# PDP11/34

MEM. MANG. PROC. STATES

MD-11-DFKTD-A

EP-DFKTD-A-DL-A

OCT 1976



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                                        IDENTIFICATION

                                PRODUCT CODE:           MAINDEC-11-DFKTD-A-A

                                PRODUCT NAME:           11/34 MEMORY MANAGEMENT PROCESSOR STATES TEST

                                DATE CREATED:           DECEMBER 21, 1975

                                MAINTAINER:             DIAGNOSTIC GROUP

                                AUTHOR:                 GLENN JOHNSON




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1.0 ABSTRACT

THIS IS A TEST THAT UTILIZES THE 11/34 MEMORY MANAGEMENT FEATURES AND TESTS THAT IN THE TWO PDP11/34 STATES (KERNEL, USER) INSTRUCTIONS ARE EXECUTED PROPERLY. THIS TEST TESTS TRAPS FROM ONE STATE TO THE OTHER AND USES THE MFPI/MTPI INSTRUCTIONS.

2.0 REQUIREMENTS

2.1 EQUIPMENT

PDP-11/34

2.2 STORAGE

UTILIZES 4K OF MEMORY.

3.0 LOADING PROCEDURE

LOAD PROGRAM INTO MEMORY USING ABSOLUTE LOADER.

4.0 STARTING PROCEDURE

LOAD ADDRESS 200. PRESS START, THE PROGRAM WILL LOOP AND RING BELL ON COMPLETION OF A PASS.

5.0 OPERATION PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

NONE

5.2 SUBROUTINE ABSTRACTS

5.2.1 SCOPE

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

5.2.2 HLT

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

5.3 PROGRAM AND/OR OPERATOR ACTION

5.3.1 PASS COUNT (ICNT)

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

                6.0     ERRORS
                        ------

                6.1     TEST ERROR WILL CAUSE A HALT

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

                6.2     ERROR RECOVERY

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

                6.3     ERROR LOOPING

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

                7.0     RESTRICTIONS
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                        THIS PROGRAM MUST BE LOADED IN LOWER 4K.

                7.1     STARTING RESTRICTION

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

                7.2     OPERATIONAL RESTRICTIONS

                        NONE

                8.1     EXECUTION TIME
                        --------------

                        ONE PASS TAKES APPROXIMATELY 10 SECONDS.


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                        .TITLE  TEST DFKTDA PDP11/34 PROCESSER STATES TEST
                        .ABS
                ;THIS TEST IS A MODIFICATION TO THE PDP-11/40 TEST, DBKTD.
                ;THIS TEST HAS BEEN MODIFIED TO ACCOUNT FOR ANY 11/40 - 11/34
                ;DIFFERENCES. THIS PROGRAM IS INTENDED TO BE RUN ON ONLY THE
                ;11/34.
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                                        ;TEST DFKTDA TESTS FEATURES OF THE TWO 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
                                        ;       START
                                        ;       KERNEL STACK POINTER IS AT 500
                                        ;       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

                                        ;STACK POINTERS
              000006                            KSP=%6                  ;KERNEL STACK POINTER
              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
              000010                            RESVEC=10               ;ADDRESS OF RESERVED INST TRAP 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
                                        ;HARDWARE REGISTER ASSIGNMENTS
              177776                            PSW=177776              ;ADDRESS OF STATUS 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
                                        ;INITIAL STACK POINTER SETTIGS
              000500                            KPTR=500                ;KERNEL 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=40000
                 020000                             BIT13=20000
                 000100                             BIT6=100


                                            ;STATUS REGISTER BIT ASSIGNMENTS
                 140000                             UM=140000                ;USER MODE
                 100000                             IM=100000                ;ILLEGAL MODE
                 040000                             IM1=40000                ;ILLEGAL MODE
                 000000                             KM=0                     ;KERNEL MODE
                 030000                             PUM=030000               ;PREVIOUS USER MODE
                 000000                             PKM=0                    ;PREVIOUS KERNEL MODE
                 000000                             REG=0                    ;REGISTER BIT:  HAS NO EFFECT!!!!
                 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


                 000000                             .=0
                                                    .REPT   100
                                                    .+2
                                                    HALT
                                                    .ENDR

                 000046                             .=46
        000046   006144                             LOGIC
                 000052                             .=52
        000052   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
```

```
     001012  012706  000500           START:  MOV     #KPTR,KSP
     001016  005067  177756                   CLR     ICNT
                                      ;TEST THAT PROCESSER POWERED UP OK FOR THE TEST
     001022  032737  000000  177776   PWRUP:  BIT     #KM+PKM,@#PSW    ;IS STATUS CORRECT
     001030  001377                           BNE     .                ;LOOP HERE IF NOT

     001032  012706  000500           BEGIN:  MOV     #KPTR,KSP        ;INITIALIZE THE STACK POINTER

                                      ;CHECK THAT THE NOP INSTRUCTION IS A 'NOP' IN USER MODE.
     001036  010701                   T1:     SCOPE
     001040  012737  140000  177776           MOV     #UM,@#PSW        ;USER MODE,PRIORITY LEVEL 0
     001046  000240                           NOP
     001050  013700  177776                   MOV     @#PSW,R0         ;GET @#PSW
     001054  005037  177776                   CLR     @#PSW            ;KERNEL MODE!!!
     001060  022700  140000                   CMP     #UM,R0           ;TEST THAT NOP DID NOT ALTER @#PSW
     001064  001401                           BEQ     .+4
     001066  000000                           HLT                      ;ERROR! NOP CHANGED STATUS WORD


                                      ;TEST TRAP FROM USER MODE TO KERNEL MODE
     001070  010701                   T5:     SCOPE
     001072  012706  000500                   MOV     #KPTR,KSP
     001076  012737  001134  000020           MOV     #T5A,@#IOTVEC
     001104  005067  176712                   CLR     IOTVEC+2
     001110  012737  140340  177776           MOV     #UM+PRTY7,@#PSW ;USER MODE!!!
     001116  012706  000700                   MOV     #UPTR,USP
     001122  000277                           SCC
     001124  000004                           IOT
     001126  005037  177776           T5AA:   CLR     @#PSW
     001132  000000                           HLT
     001134  013700  177776           T5A:    MOV     @#PSW,R0
     001140  005037  177776                   CLR     @#PSW
     001144  022700  030000                   CMP     #KM+PUM,R0
     001150  001401                           BEQ     .+4
     001152  000000                           HLT
     001154  022767  001126  177312           CMP     #T5AA,KPTR-4
     001162  001401                           BEQ     .+4
     001164  000000                           HLT
     001166  022767  140357  177302           CMP     #UM+PRTY7+17,KPTR-2
     001174  001401                           BEQ     .+4
     001176  000000                           HLT
     001200  022706  000474                   CMP     #KPTR-4,KSP
     001204  001401                           BEQ     .+4
     001206  000000                           HLT
     001210  012737  140000  177776           MOV     #UM,@#PSW
     001216  010600                           MOV     USP,R0
     001220  005037  177776                   CLR     @#PSW
     001224  022700  000700                   CMP     #UPTR,R0
     001230  001401                           BEQ     .+4
     001232  000000                           HLT
     001234  012737  000022  000020           MOV     #IOTVEC+2,@#IOTVEC

                                      ;TEST TRAP FROM USER TO USER MODE (VIA TRACE TRAP)
     001242  010701                   T7:     SCOPE
     001244  012767  001302  176542           MOV     #T7A,TRTVEC
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001252  012767  140000  176536           MOV    #UM,TRTVEC+2      ;USER MODE ON TRAP
001260  012737  140000  177776           MOV    #UM,@#PSW
001266  012706  000700                   MOV    #UPTR,USP
001272  000003                           TRT
001274  005037  177776          T7AA:    CLR    @#PSW
001300  000000                           HLT
001302  013700  177776          T7A:     MOV    @#PSW,R0
001306  010602                           MOV    USP,R2
001310  042737  140000  177776           BIC    #UM,@#PSW
001316  022767  001274  177350           CMP    #T7AA,UPTR-4
001324  001401                           BEQ    .+4
001326  000000                           HLT
001330  022700  170000                   CMP    #UM+PUM,R0
001334  001401                           BEQ    .+4
001336  000000                           HLT
001340  012767  000016  176446           MOV    #TRTVEC+2,TRTVEC
001346  005067  176444                   CLR    TRTVEC+2

                                ;TEST THAT THE 'HALT' INSTRUCTION TRAPS TO LOCATION 10 IN
                                ;USER MODE.
001352  010701                  T12:     SCOPE
001354  012737  001410  000010           MOV    #T12A,@#RESVEC
001362  005037  000012                   CLR    @#RESVEC+2
001366  012706  000500                   MOV    #KPTR,KSP
001372  012737  140000  177776           MOV    #UM,@#PSW         ;USER MODE!!!
001400  000000                           HALT                     ;HALT TRAPS IN USER MODE
001402  005037  177776          T12AA:   CLR    @#PSW
001406  000000                           HALT                     ;ERROR!  HALT DID NOT TRAP
001410  013700  177776          T12A:    MOV    @#PSW,R0
001414  005037  177776                   CLR    @#PSW
001420  022700  030000                   CMP    #KM+PUM,R0
001424  001401                           BEQ    .+4
001426  000000                           HLT
001430  022767  001402  177036           CMP    #T12AA,KPTR-4
001436  001401                           BEQ    .+4
001440  000000                           HLT

                                ;CHECK THAT SPL TRAPS TO 10 IN USER MODE.
001442  010701                  T13:     SCOPE
001444  012737  001474  000010           MOV    #T13A,@#RESVEC
001452  012706  000500                   MOV    #KPTR,KSP         ;SET KERNEL STACK PTR
001456  012737  140000  177776           MOV    #UM,@#PSW         ;USER MODE!!!
001464  000237                           SPL    7                 ;SPL TRAPS IN USER MODE
001466  005037  177776          T13AA:   CLR    @#PSW             ;KERNEL MODE!!!
001472  000000                           HLT                      ;ERROR! SPL FAILED TO TRAP IN USER MODE
001474  013700  177776          T13A:    MOV    @#PSW,R0
001500  005037  177776                   CLR    @#PSW
001504  022700  030000                   CMP    #KM+PUM,R0
001510  001401                           BEQ    .+4
001512  000000                           HLT
001514  022767  001466  176752           CMP    #T13AA,KPTR-4
001522  001401                           BEQ    .+4
001524  000000                           HLT
001526  012737  000012  000010           MOV    #RESVEC+2,@#RESVEC

                                ;TEST THAT "RESET" RESETS IN KERNEL MODE
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        001534  010701                          T18:    SCOPE
        001536  005037  177776                          CLR     @#PSW
        001542  012737  000340  177776                  MOV     #PRTY7,@#PSW    ;PRIORITY TO 7
        001550  012767  000100  176006                  MOV     #100,177564     ;SET "IE" IN TPS
        001556  000005                                  RESET                   ;CLEAR "IE"
        001560  005037  177776                          CLR     @#PSW
        001564  032767  000100  175772                  BIT     #100,177564
        001572  001401                                  BEQ     .+4
        001574  000000                                  HLT                     ;RESET DID NOT
                                                                                ;CLEAR "IE"

                                                ;TEST THAT "RESET" NOP'S IN USER MODE
        001576  010701                          T19:    SCOPE
        001600  012737  140340  177776                  MOV     #UM+PRTY7,@#PSW ;USER MODE!!!
        001606  012767  000100  175750                  MOV     #100,177564     ;SET "IE"
        001614  000005                                  RESET                   ;SHOULD NOP
        001616  032767  000100  175740                  BIT     #100,177564
        001624  001001                                  BNE     .+4
        001626  000000                                  HLT                     ;"IE" CLEARED
        001630  005067  175730                          CLR     177564
        001634  005037  177776                          CLR     @#PSW

                                                ;TEST INTERRUPT SEQUENCE USER TO KERNEL MODE
        001640  010701                          T15:    SCOPE
        001642  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
        001646  012737  170340  177776                  MOV     #UM+PUM+PRTY7,@#PSW     ;USER MODE!!!
        001654  012767  001720  176202                  MOV     #T15A,64                ;INTERRUPT VEC.
        001662  012767  000200  176176                  MOV     #KM+PRTY4,66
        001670  012706  000700                          MOV     #UPTR,USP       ;SET USER STACK POINTER
        001674  042737  000200  177776                  BIC     #PRTY4,@#PSW    ;SET PRIORITY LEVEL=3
        001702  012767  000100  175654                  MOV     #100,177564     ;REQUEST AN INTERRUPT AT LEVEL 4
        001710  000240                          T15AA:  NOP
        001712  005037  177776                          CLR     @#PSW           ;KERNEL MODE!!!
        001716  000000                                  HLT                     ;ERROR! NO INTERRUPT REQUEST
        001720  013700  177776                  T15A:   MOV     @#PSW,R0        ;GET 'NEW' @#PSW
        001724  005067  175634                          CLR     177564          ;DISABLE REQUEST
        001730  005037  177776                          CLR     @#PSW
        001734  022700  030200                          CMP     #KM+PUM+PRTY4,R0  ;TEST THAT 'NEW' @#PSW IS CORRECT
        001740  001401                                  BEQ     .+4             ;(PIRVEC+2)
        001742  000000                                  HLT                     ;ERROR! 'NEW' @#PSW NOT = TO (PIRVEC+2)
        001744  022767  001710  176522                  CMP     #T15AA,KPTR-4   ;IS RETURN ADDRESS ON KERNEL STACK
        001752  001401                                  BEQ     .+4
        001754  000000                                  HLT                     ;ERROR! RETURN ADDRESS NOT ON KERNEL STACK
        001756  022767  170140  176512                  CMP     #UM+PUM+PRTY3,KPTR-2  ;TEST THAT 'OLD' @#PSW WAS SAVED ON
        001764  001401                                  BEQ     .+4             ;KERNEL STACK
        001766  000000                                  HLT                     ;ERROR!
        001770  012767  000066  176066                  MOV     #66,64
        001776  005067  176064                          CLR     66

                                                ;TEST THAT THERE IS NO STACK OVERFLOW IN USER MODE.
        002002  010701                          T17:    SCOPE
        002004  012737  140000  177776                  MOV     #UM,@#PSW       ;USER MODE!!!
        002012  012737  002234  000004                  MOV     #T17ERR,@#ERRVEC
        002020  012706  000700                          MOV     #UPTR,USP       ;SET USER STACK POINTER
        002024  005067  176752                          CLR     TEMP            ;CLEAR INDICATOR LOCATION
        002030  004767  000006                  T17A:   JSR     7,T17B          ;PUSH ONTO USER STACK
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002034  052767  000400  176740           BIS     #400,TEMP            ;SET ERROR INDICATOR BIT
002042  052767  000001  176732  T17B:    BIS     #1,TEMP              ;SET INDICATOR BIT
002050  004567  000006                   JSR     5,T17C               ;PUSH ONTO USER STACK
002054  052767  001000  176720           BIS     #1000,TEMP           ;SET ERRROR INDICATOR BIT
002062  052767  000002  176712  T17C:    BIS     #2,TEMP              ;SET INDICATOR BIT
002070  050546                           BIS     R5,-(USP)            ;PUSH ONTO USER STACK
002072  052767  000004  176702           BIS     #4,TEMP              ;SET INDICATOR BIT
002100  004767  000006                   JSR     7,T17D               ;PUSH ONTO USER STACK
002104  052767  002000  176670           BIS     #2000,TEMP           ;SET ERROR INDICATOR BIT
002112  052767  000010  176662  T17D:    BIS     #10,TEMP
002120  012702  002134                   MOV     #T17E,R2             ;SET UP RETURN FOR RTS
002124  000202                           RTS     R2                   ;GO TO T16E
002126  052767  004000  176646           BIS     #4000,TEMP           ;SET INDICATOR TO SHOW ERROR
002134  052767  000020  176640  T17E:    BIS     #20,TEMP
002142  004567  000006                   JSR     R5,T17F
002146  052767  010000  176626           BIS     #10000,TEMP          ;SET ERROR INDICATOR BIT
002154  052767  000040  176620  T17F:    BIS     #40,TEMP
002162  012737  002206  000034           MOV     #T17G,@#TRAPVEC ;SET UP TRAP VECTOR FOR TRAP
002170  012737  140000  000036           MOV     #UM,@#TRAPVEC+2
002176  104400                           TRAP
002200  052767  020000  176574           BIS     #20000,TEMP
002206  052767  000100  176566  T17G:    BIS     #100,TEMP
002214  005037  177776                   CLR     @#PSW                ;KERNEL MODE!!!
002220  022767  000177  176554           CMP     #177,TEMP
002226  001401                           BEQ     .+4
002230  000000                           HLT
002232  000403                           BR      T17X
002234  005037  177776          T17ERR:  CLR     @#PSW
002240  000000                           HLT                          ;ERROR! OVERFLOW OCCURED
002242  000240                  T17X:    NOP
002244  012737  000036  000034           MOV     #TRAPVEC+2,@#TRAPVEC
002252  005067  175560                   CLR     TRAPVEC+2

                                ;TEST THAT MTPD/I POPS WORD OFF THE THE APPROPRIATE STACK (AS
                                ;DETERMINED BY BITS 15&14 IN @#PSW.)
                                ;MTPD, KERNEL MODE
002256  010701                  T21:     SCOPE
002260  005037  177776                   CLR     @#PSW
002264  012706  000500                   MOV     #KPTR,KSP                  ;SET KERNEL STACK POINTER
002270  012700  177777                   MOV     #-1,R0                     ;PRE-SET R0
002274  005016                           CLR     (KSP)                      ;PUT 0 ON THE STACK
002276  012737  030011  177776           MOV     #PUM+N+C,@#PSW             ;PRE SET STATUS
002304  006600                           MTPI    R0                         ;R0<--(KSP)+

002306  013702  177776                   MOV     @#PSW,R2                   ;GET STATUS
002312  022702  030005                   CMP     #PUM+Z+C,R2
002316  001401                           BEQ     .+4
002320  000000                           HLT                                ;ERROR! INCORRECT STATUS
002322  022706  000502                   CMP     #KPTR+2,KSP                ;DID KSP INCREMENT BY 2
002326  001401                           BEQ     .+4
002330  000000                           HLT                                ;ERROR!  KSP DID NOT POP
002332  005700                           TST     R0                         ;DID WORD ON STACK (0) GET TO R0?
002334  001401                           BEQ     .+4
002336  000000                           HLT                                ;ERROR! MTPD DID NOT POP 0 OFF
                                                                            ;KSP INTO R0
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                                                ;MTPI,KERNEL MODE
     002340  010701                             T22:    SCOPE
     002342  005037  177776                             CLR     @#PSW
     002346  012706  000500                             MOV     #KPTR,KSP
     002352  005002                                     CLR     R2                      ;PRESET R2
     002354  012716  177777                             MOV     #-1,(KSP)
     002360  012737  030006  177776                     MOV     #PUM+Z+V,@#PSW          ;PRESET STATUS
     002366  006602                                     MTPI    R2                      ;R2←(KSP)+

     002370  013700  177776                             MOV     @#PSW,R0                ;GET STATUS
     002374  022700  030010                             CMP     #PUM+N,R0
     002400  001401                                     BEQ     .+4
     002402  000000                                     HLT                             ;ERROR! INCORRECT STATUS
     002404  022706  000502                             CMP     #KPTR+2,KSP
     002410  001401                                     BEQ     .+4
     002412  000000                                     HLT                             ;ERROR!
     002414  005202                                     INC     R2
     002416  001401                                     BEQ     .+4
     002420  000000                                     HLT                             ;ERROR!

                                                ;MTPD, USER MODE
     002422  010701                             T25:    SCOPE
     002424  012737  140000  177776                     MOV     #UM,@#PSW
     002432  012706  000700                             MOV     #UPTR,USP
     002436  052716  177777                             BIS     #-1,(USP)
     002442  000261                                     SEC
     002444  042705  177777                             BIC     #-1,R5
     002450  006605                                     MTPI    R5                      ;R5←(USP)+

     002452  013700  177776                             MOV     @#PSW,R0
     002456  010602                                     MOV     USP,R2
     002460  005037  177776                             CLR     @#PSW
     002464  022700  140011                             CMP     #UM+N+C,R0
     002470  001401                                     BEQ     .+4
     002472  000000                                     HLT
     002474  022702  000702                             CMP     #UPTR+2,R2
     002500  001401                                     BEQ     .+4
     002502  000000                                     HLT
     002504  005205                                     INC     R5
     002506  001401                                     BEQ     .+4
     002510  000000                                     HLT


                                                ;MTPI, USER MODE
     002512  010701                             T26:    SCOPE
     002514  012737  140000  177776                     MOV     #UM,@#PSW
     002522  012706  000700                             MOV     #UPTR,USP
     002526  042716  177777                             BIC     #-1,(USP)
     002532  052700  177777                             BIS     #-1,R0
     002536  000257                                     CCC
     002540  006600                                     MTPI    R0                      ;R0←(USP)+

     002542  013702  177776                             MOV     @#PSW,R2
     002546  010603                                     MOV     USP,R3

     002550  005037  177776                             CLR     @#PSW
```

```
002554  022702  140004                  CMP     #UM+Z,R2
002560  001401                          BEQ     .+4
002562  000000                          HLT
002564  022703  000702                  CMP     #UPTR+2,R3
002570  001401                          BEQ     .+4
002572  000000                          HLT
002574  005700                          TST     R0
002576  001401                          BEQ     .+4
002600  000000                          HLT

                                ;TEST THAT MTP D/I POPS WORD OFF STACK (AS DETERMINED BY BITS 15 & 14
                                ;INTO STACK POINTER (AS DETERMINED BY BITS 13 &12).
                                ;USP+(KSP)+,MTPD
002602  010701                  T30:    SCOPE
002604  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
002612  005006                          CLR     USP             ;PRESET USER STACK POINTER
002614  012737  030000  177776          MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
002622  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
002626  012716  000700                  MOV     #UPTR,(KSP)
002632  000277                          SCC                     ;PRESET CC'S
002634  006606                          MTPI    USP             ;USP+(KSP)+

002636  013702  177776                  MOV     @#PSW,R2        ;SAVE CC'S
002642  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
002650  010600                          MOV     USP,R0          ;GET USER STACK POINTER
002652  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
002656  022700  000700                  CMP     #UPTR,R0        ;CHECK THAT MTPD SET USER STACK
002662  001401                          BEQ     .+4             ;POINTER PROPERLY
002664  000000                          HLT                     ;ERROR!
002666  022706  000502                  CMP     #KPTR+2,KSP     ;CHECK KERNEL STACK POINTER
002672  001401                          BEQ     .+4
002674  000000                          HLT


                                ;KSP+(KSP)+,MTPD
002676  010701                  T31:    SCOPE
002700  012706  000500                  MOV     #KPTR,KSP
002704  012716  000736                  MOV     #REDPTR,(KSP)
002710  006606                          MTPI    KSP             ;KSP+(KSP)+
002712  022706  000736                  CMP     #REDPTR,KSP
002716  001401                          BEQ     .+4
002720  000000                          HLT

                                ;;USP+(USP)+,MTPD
002722  010701                  T31C:   SCOPE
002724  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!, PREV USER MODE!!
002732  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK PTR
002736  005016                          CLR     (USP)           ;PUT #0 ON USER STACK
002740  000257                          CCC
002742  006606                          MTPI    USP             ;USP+(USP)+

002744  013700  177776                  MOV     @#PSW,R0                ;SAVE CC'S
002750  010602                          MOV     USP,R2          ;SAVE USER STACK POINTER
002752  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
002756  022700  170004                  CMP     #UM+PUM+Z,R0    ;CHECK STATUS
002762  001401                          BEQ     .+4
```

```
002764  000000                                  HLT                             ;ERROR! INCORRECT STATUS AFTER MTPD
002766  005702                                  TST     R2                      ;CHECK NEW STACK POINTER VALUE
002770  001401                                  BEQ     .+4
002772  000000                                  HLT                             ;ERROR! MTPD FAILED TO SET USER STACK POINTER

                                        ;USP+(KSP)+,MTPI
002774  010701                          T32A:   SCOPE
002776  012737  140000  177776                  MOV     #UM,@#PSW               ;USER MODE
003004  012706  177777                          MOV     #-1,USP                 ;PRESET USER STACK POINTER
003010  012737  030000  177776                  MOV     #KM+PUM,@#PSW           ;CURRENT KERNEL,PREVIOUS USER
003016  005046                                  CLR     -(KSP)
003020  006606                                  MTPI    USP                     ;USP+(KSP+

003022  012737  140000  177776                  MOV     #UM,@#PSW
003030  010600                                  MOV     USP,R0                          ;GET USER STACK POINTER
003032  005037  177776                          CLR     @#PSW
003036  005700                                  TST     R0
003040  001401                                  BEQ     .+4
003042  000000                                  HLT

                                        ;USP+(USP)+
003044  010701                          T35:    SCOPE
003046  012737  170000  177776                  MOV     #UM+PUM,@#PSW
003054  012706  000700                          MOV     #UPTR,USP
003060  012716  000700                          MOV     #UPTR,(USP)
003064  006606                                  MTPI    USP                             ;USP+(USP)+

003066  010600                                  MOV     USP,R0
003070  005037  177776                          CLR     @#PSW
003074  022700  000700                          CMP     #UPTR,R0
003100  001401                                  BEQ     .+4
003102  000000                                  HLT


                                        ;TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION
                                        ;KERNEL MODE
003104  010701                          T36:    SCOPE
003106  005037  177776                          CLR     @#PSW
003112  012706  000500                          MOV     #KPTR,KSP
003116  012716  177777                          MOV     #-1,(KSP)
003122  012737  003142  000004                  MOV     #T36A,@#ERRVEC
003130  005067  174652                          CLR     ERRVEC+2
003134  006667  174637                          MTPI    -1                      ;TRAPS ON ODD ADDRESS
003140  000000                          T36AA:  HLT                             ;ERROR! DID NOT TRAP
003142  022706  000476                  T36A:   CMP     #KPTR-2,KSP             ;IS KSP CORRECT?(1 POP AND 2
003146  001401                                  BEQ     .+4                     ;PUSHES)
003150  000000                                  HLT                             ;ERROR! INCORRECT VALUE IN KSP
003152  022767  003140  175316                  CMP     #T36AA,KPTR-2
003160  001401                                  BEQ     .+4
003162  000000                                  HLT

                                        ;USER MODE
003164  010701                          T40:    SCOPE
003166  012737  170000  177776                  MOV     #UM+PUM,@#PSW           ;USER MODE!!!, PREV USER MODE!!
003174  012702  000001                          MOV     #1,R2
003200  012706  000700                          MOV     #UPTR,USP               ;SET USER STACK POINTER
```

```
003204  012716  125252                   MOV     #125252,(USP)    ;PRESET USER STACK
003210  012737  003234  000004           MOV     #T40A,@#ERRVEC   ;LOAD ERROR VECTOR
003216  012737  140000  000006           MOV     #UM,@#ERRVEC+2
003224  006642                           MTPI    -(R2)            ;-(R2)+(USP)+;SHOULD TRAP ON ODD ADRS
003226  005037  177776          T40AA:   CLR     @#PSW            ;KERNEL MODE!!!
003232  000000                           HLT                      ;ERROR DID NOT TRAP
003234  010600                  T40A:    MOV     USP,R0           ;GET USEPS STACK POINTER
003236  042737  140000  177776           BIC     #UM,@#PSW        ;KERNEL MODE!!!
003244  022700  000676                   CMP     #UPTR-2,R0       ;CHECK THAT USER STACK POINTEP
003250  001401                           BEQ     .+4              ;PUSHED PROPERLY (1 POP 2 PUSHES)
003252  000000                           HLT                      ;ERROR! INCORRECT USER STACK POINTER
003254  022737  170010  000700           CMP     #UM+PUM+N,@#UPTR       ;CHECK THAT CORRECT STATUS WAS
003262  001401                           BEQ     .+4              ;SAVED ON USER STACK ('N' IS DATA POPPED)
003264  000000                           HLT                      ;ERROR! INCORRECT STATUS SAVED ON USER STACK
003266  022767  003226  175402           CMP     #T40AA,UPTR-2    ;CHECK THAT RETURN ADDRESS WAS
003274  001401                           BEQ     .+4              ;SAVED ON USER STACK
003276  000000                           HLT                      ;ERROR! RETURN PC NOT ON USER STACK
003300  022702  177777                   CMP     #-1,R2                   ;DID R2 DECREMENT BY 2
003304  001401                           BEQ     .+4
003306  000000                           HLT
                                ;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
                                ;KERNEL MODE
003310  010701                  T41:     SCOPE
003312  005037  177776                   CLR     @#PSW
003316  012700  177777                   MOV     #-1,R0
003322  012737  003356  000004           MOV     #T41A,@#ERRVEC
003330  005067  174452                   CLR     ERRVEC+2
003334  052737  000000  177776           BIS     #REG,@#PSW       ;R0-R5
003342  005000                           CLR     R0
003344  012746  000002                   MOV     #2,-(KSP)
003350  000261                           SEC
003352  006620                           MTPI    (R0)+                    ;(R0)+(KSP)+
003354  000401                           BR      .+4
003356  000000                  T41A:    HLT                      ;ERROR! TRAPPED
003360  103401                           BCS     .+4              ;MTP D/I SHOULD NOT AFFECT CARRY
003362  000000                           HLT                      ;BIT ERROR! CARRY BIT BUT CLEARED.
003364  022767  000002  174406           CMP     #2,0
003372  001401                           BEQ     .+4
003374  000000                           HLT


003376  010701                  T41B:    SCOPE
003400  012737  003426  000004           MOV     #T41BB,@#ERRVEC  ;LOAD ERROR VECTOR
003406  012706  000500                   MOV     #KPTR,KSP        ;SET KERNEL STACK POINTER
003412  012716  177777                   MOV     #-1,(KSP)        ;LOAD KERNEL STACK
003416  000257                           CCC                      ;PRESET CC'S
003420  006637  001002                   MTPI    @#TEMP           ;@#TEMP+(KSP)+

003424  000401                           BR      .+4
003426  000000                  T41BB:   HLT                      ;ERROR! TRAPPED
003430  013700  177776                   MOV     @#PSW,R0                 ;SAVE CC'S
003434  022700  000010                   CMP     #REG+N,R0        ;CHECK RESULT STATUS
003440  001401                           BEQ     .+4
003442  000000                           HLT                      ;ERROR! INCORRECT STATUS AFTER MTPD
003444  005237  001002                   INC     @#TEMP           ;CHECK RESULT
003450  001401                           BEQ     .+4
```

```
 003452  000000                          HLT                               ;ERROR! MTPD FAILED

                                  ;USER MODE
 003454  010701                   T43:   SCOPE
 003456  005037  177776                  CLR     @#PSW
 003462  012703  177777                  MOV     #-1,R3
 003466  012737  003526  000004          MOV     #T43A,@#ERRVEC
 003474  012737  140000  177776          MOV     #UM,@#PSW
 003502  012703  001004                  MOV     #TEMP+2,R3
 003506  005067  175270                  CLR     TEMP
 003512  012706  000700                  MOV     #UPTR,USP
 003516  052716  177777                  BIS     #-1,(USP)
 003522  006643                          MTPI    -(R3)                     ;-(R3)+(USP)+
 003524  000401                          BR      .+4
 003526  000000                   T43A:  HLT                               ;ERROR TRAPPED
 003530  013700  177776                  MOV     @#PSW,R0
 003534  042737  140000  177776          BIC     #UM,@#PSW                 ;KERNEL MODE!!!
 003542  122700  000010                  CMPB    #N,R0
 003546  001401                          BEQ     .+4
 003550  000000                          HLT
 003552  005167  175224                  COM     TEMP
 003556  001401                          BEQ     .+4
 003560  000000                          HLT
 003562  012737  000006  000004          MOV     #ERRVEC+2,@#ERRVEC
 003570  005067  174212                  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
 003574  010701                   T44:   SCOPE
 003576  012706  000500                  MOV     #KPTR,KSP
 003602  012716  125252                  MOV     #125252,(KSP)
 003606  012700  177777                  MOV     #-1,R0
 003612  000261                          SEC
 003614  006500                          MFPI    R0              ;-(KSP)+R0,(R0)=-1
 003616  013702  177776                  MOV     @#PSW,R2        ;GET STATUS RESULT
 003622  022702  000011                  CMP     #REG+N+C,R2     ;
 003626  001401                          BEQ     .+4
 003630  000000                          HLT                     ;ERROR! INCORRECT STATUS RESULT
 003632  022706  000476                  CMP     #KPTR-2,KSP     ;DID KERNEL STACK POINTER GET
 003636  001401                          BEQ     .+4             ;PUSHED?
 003640  000000                          HLT                     ;ERROR!
 003642  005116                          COM     (KSP)           ;TEST THAT CORRECT DATA(-1) GOT
 003644  001401                          BEQ     .+4             ;PUSHED ONTO KERNEL STACK
 003646  000000                          HLT                     ;ERROR! -1NOT PUSHED ONTO KERNEL STACK
                                  ;KERNEL MODE,MFPI
 003650  010701                   T45:   SCOPE
 003652  012706  000500                  MOV     #KPTR,KSP
 003656  012716  052525                  MOV     #52525,(KSP)    ;PRE SET STACK
 003662  005004                          CLR     R4              ;PRESET 'WRONG' REGISTER
 003664  012737  000001  177776          MOV     #REG+C,@#PSW    ;SELECT R0-R5,SET C
 003672  012704  125252                  MOV     #125252,R4      ;LOAD DATA TO BE MOVED
 003676  006504                          MFPI    R4              ;-(KSP)+R4,(R4)=125252

 003700  013700  177776                  MOV     @#PSW,R0
 003704  022700  000011                  CMP     #REG+N+C,R0     ;CHECK STATUS RESULT
```

```
003710  001401                          BEQ     .+4
003712  000000                          HLT                     ;ERROR! INCORRECT STATUS
003714  022706  000476                  CMP     #KPTR-2,KSP     ;CHECK PUSH
003720  001401                          BEQ     .+4
003722  000000                          HLT                     ;ERROR! KSP DID NOT PUSH DOWN
003724  022716  125252                  CMP     #125252,(KSP)   ;CHECK DATA ON THE STACK
003730  001401                          BEQ     .+4
003732  000000                          HLT                     ;ERROR! INCORRECT DATA ON THE STACK
                                                                ;IF DATA=0 THEN INCORRECT REGISTER
                                                                ;(R4), IF DATA=52525 NO DATA PUSHED
                                                                ;ON THE STACK.
                                ;USER MODE,MFPD
003734  010701                  T50:    SCOPE
003736  005003                          CLR     R3              ;PRESET
003740  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE, R0-R5
003746  012706  000700                  MOV     #UPTR,USP       ;SET USER'S STACK POINTER
003752  012726  125252                  MOV     #125252,(USP)+  ;PRESET STACK
003756  012703  177777                  MOV     #-1,R3          ;
003762  000257                          CCC                     ;
003764  006503                          MFPI    R3              ;-(USP)+R3 (R3)=-1

003766  013700  177776                  MOV     @#PSW,R0
003772  010604                          MOV     USP,R4
003774  042737  140000  177776          BIC     #UM,@#PSW
004002  022700  140010                  CMP     #UM+N,R0
004006  001401                          BEQ     .+4
004010  000000                          HLT
004012  022704  000700                  CMP     #UPTR,R4
004016  001401                          BEQ     .+4
004020  000000                          HLT
004022  005214                          INC     (R4)
004024  001401                          BEQ     .+4
004026  000000                          HLT
004030  005037  177776                  CLR     @#PSW
                                ;USER MODE,MFPI
004034  010701                  T51:    SCOPE
004036  005005                          CLR     R5
004040  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
004046  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK POINTER
004052  012716  177777                  MOV     #-1,(USP)       ;PRESET USER STACK
004056  012705  000700                  MOV     #UPTR,R5        ;PRESET R5
004062  000277                          SCC                     ;PRESET CONDITION CODES
004064  006505                          MFPI    R5              ;-(USP)+R5

004066  013700  177776                  MOV     @#PSW,R0                ;GET STATUS RESULT
004072  010602                          MOV     USP,R2          ;GET USER STACK POINTER
004074  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
004102  022700  140001                  CMP     #UM+C,R0        ;CHECK STATUS RESULT AFTER MFPI INST
004106  001401                          BEQ     .+4
004110  000000                          HLT                     ;ERROR! INCORRECT STATUS AFTER MFPI
004112  022702  000676                  CMP     #UPTR-2,R2
004116  001401                          BEQ     .+4
004120  000000                          HLT
004122  022712  000700                  CMP     #UPTR,(R2)
004126  001401                          BEQ     .+4
004130  000000                          HLT
```

```
                                        ;TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
                                        ;STACK.
                                        ;KERNEL MODE,MFPD
004132  010701                          TS2:    SCOPE
004134  005037  177776                          CLR     @#PSW           ;KERNEL MODE!!!
004140  012700  001002                          MOV     #TEMP,R0        ;PRESET R0
004144  052737  000000  177776                  BIS     #REG,@#PSW      ;SELECT R0-R5
004152  012700  001004                          MOV     #TEMP+2,R0      ;PRESET R0
004156  012767  177777  174616                  MOV     #-1,TEMP
004164  005067  174614                          CLR     TEMP+2
004170  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
004174  012716  125252                          MOV     #125252,(KSP)   ;PRESET KERNEL STACK
004200  006520                                  MFPI    (R0)+           ;-(KSP)+(R0)+,R0=TEMP+2,TEMP+2=0

004202  013702  177776                          MOV     @#PSW,R2
004206  022702  000004                          CMP     #REG+2,R2
004212  001401                                  BEQ     .+4
004214  000000                                  HLT
004216  022706  000476                          CMP     #KPTR-2,KSP
004222  001401                                  BEQ     .+4
004224  000000                                  HLT
004226  005716                                  TST     (KSP)
004230  001401                                  BEQ     .+4
004232  000000                                  HLT


                                        ;USER MODE MFPI
004234  010701                          TS4:    SCOPE
004236  012737  140000  177776                  MOV     #UM,@#PSW
004244  012703  001004                          MOV     #TEMP+2,R3
004250  052737  000340  177776                  BIS     #REG+PRTY7,@#PSW
004256  012703  001006                          MOV     #TEMP+4,R3
004262  005067  174514                          CLR     TEMP
004266  012767  177777  174510                  MOV     #-1,TEMP+2
004274  012706  000700                          MOV     #UPTR,USP
004300  012716  125252                          MOV     #125252,(USP)
004304  006563  177776                          MFPI    -2(R3)          ;-(USP+-2(R3),R3=#TEMP+4,TEMP+2=-1

004310  013700  177776                          MOV     @#PSW,R0
004314  010602                                  MOV     USP,R2
004316  042737  140000  177776                  BIC     #UM,@#PSW
004324  022700  140350                          CMP     #UM+PRTY7+N,R0
004330  001401                                  BEQ     .+4
004332  000000                                  HLT
004334  022702  000676                          CMP     #UPTR-2,R2
004340  001401                                  BEQ     .+4
004342  000000                                  HLT
004344  005112                                  COM     (R2)
004346  001401                                  BEQ     .+4
004350  000000                                  HLT
                                        ;TEST TRAP & RETURN USER-KERNEL-USER
004352  010701                          TS7:    SCOPE
004354  012706  000500                          MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
004360  012737  000340  000036                  MOV     #PRTY7,@#TRAPVEC+2
004366  012737  004456  000034                  MOV     #TS7A,@#TRAPVEC
004374  012737  140000  177776                  MOV     #UM,@#PSW       ;USER MODE!!!
004402  005002                                  CLR     R2
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004404  104400                            TRAP                        ;TRAP & ENTER KERNEL MODE
004406  013767  177776  174366  T57AA:    MOV     @#PSW,TEMP
004414  042737  140000  177776            BIC     #UM,@#PSW               ;KERNEL MODE!!!
004422  022767  004406  174044            CMP     #T57AA,KPTR-4       ;CHECK THAT RETURN ADDRESS IS ON
004430  001401                            BEQ     .+4                 ;KERNEL STACK
004432  000000                            HLT                         ;ERROR!RETURN ADDRESS NOT ON STACK
004434  022767  140004  174340            CMP     #UM+Z,TEMP          ;CHECK THAT CORRECT @#PSW WAS
004442  001401                            BEQ     .+4                 ;RESTORED ON THE RETURN
004444  000000                            HLT                         ;ERROR! INCORRECT STATUS WAS RETURNED
                                                                      ;BY KERNEL FROM TRAP
004446  005102                            COM     R2                  ;CHECK THAT TRAP ROUTINE WAS EXECUTED
004450  001401                            BEQ     .+4
004452  000000                            HLT                         ;ERROR! KERNEL DID NOT DO COM R2
                                                                      ;(AT T57A)
004454  000402                            BR      T57EX               ;EXIT TEST
004456  005102                  T57A:     COM     R2                  ;COMPLEMENT R2
004460  000002                            RTI                         ;AND EXIT
004462  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
004464  010701                  T60:      SCOPE
004466  005037  177776                    CLR     @#PSW               ;KERNEL MODE!!!, PREV KERNEL MODE!!
004472  012706  000500                    MOV     #KPTR,KSP           ;SET KERNEL STACK POINTER
004476  006506                            MFPI    KSP                 ;-(KSP)+KSP
004500  022767  000500  173770            CMP     #KPTR,KPTR-2        ;TEST THAT VALUE OF KERNEL STACK POINTER
004506  001401                            BEQ     .+4                 ;WAS PUSHED ONTO KERNEL STACK
004510  000000                            HLT                         ;ERROR!

                                ;-(KSP)+USP,MFPD
004512  010701                  T62:      SCOPE
004514  012737  030000  177776            MOV     #KM+PUM,@#PSW       ;KERNEL MODE!!!, PREV USER MODE!!
004522  012706  000500                    MOV     #KPTR,KSP           ;SET KERNEL STACK POINTER
004526  012716  177777                    MOV     #-1,(KSP)
004532  006606                            MTPI    USP                 ;SET USER STACK POINTER US'+(KSP)+
004534  005166  177776                    COM     -2(KSP)             ;PRESET KERNEL STACK
004540  006506                            MFPI    USP                 ;-(KSP)+USP
004542  022716  177777                    CMP     #-1,(KSP)           ;CHECK THAT USER STACK POINTER WAS
004546  001401                            BEQ     .+4                 ;PUSHED ONTO KERNEL STACK
004550  000000                            HLT                         ;ERROR!

                                ;-(USP)+USP,MFPD
004552  010701                  T65:      SCOPE
004554  012737  030000  177776            MOV     #PUM,@#PSW          ;KERNEL MODE!!!, PREV USER MODE!!
004562  012706  000500                    MOV     #KPTR,KSP           ;SET KERNEL STACK POINTER
004566  012716  000700                    MOV     #UPTR,(KSP)
004572  006606                            MTPI    USP                 ;SET USER STACK POINTER
004574  005067  174076                    CLR     UPTR-2
004600  052737  140000  177776            BIS     #UM,@#PSW               ;USER MODE!!!, PREV USER MODE!!!
004606  006506                            MFPI    USP                 ;PUSH USER STACK POINTER ONTO USER STACK
004610  042737  140000  177776            BIC     #UM,@#PSW               ;KERNEL MODE!!!, PREV USER MODE!!
004616  006506                            MFPI    USP                 ;PUSH USER STACK POINTER ONTO KERNEL STACK
004620  022716  000676                    CMP     #UPTR-2,(KSP)       ;CHECK THAT USER STACK POITER WAS
004624  001401                            BEQ     .+4                 ;PUSHED PROPERLY (ONCE)
004626  000000                            HLT                         ;ERROR!
```

```
004630  022767  000700  174040          CMP     #UPTR,UPTR-2      ;CHECK THAT USER STACK POINTER IS ON THE
004636  001401                          BEQ     .+4               ;USERS STACK
004640  000000                          HLT                       ;ERROR!

                                ;-(KSP)+KSP,MFPI
004642  010701                  T66:    SCOPE
004644  005037  177776                  CLR     @#PSW             ;KERNEL MODE!!!, PREV KERNEL MODE!!
004650  012706  000500                  MOV     #KPTR,KSP         ;SET KERNEL STACK POINTER
004654  006506                          MFPI    KSP               ;PUSH KERNEL STACK POINTER ONTO KERNEL
                                                                  ;STACK
004656  022767  000500  173612          CMP     #KPTR,KPTR-2      ;CHECK RESULT
004664  001401                          BEQ     .+4
004666  000000                          HLT                       ;ERROR!

                                ;-(KSP)+USP,MFPI
004670  010701                  T70:    SCOPE
004672  012737  030000  177776          MOV     #PUM,@#PSW        ;KERNEL MODE!!!, PREV USER MODE!!
004700  012706  000500                  MOV     #KPTR,KSP         ;SET KERNEL STACK POINTER
004704  012716  177777                  MOV     #-1,(KSP)
004710  006606                          MTPI    USP               ;SET USER STACK POINTER
004712  005166  177776                  COM     -2(KSP)           ;PRESET KERNEL STACK
004716  006506                          MFPI    USP               ;PUSH USER STACK POINTER ONTO KERNEL STACK
004720  022716  177777                  CMP     #-1,(KSP)         ;CHECK RESULT
004724  001401                          BEQ     .+4
004726  000000                          HLT                       ;ERROR! USER STACK POINTER NOT ON KERNEL STACK

                                ;-(USP)+USP,MFPI
004730  010701                  T73:    SCOPE
004732  012737  030000  177776          MOV     #PUM,@#PSW        ;KERNEL MODE!!!, PREV USER MODE!!
004740  012706  000500                  MOV     #KPTR,KSP                 ;SET KERNEL STACK POINTER
004744  012716  000700                  MOV     #UPTR,(KSP)
004750  006606                          MTPI    USP               ;SET USER STACK POINTER
004752  005067  173720                  CLR     UPTR-2            ;PRESET USER STACK
004756  052737  140000  177776          BIS     #UM,@#PSW                 ;USER MODE!!!, PREV USER MODE!!
004764  006506                          MFPI    USP               ;-(USP)+USP
004766  042737  140000  177776          BIC     #UM,@#PSW                 ;KERNEL MODE!!!
004774  006506                          MFPI    USP               ;GET USER STACK POINTER
004776  022716  000676                  CMP     #UPTR-2,(KSP)     ;CHECK THAT USER STACK POINTER WAS
005002  001401                          BEQ     .+4               ;PUSHED ONCE
005004  000000                          HLT                       ;ERROR!
005006  022767  000700  173662          CMP     #UPTR,UPTR-2      ;CHECK THAT USER STACK POINTER WAS PUSHED
005014  001401                          BEQ     .+4               ;ONTO USER STACK
005016  000000                          HLT                       ;ERROR!

                                ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
005020  010701                  T74:    SCOPE
005022  012737  100000  177776          MOV     #IM,@#PSW                 ;ILLEGAL MODE!!!
005030  013700  177776                  MOV     @#PSW,R0                  ;GET ILLEGAL MODE
005034  005037  177776                  CLR     @#PSW             ;KERNEL MODE!!
005040  022700  100000                  CMP     #IM,R0            ;CHECK THAT ILLEGAL MODE WAS SET
005044  001401                          BEQ     .+4               ;INTO STATUS
005046  000000                          HLT

                                ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
005050  010701                  T75:    SCOPE
005052  012737  040000  177776          MOV     #IM1,@#PSW                ;ILLEGAL MODE!!!
```

```
005060 013700 177776                  MOV   @#PSW,R0         ;GET ILLEGAL MODE
005064 005037 177776                  CLR   @#PSW            ;KERNEL MODE!!
005070 022700 040000                  CMP   #IMI,R0          ;CHECK THAT ILLEGAL MODE WAS SET
005074 001401                         BEQ   .+4              ;INTO STATUS
005076 000000                         HLT

                               ;TEST THAT KERNEL CAN GET DATA FROM USER STACK
005100 010701                  T76:   SCOPE
005102 012737 030000 177776           MOV   #KM+PUM,@#PSW    ;KERNEL MODE!!!, PREV USER MODE!!
005110 012706 000500                  MOV   #KPTR,KSP        ;SET KERNEL STACK POINTER
005114 012716 000700                  MOV   #UPTR,(KSP)
005120 006606                         MTPI  USP              ;SET USER STACK POINTER
005122 005067 173552                  CLR   UPTR             ;PRESET USER STAC
005126 005016                         CLR   (KSP)            ;PRESET KERNEL STACK
005130 012766 177777 177776           MOV   #-1,-2(KSP)
005136 006506                         MFPI  USP              ;-(KSP)+USP
005140 006576 000000                  MFPI  @(KSP)           ;LIKE MOV  @(6),-(6)
005144 000240                         NOP
005146 013703 177776                  MOV   @#PSW,R3         ;SAVE STATUS RESULT
005152 022767 000700 173320           CMP   #UPTR,KPTR       ;CHECK THAT USER STACK POINTER WAS
005160 001401                         BEQ   .+4              ;PUSHED ONTO KERNEL STACK
005162 000000                         HLT                    ;ERROR!
005164 022706 000476                  CMP   #KPTR-2,KSP      ;CHECK THAT KERNEL STACK POINTER IS POS-
005170 001401                         BEQ   .+4              ;ITIONED PROPERLY
005172 000000                         HLT                    ;ERROR! INCORRECT KERNEL STACK POINTER
005174 005716                         TST   (KSP)            ;CHECK THAT CORRECT DATA
005176 001401                         BEQ   .+4              ;WAS PUSHED ONTO KERNEL STACK
005200 000000                         HLT                    ;ERROR!
005202 022703 030004                  CMP   #KM+PUM+Z,R3     ;CHECK STATUS
005206 001401                         BEQ   .+4
005210 000000                         HLT                    ;ERROR! INCORRECT STATUS

                               ;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC
005212 010701                  T102:  SCOPE
005214 012737 030000 177776           MOV   #KM+PUM,@#PSW    ;KERNEL MODE!!!, PREV USER MODE!!
005222 012706 000500                  MOV   #KPTR,KSP        ;SET KERNEL STACK PTR
005226 005016                         CLR   (KSP)            ;PUT DATA ON STACK
005230 012737 001002 001004           MOV   #TEMP,@#TEMP+2   ;LOAD ADDRESS
005236 012767 177777 173536           MOV   #-1,TEMP         ;PRESET DATA
005244 000277                         SCC                    ;PRESET CC'S
005246 006677 173532                  MTPI  @TEMP+2          ;TEMP+(KSP)+
005252 013703 177776                  MOV   @#PSW,R3         ;CHECK CC'S
005256 022703 030005                  CMP   #PUM+Z+C,R3      ;CHECK CC'S
005262 001401                         BEQ   .+4
005264 000000                         HLT                    ;ERROR! INCORRECT CC'S AFTER MTPD
005266 005737 001002                  TST   @#TEMP           ;CHECK RESULT
005272 001401                         BEQ   .+4
005274 000000                         HLT                    ;ERROR! INCORRECT RESULT

                               ;CHECK THAT MTPI CAN LOAD MEMORY ADDRESS DM=7
005276 010701                  T103:  SCOPE
005300 012737 030000 177776           MOV   #KM+PUM,@#PSW    ;KERNEL MODE!!!
005306 012706 000500                  MOV   #KPTR,KSP        ;SET KERNEL STACK PTR
005312 012716 177777                  MOV   #-1,(KSP)        ;LOAD DATA ONTO STACK
005316 012704 177776                  MOV   #-2,R4           ;LOAD INDEX REGISTER
005322 005067 173454                  CLR   TEMP             ;PRESET DATA
```

```
005326 012767 001002 173450          MOV     #TEMP,TEMP+2
005334 006674 001006                 MTPI    @TEMP+4(R4)      ;TEMP+(KSP)+
005340 013703 177776                 MOV     @#PSW,R3                ;SAVE STATUS RESULT
005344 022706 000502                 CMP     #KPTR+2,KSP      ;CHECK THAT KSP POPPED
005350 001401                        BEQ     .+4
005352 000000                        HLT                      ;ERROR! INCORRECT STACK PTR
005354 022703 030010                 CMP     #PUM+N,R3        ;CHECK STATUS RESULT
005360 001401                        BEQ     .+4
005362 000000                        HLT                      ;ERROR! INCORRECT STATUS
005364 005267 173412                 INC     TEMP             ;CHECK RESULT
005370 001401                        BEQ     .+4
005372 000000                        HLT                      ;ERROR! INCORRECT RESULT

                             ;TEST THAT MTPD/I CAN LOAD PC
005374 010701                T104:   SCOPE
005376 012737 000000 177776          MOV     #KM,@#PSW        ;KERNEL MODE!!!
005404 012706 000500                 MOV     #KPTR,KSP        ;SET KERNEL STACK PTR
005410 012716 005422                 MOV     #T104A,(KSP)     ;PUT NEW PC ON STACK
005414 000277                        SCC                      ;PRESET CC'S
005416 106607                        MTPI    PC               ;PC+(KSP)+
005420 000000                        HLT                      ;ERROR! MTPD FAILED TO SET PC
005422 100001                T104A:  BPL     .+4
005424 000000                        HLT                      ;ERROR! 'N' FAILED TO CLEAR IN STATUS
005426 103401                        BCS     .+4
005430 000000                        HLT                      ;ERROR! 'C' WAS CLEARED BY MTPD

                             ;USER MODE
005432 010701                T106:   SCOPE
005434 012737 170000 177776          MOV     #UM+PUM,@#PSW    ;USER MODE!!!
005442 012706 000700                 MOV     #UPTR,USP        ;SET USER STACK PTR
005446 012716 005464                 MOV     #T106A,(USP)     ;PUT NEW PC ON STACK
005452 000277                        SCC                      ;PRESET CC'S
005454 106607                        MTPI    PC               ;PC+(USP)+
005456 005037 177776                 CLR     @#PSW            ;KERNEL MODE!!!
005462 000000                        HLT                      ;ERROR! MTPD FAILED TOMLOAD PC
005464 013705 177776         T106A:  MOV     @#PSW,R5                ;SAVE STATUS
005470 005037 177776                 CLR     @#PSW            ;KERNEL MODE!!!
005474 022705 170001                 CMP     #UM+PUM+C,R5     ;CHECK STATUS
005500 001401                        BEQ     .+4
005502 000000                        HLT

                             ;TEST ERROR TRAP (ODD ADDRESS) MFPD/I
005504 010701                T107:   SCOPE
005506 005037 177776                 CLR     @#PSW            ;KERNEL MODE!!!
005512 012706 000500                 MOV     #KPTR,KSP        ;SET KERNEL STACK PTR
005516 012737 005534 000004          MOV     #T107A,@#ERRVEC  ;LOAD ERRROR VECTOR
005524 000277                        SCC                      ;PRESET CC'S
005526 006567 172247                 MFPI    1                ;ODD ADDRESS SHOULD TRAP
005532 000000                T107AA: HLT                      ;ERROR! FAILED TO TRAP ON ODD ADDRESS
005534 022706 000474         T107A:  CMP     #KPTR-4,KSP      ;CHECK THAT STACK PTR WAS PUSHED
005540 001401                        BEQ     .+4              ;PROPERLY (2 PUSHES)
005542 000000                        HLT                      ;ERROR! INCORRECT STACK PTR AFTER ERROR
005544 022726 005532                 CMP     #T107AA,(KSP)+   ;CHECK RETURN PC ON STACK
005550 001401                        BEQ     .+4
005552 000000                        HLT                      ;ERROR! RETURN PC NOT ON STACK
005554 022716 000017                 CMP     #17,(KSP)        ;CHECK SAVED STATUS ON STACK
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005560  001401                                  BEQ     .+4
005562  000000                                  HLT                             ;ERROR! INCORRECT STATUS SAVED ON STACK
                                        ;USER MODE, TIME OUT
005564  010701                          T110:   SCOPE
005566  012737  140000  177776                  MOV     #UM,@#PSW                   ;USER MODE!!!
005574  012706  000700                          MOV     #UPTR,USP               ;SET USER STACK
005600  012737  140000  000006                  MOV     #UM,@#ERRVEC+2          ;LOAD 'NEW' STATUS
005606  012737  005626  000004                  MOV     #T110A,@#ERRVEC         ;AND PC
005614  006537  177702                          MFPI    @#177702                ;177702 IS NON-EXISTANT ADRS
005620  005037  177776                  T110AA: CLR     @#PSW                   ;KERNEL MODE!!!
005624  000000                                  HLT                             ;ERROR! DID NOT TRAP ON NON ADRS
005626  010603                          T110A:  MOV     USP,R3                  ;SAVE USER STACK PTR
005630  042737  140000  177776                  BIC     #UM,@#PSW                   ;KERNEL MODE!!!
005636  022703  000674                          CMP     #UPTR-4,R3              ;CHECK USER STACK PTR
005642  001401                                  BEQ     .+4
005644  000000                                  HLT                             ;ERROR! INCORRECT USP AFTER ERROR TRAP
005646  022723  005620                          CMP     #T110AA,(R3)+           ;CHECK RETURN PC ON USER STACK
005652  001401                                  BEQ     .+4
005654  000000                                  HLT                             ;ERROR! RETURN PC NOT ON USER STACK
005656  022713  140000                          CMP     #UM,(R3)                ;CHECK SAVED STATUS
005662  001401                                  BEQ     .+4
005664  000000                                  HLT                             ;ERROR! INCORRECT STATUS SAVED ON STACK

                                        ;USER MODE,ODD ADDRESS
005666  010701                          T111:   SCOPE
005670  012737  140000  177776                  MOV     #UM,@#PSW               ;USER MODE!!!
005676  012706  000700                          MOV     #UPTR,USP               ;SET USER STACK PTR
005702  012737  005730  000004                  MOV     #T111A,@#ERRVEC         ;LOAD ERROR TRAP VECTOR
005710  012737  140000  000006                  MOV     #UM,@#ERRVEC+2
005716  006567  172055                          MFPI    -1                      ;ODD ADDRESS SHOULD TRAP
005722  005037  177776                  T111AA: CLR     @#PSW                   ;KERNEL MODE!!!
005726  000000                                  HLT                             ;ERROR! FAILED TO TRAP
005730  010603                          T111A:  MOV     USP,R3                  ;SAVE USER STACK PTR
005732  042737  140000  177776                  BIC     #UM,@#PSW                   ;KERNEL MODE!!!
005740  022703  000674                          CMP     #UPTR-4,R3              ;CHECK USER STACK PTR
005744  001401                                  BEQ     .+4
005746  000000                                  HLT                             ;ERROR! INCORRECT USER STACK POINTER
005750  022713  005722                          CMP     #T111AA,(R3)            ;CHECK RETURN SDDRESS ON USER STACK
005754  001401                                  BEQ     .+4
005756  000000                                  HLT                             ;ERROR! RETURN PC NOT ON USER STACK
005760  012737  000006  000004                  MOV     #ERRVEC+2,@#ERRVEC;RESTORE ERROR TRAP TO HALT
005766  005067  172014                          CLR     ERRVEC+2

                                        ;TEST THAT MTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
                                        ;KERNEL MODE,PREVIOUS USER MODE
005772  010701                          T112:   SCOPE
005774  012737  030000  177776                  MOV     #KM+PUM,@#PSW           ;KERNEL MODE!!!, PREV USER MODE!!
006002  012706  000500                          MOV     #KPTR,KSP               ;SET KERNEL STACK PTR
006006  012746  000700                          MOV     #UPTR,-(KSP)
006012  006606                                  MTPI    USP                     ;SET USER STACK PTR
006014  012746  001002                          MOV     #TEMP,-(KSP)            ;PUT ADDRESS ON THE STACK
006020  012746  177777                          MOV     #-1,-(KSP)              ;PUT DATA ON THE STAK
006024  005037  001002                          CLR     @#TEMP                  ;PRESET DATA
006030  006636                                  MTPI    @(KSP)+                 ;MOVE #-1 TO TEMP
006032  022706  000500                          CMP     #KPTR,KSP               ;CHECK STACK PTR AFTER MTPD
006036  001401                                  BEQ     .+4
```

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006040  000000                                  HLT                     ;ERROR! INCORRECT STACK PTR AFTER MTPD
006042  005267  172734                          INC     TEMP            ;CHECK THAT DATA WAS MOVED TO TEMP
006046  001401                                  BEQ     .+4
006050  000000                                  HLT                     ;ERROR! DATA NOT IN TEMP
006052  006506                                  MFPI    USP             ;GET USER STACK PTR
006054  022716  000700                          CMP     #UPTR,(KSP)     ;CHECK THAT USER STACK PTR NOT CHANGED
006060  001401                                  BEQ     .+4             ;BY MTPD INSTRUCTION
006062  000000                                  HLT                     ;ERROR! USP WAS CHANGED BY MTPD INST.

006064  005267  172710                  END:    INC     ICNT            ;INCREMENT PASS COUNT
006070  026727  172704  000144                  CMP     ICNT,#100.      ;100 PASSES COMPLETED?
006076  001402                                  BEQ     DONE
006100  000167  172726                          JMP     BEGIN
006104  012767  000007  171454          DONE:   MOV     #7,TPB          ;RING BELL
006112  105767  171446                          TSTB    TPS
006116  100375                                  BPL     .-4
006120  012767  000177  171440                  MOV     #177,TPB
006126  105767  171432                          TSTB    TPS
006132  100375                                  BPL     .-4
006134  013701  000042                  LOGICT: MOV     @#42,%1         ;RETURN TO MONITOR?
006140  001405                                  BEQ     LOGICE
006142  000005                                  RESET
006144  004711                          LOGIC:  JSR     7,(1)           ;RETURN!
006146  000240                                  NOP
006150  000240                                  NOP
006152  000240                                  NOP
006154  000167  172632                  LOGICE: JMP     START
        000001                                  .END
```

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TEST DFKTDA PDP11/34 PROCESSER STATES TEST      MACY11 27(732)  09-SEP-76  17:17  PAGE 24
DFKTDA.P11      CROSS REFERENCE TABLE -- USER SYMBOLS

BEGIN    001032          264#    1165
BIT13 =  020000          218#
BIT14 =  040000          217#
BIT15 =  100000          216#
BIT6  =  000100          219#
C     =  000001          231#    466      470      513      741      755      760      808      1027     1078
DONE     006104          1164    1166#
EMTVEC=  000030          196#
END      006064          1162#
ERRVEC=  000004          194#    421*     633*     634*     650*     651*     674*     675*     691*     711*     728*     729*     1086*
                         1103*   1104*    1124*    1125*    1137*    1138*
HLT   =  000000          186#    274      287      292      295      298      301      307      318      324      327      345      348
                         357     362      365      377      387      402      408      411      414      450      453      472      475
                         478     493      496      499      515      518      521      539      542      545      565      568      578
                         593     596      611      624      636      639      642      654      659      662      665      668      682
                         684     687      698      702      705      719      724      727      743      746      749      762      765
                         768     787      790      793      810      813      816      834      837      840      859      862      865
                         878     881      885      901      913      928      931      941      953      968      971      980      989
                         1006    1009     1012     1015     1029     1032     1046     1049     1052     1061     1063     1065     1075
                         1080    1089     1092     1095     1098     1107     1112     1115     1118     1128     1133     1136     1153
                         1156    1160
ICNT     001000          254#    259*     1162*    1163
IM    =  100000          224#    975      978
IM1   =  040000          225#    984      987
IOTVEC=  000020          198#    280*     281*     308*
KM    =  000000          226#    261      290      343      360      396      406      553      602      905      993      1013     1019
                         1036    1056     1143
KPTR  =  000500          210#    258      264      279      293      296      299      336      346      353      363      393      409
                         412     463      473      484      494      554      566      573      631      637      640      692      735
                         744     752      763      827      835      868      876      897      899      906      918      936      939
                         946     958      994      1004     1007     1020     1037     1044     1057     1085     1090     1144     1151
KSP   =%000006           184#    258*     264*     279*     299      336*     353*     393*     463*     465*     473      484*     486*
                         494     554*     555*     566      573*     574*     575*     576      603*     631*     632*     637      678*
                         692*    693*     735*     736*     744      747*     752*     753*     763      766      827*     828*     835
                         838     868*     897*     898      906*     907*     909*     911      918*     919*     926      936*     937
                         946*    947*     949*     951      958*     959*     966      994*     995*     998*     999*     1001     1007
                         1010    1020*    1021*    1037*    1038*    1044     1057*    1058*    1085*    1090     1093     1096     1144*
                         1145*   1147*    1148*    1150*    1151     1158
LOGIC    006144          244     1175#
LOGICE   006154          1173    1179#
LOGICT   006134          1172#
N     =  000010          234#    466      491      513      660      700      722      741      760      785      857      1047
PC    =%000007           181#    1060*    1073*
PKM   =  000000          228#    261
PRTY3 =  000140          189#    412
PRTY4 =  000200          190#    396      398      406
PRTY7 =  000340          191#    282      296      371      382      394      846      857      869
PSW   =  177776          203#    261      268*     270      271*     282*     286*     288      289*     302*     304*     314*     317*
                         319     321*     337*     339*     341      342*     354*     356*     358      359*     370*     371*     374*
                         382*    389*     394*     398*     401*     403      405*     420*     447*     452*     462*     466*     469
                         483*    487*     490      503*     510      512*     526*     533      530*     551*     553*     559      560*
                         562*    582*     588      590*     600*     602*     606*     608*     615*     621*     630*     646*     653*
                         656*    672*     676*     699      709*     712*     720      721*     740      755*     759      775*     782
                         784*    794*     798*     805      807*     821*     823*     831      844*     846*     854      856*     871*
                         874     875*     896*     905*     917*     922*     924*     935*     945*     957*     962*     964*     975*
                         976     977*     984*     985      986*     993*     1003     1019*    1026     1036*    1043     1056*    1069*
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                     1074*  1076   1077*  1084*  1101*  1106*  1109*  1122*  1127*  1130*  1143*
PUM     = 030000      227#   290    325    343    360    394    406    412    466    470    487    491    553
                      582    591    602    615    646    660    905    917    945    957    993    1013   1019
                     1027    1036   1047   1069   1078   1143
PWRUP     001022      261#
REDPTR= 000736        213#   574    576
REG     = 000000      229#   676    700    741    755    760    823    832    846
RESVEC= 000010        195#   334*   335*   352*   366*
R0      =%000000      175#   270*   272    288*   290    303*   305    319*   325    341*   343    358*   360
                      403*   406    464*   467*   476    490*   491    510*   513    529*   531*   543    561*
                      563    588*   591    607*   609    620*   622    655*   657    673*   677*   680*   699*
                      700    720*   722    737*   739    759*   760    782*   785    805*   808    822*   824*
                      829    854*   857    976*   978    985*   987
R1      =%000001      176#
R2      =%000002      177#   320*   435*   436*   469*   470    485*   488*   497*   511*   516    533*   537
                      559*   589*   594    647*   652*   666    740*   7[illegible]    806*   811    814    831*   832
                      855*   860    863*   872*   883*   8[illegible]3*
R3      =%000003      178#   534*   540    710*   713*   717*   774*   778*   780    845*   847*   852    1003*
                     1013    1026*  1027   1043*  1047   1108*  1110   1113   1116   1129*  1131   1134
R4      =%000004      179#   754*   756*   757    783*   78[illegible]    791*   1039*  1042*
R5      =%000005      180#   430    439*   507*   508*   519*   797*   801*   803    1076*  1078
SCOPE = 010701        187#   267    278    311    333    351    369    381    392    419    461    482    502
                      525    550    572    581    599    614    629    645    671    690    708    734    751
                      773    796    820    843    867    895    904    916    934    944    956    974    983
                      992    1018   1035   1055   1068   1083   1100   1121   1142
START     001012      249    258#   1179
SWR     = 177570      208#
TBIT    = 000020      230#
TBITVE= 000014        199#
TEMP      001002      255#   423*   425*   426*   428*   429*   431*   433*   434*   437*   438*   440*   441*
                      445*   446*   448    695*   703*   713    714*   725*   822    824    825*   826*   845
                      847    848*   849*   874*   879    1022*  1023*  1025*  1030   1040*  1041*  1042*  1050*
                     1147    1149*  1154*
TKB     = 177562      205#
TKS     = 177560      204#
TPB     = 177566      207#   1166*  1169*
TPS     = 177564      206#   1167   1170
TPVEC = 000064        201#
TRAPVE= 000034        197#   442*   443*   455*   456*   869*   870*
TRT     = 000003      188#   316
TRTVEC= 000014        200#   312*   313*   328*   329*
T1        001036      267#
T102      005212     1018#
T103      005276     1035#
T104      005374     1055#
T104A     005422     1058    1062#
T106      005432     1068#
T106A     005464     1071    1076#
T107      005504     1083#
T107A     005534     1086    1090#
T107AA    005532     1089#   1093
T110      005564     1100#
T110A     005626     1104    1108#
T110AA    005620     1106#   1113
T111      005666     1121#
T111A     005730     1124    1129#
```

```
T111AA  005722       1127#   1134
T112    005772       1142#
T12     001352        333#
T12A    001410        334     341#
T12AA   001402        339#    346
T13     001442        351#
T13A    001474        352     358#
T13AA   001466        356#    363
T15     001640        392#
T15A    001720        395     403#
T15AA   001710        400#    409
T17     002002        419#
T17A    002030        424#
T17B    002042        424     426#
T17C    002062        427     429#
T17D    002112        432     434#
T17E    002134        435     438#
T17ERR  002234        421     452#
T17F    002154        439     441#
T17G    002206        442     446#
T17X    002242        451     454#
T18     001534        369#
T19     001576        381#
T21     002256        461#
T22     002340        482#
T25     002422        502#
T26     002512        525#
T30     002602        550#
T31     002676        572#
T31C    002722        581#
T32A    002774        599#
T35     003044        614#
T36     003104        629#
T36A    003142        633     637#
T36AA   003140        636#    640
T40     003164        645#
T40A    003234        650     655#
T40AA   003226        653#    663
T41     003310        671#
T41A    003356        674     682#
T41B    003376        690#
T41BB   003426        691     698#
T43     003454        708#
T43A    003526        711     719#
T44     003574        734#
T45     003650        751#
T5      001070        278#
T5A     001134        280     288#
T5AA    001126        286#    293
T50     003734        773#
T51     004034        796#
T52     004132        820#
T54     004234        843#
T57     004352        867#
T57A    004456        870     888#
T57AA   004406        874#    876
```

```
T57EX    004462        887    890#
T60      004464        895#
T62      004512        904#
T65      004552        916#
T66      004642        934#
T7       001242        311#
T7A      001302        312    319#
T7AA     001274        317#   322
T70      004670        944#
T73      004730        956#
T74      005020        974#
T75      005050        983#
T76      005100        992#
UM     = 140000        223#   268    272    282    296    302    313    314    321    325    337    354    382
                       394    412    420    443    503    513    526    537    551    560    582    591    600
                       606    615    646    651    656    660    712    721    775    784    785    798    807
                       808    844    856    857    871    875    879    922    924    962    964    1069   1078
                       1101   1103   1109   1116   1122   1125   1130
UPTR   = 000700        211#   283    305    315    322    397    422    504    516    527    540    555    563
                       583    616    617    622    648    657    660    663    715    776    788    799    801
                       811    814    850    860    919    921#   926    929    959    961#   966    969    995
                       997#   1004   1070   1102   1110   1123   1131   1145   1158
USP    =%000006        185#   283#   303    315#   320    397#   422#   430#   504#   505#   511    527#   528#
                       534    552#   557#   561    583#   584#   586#   589    601#   604#   607    616#   617#
                       618#   620    648#   649#   655    715#   716#   776#   777#   783    799#   800#   806
                       850#   851#   855    908#   910    920#   923    925    948#   950    960#   963    965
                       996#   1000   1070#  1071#  1102#  1108   1123#  1129   1146#  1157
V      = 000002        232#   487
YELPTR= 001000         212#
Z      = 000004        233#   470    487    537    591    832    879    1013   1027
.      = 006160        237#   242    243#   245#   249#   251#   256#   262    273    291    294    297    300
                       306    323    326    344    347    361    364    376    386    407    410    413    449
                       471    474    477    492    495    498    514    517    520    538    541    544    564
                       567    577    592    595    610    623    638    641    658    661    664    667    681
                       683    686    697    701    704    718    723    726    742    745    748    761    764
                       767    786    789    792    809    812    815    833    836    839    858    861    864
                       877    880    884    900    912    927    930    940    952    967    970    979    988
                       1005   1008   1011   1014   1028   1031   1045   1048   1051   1062   1064   1079   1091
                       1094   1097   1111   1114   1117   1132   1135   1152   1155   1159   1168   1171
```

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BCS | 683 | 1064 | | | | | | | | | | | | | |
| BEQ | 273 | 291 | 294 | 297 | 300 | 306 | 323 | 326 | 344 | 347 | 361 | 364 | 376 | 407 | 410 |
| | 413 | 449 | 471 | 474 | 477 | 492 | 495 | 498 | 514 | 517 | 520 | 538 | 541 | 544 | 564 |
| | 567 | 577 | 592 | 595 | 610 | 623 | 638 | 641 | 658 | 661 | 664 | 667 | 686 | 701 | 704 |
| | 723 | 726 | 742 | 745 | 748 | 761 | 764 | 767 | 786 | 789 | 792 | 809 | 812 | 815 | 833 |
| | 836 | 839 | 858 | 861 | 864 | 877 | 880 | 884 | 900 | 912 | 927 | 930 | 940 | 952 | 967 |
| | 970 | 979 | 988 | 1005 | 1008 | 1011 | 1014 | 1028 | 1031 | 1045 | 1048 | 1051 | 1079 | 1091 | 1094 |
| | 1097 | 1111 | 1114 | 1117 | 1132 | 1135 | 1152 | 1155 | 1159 | 1164 | 1173 | | | | |
| BIC | 321 | 398 | 507 | 528 | 656 | 721 | 784 | 807 | 856 | 875 | 924 | 964 | 1109 | 1130 | |
| BIS | 425 | 426 | 428 | 429 | 430 | 431 | 433 | 434 | 437 | 438 | 440 | 441 | 445 | 446 | 505 |
| | 529 | 676 | 716 | 823 | 846 | 922 | 962 | | | | | | | | |
| BIT | 261 | 375 | 385 | | | | | | | | | | | | |
| BNE | 262 | 386 | | | | | | | | | | | | | |
| BPL | 1062 | 1168 | 1171 | | | | | | | | | | | | |
| BR | 451 | 681 | 697 | 718 | 887 | | | | | | | | | | |
| CCC | 530 | 585 | 694 | 779 | | | | | | | | | | | |
| CLR | 259 | 271 | 281 | 286 | 289 | 304 | 317 | 329 | 335 | 339 | 342 | 356 | 359 | 370 | 374 |
| | 388 | 389 | 401 | 404 | 405 | 416 | 423 | 447 | 452 | 456 | 462 | 465 | 483 | 485 | 512 |
| | 536 | 552 | 562 | 584 | 590 | 603 | 608 | 621 | 630 | 634 | 653 | 672 | 675 | 677 | 709 |
| | 714 | 729 | 754 | 774 | 794 | 797 | 821 | 826 | 848 | 872 | 896 | 921 | 935 | 961 | 977 |
| | 986 | 997 | 998 | 1021 | 1040 | 1074 | 1077 | 1084 | 1106 | 1127 | 1138 | 1149 | | | |
| CMP | 272 | 290 | 293 | 296 | 299 | 305 | 322 | 325 | 343 | 346 | 360 | 363 | 406 | 409 | 412 |
| | 448 | 470 | 473 | 491 | 494 | 513 | 516 | 537 | 540 | 563 | 566 | 576 | 591 | 622 | 637 |
| | 640 | 657 | 660 | 663 | 666 | 685 | 700 | 741 | 744 | 760 | 763 | 766 | 785 | 788 | 808 |
| | 811 | 814 | 832 | 835 | 857 | 860 | 876 | 879 | 899 | 911 | 926 | 929 | 939 | 951 | 966 |
| | 969 | 978 | 987 | 1004 | 1007 | 1013 | 1027 | 1044 | 1047 | 1078 | 1090 | 1093 | 1096 | 1110 | 1113 |
| | 1116 | 1131 | 1134 | 1151 | 1158 | 1163 | | | | | | | | | |
| CMPB | 722 | | | | | | | | | | | | | | |
| COM | 725 | 747 | 863 | 883 | 888 | 909 | 949 | | | | | | | | |
| HALT | 186 | 242 | 338 | 340 | | | | | | | | | | | |
| INC | 497 | 519 | 703 | 791 | 1050 | 1154 | 1162 | | | | | | | | |
| IOT | 285 | | | | | | | | | | | | | | |
| JMP | 249 | 1165 | 1179 | | | | | | | | | | | | |
| JSR | 424 | 427 | 432 | 439 | 1175 | | | | | | | | | | |
| MFPI | 739 | 757 | 780 | 803 | 829 | 852 | 898 | 910 | 923 | 925 | 937 | 950 | 963 | 965 | 1000 |
| | 1001 | 1088 | 1105 | 1126 | 1157 | | | | | | | | | | |
| MOV | 258 | 264 | 268 | 270 | 279 | 280 | 282 | 283 | 288 | 302 | 303 | 308 | 312 | 313 | 314 |
| | 315 | 319 | 320 | 328 | 334 | 336 | 337 | 341 | 352 | 353 | 354 | 358 | 366 | 371 | 372 |
| | 382 | 383 | 393 | 394 | 395 | 396 | 397 | 399 | 403 | 415 | 420 | 421 | 422 | 435 | 442 |
| | 443 | 455 | 463 | 464 | 466 | 469 | 484 | 486 | 487 | 490 | 503 | 504 | 510 | 511 | 526 |
| | 527 | 533 | 534 | 551 | 553 | 554 | 555 | 559 | 560 | 561 | 573 | 574 | 582 | 583 | 588 |
| | 589 | 600 | 601 | 602 | 606 | 607 | 615 | 616 | 617 | 620 | 631 | 632 | 633 | 646 | 647 |
| | 648 | 649 | 650 | 651 | 655 | 673 | 674 | 678 | 691 | 692 | 693 | 699 | 710 | 711 | 712 |
| | 713 | 715 | 720 | 728 | 735 | 736 | 737 | 740 | 752 | 753 | 755 | 756 | 759 | 775 | 776 |
| | 777 | 778 | 782 | 783 | 798 | 799 | 800 | 801 | 805 | 806 | 822 | 824 | 825 | 827 | 828 |
| | 831 | 844 | 845 | 847 | 849 | 850 | 851 | 854 | 855 | 868 | 869 | 870 | 871 | 874 | 897 |
| | 905 | 906 | 907 | 917 | 918 | 919 | 936 | 945 | 946 | 947 | 957 | 958 | 959 | 975 | 976 |
| | 984 | 985 | 993 | 994 | 995 | 999 | 1003 | 1019 | 1020 | 1022 | 1023 | 1026 | 1036 | 1037 | 1038 |
| | 1039 | 1041 | 1043 | 1056 | 1057 | 1058 | 1069 | 1070 | 1071 | 1076 | 1085 | 1086 | 1101 | 1102 | 1103 |
| | 1104 | 1108 | 1122 | 1123 | 1124 | 1125 | 1129 | 1137 | 1143 | 1144 | 1145 | 1147 | 1148 | 1166 | 1169 |
| | 1172 | | | | | | | | | | | | | | |
| MTPI | 467 | 488 | 508 | 531 | 557 | 575 | 586 | 604 | 618 | 635 | 652 | 680 | 695 | 717 | 908 |
| | 920 | 948 | 960 | 996 | 1025 | 1042 | 1060 | 1073 | 1146 | 1150 | | | | | |
| NOP | 269 | 400 | 454 | 890 | 1002 | 1176 | 1177 | 1178 | | | | | | | |
| RESET | 373 | 384 | 1174 | | | | | | | | | | | | |
| RTI | 889 | | | | | | | | | | | | | | |

C03



```
RTS       436
SCC       284    556    802    1024    1059    1072    1087
SEC       506    679    738
SPL       355
TRAP      444    873
TST       476    543    594    609     838     1010    1030
TSTB      1167   1170
.ABS      156
.END      1180
.REM      3
.REPT     238
.TITLE    155
```

```
ERRORS DETECTED:  0
DEFAULT GLOBALS GENERATED:  0

*DFKTDA,DFKTDA.SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DFKTDA.P11
RUN-TIME: 3 7 1 SECONDS
RUN-TIME RATIO: 25/13=1.9
CORE USED:  7K  (13 PAGES)
```

D03

[illegible] disk reads, [illegible] disk writes, [illegible]