PDP11/34

MEM MANG PROC STATES

MD-11-DFKTD-A

EP-DFKTD-A-DL-A

OCT 1976

digital

Made In U.S.A.

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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

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
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                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
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                        ONE PASS TAKES APPROXIMATELY 10 SECONDS.


                        #

                        .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
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                    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
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```
                                ;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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                                        T18:    SCOPE
                                                CLR     @#PSW
                                                MOV     #PRTY7,@#PSW    ;PRIORITY TO 7
                                                MOV     #100,177564     ;SET "IE" IN TPS
                                                RESET                   ;CLEAR "IE"
                                                CLR     @#PSW
                                                BIT     #100,177564
                                                BEQ     .+4
                                                HLT                     ;RESET DID NOT
                                                                        ;CLEAR "IE"

                                        ;TEST THAT "RESET" NOP'S IN USER MODE
                                        T19:    SCOPE
                                                MOV     #UM+PRTY7,@#PSW ;USER MODE!!!
                                                MOV     #100,177564     ;SET "IE"
                                                RESET                   ;SHOULD NOP
                                                BIT     #100,177564
                                                BNE     .+4
                                                HLT                     ;"IE" CLEARED
                                                CLR     177564
                                                CLR     @#PSW

                                        ;TEST INTERRUPT SEQUENCE USER TO KERNEL MODE
                                        T15:    SCOPE
                                                MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
                                                MOV     #UM+PUM+PRTY7,@#PSW     ;USER MODE!!!
                                                MOV     #T15A,64                ;INTERRUPT VEC.
                                                MOV     #KM+PRTY4,66
                                                MOV     #UPTR,USP       ;SET USER STACK POINTER
                                                BIC     #PRTY4,@#PSW    ;SET PRIORITY LEVEL=3
                                                MOV     #100,177564     ;REQUEST AN INTERRUPT AT LEVEL 4
                                        T15AA:  NOP
                                                CLR     @#PSW           ;KERNEL MODE!!!
                                                HLT                     ;ERROR! NO INTERRUPT REQUEST
                                        T15A:   MOV     @#PSW,R0        ;GET 'NEW' @#PSW
                                                CLR     177564          ;DISABLE REQUEST
                                                CLR     @#PSW
                                                CMP     #KM+PUM+PRTY4,R0  ;TEST THAT 'NEW' @#PSW IS CORRECT
                                                BEQ     .+4             ;(PIRVEC+2)
                                                HLT                     ;ERROR! 'NEW' @#PSW NOT = TO (PIRVEC+2)
                                                CMP     #T15AA,KPTR-4   ;IS RETURN ADDRESS ON KERNEL STACK
                                                BEQ     .+4
                                                HLT                     ;ERROR! RETURN ADDRESS NOT ON KERNEL STACK
                                                CMP     #UM+PUM+PRTY3,KPTR-2  ;TEST THAT 'OLD' @#PSW WAS SAVED ON
                                                BEQ     .+4             ;KERNEL STACK
                                                HLT                     ;ERROR!
                                                MOV     #66,64
                                                CLR     66

                                        ;TEST THAT THERE IS NO STACK OVERFLOW IN USER MODE.
                                        T17:    SCOPE
                                                MOV     #UM,@#PSW       ;USER MODE!!!
                                                MOV     #T17ERR,@#ERRVEC
                                                MOV     #UPTR,USP       ;SET USER STACK POINTER
                                                CLR     TEMP            ;CLEAR INDICATOR LOCATION
                                        T17A:   JSR     7,T17B          ;PUSH ONTO USER STACK
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                                        BIS     #400,TEMP       ;SET ERROR INDICATOR BIT
                                T17B:   BIS     #1,TEMP         ;SET INDICATOR BIT
                                        JSR     5,T17C          ;PUSH ONTO USER STACK
                                        BIS     #1000,TEMP      ;SET ERROR INDICATOR BIT
                                T17C:   BIS     #2,TEMP         ;SET INDICATOR BIT
                                        BIS     R5,-(USP)       ;PUSH ONTO USER STACK
                                        BIS     #4,TEMP         ;SET INDICATOR BIT
                                        JSR     7,T17D          ;PUSH ONTO USER STACK
                                        BIS     #2000,TEMP      ;SET ERROR INDICATOR BIT
                                T17D:   BIS     #10,TEMP
                                        MOV     #T17E,R2        ;SET UP RETURN FOR RTS
                                        RTS     R2              ;GO TO T16E
                                        BIS     #4000,TEMP      ;SET INDICATOR TO SHOW ERROR
                                T17E:   BIS     #20,TEMP
                                        JSR     R5,T17F
                                        BIS     #10000,TEMP     ;SET ERROR INDICATOR BIT
                                T17F:   BIS     #40,TEMP
                                        MOV     #T17G,@#TRAPVEC ;SET UP TRAP VECTOR FOR TRAP
                                        MOV     #UM,@#TRAPVEC+2
                                        TRAP
                                        BIS     #20000,TEMP
                                T17G:   BIS     #100,TEMP
                                        CLR     @#PSW           ;KERNEL MODE!!!
                                        CMP     #177,TEMP
                                        BEQ     .+4
                                        HLT
                                        BR      T17X
                                T17ERR: CLR     @#PSW
                                        HLT                     ;ERROR! OVERFLOW OCCURED
                                T17X:   NOP
                                        MOV     #TRAPVEC+2,@#TRAPVEC
                                        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
                                T21:    SCOPE
                                        CLR     @#PSW
                                        MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
                                        MOV     #-1,R0          ;PRE-SET R0
                                        CLR     (KSP)           ;PUT 0 ON THE STACK
                                        MOV     #PUM+N+C,@#PSW  ;PRE SET STATUS
                                        MTPI    R0              ;R0<--(KSP)+

                                        MOV     @#PSW,R2        ;GET STATUS
                                        CMP     #PUM+Z+C,R2
                                        BEQ     .+4
                                        HLT                     ;ERROR! INCORRECT STATUS
                                        CMP     #KPTR+2,KSP     ;DID KSP INCREMENT BY 2
                                        BEQ     .+4
                                        HLT                     ;ERROR!  KSP DID NOT POP
                                        TST     R0              ;DID WORD ON STACK (0) GET TO R0?
                                        BEQ     .+4
                                        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
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                                        CMP     #UM+Z,R2
                                        BEQ     .+4
                                        HLT
                                        CMP     #UPTR+2,R3
                                        BEQ     .+4
                                        HLT
                                        TST     R0
                                        BEQ     .+4
                                        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
                                T30:    SCOPE
                                        MOV     #UM,@#PSW       ;USER MODE!!!
                                        CLR     USP             ;PRESET USER STACK POINTER
                                        MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
                                        MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
                                        MOV     #UPTR,(KSP)
                                        SCC                     ;PRESET CC'S
                                        MTPI    USP             ;USP←(KSP)+

                                        MOV     @#PSW,R2        ;SAVE CC'S
                                        MOV     #UM,@#PSW       ;USER MODE!!!
                                        MOV     USP,R0          ;GET USER STACK POINTER
                                        CLR     @#PSW           ;KERNEL MODE!!!
                                        CMP     #UPTR,R0        ;CHECK THAT MTPD SET USER STACK
                                        BEQ     .+4             ;POINTER PROPERLY
                                        HLT                     ;ERROR!
                                        CMP     #KPTR+2,KSP     ;CHECK KERNEL STACK POINTER
                                        BEQ     .+4
                                        HLT


                                ;KSP←(KSP)+,MTPD
                                T31:    SCOPE
                                        MOV     #KPTR,KSP
                                        MOV     #REDPTR,(KSP)
                                        MTPI    KSP             ;KSP←(KSP)+
                                        CMP     #REDPTR,KSP
                                        BEQ     .+4
                                        HLT


                                ;;USP←(USP)+,MTPD
                                T31C:   SCOPE
                                        MOV     #UM+PUM,@#PSW   ;USER MODE!!!, PREV USER MODE!!
                                        MOV     #UPTR,USP       ;SET USER STACK PTR
                                        CLR     (USP)           ;PUT #0 ON USER STACK
                                        CCC
                                        MTPI    USP             ;USP←(USP)+

                                        MOV     @#PSW,R0                :SAVE CC'S
                                        MOV     USP,R2          ;SAVE USER STACK POINTER
                                        CLR     @#PSW           ;KERNEL MODE!!!
                                        CMP     #UM+PUM+Z,R0    ;CHECK STATUS
                                        BEQ     .+4
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                                        HLT                     ;ERROR! INCORRECT STATUS AFTER MTPD
                                        TST     R2              ;CHECK NEW STACK POINTER VALUE
                                        BEQ     .+4
                                        HLT                     ;ERROR! MTPD FAILED TO SET USER STACK POINTER

                              ;USP←(KSP)+,MTPI
                              T32A:     SCOPE
                                        MOV     #UM,@#PSW       ;USER MODE
                                        MOV     #-1,USP         ;PRESET USER STACK POINTER
                                        MOV     #KM+PUM,@#PSW   ;CURRENT KERNEL,PREVIOUS USER
                                        CLR     -(KSP)
                                        MTPI    USP             ;USP←(KSP+

                                        MOV     #UM,@#PSW
                                        MOV     USP,R0                  ;GET USER STACK POINTER
                                        CLR     @#PSW
                                        TST     R0
                                        BEQ     .+4
                                        HLT

                              ;USP←(USP)+
                              T35:      SCOPE
                                        MOV     #UM+PUM,@#PSW
                                        MOV     #UPTR,USP
                                        MOV     #UPTR,(USP)
                                        MTPI    USP                     ;USP←(USP)+

                                        MOV     USP,R0
                                        CLR     @#PSW
                                        CMP     #UPTR,R0
                                        BEQ     .+4
                                        HLT


                              ;TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION
                              ;KERNEL MODE
                              T36:      SCOPE
                                        CLR     @#PSW
                                        MOV     #KPTR,KSP
                                        MOV     #-1,(KSP)
                                        MOV     #T36A,@#ERRVEC
                                        CLR     ERRVEC+2
                                        MTPI    -1              ;TRAPS ON ODD ADDRESS
                              T36AA:    HLT                     ;ERROR! DID NOT TRAP
                              T36A:     CMP     #KPTR-2,KSP     ;IS KSP CORRECT?(1 POP AND 2
                                        BEQ     .+4             ;PUSHES)
                                        HLT                     ;ERROR! INCORRECT VALUE IN KSP
                                        CMP     #T36AA,KPTR-2
                                        BEQ     .+4
                                        HLT

                              ;USER MODE
                              T40:      SCOPE
                                        MOV     #UM+PUM,@#PSW   ;USER MODE!!!, PREV USER MODE!!
                                        MOV     #1,R2
                                        MOV     #UPTR,USP       ;SET USER STACK POINTER
```

```
                                                        MOV     #125252,(USP)   ;PRESET USER STACK
                                                        MOV     #T40A,@#ERRVEC  ;LOAD ERROR VECTOR
                                                        MOV     #UM,@#ERRVEC+2
                                                        MTPI    -(R2)           ;-(R2)+(USP)+;SHOULD TRAP ON ODD ADRS
                                                T40AA:  CLR     @#PSW           ;KERNEL MODE!!!
                                                        HLT                     ;ERROR DID NOT TRAP
                                                T40A:   MOV     USP,R0          ;GET USERS STACK POINTER
                                                        BIC     #UM,@#PSW       ;KERNEL MODE!!!
                                                        CMP     #UPTR-2,R0      ;CHECK THAT USER STACK POINTER
                                                        BEQ     .+4             ;PUSHED PROPERLY (1 POP,2 PUSHES)
                                                        HLT                     ;ERROR! INCORRECT USER STACK POINTER
                                                        CMP     #UM+PUM+N,@#UPTR        ;CHECK THAT CORRECT STATUS WAS
                                                        BEQ     .+4             ;SAVED ON USER STACK ('N' IS DATA POPPED)
                                                        HLT                     ;ERROR! INCORRECT STATUS SAVED ON USER STACK
                                                        CMP     #T40AA,UPTR-2   ;CHECK THAT RETURN ADDRESS WAS
                                                        BEQ     .+4             ;SAVED ON USER STACK
                                                        HLT                     ;ERROR! RETURN PC NOT ON USER STACK
                                                        CMP     #-1,R2                  ;DID R2 DECREMENT BY 2
                                                        BEQ     .+4
                                                        HLT
                                                ;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
                                                ;KERNEL MODE
                                                T41:    SCOPE
                                                        CLR     @#PSW
                                                        MOV     #-1,R0
                                                        MOV     #T41A,@#ERRVEC
                                                        CLR     ERRVEC+2
                                                        BIS     #REG,@#PSW      ;R0-R5
                                                        CLR     R0
                                                        MOV     #2,-(KSP)
                                                        SEC
                                                        MTPI    (R0)+                   ;(R0)++(KSP)+
                                                        BR      .+4
                                                T41A:   HLT                     ;ERROR! TRAPPED
                                                        BCS     .+4             ;MTP D/I SHOULD NOT AFFECT CARRY
                                                        HLT                     ;BIT ERROR! CARRY BIT BUT CLEARED.
                                                        CMP     #2,0
                                                        BEQ     .+4
                                                        HLT


                                                T41B:   SCOPE
                                                        MOV     #T41BB,@#ERRVEC ;LOAD ERROR VECTOR
                                                        MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
                                                        MOV     #-1,(KSP)       ;LOAD KERNEL STACK
                                                        CCC                     ;PRESET CC'S
                                                        MTPI    @#TEMP          ;@#TEMP+(KSP)+

                                                        BR      .+4
                                                T41BB:  HLT                     ;ERROR! TRAPPED
                                                        MOV     @#PSW,R0                ;SAVE CC'S
                                                        CMP     #REG+N,R0       ;CHECK RESULT STATUS
                                                        BEQ     .+4
                                                        HLT                     ;ERROR! INCORRECT STATUS AFTER MTPD
                                                        INC     @#TEMP          ;CHECK RESULT
                                                        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
```

```
 761  003710  001401                          BEQ     .+4
 762  003712  000000                          HLT
 763  003714  022706  000476                  CMP     #KPTR-2,KSP     ;CHECK PUSH
 764  003720  001401                          BEQ     .+4
 765  003722  000000                          HLT                     ;ERROR! KSP DID NOT PUSH DOWN
 766  003724  022716  125252                  CMP     #125252,(KSP)   ;CHECK DATA ON THE STACK
 767  003730  001401                          BEQ     .+4
 768  003732  000000                          HLT                     ;ERROR! INCORRECT DATA ON THE STACK
 769                                                                  ;IF DATA=0 THEN INCORRECT REGISTER
 770                                                                  ;(R4), IF DATA=52525 NO DATA PUSHED
 771                                                                  ;ON THE STACK.
 772                                  ;USER MODE,MFPD
 773  003734  010701                  T50:    SCOPE
 774  003736  005003                          CLR     R3              ;PRESET
 775  003740  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE, RO-R5
 776  003746  012706  000700                  MOV     #UPTR,USP       ;SET USER'S STACK POINTER
 777  003752  012726  125252                  MOV     #125252,(USP)+  ;PRESET STACK
 778  003756  012703  177777                  MOV     #-1,R3          ;
 779  003762  000257                          CCC
 780  003764  006503                          MFPI    R3              ;-(USP)+R3 (R3)=-1
 781
 782  003766  013700  177776                  MOV     @#PSW,R0
 783  003772  010604                          MOV     USP,R4
 784  003774  042737  140000  177776          BIC     #UM,@#PSW
 785  004002  022700  140010                  CMP     #UM+N,R0
 786  004006  001401                          BEQ     .+4
 787  004010  000000                          HLT
 788  004012  022704  000700                  CMP     #UPTR,R4
 789  004016  001401                          BEQ     .+4
 790  004020  000000                          HLT
 791  004022  005214                          INC     (R4)
 792  004024  001401                          BEQ     .+4
 793  004026  000000                          HLT
 794  004030  005037  177776                  CLR     @#PSW
 795                                  ;USER MODE,MFPI
 796  004034  010701                  T51:    SCOPE
 797  004036  005005                          CLR     R5
 798  004040  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
 799  004046  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK POINTER
 800  004052  012716  177777                  MOV     #-1,(USP)       ;PRESET USER STACK
 801  004056  012705  000700                  MOV     #UPTR,R5        ;PRESET R5
 802  004062  000277                          SCC                     ;PRESET CONDITION CODES
 803  004064  006505                          MFPI    R5              ;-(USP)+R5
 804
 805  004066  013700  177776                  MOV     @#PSW,R0                ;GET STATUS RESULT
 806  004072  010602                          MOV     USP,R2          ;GET USER STACK POINTER
 807  004074  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
 808  004102  022700  140001                  CMP     #UM+C,R0        ;CHECK STATUS RESULT AFTER MFPI INST
 809  004106  001401                          BEQ     .+4
 810  004110  000000                          HLT                     ;ERROR! INCORRECT STATUS AFTER MFPI
 811  004112  022702  000676                  CMP     #UPTR-2,R2
 812  004116  001401                          BEQ     .+4
 813  004120  000000                          HLT
 814  004122  022712  000700                  CMP     #UPTR,(R2)
 815  004126  001401                          BEQ     .+4
 816  004130  000000                          HLT
```

```
                                        ;TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
                                        ;STACK.
                                        ;KERNEL MODE,MFPD
004132 010701                           T52:    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                           T54:    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                           T57:    SCOPE
004354 012706 000500                            MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
004360 012737 000340 000036                     MOV     #PRTY7,@#TRAPVEC+2
004366 012737 004456 000034                     MOV     #T57A,@#TRAPVEC
004374 012737 140000 177776                     MOV     #UM,@#PSW       ;USER MODE!!!
004402 005002                                   CLR     R2
```

```
 873  004404  104400                          TRAP                    ;TRAP & ENTER KERNEL MODE
 874  004406  013767  177776  174366  T57AA:  MOV     @#PSW,TEMP
 875  004414  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
 876  004422  022767  004406  174044          CMP     #T57AA,KPTR-4   ;CHECK THAT RETURN ADDRESS IS ON
 877  004430  001401                          BEQ     .+4             ;KERNEL STACK
 878  004432  000000                          HLT                     ;ERROR!RETURN ADDRESS NOT ON STACK
 879  004434  022767  140004  174340          CMP     #UM+Z,TEMP      ;CHECK THAT CORRECT @#PSW WAS
 880  004442  001401                          BEQ     .+4             ;RESTORED ON THE RETURN
 881  004444  000000                          HLT                     ;ERROR! INCORRECT STATUS WAS RETURNED
 882                                                                  ;BY KERNEL FROM TRAP
 883  004446  005102                          COM     R2              ;CHECK THAT TRAP ROUTINE WAS EXECUTED
 884  004450  001401                          BEQ     .+4
 885  004452  000000                          HLT                     ;ERROR! KERNEL DID NOT DO COM R2
 886                                                                  ;(AT T57A)
 887  004454  000402                          BR      T57EX           ;EXIT TEST
 888  004456  005102          T57A:   COM     R2                      ;COMPLEMENT R2
 889  004460  000002                          RTI                     ;AND EXIT
 890  004462  000240          T57EX:  NOP
 891
 892                          ;TEST THAT MFPD/I CAN PUSH ONTO CURRENT STACK (AS DETERMINED BY PS15 &
 893                          ;PS14) THE PREVIOUS MODES STACK POINTER (AS DETERMINED BY PS13 &PS12)
 894                          ;-(KSP)←KSP,MFPD
 895  004464  010701          T60:    SCOPE
 896  004466  005037  177776          CLR     @#PSW                   ;KERNEL MODE!!!, PREV KERNEL MODE!!
 897  004472  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
 898  004476  006506                  MFPI    KSP                     ;-(KSP)←KSP
 899  004500  022767  000500  173770  CMP     #KPTR,KPTR-2            ;TEST THAT VALUE OF KERNEL STACK POINTER
 900  004506  001401                  BEQ     .+4                     ;WAS PUSHED ONTO KERNEL STACK
 901  004510  000000                  HLT                             ;ERROR!
 902
 903                          ;-(KSP)←USP,MFPD
 904  004512  010701          T62:    SCOPE
 905  004514  012737  030000  177776  MOV     #KM+PUM,@#PSW           ;KERNEL MODE!!!, PREV USER MODE!!
 906  004522  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
 907  004526  012716  177777          MOV     #-1,(KSP)
 908  004532  006606                  MTPI    USP                     ;SET USER STACK POINTER USP←(KSP)←
 909  004534  005166  177776          COM     -2(KSP)                 ;PRESET KERNEL STACK
 910  004540  006506                  MFPI    USP                     ;-(KSP)←USP
 911  004542  022716  177777          CMP     #-1,(KSP)               ;CHECK THAT USER STACK POINTER WAS
 912  004546  001401                  BEQ     .+4                     ;PUSHED ONTO KERNEL STACK
 913  004550  000000                  HLT                             ;ERROR!
 914
 915                          ;-(USP)←USP,MFPD
 916  004552  010701          T65:    SCOPE
 917  004554  012737  030000  177776  MOV     #PUM,@#PSW              ;KERNEL MODE!!!, PREV USER MODE!!
 918  004562  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
 919  004566  012716  000700          MOV     #UPTR,(KSP)
 920  004572  006606                  MTPI    USP                     ;SET USER STACK POINTER
 921  004574  005067  174076          CLR     UPTR-2
 922  004600  052737  140000  177776  BIS     #UM,@#PSW                       ;USER MODE!!!, PREV USER MODE!!!
 923  004606  006506                  MFPI    USP                     ;PUSH USER STACK POINTER ONTO USER STACK
 924  004610  042737  140000  177776  BIC     #UM,@#PSW                       ;KERNEL MODE!!!, PREV USER MODE!!
 925  004616  006506                  MFPI    USP                     ;PUSH USER STACK POINTER ONTO KERNEL STACK
 926  004620  022716  000676          CMP     #UPTR-2,(KSP)           ;CHECK THAT USER STACK POITER WAS
 927  004624  001401                  BEQ     .+4                     ;PUSHED PROPERLY (ONCE)
 928  004626  000000                  HLT                             ;ERROR!
```

```
 929  004630  022767  000700  174040          CMP     #UPTR,UPTR-2    ;CHECK THAT USER STACK POINTER IS ON THE
 930  004636  001401                          BEQ     .+4             ;USERS STACK
 931  004640  000000                          HLT                     ;ERROR!
 932
 933                                  ;-(KSP)←KSP,MFPI
 934  004642  010701                  ↑66:    SCOPE
 935  004644  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!, PREV KERNEL MODE!!
 936  004650  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
 937  004654  006506                          MFPI    KSP             ;PUSH KERNEL STACK POINTER ONTO KERNEL
 938                                                                  ;STACK
 939  004656  022767  000500  173612          CMP     #KPTR,KPTR-2    ;CHECK RESULT
 940  004664  001401                          BEQ     .+4
 941  004666  000000                          HLT                     ;ERROR!
 942
 943                                  ;-(KSP)←USP,MFPI
 944  004670  010701                  ↑70:    SCOPE
 945  004672  012737  030000  177776          MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
 946  004700  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
 947  004704  012716  177777                  MOV     #-1,(KSP)
 948  004710  006606                          MTPI    USP             ;SET USER STACK POINTER
 949  004712  005166  177776                  COM     -2(KSP)         ;PRESET KERNEL STACK
 950  004716  006506                          MFPI    USP             ;PUSH USER STACK POINTER ONTO KERNEL STACK
 951  004720  022716  177777                  CMP     #-1,(KSP)       ;CHECK RESULT
 952  004724  001401                          BEQ     .+4
 953  004726  000000                          HLT                     ;ERROR! USER STACK POINTER NOT ON KERNEL STACK
 954
 955                                  ;-(USP)←USP,MFPI
 956  004730  010701                  ↑73:    SCOPE
 957  004732  012737  030000  177776          MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
 958  004740  012706  000500                  MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
 959  004744  012716  000700                  MOV     #UPTR,(KSP)
 960  004750  006606                          MTPI    USP             ;SET USER STACK POINTER
 961  004752  005067  173720                  CLR     UPTR-2          ;PRESET USER STACK
 962  004756  052737  140000  177776          BIS     #UM,@#PSW               ;USER MODE!!!, PREV USER MODE!!
 963  004764  006506                          MFPI    USP             ;-(USP)←USP
 964  004766  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
 965  004774  006506                          MFPI    USP             ;GET USER STACK POINTER
 966  004776  022716  000676                  CMP     #UPTR-2,(KSP)   ;CHECK THAT USER STACK POINTER WAS
 967  005002  001401                          BEQ     .+4             ;PUSHED ONCE
 968  005004  000000                          HLT                     ;ERROR!
 969  005006  022767  000700  173662          CMP     #UPTR,UPTR-2    ;CHECK THAT USER STACK POINTER WAS PUSHED
 970  005014  001401                          BEQ     .+4             ;ONTO USER STACK
 971  005016  000000                          HLT                     ;ERROR!
 972
 973                                  ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
 974  005020  010701                  ↑74:    SCOPE
 975  005022  012737  100000  177776          MOV     #IM,@#PSW               ;ILLEGAL MODE!!!
 976  005030  013700  177776                  MOV     @#PSW,R0                ;GET ILLEGAL MODE
 977  005034  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!
 978  005040  022700  100000                  CMP     #IM,R0          ;CHECK THAT ILLEGAL MODE WAS SET
 979  005044  001401                          BEQ     .+4             ;INTO STATUS
 980  005046  000000                          HLT
 981
 982                                  ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
 983  005050  010701                  ↑75:    SCOPE
 984  005052  012737  040000  177776          MOV     #IM1,@#PSW              ;ILLEGAL MODE!!!
```

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 985  005060  013700  177776          MOV     @#PSW,R0                ;GET ILLEGAL MODE
 986  005064  005037  177776          CLR     @#PSW                   ;KERNEL MODE!!
 987  005070  022700  040000          CMP     #IMI,R0                 ;CHECK THAT ILLEGAL MODE WAS SET
 988  005074  001401                  BEQ     .+4                     ;INTO STATUS
 989  005076  000000                  HLT
 990
 991                                  ;TEST THAT KERNEL CAN GET DATA FROM USER STACK
 992  005100  010701          T76:    SCOPE
 993  005102  012737  030000  177776  MOV     #KM+PUM,@#PSW           ;KERNEL MODE!!!, PREV USER MODE!!
 994  005110  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
 995  005114  012716  000700          MOV     #UPTR,(KSP)
 996  005120  006606                  MTPI    USP                     ;SET USER STACK POINTER
 997  005122  005067  173552          CLR     UPTR                    ;PRESET USER STACK
 998  005126  005016                  CLR     (KSP)                   ;PRESET KERNEL STACK
 999  005130  012766  177777  177776  MOV     #-1,-2(KSP)
1000  005136  006506                  MFPI    USP                     ;-(KSP)<-USP
1001  005140  006576  000000          MFPI    @(KSP)                  ;LIKE MOV  @(6),-(6)
1002  005144  000240                  NOP
1003  005146  013703  177776          MOV     @#PSW,R3                        ;SAVE STATUS RESULT
1004  005152  022767  000700  173320  CMP     #UPTR,KPTR              ;CHECK THAT USER STACK POINTER WAS
1005  005160  001401                  BEQ     .+4                     ;PUSHED ONTO KERNEL STACK
1006  005162  000000                  HLT                             ;ERROR!
1007  005164  022706  000476          CMP     #KPTR-2,KSP             ;CHECK THAT KERNEL STACK POINTER IS POS-
1008  005170  001401                  BEQ     .+4                     ;ITIONED PROPERLY
1009  005172  000000                  HLT                             ;ERROR! INCORRECT KERNEL STACK POINTER
1010  005174  005716                  TST     (KSP)                   ;CHECK THAT CORRECT DATA
1011  005176  001401                  BEQ     .+4                     ;WAS PUSHED ONTO KERNEL STACK
1012  005200  000000                  HLT                             ;ERROR!
1013  005202  022703  030004          CMP     #KM+PUM+Z,R3            ;CHECK STATUS
1014  005206  001401                  BEQ     .+4
1015  005210  000000                  HLT                             ;ERROR! INCORRECT STATUS
1016
1017                                  ;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC
1018  005212  010701          T102:   SCOPE
1019  005214  012737  030000  177776  MOV     #KM+PUM,@#PSW           ;KERNEL MODE!!!, PREV USER MODE!!
1020  005222  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK PTR
1021  005226  005016                  CLR     (KSP)                   ;PUT DATA ON STACK
1022  005230  012737  001002  001004  MOV     #TEMP,@#TEMP+2          ;LOAD ADDRESS
1023  005236  012767  177777  173536  MOV     #-1,TEMP                ;PRESET DATA
1024  005244  000277                  SCC                             ;PRESET CC'S
1025  005246  006677  173532          MTPI    @TEMP+2                 ;TEMP<-(KSP)+
1026  005252  013703  177776          MOV     @#PSW,R3                        ;CHECK CC'S
1027  005256  022703  030005          CMP     #PUM+Z+C,R3             ;CHECK CC'S
1028  005262  001401                  BEQ     .+4
1029  005264  000000                  HLT                             ;ERROR! INCORRECT CC'S AFTER MTPD
1030  005266  005737  001002          TST     @#TEMP                  ;CHECK RESULT
1031  005272  001401                  BEQ     .+4
1032  005274  000000                  HLT                             ;ERROR! INCORRECT RESULT
1033
1034                                  ;CHECK THAT MTPI CAN LOAD MEMORY ADDRESS DM=7
1035  005276  010701          T103:   SCOPE
1036  005300  012737  030000  177776  MOV     #KM+PUM,@#PSW           ;KERNEL MODE!!!
1037  005306  012706  000500          MOV     #KPTR,KSP               ;SET KERNEL STACK PTR
1038  005312  012716  177777          MOV     #-1,(KSP)               ;LOAD DATA ONTO STACK
1039  005316  012704  177776          MOV     #-2,R4                  ;LOAD INDEX REGISTER
1040  005322  005067  173454          CLR     TEMP                    ;PRESET DATA
```

```
1041  005326  012767  001002  173450          MOV     #TEMP,TEMP+2
1042  005334  006674  001006                  MTPI    @TEMP+4(R4)     ;TEMP+(KSP)+
1043  005340  013703  177776                  MOV     @#PSW,R3                ;SAVE STATUS RESULT
1044  005344  022706  000502                  CMP     #KPTR+2,KSP     ;CHECK THAT KSP POPPED
1045  005350  001401                          BEQ     .+4
1046  005352  000000                          HLT                     ;ERROR! INCORRECT STACK PTR
1047  005354  022703  030010                  CMP     #PUM+N,R3       ;CHECK STATUS RESULT
1048  005360  001401                          BEQ     .+4
1049  005362  000000                          HLT                     ;ERROR! INCORRECT STATUS
1050  005364  005267  173412                  INC     TEMP            ;CHECK RESULT
1051  005370  001401                          BEQ     .+4
1052  005372  000000                          HLT                     ;ERROR! INCORRECT RESULT
1053
1054                                  ;TEST THAT MTPD/I CAN LOAD PC
1055  005374  010701                  T104:   SCOPE
1056  005376  012737  000000  177776          MOV     #KM,@#PSW       ;KERNEL MODE!!!
1057  005404  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1058  005410  012716  005422                  MOV     #T104A,(KSP)    ;PUT NEW PC ON STACK
1059  005414  000277                          SCC                     ;PRESET CC'S
1060  005416  006607                          MTPI    PC              ;PC+(KSP)+
1061  005420  000000                          HLT                     ;ERROR! MTPD FAILED TO SET PC
1062  005422  100001                  T104A:  BPL     .+4
1063  005424  000000                          HLT                     ;ERROR! 'N' FAILED TO CLEAR IN STATUS
1064  005426  103401                          BCS     .+4
1065  005430  000000                          HLT                     ;ERROR! 'C' WAS CLEARED BY MTPD
1066
1067                                  ;USER MODE
1068  005432  010701                  T106:   SCOPE
1069  005434  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!
1070  005442  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK PTR
1071  005446  012716  005464                  MOV     #T106A,(USP)    ;PUT NEW PC ON STACK
1072  005452  000277                          SCC                     ;PRESET CC'S
1073  005454  006607                          MTPI    PC              ;PC+(USP)+
1074  005456  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
1075  005462  000000                          HLT                     ;ERROR! MTPD FAILED TOMLOAD PC
1076  005464  013705  177776          T106A:  MOV     @#PSW,R5                ;SAVE STATUS
1077  005470  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
1078  005474  022705  170001                  CMP     #UM+PUM+C,R5    ;CHECK STATUS
1079  005500  001401                          BEQ     .+4
1080  005502  000000                          HLT
1081
1082                                  ;TEST ERROR TRAP (ODD ADDRESS) MFPD/I
1083  005504  010701                  T107:   SCOPE
1084  005506  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
1085  005512  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1086  005516  012737  005534  000004          MOV     #T107A,@#ERRVEC ;LOAD ERROR VECTOR
1087  005524  000277                          SCC                     ;PRESET CC'S
1088  005526  006567  172247                  MFPI    1               ;ODD ADDRESS SHOULD TRAP
1089  005532  000000                  T107AA: HLT                     ;ERROR! FAILED TO TRAP ON ODD ADDRESS
1090  005534  022706  000474          T107A:  CMP     #KPTR-4,KSP     ;CHECK THAT STACK PTR WAS PUSHED
1091  005540  001401                          BEQ     .+4             ;PROPERLY (2 PUSHES)
1092  005542  000000                          HLT                     ;ERROR! INCORRECT STACK PTR AFTER ERROR
1093  005544  022726  005532                  CMP     #T107AA,(KSP)+  ;CHECK RETURN PC ON STACK
1094  005550  001401                          BEQ     .+4
1095  005552  000000                          HLT                     ;ERROR! RETURN PC NOT ON STACK
1096  005554  022716  000017                  CMP     #17,(KSP)       ;CHECK SAVED STATUS ON STACK
```

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1097  005560  001401                          BEQ     .+4
1098  005562  000000                          HLT                     ;ERROR! INCORRECT STATUS SAVED ON STACK
1099                                  ;USER MODE, TIME OUT
1100  005564  010701                  T110:   SCOPE
1101  005566  012737  140000  177776          MOV     #UM,@#PSW               ;USER MODE!!!
1102  005574  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK
1103  005600  012737  140000  000006          MOV     #UM,@#ERRVEC+2  ;LOAD 'NEW' STATUS
1104  005606  012737  005626  000004          MOV     #T110A,@#ERRVEC ;AND PC
1105  005614  006537  177702                  MFPI    @#177702        ;177702 IS NON-EXISTANT ADRS
1106  005620  005037  177776          T110AA: CLR     @#PSW           ;KERNEL MODE!!!
1107  005624  000000                          HLT                     ;ERROR! DID NOT TRAP ON NON ADRS
1108  005626  010603                  T110A:  MOV     USP,R3          ;SAVE USER STACK PTR
1109  005630  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
1110  005636  022703  000674                  CMP     #UPTR-4,R3      ;CHECK USER STACK PTR
1111  005642  001401                          BEQ     .+4
1112  005644  000000                          HLT                     ;ERROR! INCORRECT USP AFTER ERROR TRAP
1113  005646  022723  005620                  CMP     #T110AA,(R3)+   ;CHECK RETURN PC ON USER STACK
1114  005652  001401                          BEQ     .+4
1115  005654  000000                          HLT                     ;ERROR! RETURN PC NOT ON USER STACK
1116  005656  022713  140000                  CMP     #UM,(R3)        ;CHECK SAVED STATUS
1117  005662  001401                          BEQ     .+4
1118  005664  000000                          HLT                     ;ERROR! INCORRECT STATUS SAVED ON STACK
1119
1120                                  ;USER MODE,ODD ADDRESS
1121  005666  010701                  T111:   SCOPE
1122  005670  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
1123  005676  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK PTR
1124  005702  012737  005730  000004          MOV     #T111A,@#ERRVEC ;LOAD ERROR TRAP VECTOR
1125  005710  012737  140000  000006          MOV     #UM,@#ERRVEC+2
1126  005716  006567  172055                  MFPI    -1              ;ODD ADDRESS SHOULD TRAP
1127  005722  005037  177776          T111AA: CLR     @#PSW           ;KERNEL MODE!!!
1128  005726  000000                          HLT                     ;ERROR! FAILED TO TRAP
1129  005730  010603                  T111A:  MOV     USP,R3          ;SAVE USER STACK PTR
1130  005732  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
1131  005740  022703  000674                  CMP     #UPTR-4,R3      ;CHECK USER STACK PTR
1132  005744  001401                          BEQ     .+4
1133  005746  000000                          HLT                     ;ERROR! INCORRECT USER STACK POINTER
1134  005750  022713  005722                  CMP     #T111AA,(R3)    ;CHECK RETURN SODRESS ON USER STACK
1135  005754  001401                          BEQ     .+4
1136  005756  000000                          HLT                     ;ERROR! RETURN PC NOT ON USER STACK
1137  005760  012737  000006  000004          MOV     #ERRVEC+2,@#ERRVEC;RESTORE ERROR TRAP TO HALT
1138  005766  005067  172014                  CLR     ERRVEC+2
1139
1140                                  ;TEST THAT MTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
1141                                  ;KERNEL MODE,PREVIOUS USER MODE
1142  005772  010701                  T112:   SCOPE
1143  005774  012737  030000  177776          MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
1144  006002  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1145  006006  012746  000700                  MOV     #UPTR,-(KSP)
1146  006012  006606                          MTPI    USP             ;SET USER STACK PTR
1147  006014  012746  001002                  MOV     #TEMP,-(KSP)    ;PUT ADDRESS ON THE STACK
1148  006020  012746  177777                  MOV     #-1,-(KSP)      ;PUT DATA ON THE STAK
1149  006024  005037  001002                  CLR     @#TEMP          ;PRESET DATA
1150  006030  006636                          MTPI    @(KSP)+         ;MOVE #-1 TO TEMP
1151  006032  022706  000500                  CMP     #KPTR,KSP       ;CHECK STACK PTR AFTER MTPD
1152  006036  001401                          BEQ     .+4
```

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1153  006040  000000                        HLT                ;ERROR! INCORRECT STACK PTR AFTER MTPD
1154  006042  005267  172734                INC     TEMP       ;CHECK THAT DATA WAS MOVED TO TEMP
1155  006046  001401                        BEQ     .+4
1156  006050  000000                        HLT                ;ERROR! DATA NOT IN TEMP
1157  006052  006506                        MFPI    USP        ;GET USER STACK PTR
1158  006054  022716  000700                CMP     #UPTR,(KSP) ;CHECK THAT USER STACK PTR NOT CHANGED
1159  006060  001401                        BEQ     .+4        ;BY MTPD INSTRUCTION
1160  006062  000000                        HLT                ;ERROR! USP WAS CHANGED BY MTPD INST.
1161
1162  006064  005267  172710          END:  INC     ICNT       ;INCREMENT PASS COUNT
1163  006070  026727  172704  000144        CMP     ICNT,#100. ;100 PASSES COMPLETED?
1164  006076  001402                        BEQ     DONE
1165  006100  000167  172726                JMP     BEGIN
1166  006104  012767  000007  171454  DONE: MOV     #7,TPB     ;RING BELL
1167  006112  105767  171446                TSTB    TPS
1168  006116  100375                        BPL     .-4
1169  006120  012767  000177  171440        MOV     #177,TPB
1170  006126  105767  171432                TSTB    TPS
1171  006132  100375                        BPL     .-4
1172  006134  013701  000042          LOGICT: MOV     @#42,%1    ;RETURN TO MONITOR?
1173  006140  001405                        BEQ     LOGICE
1174  006142  000005                        RESET
1175  006144  004711                LOGIC:  JSR     7,(1)      ;RETURN!
1176  006146  000240                        NOP
1177  006150  000240                        NOP
1178  006152  000240                        NOP
1179  006154  000167  172632          LOGICE: JMP     START
1180            000001                      .END
```

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   536#  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#
```

DFKTDA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

```
                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*   741    806*   811    814    831*   832
                855*   860    863*   872*   883*   888*
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*   788    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#
```

DFKTDA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

```
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
```

DFKTDA.P11 CROSS REFERENCE TABLE -- USER SYMBOLS

```
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#    248#    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
```

DFKTDA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

```
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   564   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
```

DFKTDA.P11 CROSS REFERENCE TABLE -- PERMANENT SYMBOLS

```
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

Spooler runtime [illegible] Seconds, [illegible] MCS, 119 disk reads, 3 disk writes, [illegible] pages