PDP11/45

STATES 11/45

MD-11-DCKBO-A

EP DCKBO A-DL-A

FICHE 1 OF 1

OCT 1976

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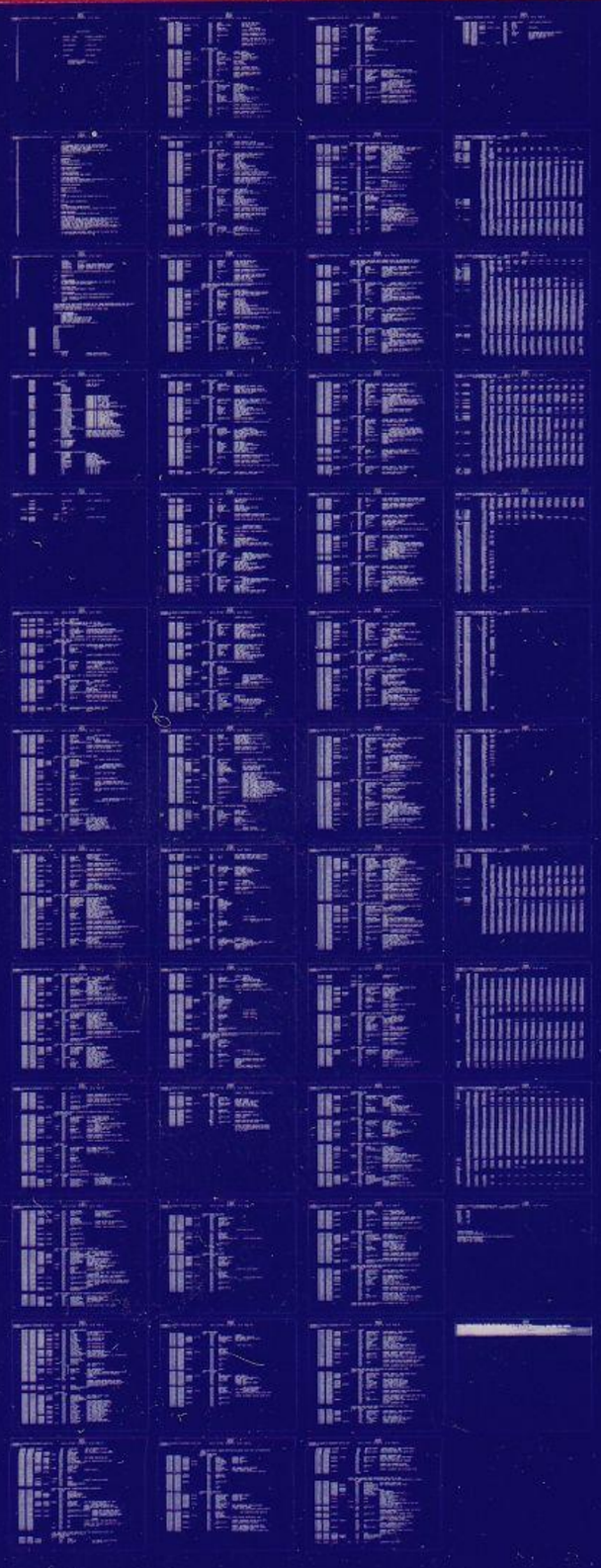

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                                .REM    %
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IDENTIFICATION

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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                        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
                                DOAA THRU DOMA

                        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 PROCEDE 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 CONTINUOSLY REPLACE THE BEQ .+4
                                INSTRUCTION IMMEDIATLY PRECEEDING 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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                                        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 TRAP ERRORS 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 INITIALY SETS THE STACK POINTER AT 500.
                                        %
                                        .TITLE  MAINDEC-11-DCKB0-A PROCESSER STATES TEST
                                        .NLIST  MC,MD,SEQ
                                        .ABS

                                ;TEST DCKB0A THIS TEST TESTS FEATURES OF THE THREE PROCESSER STATES AND INCLUDES
                                ;TRAPS FROM ALL STATES TO ALL OTHER STATES, AND MFP/MTP INSTRUCTIONS IN ALL
                                ;STATES AND PREVIOUS STATES.
                                ;NOTE: ALL TESTS ARE ENTERED AND EXITED IN KERNEL MODE.

                                ;STARTING PROCEEDURE
                                ;       LOAD ADDRESS=200
                                ;       PRESS 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=%0
000001                          R11=%1
000002                          R12=%2
000003                          R13=%3
000004                          R14=%4
000005                          R15=%5

                                ;STACK POINTERS
000006                                  KSP=%6                  ;KERNEL STACK POINTER
000006                                  SSP=%6                  ;SUPERVISOR STACK POINTER
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000006                  USP=%6                  ;USER STACK POINTER
000000          HLT=HALT
010701          SCOPE=010701                    ;MOVE PC TO R1
000003                  TRT=3                   ;TRACE TRAP
000140                  PRTY3=140
000200                  PRTY4=200
000340                  PRTY7=340

                ;VECTOR ADDRESSES
000004                  ERRVEC=4                ;ADDRESS OF ERROR VECTOR
000030                  EMTVEC=30               ;ADDRESS OF EMT VECTOR
000034                  TRAPVEC=34              ;ADDRESS OF TRAP VECTOR
000020                  IOTVEC=20               ;ADDRESS OF IOT VECTOR
000014                  TBITVEC=14              ;ADDRESS OF 'T' BIT TRAP VECTOR
000014                  TRTVEC=14               ;ADDRESS OF 'TRACE' TRAP
000064                  TPVEC=64                ;ADDRESS OF TTY PRINTER INTERRUPT VECTOR
000240                  PIRVEC=240              ;ADDRESS OF PIRQ VECTOR
                ;HARDWARE REGISTER ASSIGNMENTS
177776                  PSW=177776              ;ADDRESS OF STATUS REGISTER
177774                  SLR=177774              ;ADDRESS OF STACK LIMIT REGISTER
177772                  PIRQ=177772             ;ADDRESS OF PROGRAM INTERRUPT REQUEST
177770                  UBREAK=177770           ;ADDRESS OF MICRO BREAK REGISTER
177560                  TKS=177560              ;ADDRESS OF KEYBOARD CSR
177562                  TKB=177562              ;ADDRESS OF KEYBOARD BUFFER
177564                  TPS=177564              ;ADDRESS OF TELEPRINTER CSR
177566                  TPB=177566              ;ADDRESS OF TELEPRINTER BUFFER
177570                  SWR=177570              ;ADDRESS OF CONSOL SWITCH REGISTER
177570                  DISPLAY=177570          ;ADDRESS OF CONSOL DISPLAY REGISTER
                ;INITIAL STACK POINTER SETTIGS
000500                  KPTR=500                ;KERNEL INITIAL STACK POINTER VALUE
000600                  SPTR=600                ;SUPERVISOR INITIAL STACK POINTER VALUE
000700                  UPTR=700                ;USER INITIAL STACK POINTER VALUE
001000                  YELPTR=1000             ;STACK POINTER VALUE FOR 'YELLOW' OVFLW
000736                  REDPTR=736              ;STACK POINTER VALUE FOR 'RED' OVFLW

                ;MISC. BIT ASSIGNMENTS
100000                  BIT15=100000
040000                  BIT14=040000
020000                  BIT13=020000
000100                  BIT6=100

                ;STATUS REGISTER BIT ASSIGNMENTS
140000                  UM=140000               ;USER MODE
100000                  IM=100000               ;ILLEGAL MODE
040000                  SM=040000               ;SUPERVISOR MODE
000000                  KM=0                    ;KERNEL MODE
030000                  PUM=030000              ;PREVIOUS USER MODE
010000                  PSM=010000              ;PREVIOUS SUPERVISOR MODE
000000                  PKM=0                   ;PREVIOUS KERNEL MODE
004000                  RS=004000               ;REGISTER BIT
000020                  TBIT=20                 ;'T' BIT IN PSW
000001                  C=1                     ;'C' BIT IN PS
000002                  V=2                     ;'V' BIT IN PS
000004                  Z=4                     ;'Z' BIT IN PS
000010                  N=10                    ;'N' BIT IN PS
```

F01


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                010000                          PIR4=10000              ;LEVEL 4 REQUEST IN PIRQ
                000000                          .=0
                000200                          .=200
000200  000167  000606                          JMP     START           ;GO START
                001000                          .=1000
                                        ;TAGS
001000  000000                          ICNT:   0                       ;CONTAINS PASS COUNT
001002  000000                          TEMP:   0
                001012                          .=.+6
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001012  012706  000500          START:  MOV     #KPTR,KSP
001016  005067  177756                  CLR     ICNT
                                ;TEST THAT PROCESSER 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,@#UBREAK          ;LOAD MICRO BREAK REG WITH SR0-7

                                ;CHECK THAT THE SPL INSTRUCTION IS A 'NOP' IN SUPERVISORY/USER MODE.
                                ;SUPERVISORY MODE.
001062  010701          T0:     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 PSW
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          T1:     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 PSW
001132  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
001136  022700  140000                  CMP     #UM,R0          ;TEST THAT SPL DID NOT ALTER PSW
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          T2:     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  005067  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          T3:     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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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+PSM+REG+PRTY7,R10   ;CHECK STATUS AFTER RESET
001274  001401                  BEQ     .+4
001276  000000                  HLT                             ;ERROR! INCORRECT STATUS AFTER RESET
001300  032702  000100          BIT     #BIT6,R12               ;CHECK IE BIT AFTER RESET
001304  001001                  BNE     .+4
001306  000000                  HLT                             ;ERROR! IE BIT WAS CLEARED BY RESET
001310  005037  177776          CLR     @#PSW

                        ;TEST A TRAP FROM SUPERVISOR TO KERNEL MODE
001314  010701          T4:     SCOPE
001316  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
001322  012767  001362  176504  MOV     #T4A,TRAPVEC
001330  012767  000357  176500  MOV     #PRTY7+17,TRAPVEC+2
001336  012737  040000  177776  MOV     #SM,@#PSW                       ;SUPERVISORY MODE!!!
001344  012706  000600          MOV     #SPTR,SSP               ;SET SUPERVISORS STACK POINTER
001350  000257                  CCC                             ;CLEAR CONDITION CODES
001352  104400                  TRAP
001354  005037  177776  T4AA:   CLR     @#PSW
001360  000000                  HALT                            ;ERROR!  DID NOT TRAP
001362  013700  177776  T4A:    MOV     @#PSW,R0
001366  005037  177776          CLR     @#PSW
001372  022700  010357          CMP     #KM+PSM+PRTY7+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
001474  010701          T5:     SCOPE
001476  012706  000500          MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
001502  012737  001540  000020  MOV     #T5A,@#IOTVEC   ;SET IOT TRAP VECTOR
001510  005067  176306          CLR     IOTVEC+2        ;KERNEL MODE AFTER IOT
001514  012737  150340  177776  MOV     #UM+PSM+PRTY7,@#PSW     ;USER MODE!!!
001522  012706  000700          MOV     #UPTR,USP       ;SET USER STACK PTR
001526  000277                  SCC                     ;PRESET CONDITION CODES
001530  000004                  IOT                     ;TRAP USER MODE TO KERNEL MODE
001532  005037  177776  T5AA:   CLR     @#PSW           ;KERNEL MODE!!!
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001536  000000                          HLT                     ;ERROR! FAILED TO TRAP
001540  013700  177776          TSA:    MOV     @#PSW,R0        ;SAVE STATUS
001544  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
001550  022700  030000                  CMP     #KM+PUM,R0              ;CHECK STATUS AFTER IOT
001554  001401                          BEQ     .+4
001556  000000                          HLT                     ;ERROR! INCORRECT STATUS AFTER IOT
001560  022767  001532  176706          CMP     #TSAA,KPTR-4    ;CHECK KERNEL STACK PTR
001566  001401                          BEQ     .+4
001570  000000                          HLT                     ;ERROR! INCORRECT KSP AFTER IOT
001572  022767  150357  176676          CMP     #UM+PSM+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,R0
001624  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
001630  022700  000700                  CMP     #UPTR,R0        ;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,@#EMTVEC   ;SET EMT TRAP VECTOR
001656  012737  040000  000032          MOV     #SM,@#EMTVEC+2  ;SUPER MODE AFTER EMT
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                          EMT                     ;TRAP USER TO SUPERVISOR
001712  005037  177776          T6AA:   CLR     @#PSW           ;KERNEL MODE!!!
001716  000000                          HLT                     ;ERROR! EMT FAILED TO TRAP
001720  013700  177776          T6A:    MOV     @#PSW,R0        ;SAVE STATUS AFTER EMT TRAP
001724  010602                          MOV     SSP,R2          ;SAVE SUPER STACK PTR
001726  005037  177776                  CLR     @#PSW           ;KWERNEL MODE!!!
001732  022700  070000                  CMP     #SM+PUM,R0      ;CHECK STATUS AFTER EMT TRAP
001736  001401                          BEQ     .+4
001740  000000                          HLT                     ;ERROR! INCORRECT STATUS AFTER EMT 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 EMT
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 EMT
001772  001401                          BEQ     .+4
001774  000000                          HLT                     ;ERROR! INCORRECT SSP AFTER EMT TRAP
001776  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
002004  010600                          MOV     USP,R0  ;SAVE USER STACK PTR
002006  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
002012  022700  000700                  CMP     #UPTR,R0        ;CHECK THAT USP WAS NOT CHANGED ON TRAP
002016  001401                          BEQ     .+4
002020  000000                          HLT                     ;ERROR! INCORRECT USP AFTER EMT TRAP
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                                        ;TEST TRAP FROM USER TO USER MODE
002022  010701                    T7:     SCOPE
002024  012737  002062  000014            MOV     #T7A,@#TRTVEC   ;SET TRACE TRAP VECTOR
002032  012737  144000  000016            MOV     #UM+REG,@#TRTVEC+2      ;USER MODE AFTER TRAP
002040  012737  140000  177776            MOV     #UM,@#PSW       ;USER MODE!!!
002046  012706  000700                    MOV     #UPTR,USP       ;SET USER STACK PTR
002052  000003                            TRT                     ;TRACE TRAP
002054  005037  177776          T7AA:     CLR     @#PSW           ;KERNEL MODE!!!
002060  000000                            HLT                     ;ERROR! TRT FAILED TO TRAP
002062  013700  177776          T7A:      MOV     @#PSW,R10       ;SAVE STATUS AFTER TRAP
002066  010602                            MOV     USP,R12 ;SAVE USER STACK PTR
002070  042737  140000  177776            BIC     #UM,@#PSW       ;KERNEL MODE!!!
002076  022767  002054  176570            CMP     #T7AA,UPTR-4    ;CHECK RETURN PC ON USER STACK
002104  001401                            BEQ     .+4
002106  000000                            HLT                     ;ERROR! INCORRECT RETURN PC ON USER STACK
002110  022700  174000                    CMP     #UM+PUM+REG,R10 ;CHECK STATUS AFTER TRT TRAP
002114  001401                            BEQ     .+4
002116  000000                            HLT                     ;ERROR! INCORRECT STATUS AFTER TRT TRAP
002120  012767  000016  175666            MOV     #TRTVEC+2,TRTVEC
002126  005067  175664                    CLR     TRTVEC+2

                                        ;TEST TRAP SEQUENCE FROM SUPERVISOR TO SUPERVISOR
002132  010701                    T10:    SCOPE
002134  012737  002172  000030            MOV     #T10A,@#EMTVEC  ;SET EMT TRAP VECTOR
002142  012737  040000  000032            MOV     #SM,@#EMTVEC+2  ;SUPER MODE AFTER EMT
002150  012737  040000  177776            MOV     #SM,@#PSW       ;SUPER MODE!!!
002156  012706  000600                    MOV     #SPTR,SSP       ;SET SUPER STACK PTR
002162  104377                            EMT+377                 ;TRAP SUPER TO SUPER
002164  005037  177776          T10AA:    CLR     @#PSW           ;KERNEL MODE!!!
002170  000000                            HLT                     ;ERROR! EMT FAILED TO TRAP
002172  013700  177776          T10A:     MOV     @#PSW,R0        ;SAVE STATUS AFTER EMT TRAP
002176  005037  177776                    CLR     @#PSW           ;KERNEL MODE!!!
002202  022767  002164  176364            CMP     #T10AA,SPTR-4   ;CHECK RETURN PC ON SUPER STACK
002210  001401                            BEQ     .+4
002212  000000                            HLT                     ;ERROR! INCORRECT RETURN PC ON SUPER STACK AFTER TRAP
002214  022700  050000                    CMP     #SM+PSM,R0      ;CHECK STATUS AFTER TRAP
002220  001401                            BEQ     .+4
002222  000000                            HLT                     ;ERROR! INCORRECT STATUS AFTER TRAP
002224  012737  000032  000030            MOV     #EMTVEC+2,@#EMTVEC
002232  005037  000032                    CLR     @#EMTVEC+2

                                        ;TEST TRAP SEQUENCE SUPERVISOR TO USER
002236  010701                    T11:    SCOPE
002240  012767  002306  175566            MOV     #T11A,TRAPVEC   ;SET TARP TRAP VECTOR
002246  012767  140000  175562            MOV     #UM,TRAPVEC+2   ;USER MODE AFTER TARP
002254  012737  140000  177776            MOV     #UM,@#PSW       ;USER MODE
002262  012706  000700                    MOV     #UPTR,USP       ;SET USER STACK PTR
002266  012737  040000  177776            MOV     #SM,@#PSW       ;SUPERVISORY MODE!!!
002274  000277                            SCC                     ;PRE SET CONDITION CODES
002276  104377                            TRAP+377                ;TRAP SUPER TO USER
002300  005037  177776          T11AA:    CLR     @#PSW           ;KERNEL MODE!!!
002304  000000                            HLT                     ;ERROR! TRAP FAILED TO TRAP
002306  013700  177776          T11A:     MOV     @#PSW,R0        ;SAVE STATUS AFTER TRAP
002312  010602                            MOV     USP,R2          ;SAVE USER STACK PTR
002314  005037  177776                    CLR     @#PSW           ;KERNEL MODE!!!
002320  022722  002300                    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+PSM,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  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
002402  012737  040000  177776          MOV     #SM,@#PSW       ;SUPER MODE!!!
002410  000000                          HALT                    ;HALT TRAPS IN SUPERVISORY MODE
002412  005037  177776          T12AA:  CLR     @#PSW           ;KERNEL MODE!!!
002416  000000                          HALT                    ;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     #KM+PSM,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                          HALT                    ;HALT TRAP TO 4 IN USER MODE
002476  005037  177776          T13AA:  CLR     @#PSW
002502  000000                          HALT
002504  013700  177776          T13A:   MOV     @#PSW,R0
002510  005037  177776                  CLR     @#PSW
002514  022700  030000                  CMP     #KM+PUM,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 PROCESSER PRIORITY LEVEL 7
002550  012767  002624  175306          MOV     #T14A,TPVEC             ;LOAD TELEPRINTER
002556  012767  004200  175302          MOV     #REG+PRTY4,TPVEC+2      ;VECTOR ADDRESSES
002564  012706  000500                  MOV     #KPTR,KSP               ;SET KERNEL STACK
002570  052737  070000  177776          BIS     #SM+PUM,@#PSW           ;SUPERVISORY MODE,PREVIOUS USER MODE
002576  012706  000600                  MOV     #SPTR,SSP
```

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002602  052737  000100  177564          BIS     #BIT6,@#TPS             ;SET IE BIT IN TELEPRINTER
002610  042737  000340  177776          BIC     #PRTY7,@#PSW            ;ALLOW INTERRUPT
002616  005037  177776          T14AA:  CLR     @#PSW                   ;KERNEL MODE
002622  000000                          HLT                             ;ERROR NO INTERRUPT
002624  013700  177776          T14A:   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+PSM+REG+PRTY4,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
002722  010701                  T15:    SCOPE
002724  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
002730  012737  170340  177776          MOV     #UM+PUM+PRTY7,@#PSW     ;USER MODE!!!
002736  012737  003000  000240          MOV     #T15A,@#PIRVEC  ;LOAD PROGRAM INTERRUPT ROST VEC.
002744  012737  010200  000242          MOV     #KM+PSM+PRTY4,@#PIRVEC+2
002752  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK POINTER
002756  042737  000200  177776          BIC     #PRTY4,@#PSW    ;SET PRIORITY LEVEL=3
002764  012737  010000  177772          MOV     #PIR4,@#PIRQ    ;REQUEST AN INTERRUPT AT LEVEL 4
002772  005037  177776          T15AA:  CLR     @#PSW           ;KERNEL MODE!!!
002776  000000                          HLT                     ;ERROR! NO INTERRUPT REQUEST
003000  013700  177776          T15A:   MOV     @#PSW,R0                ;GET 'NEW" PSW
003004  005067  174762                  CLR     PIRQ            ;DISABLE REQUEST
003010  005037  177776                  CLR     @#PSW
003014  022700  030200                  CMP     #KM+PUM+PRTY4,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+PRTY3,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.
003062  010701                  T16:    SCOPE
003064  012737  001000  177774          MOV     #1000,@#SLR     ;SET STACK LIMIT=1400
003072  012737  070000  177776          MOV     #SM+PUM,@#PSW   ;SUPERVISORY MODE
003100  012706  000600                  MOV     #SPTR,SSP       ;SET SUPERVISOR STACK
003104  012716  125252                  MOV     #125252,(SSP)   ;PRE SET STACK
003110  012737  003302  000030          MOV     #T16G,@#EMTVEC
003116  012737  040000  000032          MOV     #SM,@#EMTVEC+2  ;ENTER SUPERVISORY MODE ON EMT
```

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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  000001  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  000004  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                    ;WAIT FOR INTERRUPT
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                 ;EMT TRAP
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     .+4             ;CAUSE OVERFLOW DID NOT OVERFLOW.
003324  000000                          HLT                     ;ERROR!
003326  000403                          BR      T16X            ;EXIT TEST
003330  005037  177776  T16ERR: CLR     @#PSW
003334  000000                          HLT                     ;ERROR!  STACK OVERFLOWED IN SUPER
                                                                ;SUPERVISORY MODE TEMP GIVES THE INST-
                                                                ;RUCTION WHICH CAUSED THE OVERFLOW.
003336  005037  177774  T16X:   CLR     @#SLR           ;CLEAR STACK LIMIT
003342  012737  000032  000030          MOV     #EMTVEC+2,@#EMTVEC
003350  005037  000032                  CLR     @#EMTVEC+2

                        ;USER MODE
003354  010701          T17:    SCOPE
003356  012737  000400  177774          MOV     #400,@#SLR      ;SET STACK LIMIT =1000
003364  012737  150000  177776          MOV     #UM+PSM,@#PSW   ;USER MODE!!!
003372  012737  003622  000004          MOV     #T17ERR,@#ERRVEC
003400  012706  000700                  MOV     #UPTR,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     R5,-(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          ;PUSH ONTO USER STACK
003472  052767  002000  175302          BIS     #2000,TEMP      ;SET ERROR INDICATOR BIT
003500  052767  000010  175274  T17D:   BIS     #10,TEMP
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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                BIS     #4000,TEMP      ;SET INDICATOR TO SHOW ERROR
003522  052767  000020  175252  T17E:         BIS     #20,TEMP
003530  004567  000006                        JSR     R15,T17F
003534  052767  010000  175240                BIS     #10000,TEMP     ;SET ERROR INDICATOR BIT
003542  052767  000040  175232  T17F:         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                BIS     #20000,TEMP
003574  052767  000100  175200  T17G:         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      T17X
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
003646  010701                  T20:          SCOPE
003650  012706  000500                        MOV     #KPTR,KSP
003654  012737  004000  000022                MOV     #PEG,@#IOTVEC+2
003662  012737  003764  000020                MOV     #T20A,@#IOTVEC
003670  012737  044200  177776                MOV     #SM+REG+PRTY4,@#PSW
003676  005000                                CLR     R10
003700  000004                                IOT
003702  013767  177776  175072  T20AA:       MOV     @#PSW,TEMP      ;GET RETURN STATUS FROM IOT TRAP
003710  042737  140000  177776                BIC     #UM,@#PSW               ;KERNEL MODE!!!
003716  022767  003702  174550                CMP     #T20AA,KPTR-4   ;CHECK THAT RETURN ADDRESS WAS
003724  001401                                BEQ     .+4             ;SAVED ON KERNEL STACK ON IOT TRAP
003726  000000                                HLT                     ;ERROR!
003730  022767  044204  174540                CMP     #SM+REG+PRTY4+Z,KPTR-2  ;CHECK THAT STATUS WAS SAVED
003736  001401                                BEQ     .+4                     ;CORRECTLY ON KERNEL STACK
003740  000000                                HLT                     ;ERROR! INCORRECT STATUS SAVED
003742  022767  044204  175032                CMP     #SM+REG+PRTY4+Z,TEMP    ;CHECK STATUS RETURNED BY RTT
003750  001401                                BEQ     .+4
003752  000000                                HLT                     ;ERROR
003754  005200                                INC     R10             ;CHECK THAT COM  R10 WAS EXECUTED
003756  001404                                BEQ     T21
003760  000000                                HLT                     ;ERROR! COM  R10 NOT EXECUTED AT T20A
003762  000402                                BR      T21             ;GO TO NEXT TEST
003764  005100                  T20A:         COM     R10
003766  000006                                RTT

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

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004006  005016                          CLR     (KSP)                   ;PUT 0 ON THE STACK
004010  012737  010011  177776          MOV     @#PSW+N+C,@#PSW         ;PRE SET STATUS
004016  106600                          MTPD    R0                      ;R0=(KSP)+
004020  013702  177776                  MOV     @#PSW,R2                ;GET STATUS
004024  020227  010005                  CMP     @#PSW+2+C,R2            ;CHECK STATUS AFTER MTPD
004030  001401                          BEQ     .+4
004032  000000                          HLT                             ;ERROR! INCORRECT STATUS
004034  020627  000502                  CMP     @#KPTR+2,KSP            ;DID KSP INCREMENT BY 2
004040  001401                          BEQ     .+4
004042  000000                          HLT                             ;ERROR!  KSP DID NOT POP
004044  005700                          TST     R0                      ;DID WORD ON STACK (0) GET TO R0?
004046  001401                          BEQ     .+4
004050  000000                          HLT                             ;ERROR! MTPD DID NOT POP 0 OFF
                                                                        ;KSP INTO R0

                                ;MTPI,KERNEL MODE
004052  010701                  T22:    SCOPE
004054  012737  177776                  CLR     @#PSW                   ;KERNEL MODE!!!
004060  012706  000500                  MOV     @#KPTR,KSP              ;SET KERNEL STACK PTR
004064  005002                          CLR     R2                      ;PRESET R2
004066  012716  177777                  MOV     #-1,(KSP)               ;PRESET DATA ON THE STACK
004072  012737  030006  177776          MOV     @#PUM+Z+V,@#PSW         ;PRESET STATUS
004100  006502                          MTPI    R2                      ;R2=(KSP)+
004102  013700  177776                  MOV     @#PSW,R0                ;GET STATUS
004106  012700  030010                  CMP     @#PUM+N,R0              ;CHECK STATUS
004112  001401                          BEQ     .+4
004114  000000                          HLT                             ;ERROR! INCORRECT STATUS
004116  020627  000502                  CMP     @#KPTR+2,KSP            ;CHECK STACK PTR AFTER MTPI
004122  001401                          BEQ     .+4
004124  000000                          HLT                             ;ERROR! INCORRECT STACK PTR
004126  005202                          INC     R2                      ;CHECK THAT MTPI MOVED DATA
004130  001401                          BEQ     .+4                     ;FROM STACK TO R2
004132  000000                          HLT                             ;ERROR!

                                ;MTPD, SUPERVISORY MODE
004134  010701                  T23:    SCOPE
004136  005003                          CLR     R3                      ;PRESET R3
004140  012737  044000  177776          MOV     @#SM+REG,@#PSW          ;SUPER MODE!!!
004146  012706  000600                  MOV     @#SPTR,SSP              ;SET SUPER STACK PTR
004152  052716  177777                  BIS     #-1,(SSP)               ;PRESET DATA ON SUPER STACK
004156  005003                          CLR     R13                     ;PRESET R13
004160  000261                          SEC                             ;SET 'C'
004162  106603                          MTPD    R13                     ;R13=(SSP)+
004164  013700  177776                  MOV     @#PSW,R10               ;SAVE STATUS
004170  010602                          MOV     SSP,R12                 ;SAVE SUPER STACK POINTER
004172  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
004200  022700  044011                  CMP     @#SM+REG+N+C,R10        ;CHECK STATUS RESULT
004204  001401                          BEQ     .+4
004206  000000                          HLT                             ;ERROR! INCORRECT STATUS AFTER MTPD

004210  022702  000602                  CMP     @#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     @#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

                                ;MTPI, SUPERVISORY MODE
004240  010701                 T24:    SCOPE
004242  012737  070000  177776         MOV     #SM+PUM,@#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     #-1,R4          ;PRESET R4
004262  000261                         SEC                     ;SET 'V'
004264  006604                         MTPI    R4              ;R4<-(SSP)+
004266  013700  177776                 MOV     @#PSW,R0        ;SAVE STATUS
004272  010206                         MOV     SSP,R2          ;SAVE SUPER STACK PTR
004274  005037  177776                 CLR     @#PSW           ;KERNEL MODE!!!
004300  020027  070004                 CMP     #SM+PUM+Z,R0    ;CHECK STATUS AFTER MTPI
004304  001401                         BEQ     .+4
004306  000000                         HLT                     ;ERROR! INCORRECT STATUS AFTER MTPI
004310  022702  000602                 CMP     #SPTR+2,R2      ;CHECK SUPER STACK PTR AFTER MTPI
004314  001401                         BEQ     .+4
004316  000000                         HLT                     ;ERROR! INCORECT SUPER STACK PTR AFTER MTPI
004320  005704                         TST     R4              ;CHECK THAT DATA WAS MOVED
004322  001401                         BEQ     .+4             ;FROM SUPER STACK TO R4
004324  000000                         HLT                     ;ERROR! MTPI FAILED TO MOVE DATA TO R4

                                ;MTPD, USER MODE
004326  010701                 T25:    SCOPE
004330  012737  150000  177776         MOV     #UM+PSM,@#PSW   ;USER MODE!!!
004336  012706  000700                 MOV     #UPTR,USP       ;SET USER STACK PTR
004342  052716  177777                 BIS     #-1,(USP)       ;PRESET DATA ON USER STACK
004346  000261                         SEC                     ;SET 'C'
004350  042705  177777                 BIC     #-1,R5          ;PRESET R5
004354  106525                         MTPD    R5              ;R5<-(USP)+
004356  013700  177776                 MOV     @#PSW,R0        ;SAVE STATUS AFTER MTPD
004362  010602                         MOV     USP,R2          ;SAVE USER STACK PTR
004364  005037  177776                 CLR     @#PSW           ;KERNEL MODE!!!
004370  022700  150011                 CMP     #UM+PSM+N+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     R5              ;CHECK THAT MTPD MOVED DATA FROM
004412  001401                         BEQ     .+4             ;USER STACK TO R5
004414  000000                         HLT                     ;ERROR! MTPD FAILED


                                ;MTPI, USER MODE
004416  010701                 T26:    SCOPE
004420  012737  140000  177776         MOV     #UM,@#PSW       ;USER MODE!!!
004426  012706  000700                 MOV     #UPTR,USP       ;SET USER STACK PTR
004432  042716  177777                 BIC     #-1,(USP)       ;PRESET DATA ON USER STACK
004436  052700  177777                 BIS     #-1,R0  ;PRESET R0
004442  000257                         CCC                     ;PRESET STATUS (ALL CC'S=0)
004444  006600                         MTPI    R0              ;R0<-(USP)+
```

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004446  013702  177776          MOV     @#PSW,R2        ;SAVE STATUS AFTER MTPI
004452  010303                  MOV     USP,R3          ;SAVE USP AFTER MTPI
004454  012737  177776          CLR     @#PSW           ;KERNEL MODE!!!
004460  020227  140004          CMP     #UM+Z,R2        ;CHECK STATUS AFTER MTPI
004464  001401                  BEQ     .+4
004466  000000                  HLT                     ;ERROR! INCORRECT STATUS AFTER MTPI
004470  020327  000702          CMP     #UPTR+2,R3      ;CHECK USP AFTER MTPI
004474  001401                  BEQ     .+4
004476  000000                  HLT                     ;ERROR! INCORRECT USP AFTER MTPI
004500  005700                  TST     R0              ;CHECK THAT MTPI MOVED DATA ON
004502  001401                  BEQ     .+4             ;USER STACK TO R0
004504  000000                  HLT                     ;ERROR! MTPI FAILED

                        ;TEST THAT MTP D/I POPS WORD OFF STACK (AS DETERMINED BY BITS 15 & 14
                        ;INTO STACK POINTER (AS DETERMINED BY BITS 13 &12).
                        ;SSP+(KSP)+,MTPD
                        T27:    SCOPE
004506  010701                  MOV     #SM,@#PSW       ;SUPER MODE!!!
004510  012737  040000  177776  CLR     SSP             ;PRE SET SUPERVISORS STACK POINTER
004516  005006                  MOV     #KM+PSM,@#PSW   ;KERNEL MODE!!!, PREV SUPER MODE!!
004520  012737  010000  177776  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
004526  012706  005000          MOV     #SPTR,(KSP)
004532  012716  000600          SCC                     ;PRESET CC'S
004536  000277                  MTPD    SSP             ;SSP+(KSP)+
004540  105006                  MOV     @#PSW,R2        ;SAVE STATUS
004542  013702  177776          MOV     #SM,@#PSW       ;SUPER MODE!!!
004546  012737  040000  177776  MOV     SSP,R0          ;GET SUPER STACK POINTER
004554  005000                  CLR     @#PSW           ;KERNEL MODE!!!
004556  012700  000600          CMP     #SPTR,R0        ;CHECK THAT SUPER STACK POINTER WAS
004562  000401                  BEQ     .+4             ;SET BY MTPD INST.
004564  000000                  HLT                     ;ERROR! MTPD FAILED TO SET SUPER STACK POINTER
004566  020227  010001          CMP     #PSM+C,R2       ;CHECK STATUS AFTER MTPD
004572  001401                  BEQ     .+4
004574  000000                  HLT                     ;ERROR! INCORRECT STATUS AFTER MTPD

                        ;USP+(KSP)+,MTPD
                        T30:    SCOPE
004576  010701                  MOV     #UM,@#PSW       ;USER MODE!!!
004602  012737  140000  177776  CLR     USP             ;PRE SET USER STACK POINTER
004610  005006                  MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
004614  012706  005000          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
004620  012716  000700          MOV     #UPTR,(KSP)
004624  000277                  SCC                     ;PRESET CC'S
004626  105006                  MTPD    USP             ;USP+(KSP)+
004630  013702  177776          MOV     @#PSW,R2        ;SAVE CC'S
004634  012737  140000  177776  MOV     #UM,@#PSW       ;USER MODE!!!
004642  010600                  MOV     USP,R0          ;GET USER STACK POINTER
004644  005037  177776          CLR     @#PSW           ;KERNEL MODE!!!
004650  012700  000700          CMP     #UPTR,R0        ;CHECK THAT MTPD SET USER STACK
004654  001401                  BEQ     .+4             ;POINTER PROPERLY
004656  000000                  HLT                     ;ERROR!
004660  022706  000502          CMP     #KPTR+2,KSP     ;CHECK KERNEL STACK POINTER
004664  001401                  BEQ     .+4
004666  000000                  HLT
```

```
                                        ;KSP+(KSP)+,MTPD
004676  010701                          T31:    SCOPE
004700  012706  000500                          MOV     #KPTR,KSP
004704  012716  000736                          MOV     #REDPTR,(KSP)   ;PRESET DATA ON KERNEL STACK
004710  106606                            MTPD    KSP             ;KSP+(KSP)+
004712  022706  00073E                    CMP     #REDPTR,KSP     ;CHECK THAT MTPD MOVED DATA ON
004716  001401                          BEQ     .+4             ;KERNEL STACK TO KERNEL STACK PTR
004720  000000                          HLT                     ;ERROR! MTPD FAILED

                                        ;SSP+(SSP)+
004722  010701                          T31A:   SCOPE
004724  012737  050000  177776          MOV     #SM+PSM,@#PSW   ;SUPER MODE!!!  PREV SUPER MODE!!
004732  005006                          CLR     SSP             ;SET SUPER STACK POINTER
004734  012737  000600  000000          MOV     #SPTR,@#0       ;PUT NEW STACK POINTER VALUE ON STACK
004742  000277                          SCC                     ;PRESET CC'S
004744  106606                          MTPD    SSP             ;SSP+(SSP)+
004746  013702  177776                  MOV     @#PSW,R2        ;SAVE RESULT STATUS
004752  010600                          MOV     SSP,R0          ;SAVE NEW SUPER STACK POINTER
004754  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
004760  022700  000600                  CMP     #SPTR,R0        ;CHECK THAT MTPD SET SUPER STACK
004764  001401                          BEQ     .+4             ;POINTER PROPERLY
004766  000000                          HLT                     ;ERROR!
004770  022702  050001                  CMP     #SM+PSM+C,R2    ;CHECK STATUS RESULT
004774  001401                          BEQ     .+4
004776  000000                          HLT                     ;ERROR! INCORRECT STATUS AFTER MTPD

                                        ;USP+(SSP)+,MTPD
005000  010701                          T31B:   SCOPE
005002  012737  140000  177776          MOV     #UM,@#PSW               ;USER MODE!!!
005010  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK POINTER
005014  012737  070000  177776          MOV     #SM+PUM,@#PSW   ;SUPER MODE!!!  PREV USER MODE!!
005022  012706  000600                  MOV     #SPTR,SSP       ;SET SUPER STACK POINTER
005026  005046                          CLR     -(SSP)          ;PUSH NEW USER STACK POINTER ONTO
                                                                ;SUPER STACK
005030  000277                          SCC                     ;PRESET CC'C
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

                                        ;USP+(USP)+,MTPD
005106  010701                          T31C:   SCOPE
005110  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!  PREV USER MODE!!
005116  012706  000700                  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,R0        ;SAVE CC'S
005134  010602                          MOV     USP,R2          ;SAVE USER STACK POINTER
005136  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
005142  022700  170004                  CMP     #UM+PUM+Z,R0    ;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)+,MTPI
005160  010701                  T32:    SCOPE
005162  012737  040000  177776          MOV     #SM,@#PSW               ;SUPERVISORY MODE!!!
005170  005046                          CLR     SSP             ;PRESET SUPER STACK POINTER
005172  006237  177776                  ASR     @#PSW
005176  006237  177776                  ASR     @#PSW           ;KERNEL MODE!!!, PREV SUPER MODE!!
005202  012716  000600                  MOV     #SPTR,(KSP)
005206  006606                          MTPI    SSP             ;SSP←(KSP)+
005210  006337  177776                  ASL     @#PSW
005214  006337  177776                  ASL     @#PSW           ;SUPERVISORY MODE!!!
005220  010467  173556                  MOV     SSP,TEMP        ;GET SUPER STACK POINTER
005224  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
005230  022767  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)+,MTPI
005242  010701                  T32A:   SCOPE
005244  012737  140000  177776          MOV     #UM,@#PSW               ;USER MODE
005252  012706  177777                  MOV     #-1,USP                 ;PRESET USER STACK POINTER
005256  012737  030000  177776          MOV     #KM+PUM,@#PSW           ;CURRENT KERNEL,PREVIOUS USER
005264  005046                          CLR     -(KSP)          ;PRESET DATA ON KERNEL STACK
005266  006606                          MTPI    USP                     ;USP←(KSP+
005270  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
005276  010600                          MOV     USP,R0          ;GET USER STACK POINTER
005300  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
005304  005700                          TST     R0              ;CHECK THAT DATA ON KERNEL STACK
005306  001401                          BEQ     .+4             ;WAS MOVED TO USER STACK PTR
005310  000000                          HLT                     ;ERROR! MTPI FAILED

                                ;USP←(SSP)+,MTPI
005312  010701                  T33:    SCOPE
005314  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
005322  005006                          CLR     USP                     ;PRE SET USR 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                          MTPI    USP                     ;USP←(SSP)+
005340  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
005346  010600                          MOV     USP,R0          ;SAVE USER STACK PTR
005350  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
005354  022700  000700                  CMP     #UPTR,R0        ;CHECK THAT MTPI MOVED DATA FROM
005360  001401                          BEQ     .+4             ;SUPER STACK TO USER STACK PTR
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005362  000000                          HLT                             ;ERROR! MTPI FAILED

                                ;SSP←(SSP)+,MTPI
                        T34:    SCOPE
005364  010701
005366  012737  050000  177776          MOV     #SM+PSM,@#PSW           ;SUPER MODE!!!,PREV SUPER MODE!!
005374  005006                          CLR     SSP                     ;SET SUPER STACK PTR
005376  012716  000600                  MOV     #SPTR,(SSP)             ;PRESET DATA ON SUPER STAC
005402  006606                          MTPI    SSP                     ;SSP←(SSP)+
005404  010600                          MOV     SSP,R0                  ;GET SUPER STACK PTR
005406  005037  177776                  CLR     @#PSW                   ;KERNEL MODE!!!
005412  022700  000600                  CMP     #SPTR,R0                ;CHECK THAT MTPI MOVED DATA ON
005416  001401                          BEQ     .+4                     ;SUPER STACK TO SUPER STACK PTR
005420  000000                          HLT                             ;ERROR! MTPI FAILED

                                ;USP←(USP)+
                        T35:    SCOPE
005422  010701
005424  012737  170000  177776          MOV     #UM+PUM,@#PSW           ;USER MODE!!!,PREV USER MODE!!
005432  012706  000600                  MOV     #SPTR,USP               ;SET USER STACK PTR
005436  012716  000700                  MOV     #UPTR,(USP)             ;PRESET DATA ON USER STACK
005442  006606                          MTPI    USP                     ;USP←(USP)+
005444  010600                          MOV     USP,R0                  ;SAVE USER STACK PTR IN R0
005446  005037  177776                  CLR     @#PSW                   ;KERNEL MODE!!!
005452  022700  000700                  CMP     #UPTR,R0                ;CHECK THAT MTPI MOVED DATA ON
005456  001401                          BEQ     .+4                     ;USER STACK TO USER STACK PTR
005460  000000                          HLT                             ;ERROR! MTPI FAILED

                                ;TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION
                                ;KERNEL MODE
005462  010701                  T36:    SCOPE
005464  005037  177776                  CLR     @#PSW
005470  012706  000500                  MOV     #KPTR,KSP
005474  012716  177777                  MOV     #-1,(KSP)
005500  012737  005520  000004          MOV     #T36A,@#ERRVEC
005506  005067  172274                  CLR     ERRVEC+2
005512  106667  172261                  MTPD    -1                              ;TRAPS ON ODD ADDRESS
005516  000000                  T36AA:  HLT                                     ;ERROR! DID NOT TRAP
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
005542  010701                  T37:    SCOPE
005544  012737  044000  177776          MOV     #SM+REG,@#PSW
005552  005000                          CLR     R10             ;PRESET R10
005554  042737  004000  177776          BIC     #REG,@#PSW      ;R0-R5
005562  012700  000001                  MOV     #1,R0           ;R0 CONTAINS AN ODD ADDRESS
005566  012706  000600                  MOV     #SPTR,SSP       ;SET SUPERVISOR'S STACK POINTER
005572  012716  177777                  MOV     #-1,(SSP)       ;-1 IS THE DATA TO BE MOVED
005576  012737  005622  000004          MOV     #T37A,@#ERRVEC          ;LOAD ERROR VECTOR
005604  012737  040000  000006          MOV     #SM,@#ERRVEC+2
005612  106620                          MTPD    (R0)+           ;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
005662  010701                  T40:    SCOPE
0056[illegible]  0[illegible]37  170000  177776          MOV     #UM+PUM,@#PSW           ;USER MODE!!!, PREV USER MODE!!
0056[illegible]  0[illegible]2                          CLR     R2
0056[illegible]  0[illegible]37  004000  177776          BIS     #REG,@#PSW              ;SELECT R10-R15
0056[illegible]  0[illegible]2   0[illegible]01                 MOV     #1,R12
0057[illegible]  01[illegible]6  0[illegible]0                  MOV     #UPTR,USP               ;SET USER STACK POINTER
0057[illegible]  01[illegible]16 1[illegible]2                  MOV     #125252,(USP)           ;PRESET USER STACK
0057[illegible]  01[illegible]37 0[illegible]2   000004         MOV     #T40A,@#ERRVEC          ;LOAD ERROR VECTOR
0057[illegible]  0[illegible]37  144000  000006                MOV     #UM+REG,@#ERRVEC+2
0057[illegible]  [illegible]42                                  MTPI    -(R12)                  ;-(R12)+(USP)+;SHOULD TRAP ON ODD ADRS
0057[illegible]  [illegible]37   177776          T40AA:  CLR     @#PSW                   ;KERNEL MODE!!!
0057[illegible]  [illegible]                            HLT                             ;ERROR DID NOT TRAP
0057[illegible]  0[illegible]                   T40A:   MOV     USP,R10                 ;GET USERS STACK POINTER
0057[illegible]  0[illegible]37  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
0057[illegible]  0[illegible]0   000676                  CMP     #UPTR-2,R10             ;CHECK THAT USER STACK POINTER
0057[illegible]  0[illegible]01                          BEQ     .+4                     ;PUSHED PROPERLY (1 POP,2 PUSHES)
005760  0[illegible]00                                   HLT                             ;ERROR! INCORRECT USER STACK POINTER
005762  0[illegible]37   174010  000700                 CMP     #UM+PUM+REG+N,@#UPTR    ;CHECK THAT CORRECT STATUS WAS
005770  0[illegible]1401                                 BEQ     .+4                     ;SAVED ON USER STACK ('N' IS DATA POPPED)
005772  0[illegible]00                                   HLT                             ;ERROR! INCORRECT STATUS SAVED ON USER STACK
005774  0[illegible]2767  005734  172674                 CMP     #T40AA,UPTR-2           ;CHECK THAT RETURN ADDRESS WAS
006002  001401                                          BEQ     .+4                     ;SAVED ON USER STACK
006004  0[illegible]0000                                 HLT                             ;ERROR! RETURN PC NOT ON USER STACK
006006  0[illegible]2702  177777                         CMP     #-1,R12                 ;DID R12 DECREMENT BY 2
006012  001401                                          BEQ     .+4
006014  000000                                          HLT                             ;ERROR! AUTO-DEC FAILED
006016  005037  177776                                  CLR     @#PSW

                                ;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
                                ;KERNEL MODE
006022  010701                  T41:    SCOPE
006024  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
006030  012700  177777                  MOV     #-1,R0          ;PRESET R0
006034  012737  006070  000004          MOV     #T41A,@#ERRVEC  ;SET ERROR VECTOR
006042  005067  171740                  CLR     ERRVEC+2
006046  052737  004000  177776          BIS     #REG,@#PSW      ;R10-R15
006054  005000                          CLR     R10             ;PRESET R10
006056  012746  000002                  MOV     #2,-(KSP)       ;PRESET DATA ON STACK
006062  000261                          SEC                     ;SET 'C'
006064  10[illegible]620                MTPD    (R10)+          ;(R10)+-(KSP)+
006066  00[illegible]401                BR      .+4
006070  000000                  T41A:   HLT                             ;ERROR! TRAPPED
006072  103401                          BCS     .+4             ;MTP D/I SHOULD NOT AFFECT CARRY
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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     #T41BB,@#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                  T41BB:  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  005237  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  006250  000004          MOV     #T42A,@#ERRVEC
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  000262                          SEV
006244  006622                          MTPI    (R12)+                  ;(R12)++(SSP)+
006246  000401                          BR      .+4
006250  000000                  T42A:   HLT                             ;ERROR TRAPPED ON OOD ADDRESS
006252  013700  177776                  MOV     @#PSW,R10                       ;GET CC'S
006256  042737  140000  177776          BIC     #UM,@#PSW
006264  022700  044004                  CMP     #SM+REG+Z,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     #T43BB,@#ERRVEC ;LOAD ERROR VECTOR
006322  012737  074000  177776          MOV     #SM+PUM+REG,@#PSW       ;SUPER 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)+
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006344  000401                          BR      .+4
006346  000000                  T4388:  HLT                     ;ERROR! TRAPPED
006350  013702  177776                  MOV     @#PSW,R12               ;SAVE CC'S
006354  010600                          MOV     SSP,R10         ;SAVE SUPER STACK POINTER
006356  022702  074004                  CMP     #SH+PUM+REG+Z,R12       ;CHECK STATUS RESULT
006362  001401                          BEQ     .+4
006364  000000                          HLT                     ;ERROR! INCORRECT STATUS
006366  022700  000600                  CMP     #SPTR,R10       ;CHECK SUPER STACK POINTER
006372  001401                          BEQ     .+4
006374  000000                          HLT                     ;ERROR! INCORRECT SUPER STACK POINTER

                                ;USER MODE
006376  010701                  T43:    SCOPE
006400  005037  177776                  CLR     @#PSW
006404  012703  177777                  MOV     #-1,R3
006410  012737  006450  000004          MOV     #T43A,@#ERRVEC
006416  012737  140000  177776          MOV     #UM+REG,@#PSW
006424  012703  001004                  MOV     #TEMP+2,R13
006430  005067  172346                  CLR     TEMP
006434  012706  000700                  MOV     #UPTR,USP
006440  052716  177777                  BIS     #-1,(USP)
006444  006643                          MTPI    -(R13)                  ;-(R13)+(USP)+
006446  000401                          BR      .+4
006450  000000                  T43A:   HLT                     ;ERROR TRAPPED
006452  013700  177776                  MOV     @#PSW,R10
006456  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
006464  122700  000010                  CMPB    #N,R10
006470  001401                          BEQ     .+4
006472  000000                          HLT
006474  005167  172302                  COM     TEMP
006500  001401                          BEQ     .+4
006502  000000                          HLT
006504  012737  000006  000004          MOV     #ERRVEC+2,@#ERRVEC
006512  005067  171270                  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                  T44:    SCOPE
006520  012706  000500                  MOV     #KPTR,KSP
006524  012716  125252                  MOV     #125252,(KSP)
006530  005027  000000                  CLR     #R0
006534  012737  004000  177776          MOV     #REG,@#PSW
006542  012700  177777                  MOV     #-1,R10
006546  000261                          SEC
006550  106500                          MFPD    R10             ;-(KSP)+R10,(R10)=-1

006552  013702  177776                  MOV     @#PSW,R12               ;GET STATUS RESULT
006556  022702  004011                  CMP     #REG+N+C,R12    ;
006562  001401                          BEQ     .+4
006564  000000                          HLT                     ;ERROR! INCORRECT STATUS RESULT
006566  022706  000476                  CMP     #KPTR-2,KSP     ;DID KERNEL STACK POINTER GET
006572  001401                          BEQ     .+4             ;PUSHED?
006574  000000                          HLT                     ;ERROR!
006576  005116                          COM     (KSP)           ;TEST THAT CORRECT DATA(-1) GOT
006600  001401                          BEQ     .+4             ;PUSHED ONTO KERNEL STACK
```

```
006602  000000                          HLT                     ;ERROR! -1NOT PUSHED ONTO KERNEL STACK
                              ;KERNEL MODE,MFPI
006604  010701                T45:      SCOPE
006606  012706  000500                  MOV     #KPTR,KSP
006612  012716  052525                  MOV     #52525,(KSP)    ;PRE SET STACK
006616  005004                          CLR     R4              ;PRESET 'WRONG' REGISTER
006620  012737  004001  177776          MOV     #REG+C,@#PSW    ;SELECT R10-R15,SET C
006626  012704  125252                  MOV     #125252,R14     ;LOAD DATA TO BE MOVED
006632  006504                          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.
```

```
                                        ;SUPERVISORY MODE,MFPD
006670  010701                  T46:    SCOPE
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  000000                          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,MFPI
006772  010701                  T47:    SCOPE
006774  012737  040200  177776          MOV     #SM+PRTY4,@#PSW
007002  012706  000600                  MOV     #SPTR,SSP
007006  012705  177777                  MOV     #-1,R5
007012  012716  125252                  MOV     #125252,(SSP)
007016  052737  004000  177776          BIS     #REG,@#PSW
007024  012705  052525                  MOV     #52525,R15
007030  000277                          SCC
007032  006505                          MFPI    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
```

```
                                        ;USER MODE,MFPD
007102  010701                  T50:    SCOPE
007104  005003                          CLR     R3                      ;PRESET
007106  012737  144000  177776          MOV     #UM+REG,@#PSW           ;USER MODE, R10-R15
007114  012706  000700                  MOV     #UPTR,USP               ;SET USER'S STACK POINTER
007120  012726  125252                  MOV     #125252,(USP)+          ;PRESET STACK
007124  012703  177777                  MOV     #-1,R13                 ;
007130  000257                          CCC
007132  106503                          MFPD    R13                     ;-(USP)+R13 (R13)=-1

007134  013700  177776                  MOV     @#PSW,R10
007140  010604                          MOV     USP,R14
007142  042737  140000  177776          BIC     #UM,@#PSW
007150  022700  144010                  CMP     #UM+REG+N,R10
007154  001401                          BEQ     .+4
007156  000000                          HLT
007160  022704  000700                  CMP     #UPTR,R14
007164  001401                          BEQ     .+4
007166  000000                          HLT
007170  005214                          INC     (R14)
007172  001401                          BEQ     .+4
007174  000000                          HLT
007176  005037  177776                  CLR     @#PSW
                                        ;USER MODE,MFPI
007202  010701                  T51:    SCOPE
007204  005005                          CLR     R5
007206  012737  144000  177776          MOV     #UM+REG,@#PSW           ;USER MODE!!!
007214  012706  000700                  MOV     #UPTR,USP               ;SET USER STACK POINTER
007220  012716  177777                  MOV     #-1,(USP)               ;PRESET USER STACK
007224  012705  000700                  MOV     #UPTR,R15               ;PRESET R15
007230  000277                          SCC                             ;PRESET CONDITION CODES
007232  006505                          MFPI    R15                     ;-(USP)+R15

007234  013700  177776                  MOV     @#PSW,R10                       ;GET STATUS RESULT
007240  010602                          MOV     USP,R2                  ;GET USER STACK POINTER
007242  042737  140000  177776          BIC     #UM,@#PSW                       ;KERNEL MODE!!!
007250  022700  144001                  CMP     #UM+REG+C,R10           ;CHECK STATUS RESULT AFTER MFPI INST
007254  001401                          BEQ     .+4
007256  000000                          HLT                             ;ERROR! INCORRECT STATUS AFTER MFPI
007260  022702  000676                  CMP     #UPTR-2,R2
007264  001401                          BEQ     .+4
007266  000000                          HLT
007270  022712  000700                  CMP     #UPTR,(R2)
007274  001401                          BEQ     .+4
007276  000000                          HLT
```

```
                                        ;TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
                                        ;STACK.
                                        ;KERNEL MODE,MFPD
007300  010701                  ;T52:   SCOPE
007302  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
007306  012700  001002                  MOV     #TEMP,R0        ;PRESET R0
007312  052737  004000  177776          BIS     #REG,@#PSW      ;SELECT R10-R15
007320  012700  001004                  MOV     #TEMP+2,R10     ;PRESET R10
007324  012767  177777  171450          MOV     #-1,TEMP
007332  005067  171446                  CLR     TEMP+2
007336  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
007342  012716  125252                  MOV     #125252,(KSP)   ;PRESET KERNEL STACK
007346  106520                        MFPD    (R10)+          ;-(KSP)=(R10)+,R10=TEMP+2,TEMP+2=0

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
007402  010701                  ;T53:   SCOPE
007404  012737  070000  177776          MOV     #SM+PUM,@#PSW   ;SUPERVISORY MODE!!!
007412  012702  001004                  MOV     #TEMP+2,R2      ;PRESET R2
007416  052737  004000  177776          BIS     #REG,@#PSW      ;SELECT R10-R15
007424  012702  001006                  MOV     #TEMP+4,R12     ;PRESET R12
007430  005067  171346                  CLR     TEMP
007434  012767  001004  171342          MOV     #TEMP+2,TEMP+2
007442  012706  000600                  MOV     #SPTR,SSP       ;SET SUPEPVISORY STACK POINTER
007446  012716  052525                  MOV     #52525,(SSP)    ;PRESET SUPER STACK
007452  006552                        MFPI    @-(R12)         ;-(SSP)=(R12),R12=TEMP+4,TEMP+2=TEMP+2

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 MTPI
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
```

```
                                        ;USER MODE MFPI
007520  010701                  TS4:    SCOPE
007522  012737  150000  177776          MOV     @#PSW,@#PSW
007530  012703  001004                  MOV     #TEMP+2,R3
007534  052737  004340  177776          BIS     #REG+PRTY7,@#PSW
007542  012703  001006                  MOV     #TEMP+4,R13
007546  005067  171230                  CLR     TEMP
007552  012767  177777  171224          MOV     #-1,TEMP+2
007560  012706  000700                  MOV     #UPTR,USP
007564  012716  125252                  MOV     #125252,(USP)
007570  006563  177776                  MFPI    -2(R13)         ;-(USP)=-2(R13),R13=#TEMP+4,TEMP+2=-1

007574  013700  177776                  MOV     @#PSW,R10
007600  010602                          MOV     USP,R12
007602  042737  140000  177776          BIC     #PSW,@#PSW
007610  022700  154350                  CMP     #PSW+REG+PRTY7+N,R10
007614  001401                          BEQ     .+4
007616  000000                          HLT
007620  022702  000676                  CMP     #UPTR-2,R12
007624  001401                          BEQ     .+4
007626  000000                          HLT
007630  005112                          COM     (R12)
007632  001401                          BEQ     .+4
007634  000000                          HLT
                                        ;TEST OVERFLOW (YELLOW) USING MFPD INSTRUCTION

007636  010701                  TS5:    SCOPE
007640  012737  014000  177776          MOV     #PSW+REG,@#PSW  ;KERNEL MODE!!! PREV SUPER MODE
007646  012706  001000                  MOV     #YELPTR,KSP     ;SET STACK PTR AT TOP OF YELLOW ZONE
007652  012767  177777  171122          MOV     #-1,TEMP        ;PRESET DATA
007660  005066  177776                  CLR     -2(KSP)         ;PRESET STACK DATA
007664  012737  007712  000004          MOV     #TS5A,@#ERRVEC  ;LOAD ERROR TRAP VECTOR
007672  005037  000006                  CLR     @#ERRVEC+2
007676  012737  000400  177774          MOV     #400,@#SLR              ;SET STACK LIMIT =1000
007704  106567  171072                  MFPD    TEMP            ;PUSH TEMP ONTO KERNEL STACK
                                                                ;SHOULD OVERFLOW STACK
007710  000000                  TS5AA:  HLT                     ;ERROR! FAILED TO TRAP ON OVERFLOW
007712  022767  177777  171056  TS5A:   CMP     #-1,YELPTR-2    ;CHECK THAT MFPD PUSHED DATA
007720  001401                          BEQ     .+4             ;ONTO STACK
007722  000000                          HLT                     ;ERROR! MTPD FAILED TO PUSH DATA
007724  022767  014010  171042          CMP     #PSW+REG+N,YELPTR-4     ;CHECK SAVED STATUS ON TRAP
007732  001401                          BEQ     .+4
007734  000000                          HLT                     ;ERROR! INCORRECT STATUS SAVED
007736  022767  007710  171026          CMP     #TS5AA,YELPTR-6 ;CHECK SAVED PC ON STACK
007744  001401                          BEQ     .+4
007746  000000                          HLT                     ;ERROR! INCORRECCT PC SAVED ON STACK
007750  005037  177774                  CLR     @#SLR           ;CLEAR STACK LIMIT REGISTER
```

```
                                                ;TEST OVERFLOW (RED) USING MFPI INSTRUCTION
007754  010701                          T56:    SCOPE
007756  012737  010030  000004                  MOV     #T56A,@#ERRVEC  ;SET ERROR TRAP VECTOR
007764  012737  034340  177776                  MOV     #PUM+REG+PRTY7,@#PSW    ;KERNEL MODE!!!, PREV USER MODE!!
007772  012706  000736                          MOV     #REDPTR,KSP     ;SET STACK PTR TO TOP OF RED ZONE
007776  012766  177777  177776                  MOV     #-1,-2(KSP)     ;PRESET RED LOCATION=-1
010004  005067  170772                          CLR     TEMP            ;(TEMP)WILL BE THE DATA MOVED
                                                                        ;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  022737  034344  000002                  CMP     #PUM+REG+PRTY7+Z,@#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
010106  010701                          T57:    SCOPE
010110  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010114  012767  004000  167714                  MOV     #REG,TRAPVEC+2
010122  012767  010212  167704                  MOV     #T57A,TRAPVEC
010130  012737  144000  177776                  MOV     #UM+REG,@#PSW   ;USER MODE!!!
010136  005002                                  CLR     R12
010140  104400                                  TRAP                    ;TRAP & ENTER KERNEL MODE
010142  013767  177776  170632          T57AA:  MOV     @#PSW,TEMP
010150  042737  140000  177776                  BIC     #UM,@#PSW               ;KERNEL MODE!!!
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     #UM+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
010220  010701                          ↑60:    SCOPE
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
010246  010701                          ↑61:SCOPE
010250  012737  014000  177776                  MOV     #KM+PSM+REG,@#PSW       ;KERNEL MODE!!!, PREV SUPER MODE!!
010256  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010262  005016                          CLR     (KSP)
010264  006606                          MTPI    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
010312  010701                          ↑62:    SCOPE
010314  012737  034000  177776                  MOV     #KM+PUM+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
010352  010701                          ↑63:    SCOPE
010354  012737  014000  177776                  MOV     #KM+PSM+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)+
010374  052737  040000  177776                  BIS     #SM,@#PSW               ;SUPER MODE!!!, PREV SUPER MODE!!
010402  106506                          MFPD    SSP                     ;-(SSP)←SSP
010404  042737  140000  177776                  BIC     #UM,@#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!
```

```
                                        ;-(SSP)←USP,MFPD
010436  010701                          ↑64:    SCOPE
010440  012737  014000  177776                  MOV     #PSW+REG,@#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
010446  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010452  012716  000600                          MOV     #SPTR,(KSP)
010456  106606                                  MTPD    SSP             ;SET SUPER STACK POINTER
010460  052737  030000  177776                  BIS     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
010466  005016                                  CLR     (KSP)
010470  106606                                  MTPD    USP             ;SET USER STACK POINTER=0
010472  052737  040000  177776                  BIS     #SM,@#PSW               ;SUPER MODE!!!, PREV USER MODE!!
010500  012767  177777  170070                  MOV     #-1,SPTR-2      ;PRESET SUPER STACK
010506  106506                                  MFPD    USP             ;PUSH USER STACK POINTER ONTO SUPER STACK
010510  042737  160000  177776                  BIC     #UM+BIT13,@#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
010516  106506                                  MFPD    SSP             ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
010520  022716  000576                          CMP     #SPTR-2,(KSP)   ;CHECK THAT SUPER STACK POINTER WAS
010524  001401                                  BEQ     .+4             ;PUSHED ONCE
010526  000000                                  HLT                     ;ERROR!
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,MFPD
010540  010701                          ↑65:    SCOPE
010542  012737  030000  177776                  MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
010550  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010554  012716  000700                          MOV     #UPTR,(KSP)
010560  106506                                  MTPD    USP             ;SET USER STACK POINTER
010562  005067  170110                          CLR     UPTR-2
010566  052737  140000  177776                  BIS     #UM,@#PSW               ;USER MODE!!!, PREV USER MODE!!!
010574  106506                                  MFPD    USP             ;PUSH USER STACK POINTER ONTO USER STACK
010576  042737  140000  177776                  BIC     #UM,@#PSW               ;KERNEL MODE!!!, PREV USER MODE!!
010604  106506                                  MFPD    USP             ;PUSH USER STACK POINTER ONTO KERNEL STACK
010606  022716  000676                          CMP     #UPTR-2,(KSP)   ;CHECK THAT USER STACK POITER WAS
010612  001401                                  BEQ     .+4             ;PUSHED PROPERLY (ONCE)
010614  000000                                  HLT                     ;ERROR!
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
010630  010701                          ↑66:    SCOPE
010632  005037  177776                          CLR     @#PSW           ;KERNEL MODE!!!, PREV KERNEL MODE!!
010636  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010642  006506                                  MFPI    KSP             ;PUSH KERNEL STACK POINTER ONTO KERNEL
                                                                        ;STACK
010644  022767  000500  167624                  CMP     #KPTR,KPTR-2    ;CHECK RESULT
010652  001401                                  BEQ     .+4
010654  000000                                  HLT                     ;ERROR!

                                        ;-(KSP)←SSP,MFPI
010656  010701                          ↑67:    SCOPE
010660  012737  014000  177776                  MOV     #PSW+REG,@#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
010666  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010672  005016                                  CLR     (KSP)
010674  006606                                  MTPI    SSP             ;SET SUPER STACK POINTER
010676  005166  177776                          COM     -2(KSP)         ;PRESET KERNEL STACK
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010702  006506                          MFPI    SSP             ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
010704  020627  000500                   CMP     #KPTR,KSP       ;CHECK THAT KERNEL STACK POINTER IS CORRECT
010710  001401                          BEQ     .+4
010712  000000                          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                  170:    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  006506                          MTPI    USP             ;SET USER STACK POINTER
010744  005166  177776                  COM     -2(KSP)         ;PRESET KERNEL STACK
010750  006506                          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                  171:    SCOPE
010764  012737  014000  177776          MOV     #PSM+REG,@#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
010772  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
010776  012716  000600                  MOV     #SPTR,(KSP)
011002  006606                          MTPI    SSP             ;SET SUPER STACK
011004  052737  040000  177776          BIS     #SM,@#PSW               ;SUPER MODE!!!, PREV SUPER MODE!!
011012  006506                          MFPI    SSP             ;PUSH SUPER STACK POINTER ONTO SUPER STACK
011014  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!, PREV SUPER MODE!!
011022  006506                          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
                                                                (ON KERNEL STACK)
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                  172:    SCOPE
011050  012737  014000  177776          MOV     #PSM+REG,@#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
011056  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
011062  012716  000600                  MOV     #SPTR,(KSP)
011066  006606                          MTPI    SSP             ;SET SUPER STACK POINTER
011070  052737  030000  177776          BIS     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
011076  005016                          CLR     (KSP)
011100  006606                          MTPI    USP             ;SET USER STACK POINTER = 0
011102  052737  040000  177776          BIS     #SM,@#PSW               ;SUPER MODE!!!, PREV SUPER MODE!!
011110  006506                          MFPI    USP             ;PUSH USER STACK POINTER ONTO SUPER STACK
011112  042737  160000  177776          BIC     #UM+BIT13,@#PSW ;KERNEL MODE!!!, PREV SUPER MODE!!!
011120  006506                          MFPI    SSP             ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
011122  022716  000576                  CMP     #SPTR-2,(KSP)   ;CHECK THAT SUPER STACK POINETER 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
011142  010701                 T73:    SCOPE
011144  012737  034000  177776        MOV     #PUM+REG,@#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
011152  012706  000500                MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
011156  012716  000700                MOV     #UPTR,(KSP)
011162  006606                        MTPI    USP             ;SET USER STACK POINTER
011164  005067  167506                CLR     UPTR-2          ;PRESET USER STACK
011170  052737  140000  177776        BIS     #UM,@#PSW               ;USER MODE!!!, PREV USER MODE!!
011176  006506                        MFPI    USP             ;-(USP)←USP
011200  042737  140000  177776        BIC     #UM,@#PSW               ;KERNEL MODE!!!
011206  006506                        MFPI    USP             ;GET USER STACK POINTER
011210  022716  000676                CMP     #UPTR-2,(KSP)   ;CHECK THAT USER STACK POINTER WAS
011214  001401                        BEQ     .+4             ;PUSHED ONCE
011216  000000                        HLT                     ;ERROR!
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.
011232  010701                 T74:    SCOPE
011234  012737  100000  177776        MOV     #IM,@#PSW               ;ILLEGAL MODE!!!
011242  013700  177776                MOV     @#PSW,R0                ;GET ILLEGAL MODE
011246  005037  177776                CLR     @#PSW           ;KERNEL MODE!!
011252  022700  100000                CMP     #IM,R0          ;CHECK THAT ILLEGAL MODE WAS SET
011256  001401                        BEQ     .+4             ;INTO STATUS
011260  000000                        HLT

                                ;TEST THAT KERNEL CAN GET DATA FROM SUPER STACK
011262  010701                 T75:    SCOPE
011264  012737  014000  177776        MOV     #KM+PSM+REG,@#PSW       ;KERNEL MODE!!!, PREV SUPER MODE!!
011272  012706  000500                MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
011276  012716  000600                MOV     #SPTR,(KSP)
011302  106606                        MTPD    SSP             ;SET SUPER STACK POINTER
011304  012767  177777  167266        MOV     #-1,SPTR        ;PRESET SUPER STACK
011312  005016                        CLR     (KSP)           ;PRESET KERNEL
011314  005066  177776                CLR     -2(KSP)         ;STACK
011320  000277                        SCC                     ;PRESET CONDITION CODES
011322  106506                        MFPD    SSP             ;GET SUPER STACK POINTER
011324  106576  000000                MFPD    @(KSP)          ;LIKE MOV  @(6),-(6)
011330  000240                        NOP
011332  013702  177776                MOV     @#PSW,R12               ;SAVE STATUS RESULT
011336  022767  000600  167134        CMP     #SPTR,KPTR      ;TEST THAT SUPER STACK POINTER WAS PUSH-
011344  001401                        BEQ     .+4             ;ONTO KERNEL STACK BY MFPD  SSP INST.
011346  000000                        HLT                     ;ERROR!
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+PSM+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
011376  010701                          176:    SCOPE
011400  012737  034000  177776                MOV     #KM+PUM+REG,@#PSW       ;KERNEL MODE!!!, PREV SUPER MODE!!
011406  012706  000500                        MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
011412  012716  000700                        MOV     #UPTR,(KSP)
011416  106606                              MTPD    USP             ;SET USER STACK POINTER
011420  0[illegible]67  167254               CLR     UPTR            ;P[illegible]SET U[illegible]R STACK
011424  C[illegible]016                      CLR     (KSP)           ;PR[illegible]ET KE[illegible]EL STACK
011426  012766  177777  177776              MOV     #-1,-2(KSP)
011434  10[illegible]506                     MFPD    USP             ;-(KSP)←USP
011436  1[illegible]76  000000               MFPD    @(KSP)          ;LIKE MOV  @(6),-(6)
011442  0[illegible]40                      NOP
011444  013703  177776                      MOV     @#PSW,R13               ;SAVE STATUS RESULT
011450  0[illegible]2767  000700  167022    CMP     #UPTR,KPTR      ;CHECK THAT USER STACK POINTER WAS
011456  0[illegible]1401                    BEQ     .+4             ;P[illegible]ED ONTO KERNEL STACK
011460  C[illegible]30                      HLT                     ;E[illegible]R!
011462  C[illegible]706  000476             CMP     #KPTR-2,KSP     ;CHECK THAT KERNEL STACK POINTER IS POS-
011466  0[illegible]1401                    BEQ     .+4             ;ITIONED PROP[illegible]LY
011470  000000                            HLT                     ;ERROR! INCO[illegible]CT KERNEL STACK POINTER
011472  005716                            TST     (KSP)           ;CHECK THAT C[illegible]ECT DATA
011474  001401                            BEQ     .+4             ;WAS PUSHED ONTO KERNEL STACK
011476  000000                            HLT                     ;ERROR!
011500  022703  034004                      CMP     #KM+PUM+REG+Z,R13       ;CHECK STATUS
011504  001401                            BEQ     .+4
011506  000000                            HLT                     ;ERROR! INCORRECT STATUS

                                        ;TEST THAT SUPERVISOR CAN GET DATA FROM USER STACK
011510  010701                          177:    SCOPE
011512  012737  074000  177776                MOV     #SM+PUM+REG,@#PSW       ;SUPER MODE!!!, PREV USER MODE!!
011520  012706  000600                        MOV     #SPTR,SSP       ;SET SUPER STACK POINTER
011524  012716  000700                        MOV     #UPTR,(SSP)
011530  106606                              MTPD    USP             ;SET USER STACK POINTER
011532  0[illegible]037  000700               CLR     @#UPTR          ;PRESET USER STACK
011536  0[illegible]016                      CLR     (SSP)           ;AND SUPER STACK
011540  012766  177777  177776              MOV     #-1,-2(SSP)
011546  000277                            SCC                     ;PRESET CC'S
011550  106506                            MFPD    USP             ;GET USER STACK POINTER
011552  106576  000000                      MFPD    @(SSP)          ;LIKE MOV  @-(6),-(6)
011556  000240                            NOP
011560  013704  177776                      MOV     @#PSW,R14               ;SAVE STATUS
011564  012737  014000  177776              MOV     #PSM+REG,@#PSW  ;KERNEL MODE!!!, PREV SUPER MODE!!
011572  012706  000500                        MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
011576  106506                            MFPD    SSP             ;PUSH SUPER STACK POINTER ONTO KERNEL STACK
011600  022716  000576                      CMP     #SPTR-2,(KSP)   ;CHECK THAT SUPER STACK POINTER IS POS-
011604  001401                            BEQ     .+4             ;ITIONED PROPERLY (1 POP, 2 PUSHES)
011606  000000                            HLT                     ;ERROR! INCORRECT SUPER STACK POINTER
011610  022737  000700  000600              CMP     #UPTR,@#SPTR    ;CHECK THAT MFPD  USP PUSHED USER STACK
011616  001401                            BEQ     .+4             ;ONTO SUPER STACK
011620  000000                            HLT                     ;ERROR!
011622  005737  000576                      TST     @#SPTR-2        ;CHECK THAT DATA ON USER STACK WAS PUSH-
011626  001401                            BEQ     .+4             ;ONTO SUPER STACK (MFPD  @(SSP))
011630  000000                            HLT                     ;ERROR!
011632  022704  074005                      CMP     #SM+PUM+REG+Z+C,R14     ;CHECK STATUS RESULT
011636  001401                            BEQ     .+4
011640  000000                            HLT                     ;ERROR! INCORRECT STATUS AFTER MFPD  @(SSP)
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                                        ;TEST THAT INTERRUPT SEQUENCE USER TO SUPERVISOR (VIA TTY)
011642  010701                  T100:   SCOPE
011644  012737  040000  177776          MOV     #SM,@#PSW               ;SUPER MODE!!!
011652  012706  000600                  MOV     #SPTR,SSP       ;SET SUPER STACK POINTER
011656  012737  000340  177776          MOV     #PRTY7,@#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+PUM+REG,TPVEC+2 ;AND 'NEW' STATUS
011706  012737  140000  177776          MOV     #UM,@#PSW               ;USER MODE!!!, ALLOW TTY INTERRUPT
011714  000137  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     #PSM,@#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
012012  010701                  T101:   SCOPE
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     #PSM+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                  T101A:  COM     R12             ;COMPLEMENT E12
012152  000002                          RTI                     ;RETURN

012154  000240                  T101EX: NOP

                                ;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC
012156  010701                  T102:   SCOPE
012160  012737  010000  177776          MOV     #KM+PSM,@#PSW   ;KERNEL MODE!!!, PREV SUPER MODE!!
012166  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
012172  005016                          CLR     (KSP)           ;PUT DATA ON STACK
012174  012737  001002  001004          MOV     #TEMP,@#TEMP+2  ;LOAD ADDRESS
012202  012767  177777  166572          MOV     #-1,TEMP        ;PRESET DATA
012210  000277                          SCC                     ;PRESET CC'S
012212  106677  166566                  MTPD    @TEMP+2         ;TEMP+(KSP)+
012216  013703  177776                  MOV     @#PSW,R3                ;CHECK CC'S
012222  022703  010005                  CMP     #KM+PSM+Z+C,R3  ;CHECK CC'S
012226  001401                          BEQ     .+4
012230  000000                          HLT                     ;ERROR! INCORRECT CC'S AFTER MTPD
012232  005737  001002                  TST     @#TEMP          ;CHECK RESULT
012236  001401                          BEQ     .+4
012240  000000                          HLT                     ;ERROR! INCORRECT RESULT

                                ;CHECK THAT MTPI CAN LOAD MEMORY ADDRESS DM=7
012242  010701                  T103:   SCOPE
012244  012737  034000  177776          MOV     #KM+PUM+REG,@#PSW       ;KERNEL MODE!!!
012252  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
012256  012716  177777                  MOV     #-1,(KSP)       ;LOAD DATA ONTO STACK
012262  012704  177776                  MOV     #-2,R14         ;LOAD INDEX REGISTER
012266  005067  166510                  CLR     TEMP            ;PRESET DATA
012272  012767  001002  166504          MOV     #TEMP,TEMP+2
012300  006674  001006                  MTPI    @TEMP+4(R14)    ;TEMP+(KSP)+
012304  013703  177776                  MOV     @#PSW,R13               ;SAVE STATUS RESULT
012310  022706  000502                  CMP     #KPTR+2,KSP     ;CHECK THAT KSP POPPED
012314  001401                          BEQ     .+4
012316  000000                          HLT                     ;ERROR! INCORRECT STACK PTR
012320  022703  034010                  CMP     #PUM+REG+N,R13  ;CHECK STATUS RESULT
012324  001401                          BEQ     .+4
012326  000000                          HLT                     ;ERROR! INCORRECT STATUS
012330  005267  166446                  INC     TEMP            ;CHECK RESULT
012334  001401                          BEQ     .+4
012336  000000                          HLT                     ;ERROR! INCORRECT RESULT

                                ;TEST THAT MTPD/I CAN LOAD PC
012340  010701                  T104:   SCOPE
012342  012737  010000  177776          MOV     #KM+PSM,@#PSW   ;KERNEL MODE!!!
012350  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
012354  012716  012366                  MOV     #T104A,(KSP)    ;PUT NEW PC ON STACK
012360  000277                          SCC                     ;PRESET CC'S
012362  106607                          MTPD    PC              ;PC+(KSP)+
012364  000000                          HLT                     ;ERROR! MTPD FAILED TO SET PC
012366  100001                  T104A:  BPL     .+4
012370  000000                          HLT                     ;ERROR! 'N' FAILED TO CLEAR IN STATUS
012372  103401                          BCS     .+4
012374  000000                          HLT                     ;ERROR! 'C' WAS CLEARED BY MTPD
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                                        ;SUPERVISORY MODE
012376  010701                  T105:   SCOPE
012400  012737  074000  177776          MOV     #SM+PUM+REG,@#PSW       ;SUPER MODE!!!
012406  012706  000600                  MOV     #SPTR,SSP               ;SET SUPER STACK
012412  012716  012430                  MOV     #T105A,(SSP)            ;PUT NEW PC ON STACK
012416  000277                          SCC                             ;PRESET CC'S
012420  106607                          MTPI    PC                      ;PC←(SSP)+
012422  005037  177776                  CLR     @#PSW                   ;KERNEL MODE!!!
012426  000000                          HLT                             ;ERROR! MTPI FAILED TO LOAD PC
012430  013704  177776          T105A:  MOV     @#PSW,R14                       ;SAVE STATUS RESULT
012434  042737  140000  177776          BIC     #UM,@#PSW                       ;KERNEL MODE!!!
012442  022704  074001                  CMP     #SM+PUM+REG+C,R14               ;CHECK STATUS RESULT
012446  001401                          BEQ     .+4
012450  000000                          HLT                                     ;ERROR! INCORRECT STATUS RESULT

                                        ;USER MODE
012452  010701                  T106:   SCOPE
012454  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!
012462  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK PTR
012466  012716  012504                  MOV     #T106A,(USP)    ;PUT NEW PC ON STACK
012472  000277                          SCC                     ;PRESET CC'S
012474  106607                          MTPD    PC              ;PC←(USP)+
012476  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
012502  000000                          HLT                     ;ERROR! MTPD FAILED TOMLOAD PC
012504  013705  177776          T106A:  MOV     @#PSW,R5                ;SAVE STATUS
012510  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
012514  022705  170001                  CMP     #UM+PUM+C,R5    ;CHECK STATUS
012520  001401                          BEQ     .+4
012522  000000                          HLT

                                        ;TEST ERROR TRAP (ODD ADDRESS) MFPD/I
012524  010701                  T107:   SCOPE
012526  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
012532  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
012536  012737  012554  000004          MOV     #T107A,@#ERRVEC ;LOAD ERRROR VECTOR
012544  000277                          SCC                     ;PRESET CC'S
012546  106567  165227                  MFPD    1               ;ODD ADDRESS SHOULD TRAP
012552  000000          T107AA: HLT                             ;ERROR! FAILED TO TRAP ON ODD ADDRESS
012554  022706  000474          T107A:  CMP     #KPTR-4,KSP     ;CHECK THAT STACK PTR WAS PUSHED
012560  001401                          BEQ     .+4             ;PROPERLY (2 PUSHES)
012562  000000                          HLT                     ;ERROR! INCORRECT STACK PTR AFTER ERROR
012564  022726  012552                  CMP     #T107AA,(KSP)+  ;CHECK RETURN PC ON STACK
012570  001401                          BEQ     .+4
012572  000000                          HLT                     ;ERROR! RETURN PC NOT ON STACK
012574  022716  000017                  CMP     #17,(KSP)       ;CHECK SAVED STATUS ON STACK
012600  001401                          BEQ     .+4
012602  000000                          HLT                     ;ERROR! INCORRECT STATUS SAVED ON STACK
                                        ;SUPER MODE, TIME OUT
012604  010701                  T110:   SCOPE
012606  012737  040000  177776          MOV     #SM,@#PSW               ;SUPER MODE!!!
012614  012706  000600                  MOV     #SPTR,SSP               ;SET SUPER STACK
012620  012737  044000  000006          MOV     #SM+REG,@#ERRVEC+2      ;LOAD 'NEW' STATUS
012626  012737  012646  000004          MOV     #T110A,@#ERRVEC         ;AND PC
012634  106537  177702                  MFPD    @#177702                ;177702 IS NON-EXISTANT ADRS
012640  005037  177776          T110AA: CLR     @#PSW                   ;KERNEL MODE!!!
012644  000000                          HLT                             ;ERROR! DID NOT TRAP ON NON ADRS
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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

                                        ;USER MODE,ODD 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              ;ODD 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 SDORESS 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 STAK
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 STCAK 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.

                                        ;CHECK THAT MTPI CAN LOAD DATA TO AN ADDRESS VIA THE STACK
                                        ;SUPER MODE,PREV USER MODE
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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 ADDRES 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                     ;ERROR! INCORECT SUPER STACK PTR
013166  012737  030000  177776                  MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
013174  106506                                  MFPD    USP             ;GET USER STACK PTR
013176  022726  000700                          CMP     #UPTR,(KSP)+    ;CHECK THAT USER STACK PTR WAS NOT CHANGED
013202  001401                                  BEQ     .+4
013204  000000                                  HLT                     ;ERROR! USER STACK PTR CHANGED BY MTPI
013206  005267  165570                          INC     TEMP            ;CHECK THAT DATA WAS MOVED TO TEMP
013212  001401                                  BEQ     .+4
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
013216  010701                          T114:   SCOPE
013220  012737  010000  177776                  MOV     #KM+PSM,@#PSW   ;KERNEL MODE!!!, PREV SUPER MODE!!
013226  012706  000500                          MOV     #KPTR,KSP       ;SET KERENL 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
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
```

```
013356  012737  010000  177776          MOV     #KM+PSM,@#PSW   ;KERNEL MODE!!!, PREV SUPER MODE!!
013364  106506                          MFPD    SSP             ;GET SUPER STACK PTR
013366  022726  000576                  CMP     #SPTR-2,(KSP)+  ;CHECK SUPER STACK PTR AFTER MFPD
013372  001401                          BEQ     .+4
013374  000000                          HLT                     ;ERROR! INCORRECT SSP
013376  012737  030000  177776          MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
013404  106506                          MFPD    USP             ;GET USER STACK PTR
013406  022726  000700                  CMP     #UPTR,(KSP)+    ;CHECK THAT USP WAS NOT CHANGED
013412  001401                          BEQ     .+4
013414  000000                          HLT                     ;ERROR! USP CHANGED BY MFPD
013416  005237  000576                  INC     @#SPTR-2        ;CHECK DATA ON THE SUPER STACK
013422  001401                          BEQ     .+4
013424  000000                          HLT                     ;ERROR! INCORRECT DATA ON SUPER STACK
013426  005037  177776                  CLR     @#PSW
013432  010701                          SCOPE


                                ;CHECK TRAP SEQUENCE WHEN SUPERVISOR STACK PTR IS ODD.
                                ;THE TEST TRAPS FROM USER TO SUPERVISOR AND THEN FROM SUPERVISOR TO KERNEL
013434  010701                          SCOPE
013436  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
013442  012737  013526  000004          MOV     #T116B,@#ERRVEC ;SET ODD ADDRESS ERROR TRAP
013450  005037  000006                  CLR     @#ERRVEC+2
013454  012737  013520  000020          MOV     #T116A,@#IOTVEC
013462  012737  040340  000022          MOV     #SM+PRTY7,@#IOTVEC+2
013470  012737  040000  177776          MOV     #SM,@#PSW       ;SUPER MODE!!!
013476  012706  000601                  MOV     #SPTR+1,SSP     ;SET SUPER STACK PTR ODD
013502  012737  144000  177776          MOV     #UM+REG,@#PSW   ;USER MODE!!!
013510  000004                          IOT                     ;TRAP TO SUPERVISOR
013512  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
013516  000000                          HLT                     ;ERROR! IOT FAILED TO TRAP
013520  005037  177776          T116A:  CLR     @#PSW           ;KERNEL MODE!!!
013524  000000                          HLT                     ;ERROR! NO ODD ADDRESS TRAP ON ODD SUP-
                                                                ;ERVISOR STACK PTR
013526  022706  000474          T116B:  CMP     #KPTR-4,KSP     ;CHECK KERNEL STACK PTR
013532  001401                          BEQ     .+4
013534  000000                          HLT                     ;ERROR! INCORRECT KERNEL STACK PTR AFTER
                                                                ;ODD ADDRESS TRAP
013536  022716  013520                  CMP     #T116A,(KSP)    ;CHECK RETURN PC ON KERNEL STACK
013542  001401                          BEQ     .+4
013544  000000                          HLT                     ;ERROR! RETURN PC FROM ODD ADDRESS
                                                                ;TRAP NOT ON KERNEL STACK
013546  022766  070340  000002          CMP     #SM+PUM+PRTY7,2(KSP)    ;CHECK STATUS ON STACK
013554  001401                          BEQ     .+4
013556  000000                          HLT                     ;ERROR! INCORRECT STATUS ON STACK
013560  106506                          MFPD    SSP             ;GET SUPERVISOR STACK PTR
013562  022716  000575                  CMP     #SPTR-3,(KSP)   ;CHECK SUPER STACK PTR
013566  001401                          BEQ     .+4
013570  000000                          HLT                     ;ERROR! INCORRECT SUPER STACK PTR
                                                                ;AFTER IOT
013572  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
013576  012737  000006  000004          MOV     #ERRVEC+2,@#ERRVEC
013604  012737  000022  000020          MOV     #IOTVEC+2,@#IOTVEC
013612  005037  000022                  CLR     @#IOTVEC+2

013616  005267  165156          END:    INC     ICNT            ;INCREMENT PASS COUNT
```

```
013622  026727  165152  012000          CMP     ICNT,#12000     ;12000 PASSES COMPLETED?
013630  001407                          BEQ     DONE
013632  000167  165174                  JMP     BEGIN
013636  012767  000007  163722  DONE:   MOV     #7,TPB          ;RING BELL
013644  105767  163714                  TSTB    TPS
013650  100375                          BPL     .-4
013652  013702  000042                  MOV     @#42,R2         ;GET DETAPE MONITOR RETURN ADDRESS
013656  001404                          BEQ     DONE1           ;DO NOT RETURN IF (42)=0
013660  004712                          JSR     7,(2)           ;RETURN TO DECTAPE MONITOR
013662  000240                          NOP                     ;OVERLAY AREA FOR
013664  000240                          NOP                     ;ACT11
013666  000240                          NOP
013670  000167  165116          DONE1:  JMP     START
        000001                          .END
```

```
BEGIN   001032          225#  2058
BIT13 = 020000          186#  1508  1601
BIT14 = 040000          185#
BIT15 = 100000          184#
BIT6  = 000100          187#   256   265   272   281   498   504   569   571  1725
C     = 000001          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  2[illegible]#
ENTVEC= 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#  1066#  1[illegible]#  1108#  1129#  1146#  1147#  1368#  1369#  1387#  1412#  1866#
                       1883#  1[illegible]#  1[illegible]#  1[illegible]#  1917#  1918#  2021#  2022#  2051#
HLT   = 000000          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   932   946   958
                        970   981   [illegible]   [illegible]  1001  1006  1009  1012  1026  1031  1034  1037  1040
                       1056  1058  1061  1073  1077  1[illegible]  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  1[illegible]  1543
                       1555  1[illegible]  1570  1584  1588  1605  1608  1623  1626  1635  1[illegible]  1656  1659
                       1662  1[illegible]  1682  1695  1[illegible]  1709  1712  1715  1718  1730  1737  1740  1743
                       1746  1761  1764  1767  1771  1774  1794  1797  1811  1814  1817  1826  1828
                       1830  1840  1845  1[illegible]  1860  1869  1872  1875  1878  1[illegible]  1892  1895  1898
                       1908  1913  1916  1933  1936  1940  19[illegible]  1962  1965  1980  1983  1987  2004
                       2009  2012  2030  [illegible]  [illegible]  2040  2044  2048
ICNT    001000          215#   220#   226   2[illegible]#  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   526   534   797   817   824  1453  1468
                       1480  1639  1660  1666  1686  1784  1792  1801  1821  1923  1970  2000  2005
KPTR  = 000500          177#   219   225   [illegible]   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   798   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
                       2020  2034
KSP   =%000006          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#
```

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                1931    1938    1955    1960    1971#   1972#   1974#   1975#   1977    1978    1981    1985    2002
                2007    2020#   2034    2038    2042    2046
N       = 000010  203#    667     690     712     759     1032    1075    1140    1162    1181    1255    1352    1377
                1660    1812
PC      =x000007  137#    1625#   1838#   1853#
PIRQ    = 177772  168#    528#    532#
PIRVEC= 000240  164#    524#    525#    543#    544#
PIR4    = 010000  205#    528
PKM     = 000000  197#
PRTY3   = 000140  152#    540
PRTY4   = 000200  153#    494     505     525     527     534     638     646     649     1220    1232
PRTY7   = 000340  154#    234     238     255     262     271     278     290     299     325     339     499     523
                1197    1209    1341    1352    1368    1405    1724    2024    2042
PSM     = 010000  196#    271     278     288     325     339     421     447     465     505     525     594     667
                670     750     759     797     809     845     856     950     1339    1352    1364    1377    1453
                1403    1413    1547    1574    1592    1639    1660    1704    1732    1758    1784    1792    1821
                1923    1953    1970    2000
PSW     = 177776  166#    222     234#    236     237#    244#    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#    689     703#    709     711#    722#    729#    735     737#    750#    756
                758#    772#    778     780#    795#    797#    802     803#    805#    815#    817#    822     823#
                825#    845#    850     852#    862#    864#    871     873#    875#    888#    894     906#    906#
                908#    909#    912#    913#    915#    922#    924#    927#    929#    936#    938#    941#    943#
                950#    955#    962#    967#    975#    991#    993#    1002#   1003#   1016#   1018#   1025#   1028#
                1041#   1046#   1050#   1065#   1074    1084#   1087#   1097    1103#   1109#   1116    1127#   1130#
                1138    1139#   1156#   1161    1176#   1180    1197#   1201#   1206    1208#   1220#   1224#   1229
                1231#   1245#   1252    1254#   1264#   1268#   1275    1277#   1292#   1294#   1302    1314#   1316#
                1324    1326#   1339#   1341#   1349    1351#   1364#   1373#   1419#   1422    1423#   1444#   1453#
                1468#   1473#   1478#   1487#   1498#   1502#   1506#   1513#   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#   1891#   1896#   1903#   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#
REDPTR= 000736  181#    837     839     1389    1399
REG     = 004000  198#    222     271     278     357     359     373     389     401     494     505     560     568
                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
R0      =%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#
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```
                    930     942*    944     954*    956     966*    968     994*    999*    1010    1047*   1155*   1293*
                   1631*   1633
R1      =x000001    132*
R10     =x000010    138*    274*    278     395*    401     502*    505     639*    652*    656*    709*    712     992*
                   1027*   1029    1051*   1054*   1074*   1075    1097*   1099    1117*   1121    1138*   1140    1157*
                   1159    1180*   1181    1206*   1209    1229*   1232    1252*   1255    1275*   1278    1295*   1300
                   1324*   1327    1349*   1352
R11     =x000001    139*
R12     =x000002    140*    275*    281     396*    610*    611*    710*    716     1019*   1024*   1038    1088*   1094*
                   1116*   1118    1161*   1162    1202*   1204    1276*   1281    1284    1302*   1303    1317*   1322
                   1350*   1355    1358*   1420*   1431*   1436*   1650*   1660    1754*   1772*   1777*
R13     =x000003    141*    706*    708*    719*    1131*   1135*   1207*   1212    1215    1248*   1250    1325*   1330
                   1333    1342*   1347    1393*   1395    1676*   1686    1808*   1812    1868*   1890    1893    1896
R14     =x000004    142*    1177*   1178    1230*   1235    1253*   1258    1261*   1703*   1716    1804*   1807*   1841*
                   1843
R15     =x000005    143*    563*    614*    1225*   1227    1271*   1273
R2      =x000002    133*    259*    265     365*    376     439*    441     444     669*    670     685*    688*    696*
                    736*    741     757*    762     778*    781     802*    809     822*    850*    856     871*    876
                    895*    900     1002*   1004    1017*   1085*   1199*   1315*   2052*
R3      =x000003    134*    702*    723     779*    784     874*    882     1128*   1244*   1340*   1791*   1792    1909*
                   1911    1914
R4      =x000004    135*    732*    734*    744     1175*
R5      =x000005    136*    604     754*    755*    765*    1222*   1267*   1856*   1858
SCOPE   = 010701    150*    233     243     254     270     287     321     354     [illegible]     408     428     455     473
                    491     521     547     592     634     662     682     701     728     749     771     794     814
                    835     844     861     887     905     921     935     949     961     974     990     1015    1045
                   1064    1083    1106    1126    1152    1172    1196    1219    1243    1256    1291    1313    1338
                   1363    1386    1415    1443    1462    1467    1479    1497    1518    1536    1546    1561    1573
                   1591    1611    1629    1638    1665    1691    1721    1749    1783    1800    1820    1833    1848
                   1863    1880    1901    1912    1944    1969    1991    2014    2019
SLR     = 177774    167*    583*    587*    593*    629*    1370*   1383*   1394*   1411*
SM      = 040000    193*    234     238     245     252     291     305     311     355     357     367     410     411
                    421     433     444     459     486     514     549     553     588     638     646     649     703
                    712     729     738     795     803     845     856     864     876     906     938     950     991
                    998    1087    1099    1109    1118    1197    1209    1230    1232    1314    1327    1435    1505
                   1578    1599    1692    1716    1722    1727    1735    1750    1753    1834    1843    1881    1883
                   1896    1945    1952    2024    2045    2052
SPTR    = 000600    178*    292     314     358     370     373     376     412     418     497     550     704     716
                    730     741     799     806     847     853     865     879     910     916     952     956     963
                    995    1004    1007    1010    1110    1121    1158    1212    1221    1235    1238    1320    1330
                   1482    1489    1492    1500    1536*   1510    1513    1576    1583    1586    1594    1603    1606
                   1641    1643*   1651    1693    1707    1710    1713    1723    1738    1741    1744    1751    1759
                   1762    1769    1835    1882    1890    1925    1938    1946    1955    1972    1985    1993    2002
                   2010*   2036    2046
SSP     =x000006    147*    292*    312     358*    365     412*    497*    550*    551*    565*    604*    704*    705*
                    710     730*    731*    736     796*    801*    804     846*    849*    851     865*    866*    872
                    907*    911*    914     939*    951*    952*    953*    954     995*    996*    1002    1090*   1092*
                   1110*   1111*   1117    1138*   1200*   1207    1221*   1223*   1230    1320*   1321*   1325    1456*
                   1458    1483*   1486    1488    1501*   1509    1530*   1552    1577*   1579    1581    1595*   1602
                   1642*   1647    1693*   1694*   1697*   1698*   1701    1706    1723*   1734    1751*   1768    1835*
                   1836*   1892*   1898    1926*   1937    1946*   1947*   1949*   1950*   1952*   1954    1973*   1984
                   1993*   1994*   1996*   1997*   1999    2001    2026*   2045
START   001012      210     219*    2068
SWR     = 177570    174*    227     229
TBIT    = 000020    199*
TBITVE= 000014      161*
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DCKBOA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

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TEMP    001002          216#   555#   557#   559#   562#   564#   566#   574#   577#   579    597#   599#   600#
                        602#   603#   605#   609#   611#   612#   613#   615#   616#   620#   621#   623    641#
                        649    914#   916    1077#  1078#  1083   1089#  1102   1107#  1113#  1131   1132#  1143#
                       1293   1295   1296#  1297#  1315   1317   1318#  1319#  1333   1340   1342   1343#  1344#
                       1365#  1371   1372#  1393   1422#  1427   1731#  1735   1757#  1765   1787#  1788#  1790#
                       1795   1805#  1806#  1807#  1815#  1927   1929#  1934#  1949   1951#  1963#  1975   1976#
                       1996   1998#
TKB     = 177562        171#
TKS     = 177560        170#   255#   259    261#   272#   275    276#
TPB     = 177566        173#   2001#
TPS     = 177564        172#   456#   504#   569#   571#   1725#  1733#  2060
TPVEC   = 000064        163#   493#   494#   517#   518#   567#   568#   572#   573#   1726#  1727#
TRAPVE= 000034          159#   289#   290#   317#   318#   429#   430#   450#   451#   617#   618#   630#   631#
                       1417#  1418#
TRT     = 000003        151#   392
TRTVEC= 000014          162#   388#   389#   404#   405#
T0      001062          233#
T1      001114          243#
T10     002132          408#
T10A    002172          409    416#
T10AA   002164          414#   418
T100    011642         1721#
T100A   011722         1726   1731#
T100AA  011714         1729#  1741
T101    012012         1749#
T101A   012150         1752   1777#
T101AA  012054         1757#  1759
T101EX  012154         1775   1780#
T102    012156         1783#
T103    012242         1800#
T104    012340         1820#
T104A   012366         1823   1827#
T105    012376         1833#
T105A   012430         1836   1841#
T106    012452         1848#
T106A   012504         1851   1856#
T107    012524         1863#
T107A   012554         1866   1870#
T107AA  012552         1869#  1873
T11     002236          428#
T11A    002306          429    438#
T11AA   002300          436#   441
T110    012604         1870#
T110A   012646         1874   1888#
T110AA  012640         1886#  1893
T111    012706         1901#
T111A   012750         1904   1909#
T111AA  012742         1907#  1914
T112    013012         1922#
T113    013104         1944#
T114    013216         1969#
T115    013314         1991#
T116A   013520         2023   2031#  2038
T116B   013526         2021   2034#
T12     002362          455#
T12A    002420          456    463#
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T12AA	002412	461#	468
T13	0 452	473#	
T13A	0 524	474	480#
T13AA	0 476	478#	485
T14	0 544	491#	
T14A	0 624	493	502#
T14AA	0 616	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	583#
T16F	0 550	567	571#
T16G	003302	552	577#
T16X	003336	592	587#
T17	0 354	592#	
T17A	003410	598#	
T17B	003422	598	600#
T17C	003442	601	603#
T17D	0 580	607	609#
T17E	0 622	610	613#
T17ERR	0 622	595	627#
T17F	0 642	614	616#
T17G	0 674	617	621#
T17X	003630	626	629#
T2	001146	254#	
T20	003646	634#	
T20A	003764	637	656#
T20AA	003702	641#	643
T21	003770	65?	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#	
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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#	

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T72     011046          1591#
T73     011142          1611#
T74     011232          1629#
T75     011262          1638#
T76     011376          1665#
T77     011510          1691#
UBREAK= 177770           169#   229*
UM      = 140000         191#   222    244    248    271    277    278    325    339    345    359    373    379
                         389    390    397    401    430    431    447    476    503    523    540    594    618
                         642    711    750    759    772    781    815    823    842    873    888    897    922
                         927    936    941    962   1016   1023   1028   1032   1038   1130   1139   1218   1231
                        1245   1254   1255   1268   1277   1278   1326   1339   1351   1352   1419   1423   1427
                        1487   1508   1524   1526   1580   1601   1617   1619   1728   1744   1755   1762   1765
                        1842   1849   1858   1889   1902   1905   1910   2027
UPTR    = 000700         179#   326    348    360    382    391    398    432    526    596    751    762    773
                         784    819    826    863    869    939    944    964    978   1020   1029   1032   1035
                        1133   1246   1258   1269   1271   1281   1284   1345   1355   1521   1523*  1528   1531
                        1614   1616*  1621   1624   1668   1670*  1677   1694   1696*  1710   1850   1913   1911
                        1947   1960   1994   2007
USP     =%000006         148#   326*   346    360*   380    391*   396    432*   439    526*   596*   751*   752*
                         757    773*   774*   779    816*   821*   824    863*   870*   874    883*   890*   892*
                         895    923*   926*   928    937*   940*   942    963*   964*   965*   966   1020*  1021*
                        1027   1133*  1134*  1246*  1247*  1253   1269*  1270*  1276   1345*  1346*  1350   1471*
                        1473   1504*  1507   1522*  1525   1527   1565*  1567   1598*  1600   1615*  1618   1620
                        1669*  1673   1695*  1700   1850*  1851*  1903*  1909   1948*  1959   1995*  2006
V       = 000002         201#   687
YELPTR= 001000           180#  1365   1374   1377   1380
Z       = 000004         202#   646    649    670    687    738    781    876    897   1099   1118   1209   1303
                        1405   1427   1686   1716   1792
.       = 013674         207#   208    209#   212#   217#   223    228    239    249    263    266    279    282
                         300    303    306    309    315    334    337    340    343    349    368    371    374
                         377    383    399    402    419    422    442    445    448    466    469    483    486
                         506    509    512    515    535    538    541    580    624    644    647    650    671
                         674    677    691    694    697    713    717    720    724    739    742    745    760
                         763    766    782    785    788    807    810    827    830    840    854    857    877
                         880    883    898    901    917    931    945    957    969    983    936   1005   1008
                        1011   1030   1033   1036   1039   1055   1057   1060   1072   1076   1079   1095   1100
                        1103   1114   1119   1122   1135   1141   1144   1163   1166   1169   1182   1185   1188
                        1210   1213   1216   1233   1236   1239   1256   1259   1262   1279   1282   1285   1304
                        1307   1310   1328   1331   1334   1353   1356   1359   1375   1378   1381   1400   1403
                        1406   1409   1425   1428   1432   1448   1460   1463   1475   1490   1493   1511   1514
                        1529   1532   1542   1554   1557   1569   1583   1587   1604   1607   1622   1625   1634
                        1652   1655   1658   1661   1678   1681   1684   1687   1708   1711   1714   1717   1736
                        1739   1742   1745   1760   1763   1766   1770   1773   1793   1796   1810   1813   1816
                        1827   1829   1844   1859   1871   1874   1877   1891   1894   1897   1912   1915   1932
                        1935   1939   1956   1961   1964   1979   1982   1986   2003   2008   2011   2035   2039
                        2043   2047   2061
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ASL     912   913
ASR     908   909
BCS    1057  1829
BEQ     228   239   249   263   279   300   303   306   309   315   334   337   340   343   349
        368   371   374   377   383   399   402   419   422   442   445   448   466   469   483
        486   506   509   512   515   535   538   541   580   624   644   647   650   653   671
        674   677   691   694   697   713   717   720   724   739   742   745   760   763   766
        782   785   788   807   810   827   830   840   854   857   877   880   883   898   901
        917   931   945   957   969   983   986  1005  1008  1011  1030  1033  1036  1039  1060
       1076  1079  1100  1103  1119  1123  1141  1144  1163  1166  1169  1182  1185  1188  1210
       1213  1216  1233  1236  1239  1256  1259  1262  1279  1282  1285  1304  1307  1310  1328
       1331  1334  1353  1356  1359  1375  1378  1381  1400  1403  1406  1409  1425  1428  1432
       1448  1460  1463  1475  1490  1493  1511  1514  1533  1532  1542  1554  1557  1569  1583
       1587  1604  1607  1622  1625  1634  1652  1655  1658  1661  1678  1681  1684  1687  1708
       1711  1714  1717  1736  1739  1742  1745  1760  1763  1766  1770  1773  1793  1796  1810
       1813  1816  1844  1859  1871  1874  1877  1891  1894  1897  1912  1915  1932  1935  1939
       1956  1961  1964  1974  1982  1986  2003  2008  2011  2035  2039  2043  2047  2057  2063
BIC     277   397   498   503   504   527   571   642   711   754   774   993  1028  1098  1139
       1208  1231  1254  1277  1326  1351  1423  1487  1508  1526  1580  1601  1619  1842  1889
       1910
BIS     256   272   496   498   557   559   560   562   564   566   569   574   577   599   600
        602   603   604   605   606   608   609   612   613   615   616   620   621   705   752
        775   873  1018  1050  1087  1134  1201  1224  1294  1316  1341  1485  1502  1505  1524
       1578  1596  1599  1617
BIT     222   227   265   281
BNE     223   266   282
BPL    1827  2061
BR      582   626   655  1055  1072  1095  1114  1136  1435  1775
CCC     293   776   891  1069  1112  1249
CLR     220   237   247   260   261   276   284   295   298   313   318   324   329   332   347
        362   366   381   393   405   414   417   425   436   440   451   457   461   464   478
        481   500   518   529   532   533   544   555   573   578   583   587   589   597   622
        627   629   631   639   653   676   683   685   702   706   722   731   737   758   780
        796   805   816   825   846   852   866   875   890   896   907   915   925   929   937
        943   951   955   967   975   979   982  1000  1003  1017  1025  1041  1046  1049  1051
       1084  1092  1111  1127  1132  1147  1155  1175  1202  1244  1264  1267  1292  1297  1318
       1343  1367  1369  1383  1391  1411  1420  1444  1455  1503  1523  1537  1549  1597  1616
       1632  1644  1645  1670  1671  1696  1697  1729  1733  1754  1786  1805  1839  1854  1857
       1864  1886  1907  1918  1929  1951  1974  1997  2013  2022  2029  2031  2050  2053
CLZ     869
CMP     238   248   262   278   299   302   305   308   314   333   336   339   342   348   367
        370   373   376   382   398   401   418   421   441   444   447   465   468   482   485
        505   508   511   514   534   537   540   579   623   643   646   649   670   673   690
        693   712   716   738   741   759   762   781   784   806   809   826   829   839   853
        856   876   879   897   916   944   956   968   982   985  1004  1007  1010  1029  1032
       1035  1038  1059  1075  1099  1118  1121  1162  1165  1181  1184  1187  1209  1212  1232
       1235  1238  1255  1258  1278  1281  1284  1303  1306  1327  1330  1333  1352  1355  1374
       1377  1380  1399  1405  1408  1424  1427  1447  1459  1474  1489  1492  1510  1528  1531
       1541  1553  1568  1582  1586  1603  1621  1624  1633  1651  1654  1660  1677  1680  1686
       1707  1710  1716  1735  1738  1741  1744  1759  1762  1765  1769  1792  1809  1812  1843
       1858  1870  1873  1876  1890  1893  1896  1911  1914  1931  1938  1955  1960  1978  1981
       1985  2002  2007  2034  2038  2042  2046  2056
CMPB    1140
COM     656  1143  1168  1358  1431  1436  1457  1472  1551  1566  1772  1777
EMT     361   413   575
HALT    149   208   296   460   462   477   479
```

```
INC      652  696  719  765 1078 1261 1657 1815 1934 1963 2010 2055
IOT      328  640 1756 2028
JMP      210 2038 2068
JSR      556  558  561  563  598  601  607  614 2064
MFPD    1159 1204 1250 1300 1371 1446 1458 1473 1486 1488 1507 1509 1525 1527 1647
        1648 1673 1674 1700 1701 1706 1734 1768 1868 1885 1906 1937 1954 1959 1999
        2001 2006 2045
MFPI    1178 1227 1273 1322 1347 1395 1539 1552 1567 1579 1581 1600 1602 1618 1620
        1977 1984
MOV      219  225  226  234  236  244  246  255  258  259  271  274  275  288  289
         290  291  292  297  311  312  317  322  323  325  326  331  345  346  351
         355  356  357  358  359  360  364  365  379  370  368  389  390  391  395
         396  404  409  410  411  412  416  424  429  430  471  432  433  438  439
         450  456  458  459  463  474  475  476  480  483  493  494  495  497  502
         517  522  523  524  525  526  528  531  543  548  549  550  551  552  553
         554  565  567  568  572  588  593  594  595  596  610  617  618  630  635
         636  637  638  641  664  665  667  669  684  686  687  689  703  704  709
         710  729  730  732  735  736  750  751  756  757  772  773  778  779  795
         797  798  799  802  803  804  815  817  818  819  822  823  824  836  837
         845  847  850  851  862  863  864  865  871  872  874  888  889  894  895
         906  910  914  922  923  924  927  928  936  938  939  941  942  950  952
         954  962  963  964  966  976  977  978  991  994  995  996  997  998 1002
        1016 1019 1020 1021 1022 1023 1027 1047 1048 1052 1065 1066 1067 1068 1074
        1085 1086 1088 1089 1090 1097 1107 1108 1109 1110 1116 1117 1128 1129 1130
        1131 1133 1138 1146 1153 1154 1156 1157 1161 1173 1174 1176 1177 1180 1197
        1198 1199 1200 1206 1207 1220 1221 1222 1223 1225 1229 1230 1245 1246 1247
        1248 1252 1253 1268 1269 1270 1271 1275 1276 1293 1295 1296 1298 1299 1302
        1314 1315 1317 1319 1320 1321 1324 1325 1339 1340 1342 1344 1345 1346 1349
        1350 1364 1365 1366 1368 1370 1387 1388 1389 1390 1393 1394 1412 1416 1417
        1418 1419 1422 1445 1453 1454 1468 1469 1470 1480 1481 1482 1498 1499 1500
        1506 1519 1520 1521 1538 1547 1548 1562 1563 1564 1574 1575 1576 1592 1593
        1594 1612 1613 1614 1630 1631 1639 1640 1641 1643 1650 1666 1667 1668 1672
        1676 1692 1693 1694 1698 1703 1704 1705 1722 1723 1724 1725 1726 1727 1728
        1731 1732 1750 1751 1752 1753 1755 1757 1758 1784 1785 1787 1788 1791 1801
        1802 1803 1804 1806 1808 1821 1822 1823 1834 1835 1836 1841 1849 1850 1851
        1856 1865 1866 1881 1882 1883 1884 1888 1902 1903 1904 1905 1909 1917 1923
        1924 1925 1927 1928 1945 1946 1947 1949 1950 1953 1958 1970 1971 1972 1975
        1976 1992 1993 1994 1996 1998 2000 2005 2020 2021 2023 2024 2025 2026 2027
        2051 2052 2059 2062
MOVB     229
MTPD     668  708  755  801  821  838  849  870  892  980  999 1054 1070 1113 1471
        1483 1501 1504 1522 1642 1669 1695 1790 1825 1853 1926 1930 1948 1973 1995
MTPI     688  734  777  911  926  940  953  965 1024 1094 1135 1456 1550 1565 1577
        1595 1598 1615 1807 1838 1952
NOP     1438 1649 1675 1702 1780 2065 2066 2067
RESET    257  273
RTI     1437 1778
RTS      611
RTT      657
SCC      327  434  800  820  848  868 1226 1272 1646 1699 1789 1824 1837 1852 1867
SEC      707  753 1053 1158
SEV      733 1093 1203
SPL      235  245  492
TRAP     294  435  619 1421
TST      676  723  744  787  882  900  930 1102 1215 1309 1402 1462 1513 1556 1606
        1683 1713 1795
```

DCKBOA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

```
TSTB     2060
WAIT      570
.ABS      115
.END     2069
.NLIST    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)
```

M04

Spooler runtime [illegible] Seconds, [illegible] disk pages, 3 disk writes, 50 pages [illegible]

```
0000000000111111111111111111111111111110
111111111122222222222233312
567890123456789012 ##
00000000000000000000111111111111111111111111111111111110
00000000011111111112222222222333333333344444444445555555555666666666677777777778888888888999999999900000000001111111111222222222233312
```