK THAT KERNEL STACK POINTER IS POS-
011462 000000 000476          BEQ     .+4                      ;ITIONED PROPERLY
011466 001401          HLT                               ;ERROR! INCORRECT KERNEL STACK POINTER
011470 000000          TST     (KSP)                   ;CHECK THAT CORRECT DATA
011472 005716          BEQ     .+4                      ;WAS PUSHED ONTO KERNEL STACK
011474 001401          HLT                               ;ERROR!
011476 000000          CMP      #KH+PUM+REG+Z, R13     ;CHECK STATUS
011500 022703 034004          BEQ     .+4
011504 001401          HLT                               ;ERROR! INCORRECT STATUS
011506 000000

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:TEST THAT SUPERVISOR CAN GET DATA FROM USER STACK
†77: SCOPE
011510 010701          MOV      #SM+PUM+REG, @#PSW     ;SUPER MODE!!!  PREV USER MODE!!
011512 012737 074000 177776  MOV      #SPTR, SSP              ;SET SUPER STACK POINTER
011520 012706 000600          MOV      #UPTR, (SSP)
011524 012716 000700          MTPD    USP                      ;SET USER STACK POINTER
011530 106606          CLR      @#UPTR                 ;PRESET USER STACK
011532 000000 000700          CLR      (SSP)                  ;AND SUPER STACK
011536 000000 177777 177776  MOV      @-1, -2(SSP)
011540 012766          SCC
011546 000277          MFPD    USP                      ;PRESET CC'S
011550 106506          MFPD    @ (SSP)                 ;GET USER STACK POINTER
011552 106576 000000          NOP                               ;LIKE MOV @-(6), -(6)
011556 000240          MOV      @#PSW, R14              ;SAVE STATUS
011560 013704 177776          MOV      #PSM+REG, @#PSW       ;KERNEL MODE!!!  PREV SUPER MODE!!
011564 012737 014000 177776  MOV      #KPTR, KSP              ;SET KERNEL STACK POINTER
011572 012706 000500          MFPD    SSP                      ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
011576 106506          CMP      #SPTR-2, (KSP)         ;CHECK THAT SUPER STACK POINTER IS POS-
011600 022716 000576          BEQ     .+4                      ;ITIONED PROPERLY (1 POP, 2 PUSHES)
011604 001401          HLT                               ;ERROR! INCORRECT SUPER STACK POINTER
011606 000000          CMP      #UPTR, @#SPTR         ;CHECK THAT MFPD USP PUSHED USER STACK
011610 022737 000700 000600          BEQ     .+4                      ;ONTO SUPER STACK
011616 001401          HLT                               ;ERROR!
011620 000000          TST     @#SPTR-2               ;CHECK THAT DATA ON USER STACK WAS PUSH-
011622 005737 000576          BEQ     .+4                      ;ONTO SUPER STACK (MFPD @ (SSP))
011626 001401          HLT                               ;ERROR!
011630 000000          CMP      #SM+PUM+REG+Z+C, R14   ;CHECK STATUS RESULT
011632 022704 074005          BEQ     .+4
011636 001401          HLT                               ;ERROR! INCORRECT STATUS AFTER MFPD @ (SSP)
011640 000000

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:TEST THAT INTERRUPT SEQUENCE USER TO SUPERVISOR (VIA TTY)
↑100:  SCOPE
011642 010701
011644 012737 040000 177776      MOV      #SM, @PSW          ;SUPER MODE!!!
011652 012706 000600          MOV      #SPTR, SSP       ;SET SUPER STACK POINTER
011656 012737 002340 177776      MOV      #PTY?, @PSW      ;KERNEL MODE!!!, PRIORITY LEVEL 7
011664 012737 000100 177564      MOV      #BIT6, @TPS      ;SET IE BIT IN TELEPRINTER STATUS
011672 012737 011722 000064      MOV      @T100A, @TPVEC   ;LOAD INTERRUPT VECTOR
011700 012767 044000 166160      MOV      #SM+REG, TPVEC+2 ;AND 'NEW' STATUS
011706 012737 140000 177776      MOV      #UM, @PSW        ;USER MODE!!!, ALLOW TTY INTERRUPT
011714 012737 177776      T100AA: CLR      @PSW        ;KERNEL MODE!!!
011720 000000          HLT                      ;ERROR! INTERRUPT FAILED
011722 013767 177776 167052      T100A: MOV      @PSW, TEMP   ;SAVE 'NEW' STATUS
011730 012737 010000 177776      MOV      #PSW, @PSW       ;KERNEL MODE!!!, PREV SUPER MODE!!
011736 005067 165622          CLR      TPS              ;CLEAR IE BIT
011742 106506          MFPD      SSP             ;PUSH SUPER STACK PTR ONTO KERNEL STACK
011744 022767 074000 167030      CMP      #SM+PUM+REG, TEMP;CHECK THAT 'NEW' STATUS IS CORRECT
011752 001401          BEQ      .+4
011754 000000          HLT                      ;ERROR! INCORRECT STATUS AFTER INTERRUPT
011756 022716 000574          CMP      #SPTR-4, (KSP)   ;CHECK SUPER STACK POINTER
011762 001401          BEQ      .+4             ;(2 PUSHES)
011764 000000          HLT                      ;ERROR! INCORRECT SUPER STACK POINTER
011766 022737 011714 000574      CMP      @T100AA, @SPTR-4;CHECK RETURN PC ON SUPER STACK
011774 001401          BEQ      .+4
011776 000000          HLT                      ;ERROR! RETURN PC NOT ON SUPER STACK
012000 022767 140000 166570      CMP      #UM, SPTR-2      ;CHECK THAT STATUS WAS SAVED ON
012006 001401          BEQ      .+4             ;SUPER STACK
012010 000000          HLT                      ;ERROR! OLD STATUS NOT ON SUPER STACK

:TEST TRAP & RETURN USER-SUPER-USER
↑101:  SCOPE
012012 010701
012014 012737 074000 177776      MOV      #SM+PUM+REG, @PSW;SUPER MODE!!!, PREV USER MODE!!
012022 012706 000600          MOV      #SPTR, SSP       ;SET SUPER STACK POINTER
012026 012737 012150 000020      MOV      @T101A, @IOTVEC  ;LOAD IOT TRAP VECTOR
012034 012737 044000 000022      MOV      #SM+REG, @IOTVEC+2;AND 'NEW' STATUS
012042 005002          CLR      R12
012044 012737 144000 177776      MOV      #UM+REG, @PSW    ;USER MODE!!!
012052 000004          IOT                      ;TRAP
012054 013767 177776 166720      T101AA: MOV      @PSW, TEMP   ;SAVE 'OLD' STATUS RETURN BY RTI
012062 012737 014000 177776      MOV      #PSW+REG, @PSW   ;KERNEL MODE!!!, PREV SUPER MODE!!
012070 022767 012054 166476      CMP      @T101AA, SPTR-4  ;CHECK THAT RETURN PC WAS SAVED ON SUPER
012076 001401          BEQ      .+4             ;STACK
012100 000000          HLT                      ;ERROR! RETURN PC NOT SAVED ON SUPER STACK
012102 022767 144000 166466      CMP      #UM+REG, SPTR-2  ;CHECK 'OLD' STATUS SAVED ON SUPER STACK
012110 001401          BEQ      .+4
012112 000000          HLT                      ;ERROR! INCORRECT STATUS SAVED
012114 022767 174000 166660      CMP      #UM+PUM+REG, TEMP;CHECK RETURNED 'OLD' STATUS
012122 001401          BEQ      .+4
012124 000000          HLT                      ;ERROR! RETURNED 'OLD' STATUS INCORRECT
012126 106506          MFPD      SSP             ;GET SUPER STACK POINTER
012130 022716 000600          CMP      #SPTR, (KSP)     ;CHECK SUPER STACK POINTER
012134 001401          BEQ      .+4             ;(2 PUSHES, 2 POPS)
012136 000000          HLT                      ;ERROR! INCORRECT SSP AFTER TRAP & RETURN
012140 005102          COM      R12             ;CHECK THAT COM R12 WAS EXECUTED
012142 001401          BEQ      .+4             ;IN IOT ROUTINE AT T101A
012144 000000          HLT                      ;ERROR!
012146 000402          BR       T101EX         ;EXIT TEST

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012150 005102
012152 000002

T101A: COM R12 ;COMPLEMENT E12
RTI ;RETURN

012154 000240

T101EX: NOP

;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC

012156 010701
012160 012737 010000 177776
012166 012706 000500
012172 005016
012174 012737 001002 001004
012202 012767 177777 166572
012210 000277
012212 106677 166566
012216 013703 177776
012222 022703 010005
012226 001401
012230 000000
012232 005737 001002
012236 001401
012240 000000

T102: SCOPE
MOV #KM+PSM, @#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
MOV #KPTR, KSP ;SET KERNEL STACK PTR
CLR (KSP) ;PUT DATA ON STACK
MOV @TEMP, @TEMP+2 ;LOAD ADDRESS
MOV @-1, TEMP ;PRESET DATA
SCC ;PRESET CC'S
MTPD @TEMP+2 ;TEMP+(KSP)+
MOV @#PSW, R3 ;CHECK CC'S
CMP #KM+PSM+Z+C, R3 ;CHECK CC'S
BEQ .+4
HLT ;ERROR! INCORRECT CC'S AFTER MTPD
TST @TEMP ;CHECK RESULT
BEQ .+4
HLT ;ERROR! INCORRECT RESULT

;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7

012242 010701
012244 012737 034000 177776
012252 012706 000500
012256 012716 177777
012262 012704 177776
012266 005067 166510
012272 012767 001002 166504
012300 006674 001006
012304 013703 177776
012310 022706 000502
012314 001401
012316 000000
012320 022703 034010
012324 001401
012326 000000
012330 005267 166446
012334 001401
012336 000000

T103: SCOPE
MOV #KM+PUM+REG, @#PSW ;KERNEL MODE!!!
MOV #KPTR, KSP ;SET KERNEL STACK PTR
MOV @-1, (KSP) ;LOAD DATA ONTO STACK
MOV @-2, R14 ;LOAD INDEX REGISTER
CLR TEMP ;PRESET DATA
MOV @TEMP, TEMP+2
MTPD @TEMP+4(R14) ;TEMP+(KSP)+
MOV @#PSW, R13 ;SAVE STATUS RESULT
CMP #KPTR+2, KSP ;CHECK THAT KSP POPPED
BEQ .+4
HLT ;ERROR! INCORRECT STACK PTR
CMP #PUM+REG+N, R13 ;CHECK STATUS RESULT
BEQ .+4
HLT ;ERROR! INCORRECT STATUS
INC TEMP ;CHECK RESULT
BEQ .+4
HLT ;ERROR! INCORRECT RESULT

;TEST THAT MTPD/I CAN LOAD PC

012340 010701
012342 012737 010000 177776
012350 012706 000500
012354 012716 012366
012360 000277
012362 106607
012364 000000
012366 100001
012370 000000
012372 103401
012374 000000

T104: SCOPE
MOV #KM+PSM, @#PSW ;KERNEL MODE!!!
MOV #KPTR, KSP ;SET KERNEL STACK PTR
MOV @T104A, (KSP) ;PUT NEW PC ON STACK
SCC ;PRESET CC'S
MTPD PC ;PC+(KSP)+
HLT ;ERROR! MTPD FAILED TO SET PC
T104A: BPL .+4
HLT ;ERROR! 'N' FAILED TO CLEAR IN STATUS
BCS .+4
HLT ;ERROR! 'C' WAS CLEARED BY MTPD


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012646 010603 T110A: MOV SSP,R13 ;SAVE SUPER STACK PTR
012650 042737 140000 177776 BIC #UM,#PSW ;KERNEL MODE!!!
012656 022703 000574 CMP #SPTR-4,R13 ;CHECK SUPER STACK PTR
012662 001401 BEQ .+4
012664 000000 HLT ;ERROR! INCORRECT SSP AFTER ERROR TRAP
012666 022723 012640 CMP #T110AA,(R13)+ ;CHECK RETURN PC ON SUPER STACK
012672 001401 BEQ .+4
012674 000000 HLT ;ERROR! RETURN PC NOT ON SUPER STACK
012676 022713 040000 CMP #SM,(R13) ;CHECK SAVED STATUS
012702 001401 BEQ .+4
012704 000000 HLT ;ERROR! INCORRECT STATUS SAVED ON STACK

```

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;USER MODE, OOD ADDRESS
012706 010701 T111: SCOPE
012710 012737 144000 177776 MOV #UM+REG,#PSW ;USER MODE!!!
012716 012706 000700 MOV #UPTR,USP ;SET USER STACK PTR
012722 012737 012750 000004 MOV #T111A,#ERRVEC ;LOAD ERROR TRAP VECTOR
012730 012737 140000 000006 MOV #UM,#ERRVEC+2
012736 106567 165035 MFPD -1 ;OOD ADDRESS SHOULD TRAP
012742 005037 177776 T111AA: CLR #PSW ;KERNEL MODE!!!
012746 000000 HLT ;ERROR! FAILED TO TRAP
012750 010603 T111A: MOV USP,R3 ;SAVE USER STACK PTR
012752 042737 140000 177776 BIC #UM,#PSW ;KERNEL MODE!!!
012760 022703 000674 CMP #UPTR-4,R3 ;CHECK USER STACK PTR
012764 001401 BEQ .+4
012766 000000 HLT ;ERROR! INCORRECT USER STACK POINTER
012770 022713 012742 CMP #T111AA,(R3) ;CHECK RETURN ADDRESS ON USER STACK
012774 001401 BEQ .+4
012776 000000 HLT ;ERROR! RETURN PC NOT ON USER STACK
013000 012737 000006 000004 MOV #ERRVEC+2,#ERRVEC;RESTORE ERROR TRAP TO HALT
013006 005067 164774 CLR ERRVEC+2

```

```

;TEST THAT MTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
;KERNEL MODE, PREVIOUS SUPER MODE
013012 010701 T112: SCOPE
013014 012737 010000 177776 MOV #KM+PSM,#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
013022 012706 000500 MOV #KPTR,KSP ;SET KERNEL STACK PTR
013026 012746 000600 MOV #SPTR,-(KSP)
013032 106606 MTPD SSP ;SET SUPER STACK PTR
013034 012746 001002 MOV #TEMP,-(KSP) ;PUT ADDRESS ON THE STACK
013040 012746 177777 MOV #-1,-(KSP) ;PUT DATA ON THE STACK
013044 005037 001002 CLR #TEMP ;PRESET DATA
013050 106636 MTPD @(KSP)+ ;MOVE #-1 TO TEMP
013052 022706 000500 CMP #KPTR,KSP ;CHECK STACK PTR AFTER MTPD
013056 001401 BEQ .+4
013060 000000 HLT ;ERROR! INCORRECT STACK PTR AFTER MTPD
013062 005267 165714 INC TEMP ;CHECK THAT DATA WAS MOVED TO TEMP
013066 001401 BEQ .+4
013070 000000 HLT ;ERROR! DATA NOT IN TEMP
013072 106506 MFPD SSP ;GET SUPER STACK PTR
013074 022716 000600 CMP #SPTR,(KSP) ;CHECK THAT SUPER STACK PTR NOT CHANGED
013100 001401 BEQ .+4 ;BY MTPD INSTRUCTION
013102 000000 HLT ;ERROR! SSP WAS CHANGED BY MTPD INST.

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;CHECK THAT MTPD CAN LOAD DATA TO AN ADDRESS VIA THE STACK
;SUPER MODE, PREV USER MODE

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M03

MAINDEC-11-DCKBO-A PROCESSOR STATES TEST
DCKBOA.P11

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013104 010701          T113: SCOPE
013106 012737 070000 177776 MOV    #SM+PUM,@#PSW ; SUPER MODE!!!  PREV USER MODE!!
013114 012706 000600          MOV    #SPTR,SSP ; SET SUPER STACK PTR
013120 012746 000700          MOV    #UPTR,-(SSP)
013124 106606          MTPD   USP ; SET USER STACK PTR
013126 012746 001002          MOV    #TEMP,-(SSP) ; PUT ADDRESS ON THE STACK
013132 012746 177777          MOV    #-1,-(SSP) ; PUT DATA ON THE STACK
013136 005037 001002          CLR    @#TEMP ; PRESET DATA
013142 006676 000000          MTPI  @#(SSP) ; MOVE #-1 TO TEMP
013146 012737 010000 177776 MOV    #PSM,@#PSW ; KERNEL MODE!!!  PREV SUPER MODE!!
013154 106506          MFPD   SSP ; GET SUPER STACK PTR
013156 022726 000576          CMP    #SPTR-2,(KSP)+ ; CHECK SUPER STACK PTR AFTER MTPI
013162 001401          BEQ    .+4
013164 000000          HLT
013166 012737 030000 177776 MOV    #PUM,@#PSW ; ERROR! INCORRECT SUPER STACK PTR
013174 106506          MFPD   USP ; KERNEL MODE!!!  PREV USER MODE!!
013176 022726 000700          CMP    #UPTR,(KSP)+ ; GET USER STACK PTR
013202 001401          BEQ    .+4 ; CHECK THAT USER STACK PTR WAS NOT CHANGED
013204 000000          HLT
013206 005267 165570          INC    TEMP ; ERROR! USER STACK PTR CHANGED BY MTPI
013212 001401          BEQ    .+4 ; CHECK THAT DATA WAS MOVED TO TEMP
013214 000000          HLT ; ERROR! INCORRECT DATA IN TEMP AFTER MTPI

```

; TEST THAT MFPI CAN GET DATA FROM AN ADDRESS VIA THE STACK

; KERNEL MODE, PREV SUPER MODE

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013216 010701          T114: SCOPE
013220 012737 010000 177776 MOV    #KM+PSM,@#PSW ; KERNEL MODE!!!  PREV SUPER MODE!!
013226 012706 000500          MOV    #KPTR,KSP ; SET KERNEL STACK PTR
013232 012746 000600          MOV    #SPTR,-(KSP)
013236 106606          MTPD   SSP ; SET SUPER STACK PTR
013240 005066 177776          CLR    -2(KSP) ; PRESET DATA ON THE STACK
013244 012716 001002          MOV    #TEMP,(KSP) ; PUT ADDRESS ON THE STACK
013250 012737 177777 001002 MOV    #-1,@#TEMP ; LOAD DATA INTO ADDRESS
013256 006576 000000          MFPI  @#(KSP) ; MOVE TEMP TO STACK
013262 022706 000476          CMP    #KPTR-2,KSP ; CHECK STACK PTR AFTER MFPI
013266 001401          BEQ    .+4
013270 000000          HLT ; ERROR! INCORRECT STACK PTR AFTER MFPI
013272 022716 177777          CMP    #-1,(KSP) ; CHECK DATA ON THE STACK
013276 001401          BEQ    .+4
013300 000000          HLT ; ERROR! INCORRECT DATA MOVED ONTO THE STACK
013302 006506          MFPI  SSP ; GET SUPER STACK PTR
013304 022726 000600          CMP    #SPTR,(KSP)+ ; CHECK THAT SUPER STACK PTR WAS NOT
013310 001401          BEQ    .+4 ; BY MFPI
013312 000000          HLT ; ERROR! INCORRECT SSP

```

; TEST THAT MFPD CAN GET DATA FROM AN ADDRESS VIA THE STACK

; SUPER MODE, PREV USER MODE

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013314 010701          T115: SCOPE
013316 012737 070000 177776 MOV    #SM+PUM,@#PSW ; SUPER MODE!!!  PREV USER MODE!!
013324 012706 000600          MOV    #SPTR,SSP ; SET SUPER STACK PTR
013330 012746 000700          MOV    #UPTR,-(SSP)
013334 106606          MTPD   USP ; SET USER STACK PTR
013336 012726 001002          MOV    #TEMP,(SSP)+ ; PUT THE ADDRESS ON THE STACK
013342 005066 177774          CLR    -4(SSP) ; PRESET DATA ON THE STACK
013346 012737 177777 001002 MOV    #-1,@#TEMP ; PRESET MEMORY DATA
013354 106556          MFPD   @-(SSP) ; MOVE TEMP TO THE STACK

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013622	026727	165152	012000		CMP	ICNT, #12000	;12000 PASSES COMPLETED?
013623	001401				BEG	DONE	
013624	000157	165174			JMP	BEGIN	
013625	012767	000007	163722	DONE:	MOV	#7, T7B	;RING BELL
013626	105767	163714			TSTB	TPS	
013627	100375				BPL	-4	
013628	013702	000042			MOV	#42, R2	;GET DETAPE MONITOR RETURN ADDRESS
013629	001404				BEG	DONE1	;DO NOT RETURN IF (42)=0
013630	004712				JSR	7, (2)	;RETURN TO DETAPE MONITOR
013631	000240				NOP		;OVERLAY AREA FOR
013632	000240				NOP		;ACT11
013633	000240				NOP		
013634	000240				NOP		
013635	000240				NOP		
013636	000240				NOP		
013637	000167	165116		DONE1:	JMP	START	
013638	000001				.END		

BEGIN	001032	225#	2058																
BIT13 =	020000	186#	1508	1601															
BIT14 =	040000	185#																	
BIT15 =	100C30	184#																	
BIT6 =	000,00	187#	256	265	272	281	498	504	569	571	1725								
C =	003001	200#	667	670	712	759	809	856	876	1162	1176	1181	1232	1278					
		1660	1716	1792	1843	1858													
DISPLA=	177570	175#	226#																
DONE	013636	2057	2059#																
DONE1	013670	2063	2089#																
ETVEEC=	000030	158#	355#	356#	409#	410#	424#	425#	552#	553#	588#	589#							
END	013676	2055#																	
ERRVEC=	000004	157#	456#	457#	474#	488#	554#	595#	978#	979#	997#	998#	1022#	1023#					
		1048#	1049#	1056#	1065#	1108#	1129#	1146#	1147#	1368#	1369#	1387#	1412#	1866#					
HLT =	000000	1883#	1874#	1904#	1905#	1917#	1918#	2021#	2022#	2051#									
		149#	240	250	264	267	280	283	301	304	307	310	316	330					
		335	338	341	344	350	363	369	372	375	378	384	394	400					
		403	415	420	423	437	443	446	449	467	470	484	487	501					
		507	510	513	516	530	536	539	542	576	581	584	625	628					
		645	648	651	654	672	675	678	692	695	698	714	718	721					
		725	740	743	746	761	764	767	783	786	789	808	811	828					
		831	841	855	858	878	881	884	899	902	918	922	946	958					
		970	981	994	997	1001	1006	1009	1012	1026	1031	1034	1037	1040					
		1056	1058	1061	1073	1077	1080	1096	1101	1104	1115	1120	1123	1137					
		1142	1145	1164	1167	1170	1183	1186	1189	1211	1214	1217	1234	1237					
		1240	1257	1260	1263	1280	1283	1286	1305	1308	1311	1329	1332	1335					
		1354	1357	1360	1373	1376	1379	1382	1397	1401	1404	1407	1410	1426					
		1429	1433	1449	1461	1464	1476	1491	1494	1512	1515	1530	1533	1543					
		1555	1558	1570	1584	1588	1605	1608	1623	1626	1635	1653	1656	1659					
		1662	1679	1682	1685	1688	1709	1712	1715	1718	1730	1737	1740	1743					
		1746	1761	1764	1767	1771	1774	1794	1797	1811	1814	1817	1826	1828					
		1830	1840	1845	1855	1860	1869	1872	1875	1878	1897	1892	1895	1898					
		1908	1913	1916	1933	1936	1940	1951	1962	1965	1980	1983	1987	2004					
		2009	2012	2030	2032	2036	2040	2044	2048										
ICNT	001000	215#	220#	226	2035#	2056													
IM =	100000	192#	1630	1633															
IOTVEC=	000020	160#	323#	324#	351#	636#	637#	1752#	1753#	2023#	2024#	2052#	2053#						
KM =	000000	194#	299	333	465	482	505	525	534	797	817	924	1453	1468					
KPTR =	000500	1480	1639	1660	1666	1686	1784	1783	1801	1821	1923	1970	2000	2005					
		177#	219	225	268	302	305	308	322	336	339	342	458	468					
		475	485	495	508	511	514	522	537	540	635	643	646	664					
		673	684	693	788	818	829	836	976	982	985	1067	1153	1165					
		1173	1184	1298	1306	1416	1424	1445	1447	1454	1459	1469	1481	1499					
		1520	1538	1541	1548	1553	1563	1575	1593	1613	1640	1651	1654	1667					
		1677	1680	1705	1785	1802	1809	1822	1865	1870	1924	1931	1971	1978					
KSP	=%000006	2020	2034																
		146#	219#	225#	288#	308	322#	342	458#	475#	495#	508	522#	635#					
		664#	666#	673	684#	686#	693	798#	799#	818#	819#	829	836#	837#					
		838#	839	910#	925#	976#	977#	982	1052#	1067#	1068#	1153#	1154#	1165					
		1168#	1173#	1174#	1184	1187	1298#	1299#	1306	1309	1365#	1367#	1389#	1390#					
		1402	1416#	1445#	1446	1454#	1455#	1457#	1459	1462	1469#	1470#	1472#	1474					
		1481#	1482#	1489	1499#	1500#	1503#	1510	1520#	1521#	1528	1538#	1539	1548#					
		1549#	1551#	1553	1556	1563#	1564#	1566#	1568	1575#	1576#	1582	1593#	1594#					
		1597#	1603	1613#	1614#	1621	1640#	1641#	1644#	1645#	1648	1654	1657#	1667#					
		1668#	1671#	1672#	1674	1680	1683	1705#	1707	1738	1769	1785#	1786#	1802#					
		1803#	1809	1822#	1823#	1865#	1870	1873	1876	1924#	1925#	1927#	1928#	1930#					

	1931	1938	1955	1960	1971*	1972*	1974*	1975*	1977	1978	1981	1985	2002
N = 000010	2007	2020*	2034	2038	2042	2046	1075	1140	1162	1181	1255	1352	1377
PC = 000007	1660	1812	1838*	1853*	1859	1032	1075	1140	1162	1181	1255	1352	1377
PIRQ = 177772	137*	1625*	1838*	1853*	1859	1032	1075	1140	1162	1181	1255	1352	1377
PIRVEC = 000240	168*	528*	532*	543*	544*	1032	1075	1140	1162	1181	1255	1352	1377
PIR4 = 010000	164*	524*	525*	543*	544*	1032	1075	1140	1162	1181	1255	1352	1377
PKH = 000000	205*	528	525*	543*	544*	1032	1075	1140	1162	1181	1255	1352	1377
PRTY3 = 000140	197*	540	505	505	527	527	638	646	649	1220	1232	499	523
PRTY4 = 000200	152*	494	238	527	527	527	638	646	649	1220	1232	499	523
PRTY7 = 000340	153*	494	238	527	527	527	638	646	649	1220	1232	499	523
PSH = 010000	154*	234	1341	1352	1362	1362	1724	2024	2042	325	339	499	523
	1197	1209	1341	1352	1362	1362	1724	2024	2042	325	339	499	523
	196*	271	278	299	326	326	421	447	465	505	525	594	667
	670	750	759	797	809	809	856	950	1339	1352	1364	1377	1453
	1470	1473	1547	1574	1592	1592	1660	1704	1732	1758	1784	1792	1821
PSH = 177776	1923	1953	1970	2000	2000	2000	1660	1704	1732	1758	1784	1792	1821
	166*	222	234*	236	237*	237*	246	247*	255*	258	260*	271*	274
	277*	284*	291*	295*	297	298*	311*	313*	325*	329*	331	332*	345*
	347*	357*	359*	362*	364	366*	379*	381*	390*	393*	395	397*	411*
	414*	416	417*	431*	433*	436*	438	440*	459*	461*	463	464*	476*
	478*	480	481*	496*	499*	500*	502	503*	523*	527*	529*	531	533*
	549*	560*	578*	583*	594*	606*	622*	627*	638*	641	642*	663*	667*
	669	683*	687*	699	703*	709	711*	722*	729*	735	737*	750*	756
	758*	772*	778	780*	795*	797	802	803*	805*	815*	817*	812	823*
	825*	845*	850	852*	862*	864*	871	873*	875*	878*	894	876*	906*
	908*	909*	912*	913*	915*	924*	924*	927*	929*	936*	938*	941*	943*
	950*	955*	952*	967*	975*	991*	993*	1000*	1003*	1016*	1018*	1025*	1028*
	1041*	1046*	1053*	1065*	1074*	1074*	1087*	1097*	1097*	1109*	1116*	1127*	1130*
	1138	1139*	1156*	1161	1176*	1180	1180	1197*	1201*	1208*	1220*	1224*	1229
	1231*	1245*	1252*	1254*	1264*	1268*	1275	1277*	1292*	1294*	1302	1314*	1316*
	1324	1326*	1339*	1341*	1349	1351*	1364*	1372*	1419*	1422	1423*	1444*	1453*
	1468*	1470*	1475*	1487*	1498*	1502*	1505*	1505*	1519*	1524*	1526*	1537*	1547*
	1562*	1574*	1578*	1580*	1592*	1596*	1599*	1601*	1612*	1617*	1619*	1630*	1631
	1632*	1639*	1650	1666*	1676	1692*	1703	1704*	1722*	1724*	1728*	1729*	1731
	1732*	1750*	1755*	1757	1758*	1784*	1791	1801*	1808	1821*	1834*	1839*	1841
	1842*	1849*	1854*	1856	1857*	1874*	1871*	1876*	1878	1902*	1907*	1910*	1923*
	1945*	1953*	1958*	1970*	1992*	2000*	2005*	2013*	2025*	2027*	2029*	2031*	2050*
PUM = 030000	195*	222	255	262	333	367	401	482	496	514	523	534	540
	549	687	690	729	738	817	864	876	888	897	924	938	962
	1016	1032	1109	1118	1314	1327	1388	1405	1468	1502	1519	1562	1596
	1612	1666	1686	1692	1716	1735	1750	1765	1801	1812	1834	1843	1849
	1858	1945	1958	1992	2005	2042							
PWRUP 001022	222*	837	839	1389	1399								
REDPTR = 000736	181*	222	271	278	357	359	373	389	401	494	505	560	568
REG = 004000	198*	618	636	638	646	649	703	712	991	993	1018	1023	1032
	606	618	636	638	646	649	703	712	991	993	1018	1023	1032
	1050	1065	1075	1087	1099	1109	1118	1130	1156	1162	1176	1181	1201
	1209	1224	1232	1245	1255	1268	1278	1294	1303	1316	1327	1341	1352
	1364	1377	1388	1405	1417	1419	1427	1453	1468	1480	1498	1547	1562
	1574	1592	1612	1639	1660	1666	1686	1692	1704	1716	1727	1735	1750
	1753	1755	1758	1762	1765	1801	1812	1834	1843	1883	1902	2027	
RO = 000000	131*	236*	238	246*	248	258*	262	297*	299	312*	314	331*	333
	346*	348	364*	367	380*	382	416*	421	438*	447	463*	465	480*
	482	531*	534	665*	668*	676	689*	690	735*	738	756*	759	775*
	777*	787	804*	806	824*	826	851*	853	872*	879	894*	897	928*

T12AA	002412	461#	468	
T13	002452	473#		
T13A	002434	474#	490#	
T13AA	002476	478#	465	
T14	002544	491#		
T14A	002624	493#	502#	
T14AA	002616	500#	511	
T15	002722	521#		
T15A	003000	524#	531#	
T15AA	002772	529#	537	
T16	003062	547#		
T16A	003136	556#		
T16B	003142	556#	557#	
T16C	003154	558#	559#	
T16D	003174	561#	562#	
T16E	003206	563#	564#	
T16ERR	003330	554#	533#	
T16F	003250	567#	571#	
T16G	003302	552#	577#	
T16X	003336	582#	587#	
T17	003354	592#		
T17A	003410	598#		
T17B	003422	598#	600#	
T17C	003442	601#	603#	
T17D	003500	607#	609#	
T17E	003522	610#	613#	
T17ERR	003522	595#	627#	
T17F	003542	614#	616#	
T17G	003574	617#	621#	
T17X	003630	626#	629#	
T2	001146	254#		
T20	003646	634#		
T20A	003764	637#	656#	
T20AA	003702	641#	643	
T21	003770	653#	655	662#
T22	004052	682#		
T23	004134	701#		
T24	004240	728#		
T25	004326	749#		
T26	004416	771#		
T27	004506	794#		
T3	001226	270#		
T30	004602	814#		
T31	004676	835#		
T31A	004722	844#		
T31B	005000	861#		
T31C	005106	887#		
T32	005160	905#		
T32A	005242	921#		
T33	005312	935#		
T34	005364	949#		
T35	005422	961#		
T36	005462	974#		
T36A	005520	978#	982#	
T36AA	005516	981#	985	
T37	005542	990#		

T37A	005622	997	1002#
T37AA	005614	1000#	1007
T4	001314	237#	
T4A	001362	289	297#
T4AA	001354	295#	302
T40	005762	1015#	
T40A	005742	1022	1027#
T40AA	005734	1025#	1035
T41	006022	1045#	
T41A	006070	1048	1056#
T41B	006110	1064#	
T41BB	006146	1066	1073#
T42	006174	1083#	
T42A	006250	1086	1096#
T43	006376	1126#	
T43A	006450	1129	1137#
T43B	006304	1106#	
T43BB	006346	1108	1115#
T44	005516	1152#	
T45	005604	1172#	
T46	006670	1196#	
T47	006772	1219#	
T5	001474	321#	
T5A	001540	323	331#
T5AA	001532	329#	336
T50	007102	1243#	
T51	007202	1266#	
T52	007300	1291#	
T53	007402	1313#	
T54	007520	1338#	
T55	007636	1363#	
T55A	007712	1368	1374#
T55AA	007710	1373#	1380
T56	007754	1386#	
T56A	010030	1387	1399#
T56AA	010026	1397#	1408
T57	010106	1415#	
T57A	010212	1418	1436#
T57AA	010142	1422#	1424
T57EX	010216	1435	1438#
T6	001646	354#	
T6A	001720	355	364#
T6AA	001712	362#	370
T60	010220	1443#	
T61	010246	1452#	
T62	010312	1467#	
T63	010352	1479#	
T64	010436	1497#	
T65	010540	1518#	
T66	010630	1536#	
T67	010656	1546#	
T7	002022	387#	
T7A	002062	388	395#
T7AA	002054	393#	398
T70	010722	1561#	
T71	010762	1573#	

L04

MAINDEC-11-DCKBO-A PROCESSOR STATES TEST MACY11 27(732) 03-SEP-76 18:18 PAGE 52
DCKBOA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

TSTB	2060
WAIT	570
.ABS	115
.END	2069
.MLIST	114
.REM	1
.REPT	208
.TITLE	113

ERRORS DETECTED: 0
DEFAULT GLOBALS GENERATED: 0

*DCKBOA, DCKBOA, SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DCKBOA.P11
RUN-TIME: 7 15 5 SECONDS
RUN-TIME RATIO: 632/29=21.7
CORE USED: 9K (18 PAGES)

