KT11-D

KT11-D STATES

MD-11-DBKTD-C

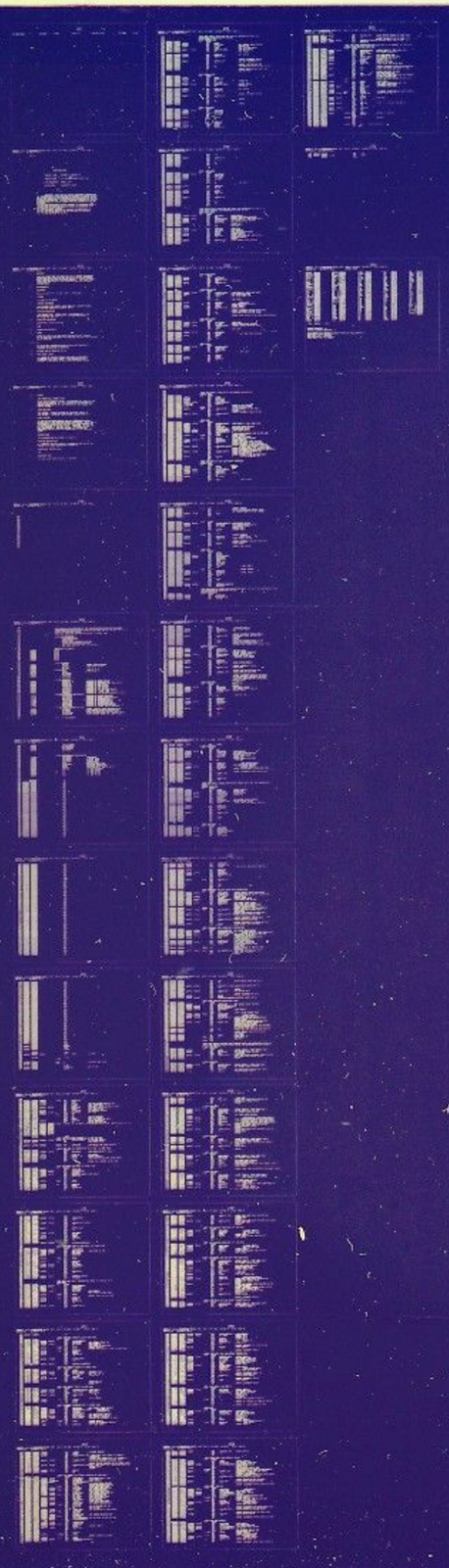
EP-DBKTD-C-DL-C

FICHE 1 OF 1

APR 1977

digital

MADE IN USA



B01

EOF1DBKTCBSEQ	00010000	770323	PDP10 411	HDR1DBKTDCSEQ	00010000	770323

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.REM %
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IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DBKTD-C-D

PRODUCT NAME: KT11-D PROCESSORS STATES TEST

DATE RELEASED: MARCH, 1977

MAINTAINER: DIAGNOSTIC GROUP

1.0 ABSTRACT

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

2.0 REQUIREMENTS

2.1 EQUIPMENT

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

2.2 STORAGE

UTILIZES 4K OF MEMORY

3.0 LOADING PROCEDURE

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

4.0 STARTING PROCEDURE

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

5.0 OPERATION PROCEDURE

5.1 OPERATIONAL SWITCH SETTINGS

NONE

5.2 SUBROUTINE ABSTRACTS

5.2.1 SCOPE

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

5.2.2 HLT

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

5.3 PROGRAM AND/OR OPERATOR ACTION

5.3.1 PASS COUNT (ICNT)

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

6.0 ERRORS

6.1 TEST ERROR WILL CAUSE A HALT

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

6.2 ERROR RECOVERY

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

6.3 ERROR LOOPING

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

7.0 RESTRICTIONS

THIS PROGRAM MUST BE LOADED IN LOWER 4K.

7.1 STARTING RESTRICTION

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

7.2 OPERATIONAL RESTRICTIONS

NONE

8.1 EXECUTION TIME

ONE PASS TAKES APPROXIMATELY 10 SECONDS.

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                                ;TEST DBKTDC 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
                                ;       PRESS 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
177774                                  SLR=177774              ;ADDRESS OF STACK LIMIT 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
```

```
                                                BIT15=100000
                                                BIT14=40000
                                                BIT13=20000
                                                BIT6=100


                                        ;STATUS REGISTER BIT ASSIGNMENTS
                                                UM=140000               ;USER MODE
                                                IM=100000               ;ILLEGAL MODE
                                                IM1=40000               ;ILLEGAL MODE
                                                KM=0                    ;KERNEL MODE
                                                PUM=030000              ;PREVIOUS USER MODE
                                                PKM=0                   ;PREVIOUS KERNEL MODE
                                                REG=0                   ;REGISTER BIT:  HAS NO EFFECT!!!!
                                                TBIT=20                 ;'T' BIT IN @#PSW
                                                C=1                     ;'C' BIT IN PS
                                                V=2                     ;'V' BIT IN PS
                                                Z=4                     ;'Z' BIT IN PS
                                                N=10                    ;'N' BIT IN PS


000000  000000                                  .=0
000000  000002                                  .+2
000002  000000                                  HALT
000004  000006                                  .+2
000006  000000                                  HALT
000010  000012                                  .+2
000012  000000                                  HALT
000014  000016                                  .+2
000016  000000                                  HALT
000020  000022                                  .+2
000022  000000                                  HALT
000024  000026                                  .+2
000026  000000                                  HALT
000030  000032                                  .+2
000032  000000                                  HALT
000034  000036                                  .+2
000036  000000                                  HALT
000040  000042                                  .+2
000042  000000                                  HALT
000044  000046                                  .+2
000046  000000                                  HALT
000050  000052                                  .+2
000052  000000                                  HALT
000054  000056                                  .+2
000056  000000                                  HALT
000060  000062                                  .+2
000062  000000                                  HALT
000064  000066                                  .+2
000066  000000                                  HALT
000070  000072                                  .+2
000072  000000                                  HALT
000074  000076                                  .+2
000076  000000                                  HALT
000100  000102                                  .+2
000102  000000                                  HALT
```

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

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                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .+2
                                                                HALT
                                                                .=46
                                                                $ENDAD
                                                                .=52
                                                                000000

                                                                .=200
                                                                JMP     START           ;GO START

                                                                .=1000
                                                        ;TAGS

                                                        ICNT:   0                       ;CONTAINS PASS COUNT
                                                        TEMP:   0
                                                                .=.+6
                                                                FTITLE: 0               ;TITLE FLAG
                                                                PASCNT: 0
```

```
392
393  001016  012706  000500          START:  MOV     #KPTR,KSP
394  001022  005067  177752                  CLR     ICNT
395  001026  005767  177760                  TST     FTITLE          ;HAS TITLE BEEN PRINTED YET?
396  001032  001050                          BNE     PWRUP           ;YES, SKIP TITLE
397  001034  023737  000042  000046          CMP     @#42,@#46       ;ARE WE IN ACT11 AUTOMATIC MODE?
398  001042  001444                          BEQ     PWRUP           ;YES, SKIP TITLE
399  001044  012700  001076                  MOV     #TITLE,R0       ;GET MESSAGE ADDRESS
400  001050  012767  000001  177734          MOV     #1,FTITLE       ;SET FLAG
401  001056  105767  176502          1$:     TSTB    TPS
402  001062  100375                          BPL     1$
403  001064  105710                          TSTB    (R0)            ;END OF MESSAGE?
404  001066  001432                          BEQ     PWRUP           ;YES, GET OVER THE ASCII
405  001070  112067  176472                  MOVB    (R0)+,TPB       ;PRINT CHARACTER
406  001074  000770                          BR      1$              ;GO DO THE NEXT ONE
407  001076  005015  042120  030520  TITLE:  .ASCIZ <15><12>@PDP11/40 PROCESSOR STATES TEST, DBKTD-C@<15><12><177>
408  001104  027461  030064  050040
409  001112  047522  042503  051523
410  001120  051117  051440  040524
411  001126  042524  020123  042524
412  001134  052123  020054  041104
413  001142  052113  026504  006503
414  001150  077412    000
415          001154                      .EVEN
416                                  ;TEST THAT PROCESSER POWERED UP OK FOR THE TEST
417  001154  032737  000000  177776  PWRUP:  BIT     #KM+PKM,@#PSW   ;IS STATUS CORRECT
418  001162  001377                          BNE     .               ;LOOP HERE IF NOT
419
420  001164  012706  000500          BEGIN:  MOV     #KPTR,KSP       ;INITIALIZE THE STACK POINTER
421
422                                  ;CHECK THAT THE NOP INSTRUCTION IS A 'NOP' IN USER MODE.
423  001170  010701                  ↑1:     SCOPE
424  001172  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE,PRIORITY LEVEL 0
425  001200  000240                          NOP
426  001202  013700  177776                  MOV     @#PSW,R0        ;GET @#PSW
427  001206  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
428  001212  022700  140000                  CMP     #UM,R0          ;TEST THAT NOP DID NOT ALTER @#PSW
429  001216  001401                          BEQ     .+4
430  001220  000000                          HLT                     ;ERROR! NOP CHANGED STATUS WORD
431
432
433                                  ;TEST TRAP FROM USER MODE TO KERNEL MODE
434  001222  010701                  ↑5:     SCOPE
435  001224  012706  000500                  MOV     #KPTR,KSP
436  001230  012737  001266  000020          MOV     #T5A,@#IOTVEC
437  001236  005067  176560                  CLR     IOTVEC+2
438  001242  012737  140340  177776          MOV     #UM+PRTY7,@#PSW ;USER MODE!!!
439  001250  012706  000700                  MOV     #UPTR,USP
440  001254  000277                          SCC
441  001256  000004                          IOT
442  001260  005037  177776          T5AA:   CLR     @#PSW
443  001264  000000                          HLT
444  001266  013700  177776          T5A:    MOV     @#PSW,R0
445  001272  005037  177776                  CLR     @#PSW
446  001276  022700  030000                  CMP     #KM+PUM,R0
447  001302  001401                          BEQ     .+4
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```
                                                HLT
001304  000000                                  CMP     #T5AA,KPTR-4
001306  022767  001260  177160                  BEQ     .+4
001314  001401                                  HLT
001316  000000                                  CMP     #UM+PRTY7+17,KPTR-2
001320  022767  140357  177150                  BEQ     .+4
001326  001401                                  HLT
001330  000000                                  CMP     #KPTR-4,KSP
001332  022706  000474                          BEQ     .+4
001336  001401                                  HLT
001340  000000                                  MOV     #UM,@#PSW
001342  012737  140000  177776                  MOV     USP,R0
001350  010600                                  CLR     @#PSW
001352  005037  177776                          CMP     #UPTR,R0
001356  022700  000700                          BEQ     .+4
001362  001401                                  HLT
001364  000000                                  MOV     #IOTVEC+2,@#IOTVEC
001366  012737  000022  000020

                                        ;TEST TRAP FROM USER TO USER MODE (VIA TRACE TRAP)
001374  010701                          T7:     SCOPE
001376  012767  001434  176410                  MOV     #T7A,TRTVEC
001404  012767  140000  176404                  MOV     #UM,TRTVEC+2    ;USER MODE ON TRAP
001412  012737  140000  177776                  MOV     #UM,@#PSW
001420  012706  000700                          MOV     #UPTR,USP
001424  000003                                  TRT
001426  005037  177776                  T7AA:   CLR     @#PSW
001432  000000                                  HLT
001434  013700  177776                  T7A:    MOV     @#PSW,R0
001440  010602                                  MOV     USP,R2
001442  042737  140000  177776                  BIC     #UM,@#PSW
001450  022767  001426  177216                  CMP     #T7AA,UPTR-4
001456  001401                                  BEQ     .+4
001460  000000                                  HLT
001462  022700  170000                          CMP     #UM+PUM,R0
001466  001401                                  BEQ     .+4
001470  000000                                  HLT
001472  012767  000016  176314                  MOV     #TRTVEC+2,TRTVEC
001500  005067  176312                          CLR     TRTVEC+2

                                        ;TEST THAT THE 'HALT' INSTRUCTION TRAPS TO LOCATION 10 IN
                                        ;USER MODE.
001504  010701                          T12:    SCOPE
001506  012737  001542  000010                  MOV     #T12A,@#RESVEC
001514  005037  000012                          CLR     @#RESVEC+2
001520  012706  000500                          MOV     #KPTR,KSP
001524  012737  140000  177776                  MOV     #UM,@#PSW       ;USER MODE!!!
001532  000000                                  HALT                    ;HALT TRAPS IN USER MODE
001534  005037  177776                  T12AA:  CLR     @#PSW
001540  000000                                  HALT                    ;ERROR!  HALT DID NOT TRAP
001542  013700  177776                  T12A:   MOV     @#PSW,R0
001546  005037  177776                          CLR     @#PSW
001552  022700  030000                          CMP     #KM+PUM,R0
001556  001401                                  BEQ     .+4
001560  000000                                  HLT
001562  022767  001534  176704                  CMP     #T12AA,KPTR-4
001570  001401                                  BEQ     .+4
```

```
                                                HLT

                                        ;CHECK THAT SPL TRAPS TO 10 IN USER MODE.
                                T13:    SCOPE
001574  010701
001576  012737  001626  000010                MOV     #T13A,@#RESVEC
001604  012706  000500                        MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
001610  012737  140000  177776                MOV     #UM,@#PSW       ;USER MODE!!!
001616  000237                                SPL     7               ;SPL TRAPS IN USER MODE
001620  005037  177776                T13AA:  CLR     @#PSW           ;KERNEL MODE!!!
001624  000000                                HLT                     ;ERROR! SPL FAILED TO TRAP IN USER MODE
001626  013700  177776                T13A:   MOV     @#PSW,R0
001632  005037  177776                        CLR     @#PSW
001636  022700  030000                        CMP     #KM+PUM,R0
001642  001401                                BEQ     .+4
001644  000000                                HLT
001646  022767  001620  176620                CMP     #T13AA,KPTR-4
001654  001401                                BEQ     .+4
001656  000000                                HLT
001660  012737  000012  000010                MOV     #RESVEC+2,@#RESVEC

                                        ;TEST THAT "RESET" RESETS IN KERNEL MODE
                                T18:    SCOPE
001666  010701
001670  005037  177776                        CLR     @#PSW
001674  012737  000340  177776                MOV     #PRTY7,@#PSW    ;PRIORITY TO 7
001702  012767  000100  175654                MOV     #100,177564     ;SET "IE" IN TPS
001710  000005                                RESET                   ;CLEAR "IE"
001712  005037  177776                        CLR     @#PSW
001716  032767  000100  175640                BIT     #100,177564
001724  001401                                BEQ     .+4
001726  000000                                HLT                     ;RESET DID NOT
                                                                        ;CLEAR "IE"

                                        ;TEST THAT "RESET" NOP'S IN USER MODE
                                T19:    SCOPE
001730  010701
001732  012737  140340  177776                MOV     #UM+PRTY7,@#PSW ;USER MODE!!!
001740  012767  000100  175616                MOV     #100,177564     ;SET "IE"
001746  000005                                RESET                   ;SHOULD NOP
001750  032767  000100  175606                BIT     #100,177564
001756  001001                                BNE     .+4
001760  000000                                HLT                     ;"IE" CLEARED
001762  005067  175576                        CLR     177564
001766  005037  177776                        CLR     @#PSW

                                        ;TEST INTERRUPT SEQUENCE USER TO KERNEL MODE
                                T15:    SCOPE
001772  010701
001774  012706  000500                        MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
002000  012737  170340  177776                MOV     #UM+PUM+PRTY7,@#PSW     ;USER MODE!!!
002006  012767  002052  176050                MOV     #T15A,64                ;INTERRUPT VEC.
002014  012767  000200  176044                MOV     #KM+PRTY4,66
002022  012706  000700                        MOV     #UPTR,USP       ;SET USER STACK POINTER
002026  042737  000200  177776                BIC     #PRTY4,@#PSW    ;SET PRIORITY LEVEL=3
002034  012767  000100  175522                MOV     #100,177564     ;REQUEST AN INTERRUPT AT LEVEL 4
002042  000240                                NOP
002044  005037  177776                T15AA:  CLR     @#PSW           ;KERNEL MODE!!!
002050  000000                                HLT                     ;ERROR! NO INTERRUPT REQUEST
002052  013700  177776                T15A:   MOV     @#PSW,R0        ;GET 'NEW" @#PSW
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560  002056  005067  175502                CLR     177564          ;DISABLE REQUEST
561  002062  005037  177776                CLR     @#PSW
562  002066  022700  030200                CMP     #KM+PUM+PRTY4,R0  ;TEST THAT 'NEW' @#PSW IS CORRECT
563  002072  001401                        BEQ     .+4               ;(PIRVEC+2)
564  002074  000000                        HLT                       ;ERROR! 'NEW' @#PSW NOT = TO (PIRVEC+2)
565  002076  022767  002044  176370        CMP     #T15AA,KPTR-4     ;IS RETURN ADDRESS ON KERNEL STACK
566  002104  001401                        BEQ     .+4
567  002106  000000                        HLT                       ;ERROR! RETURN ADDRESS NOT ON KERNEL STACK
568  002110  022767  170140  176360        CMP     #UM+PUM+PRTY3,KPTR-2  ;TEST THAT 'OLD' @#PSW WAS SAVED ON
569  002116  001401                        BEQ     .+4               ;KERNEL STACK
570  002120  000000                        HLT                       ;ERROR!
571  002122  012767  000066  175734        MOV     #66,64
572  002130  005067  175732                CLR     66
573
574                                  ;TEST THAT THERE IS NO STACK OVERFLOW IN USER MODE.
575  002134  010701                 T17:    SCOPE
576  002136  012737  000400  177774        MOV     #400,@#SLR        ;SET STACK LIMIT =1000
577  002144  012737  140000  177776        MOV     #UM,@#PSW         ;USER MODE!!!
578  002152  012737  002402  000004        MOV     #T17ERR,@#ERRVEC
579  002160  012706  000700                MOV     #UPTR,USP         ;SET USER STACK POINTER
580  002164  005067  176612                CLR     TEMP              ;CLEAR INDICATOR LOCATION
581  002170  004767  000006         T17A:  JSR     7,T17B            ;PUSH ONTO USER STACK
582  002174  052767  000400  176600        BIS     #400,TEMP         ;SET ERROR INDICATOR BIT
583  002202  052767  000001  176572  T17B:  BIS     #1,TEMP           ;SET INDICATOR BIT
584  002210  004567  000006                JSR     5,T17C            ;PUSH ONTO USER STACK
585  002214  052767  001000  176560        BIS     #1000,TEMP        ;SET ERRROR INDICATOR BIT
586  002222  052767  000002  176552  T17C:  BIS     #2,TEMP           ;SET INDICATOR BIT
587  002230  050546                        BIS     R5,-(USP)         ;PUSH ONTO USER STACK
588  002232  052767  000004  176542        BIS     #4,TEMP           ;SET INDICATOR BIT
589  002240  052737  000000  177776        BIS     #REG,@#PSW        ;SELECT R0-R5
590  002246  004767  000006                JSR     7,T17D            ;PUSH ONTO USER STACK
591  002252  052767  002000  176522        BIS     #2000,TEMP        ;SET ERROR INDICATOR BIT
592  002260  052767  000010  176514  T17D:  BIS     #10,TEMP
593  002266  012702  002302                MOV     #T17E,R2          ;SET UP RETURN FOR RTS
594  002272  000202                        RTS     R2                ;GO TO T16E
595  002274  052767  004000  176500        BIS     #4000,TEMP        ;SET INDICATOR TO SHOW ERROR
596  002302  052767  000020  176472  T17E:  BIS     #20,TEMP
597  002310  004567  000006                JSR     R5,T17F
598  002314  052767  010000  176460        BIS     #10000,TEMP       ;SET ERROR INDICATOR BIT
599  002322  052767  000040  176452  T17F:  BIS     #40,TEMP
600  002330  012737  002354  000034        MOV     #T17G,@#TRAPVEC   ;SET UP TRAP VECTOR FOR TRAP
601  002336  012737  140000  000036        MOV     #UM,@#TRAPVEC+2
602  002344  104400                        TRAP
603  002346  052767  020000  176426        BIS     #20000,TEMP
604  002354  052767  000100  176420  T17G:  BIS     #100,TEMP
605  002362  005037  177776                CLR     @#PSW             ;KERNEL MODE!!!
606  002366  022767  000177  176406        CMP     #177,TEMP
607  002374  001401                        BEQ     .+4
608  002376  000000                        HLT
609  002400  000403                        BR      T17X
610  002402  005037  177776  T17ERR: CLR     @#PSW
611  002406  000000                        HLT                       ;ERROR! OVERFLOW OCCURED
612  002410  005037  177774  T17X:   CLR     @#SLR
613  002414  012737  000036  000034        MOV     #TRAPVEC+2,@#TRAPVEC
614  002422  005067  175410                CLR     TRAPVEC+2
615
```

```
                                        ;TEST THAT MTPD/I POPS WORD OFF THE THE APPROPRIATE STACK (AS
                                        ;DETERMINED BY BITS 15&14 IN @#PSW.)
                                        ;MTPD, KERNEL MODE
002426  010701                          †21:    SCOPE
002430  005037  177776                          CLR     @#PSW
002434  012706  000500                          MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
002440  012700  177777                          MOV     #-1,R0                  ;PRE-SET R0
002444  005016                                  CLR     (KSP)                   ;PUT 0 ON THE STACK
002446  012737  030011  177776                  MOV     #PUM+N+C,@#PSW          ;PRE SET STATUS
002454  006600                                  MTPI    R0                      ;R0←-(KSP)+

002456  013702  177776                          MOV     @#PSW,R2                ;GET STATUS
002462  022702  030005                          CMP     #PUM+Z+C,R2
002466  001401                                  BEQ     .+4
002470  000000                                  HLT                             ;ERROR! INCORRECT STATUS
002472  022706  000502                          CMP     #KPTR+2,KSP             ;DID KSP INCREMENT BY 2
002476  001401                                  BEQ     .+4
002500  000000                                  HLT                             ;ERROR!  KSP DID NOT POP
002502  005700                                  TST     R0                      ;DID WORD ON STACK (0) GET TO R0?
002504  001401                                  BEQ     .+4
002506  000000                                  HLT                             ;ERROR! MTPD DID NOT POP 0 OFF
                                                                                ;KSP INTO R0

                                        ;MTPI,KERNEL MODE
002510  010701                          †22:    SCOPE
002512  005037  177776                          CLR     @#PSW
002516  012706  000500                          MOV     #KPTR,KSP
002522  005002                                  CLR     R2                      ;PRESET R2
002524  012716  177777                          MOV     #-1,(KSP)
002530  012737  030006  177776                  MOV     #PUM+Z+V,@#PSW          ;PRESET STATUS
002536  006602                                  MTPI    R2                      ;R2←(KSP)+

002540  013700  177776                          MOV     @#PSW,R0                ;GET STATUS
002544  022700  030010                          CMP     #PUM+N,R0
002550  001401                                  BEQ     .+4
002552  000000                                  HLT                             ;ERROR! INCORRECT STATUS
002554  022706  000502                          CMP     #KPTR+2,KSP
002560  001401                                  BEQ     .+4
002562  000000                                  HLT                             ;ERROR!
002564  005202                                  INC     R2
002566  001401                                  BEQ     .+4
002570  000000                                  HLT                             ;ERROR!

                                        ;MTPD, USER MODE
002572  010701                          †25:    SCOPE
002574  012737  140000  177776                  MOV     #UM,@#PSW
002602  012706  000700                          MOV     #UPTR,USP
002606  052716  177777                          BIS     #-1,(USP)
002612  000261                                  SEC
002614  042705  177777                          BIC     #-1,R5
002620  006605                                  MTPI    R5                      ;R5←(USP)+

002622  013700  177776                          MOV     @#PSW,R0
002626  010602                                  MOV     USP,R2
002630  005037  177776                          CLR     @#PSW
002634  022700  140011                          CMP     #UM+N+C,R0
```

```
   672  002640  001401                          BEQ     .+4
   673  002642  000000                          HLT
   674  002644  022702  000702                  CMP     #UPTR+2,R2
   675  002650  001401                          BEQ     .+4
   676  002652  000000                          HLT
   677  002654  005205                          INC     R5
   678  002656  001401                          BEQ     .+4
   679  002660  000000                          HLT
   680
   681
   682                                  ;MTPI, USER MODE
   683  002662  010701                 T26:     SCOPE
   684  002664  012737  140000  177776          MOV     #UM,@#PSW
   685  002672  012706  000700                  MOV     #UPTR,USP
   686  002676  042716  177777                  BIC     #-1,(USP)
   687  002702  052700  177777                  BIS     #-1,R0
   688  002706  000257                          CCC
   689  002710  006600                          MTPI    R0                      ;R0←(USP)+
   690
   691  002712  013702  177776                  MOV     @#PSW,R2
   692  002716  010603                          MOV     USP,R3
   693
   694  002720  005037  177776                  CLR     @#PSW
   695  002724  022702  140004                  CMP     #UM+Z,R2
   696  002730  001401                          BEQ     .+4
   697  002732  000000                          HLT
   698  002734  022703  000702                  CMP     #UPTR+2,R3
   699  002740  001401                          BEQ     .+4
   700  002742  000000                          HLT
   701  002744  005700                          TST     R0
   702  002746  001401                          BEQ     .+4
   703  002750  000000                          HLT
   704
   705                                  ;TEST THAT MTP D/I POPS WORD OFF STACK (AS DETERMINED BY BITS 15 & 14
   706                                  ;INTO STACK POINTER (AS DETERMINED BY BITS 13 &12).
   707                                  ;USP←(KSP)+,MTPD
   708  002752  010701                 T30:     SCOPE
   709  002754  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
   710  002762  005006                          CLR     USP             ;PRESET USER STACK POINTER
   711  002764  012737  030000  177776          MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!  PREV USER MODE!!
   712  002772  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
   713  002776  012716  000700                  MOV     #UPTR,(KSP)
   714  003002  000277                          SCC                     ;PRESET CC'S
   715  003004  006606                          MTPI    USP             ;USP←(KSP)+
   716
   717  003006  013702  177776                  MOV     @#PSW,R2        ;SAVE CC'S
   718  003012  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE!!!
   719  003020  010600                          MOV     USP,R0          ;GET USER STACK POINTER
   720  003022  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
   721  003026  022700  000700                  CMP     #UPTR,R0        ;CHECK THAT MTPD SET USER STACK
   722  003032  001401                          BEQ     .+4             ;POINTER PROPERLY
   723  003034  000000                          HLT                     ;ERROR!
   724  003036  022706  000502                  CMP     #KPTR+2,KSP     ;CHECK KERNEL STACK POINTER
   725  003042  001401                          BEQ     .+4
   726  003044  000000                          HLT
   727
```

```
                                        ;KSP←(KSP)+,MTPD
003046  010701                  T31:    SCOPE
003050  012706  000500                  MOV     #KPTR,KSP
003054  012716  000736                  MOV     #REDPTR,(KSP)
003060  006606                          MTPI    KSP             ;KSP←(KSP)+
003062  022706  000736                  CMP     #REDPTR,KSP
003066  001401                          BEQ     .+4
003070  000000                          HLT

                                        ;;USP←(USP)+,MTPD
003072  010701                  T31C:   SCOPE
003074  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!, PREV USER MODE!!
003102  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK PTR
003106  005016                          CLR     (USP)           ;PUT #0 ON USER STACK
003110  000257                          CCC
003112  006606                          MTPI    USP             ;USP←(USP)+

003114  013700  177776                  MOV     @#PSW,R0                ;SAVE CC'S
003120  010602                          MOV     USP,R2          ;SAVE USER STACK POINTER
003122  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
003126  022700  170004                  CMP     #UM+PUM+Z,R0    ;CHECK STATUS
003132  001401                          BEQ     .+4
003134  000000                          HLT                     ;ERROR! INCORRECT STATUS AFTER MTPD
003136  005702                          TST     R2              ;CHECK NEW STACK POINTER VALUE
003140  001401                          BEQ     .+4
003142  000000                          HLT                     ;ERROR! MTPD FAILED TO SET USER STACK POINTER

                                        ;USP←(KSP)+,MTPI
003144  010701                  T32A:   SCOPE
003146  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE
003154  012706  177777                  MOV     #-1,USP         ;PRESET USER STACK POINTER
003160  012737  030000  177776          MOV     #KM+PUM,@#PSW   ;CURRENT KERNEL,PREVIOUS USER
003166  005046                          CLR     -(KSP)
003170  006606                          MTPI    USP             ;USP←(KSP+

003172  012737  140000  177776          MOV     #UM,@#PSW
003200  010600                          MOV     USP,R0                  ;GET USER STACK POINTER
003202  005037  177776                  CLR     @#PSW
003206  005700                          TST     R0
003210  001401                          BEQ     .+4
003212  000000                          HLT

                                        ;USP←(USP)+
003214  010701                  T35:    SCOPE
003216  012737  170000  177776          MOV     #UM+PUM,@#PSW
003224  012706  000700                  MOV     #UPTR,USP
003230  012716  000700                  MOV     #UPTR,(USP)
003234  006606                          MTPI    USP                     ;USP←(USP)+

003236  010600                          MOV     USP,R0
003240  005037  177776                  CLR     @#PSW
003244  022700  000700                  CMP     #UPTR,R0
003250  001401                          BEQ     .+4
003252  000000                          HLT
```

```
                                        ;TEST THAT MTPD/I TRAPS ON AN ODD ADDRESS DESTINATION
                                        ;KERNEL MODE
003254  010701                  T36:    SCOPE
003256  005037  177776                  CLR     @#PSW
003262  012706  000500                  MOV     #KPTR,KSP
003266  012716  177777                  MOV     #-1,(KSP)
003272  012737  003312  000004          MOV     #T36A,@#ERRVEC
003300  005067  174502                  CLR     ERRVEC+2
003304  006667  174467                  MTPI    -1              ;TRAPS ON ODD ADDRESS
003310  000000                  T36AA:  HLT                     ;ERROR! DID NOT TRAP
003312  022706  000476          T36A:   CMP     #KPTR-2,KSP     ;IS KSP CORRECT?(1 POP AND 2
003316  001401                          BEQ     .+4             ;PUSHES)
003320  000000                          HLT                     ;ERROR! INCORRECT VALUE IN KSP
003322  022767  003310  175146          CMP     #T36AA,KPTR-2
003330  001401                          BEQ     .+4
003332  000000                          HLT

                                        ;USER MODE
003334  010701                  T40:    SCOPE
003336  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!, PREV USER MODE!!
003344  012702  000001                  MOV     #1,R2
003350  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK POINTER
003354  012716  125252                  MOV     #125252,(USP)   ;PRESET USER STACK
003360  012737  003404  000004          MOV     #T40A,@#ERRVEC  ;LOAD ERROR VECTOR
003366  012737  140000  000006          MOV     #UM,@#ERRVEC+2
003374  006642                          MTPI    -(R2)           ;-(R2)+(USP)+;SHOULD TRAP ON ODD ADRS
003376  005037  177776          T40AA:  CLR     @#PSW           ;KERNEL MODE!!!
003402  000000                          HLT                     ;ERROR DID NOT TRAP
003404  010600                  T40A:   MOV     USP,R0          ;GET USERS STACK POINTER
003406  042737  140000  177776          BIC     #UM,@#PSW       ;KERNEL MODE!!!
003414  022700  000676                  CMP     #UPTR-2,R0      ;CHECK THAT USER STACK POINTER
003420  001401                          BEQ     .+4             ;PUSHED PROPERLY (1 POP,2 PUSHES)
003422  000000                          HLT                     ;ERROR! INCORRECT USER STACK POINTER
003424  022737  170010  000700          CMP     #UM+PUM+N,@#UPTR        ;CHECK THAT CORRECT STATUS WAS
003432  001401                          BEQ     .+4             ;SAVED ON USER STACK ('N' IS DATA POPPED)
003434  000000                          HLT                     ;ERROR! INCORRECT STATUS SAVED ON USER STACK
003436  022767  003376  175232          CMP     #T40AA,UPTR-2   ;CHECK THAT RETURN ADDRESS WAS
003444  001401                          BEQ     .+4             ;SAVED ON USER STACK
003446  000000                          HLT                     ;ERROR! RETURN PC NOT ON USER STACK
003450  022702  177777                  CMP     #-1,R2                  ;DID R2 DECREMENT BY 2
003454  001401                          BEQ     .+4
003456  000000                          HLT
                                        ;TEST THAT MTP D/I CAN LOAD MEMORY ADDRESSES.
                                        ;KERNEL MODE
003460  010701                  T41:    SCOPE
003462  005037  177776                  CLR     @#PSW
003466  012700  177777                  MOV     #-1,R0
003472  012737  003526  000004          MOV     #T41A,@#ERRVEC
003500  005067  174302                  CLR     ERRVEC+2
003504  052737  000000  177776          BIS     #REG,@#PSW      ;R0-R5
003512  005000                          CLR     R0
003514  012746  000002                  MOV     #2,-(KSP)
003520  000261                          SEC
003522  006620                          MTPI    (R0)+                   ;(R0)+-(KSP)+
003524  000401                          BR      .+4
```

```
  840  003526  000000                    T41A:   HLT                     ;ERROR! TRAPPED
  841  003530  103401                            BCS     .+4             ;MTP D/I SHOULD NOT AFFECT CARRY
  842  003532  000000                            HLT                     ;BIT ERROR! CARRY BIT BUT CLEARED.
  843  003534  022767  000002  174236            CMP     #2,0
  844  003542  001401                            BEQ     .+4
  845  003544  000000                            HLT
  846
  847
  848  003546  010701                    T41B:   SCOPE
  849  003550  012737  003576  000004            MOV     #T41BB,@#ERRVEC ;LOAD ERROR VECTOR
  850  003556  012706  000500                    MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
  851  003562  012716  177777                    MOV     #-1,(KSP)       ;LOAD KERNEL STACK
  852  003566  000257                            CCC                     ;PRESET CC'S
  853  003570  006637  001002                    MTPI    @#TEMP          ;@#TEMP←(KSP)+
  854
  855  003574  000401                            BR      .+4
  856  003576  000000                    T41BB:  HLT                     ;ERROR! TRAPPED
  857  003600  013700  177776                    MOV     @#PSW,R0                ;SAVE CC'S
  858  003604  022700  000010                    CMP     #REG+N,R0       ;CHECK RESULT STATUS
  859  003610  001401                            BEQ     .+4
  860  003612  000000                            HLT                     ;ERROR! INCORRECT STATUS AFTER MTPD
  861  003614  005237  001002                    INC     @#TEMP          ;CHECK RESULT
  862  003620  001401                            BEQ     .+4
  863  003622  000000                            HLT                     ;ERROR! MTPD FAILED
  864
  865                                     ;USER MODE
  866  003624  010701                    T43:    SCOPE
  867  003626  005037  177776                    CLR     @#PSW
  868  003632  012703  177777                    MOV     #-1,R3
  869  003636  012737  003676  000004            MOV     #T43A,@#ERRVEC
  870  003644  012737  140000  177776            MOV     #UM,@#PSW
  871  003652  012703  001004                    MOV     #TEMP+2,R3
  872  003656  005067  175120                    CLR     TEMP
  873  003662  012706  000700                    MOV     #UPTR,USP
  874  003666  052716  177777                    BIS     #-1,(USP)
  875  003672  006643                            MTPI    -(R3)                   ;-(R3)←(USP)+
  876  003674  000401                            BR      .+4
  877  003676  000000                    T43A:   HLT                             ;ERROR TRAPPED
  878  003700  013700  177776                    MOV     @#PSW,R0
  879  003704  042737  140000  177776            BIC     #UM,@#PSW               ;KERNEL MODE!!!
  880  003712  122700  000010                    CMPB    #N,R0
  881  003716  001401                            BEQ     .+4
  882  003720  000000                            HLT
  883  003722  005167  175054                    COM     TEMP
  884  003726  001401                            BEQ     .+4
  885  003730  000000                            HLT
  886  003732  012737  000006  000004            MOV     #ERRVEC+2,@#ERRVEC
  887  003740  005067  174042                    CLR     ERRVEC+2
  888
  889                                     ;TEST THAT MFP D/I PUSHES DESTINATION REGISTER DATA ONTO THE APPROPRIATE STACK
  890                                     ;(AS DETERMINED BY @#PSW BITS 15 &14)
  891                                     ;KERNEL MODE,MFPD
  892  003744  010701                    T44:    SCOPE
  893  003746  012706  000500                    MOV     #KPTR,KSP
  894  003752  012716  125252                    MOV     #125252,(KSP)
  895  003756  012700  177777                    MOV     #-1,R0
```

```
 896  003762  000261                          SEC
 897  003764  006500                          MFPI    R0              ;-(KSP)←R0,(R0)=-1
 898  003766  013702  177776                  MOV     @#PSW,R2        ;GET STATUS RESULT
 899  003772  022702  000011                  CMP     #REG+N+C,R2     ;
 900  003776  001401                          BEQ     .+4
 901  004000  000000                          HLT                     ;ERROR! INCORRECT STATUS RESULT
 902  004002  022706  000476                  CMP     #KPTR-2,KSP     ;DID KERNEL STACK POINTER GET
 903  004006  001401                          BEQ     .+4             ;PUSHED?
 904  004010  000000                          HLT                     ;ERROR!
 905  004012  005116                          COM     (KSP)           ;TEST THAT CORRECT DATA(-1) GOT
 906  004014  001401                          BEQ     .+4             ;PUSHED ONTO KERNEL STACK
 907  004016  000000                          HLT                     ;ERROR! -1NOT PUSHED ONTO KERNEL STACK
 908                                  ;KERNEL MODE,MFPI
 909  004020  010701                  T45:    SCOPE
 910  004022  012706  000500                  MOV     #KPTR,KSP
 911  004026  012716  052525                  MOV     #52525,(KSP)    ;PRE SET STACK
 912  004032  005004                          CLR     R4              ;PRESET 'WRONG' REGISTER
 913  004034  012737  000001  177776          MOV     #REG+C,@#PSW    ;SELECT R0-R5,SET C
 914  004042  012704  125252                  MOV     #125252,R4      ;LOAD DATA TO BE MOVED
 915  004046  006504                          MFPI    R4              ;-(KSP)←R4,(R4)=125252
 916
 917  004050  013700  177776                  MOV     @#PSW,R0
 918  004054  022700  000011                  CMP     #REG+N+C,R0     ;CHECK STATUS RESULT
 919  004060  001401                          BEQ     .+4
 920  004062  000000                          HLT                     ;ERROR! INCORRECT STATUS
 921  004064  022706  000476                  CMP     #KPTR-2,KSP     ;CHECK PUSH
 922  004070  001401                          BEQ     .+4
 923  004072  000000                          HLT                     ;ERROR! KSP DID NOT PUSH DOWN
 924  004074  022716  125252                  CMP     #125252,(KSP)   ;CHECK DATA ON THE STACK
 925  004100  001401                          BEQ     .+4
 926  004102  000000                          HLT                     ;ERROR! INCORRECT DATA ON THE STACK
 927                                                                  ;IF DATA=0 THEN INCORRECT REGISTER
 928                                                                  ;(R4), IF DATA=52525 NO DATA PUSHED
 929                                                                  ;ON THE STACK.
 930                                  ;USER MODE,MFPD
 931  004104  010701                  T50:    SCOPE
 932  004106  005003                          CLR     R3              ;PRESET
 933  004110  012737  140000  177776          MOV     #UM,@#PSW       ;USER MODE, R0-R5
 934  004116  012706  000700                  MOV     #UPTR,USP       ;SET USER'S STACK POINTER
 935  004122  012726  125252                  MOV     #125252,(USP)+  ;PRESET STACK
 936  004126  012703  177777                  MOV     #-1,R3          ;
 937  004132  000257                          CCC
 938  004134  006503                          MFPI    R3              ;-(USP)←R3 (R3)=-1
 939
 940  004136  013700  177776                  MOV     @#PSW,R0
 941  004142  010604                          MOV     USP,R4
 942  004144  042737  140000  177776          BIC     #UM,@#PSW
 943  004152  022700  140010                  CMP     #UM+N,R0
 944  004156  001401                          BEQ     .+4
 945  004160  000000                          HLT
 946  004162  022704  000700                  CMP     #UPTR,R4
 947  004166  001401                          BEQ     .+4
 948  004170  000000                          HLT
 949  004172  005214                          INC     (R4)
 950  004174  001401                          BEQ     .+4
 951  004176  000000                          HLT
```

```
                                        CLR     @#PSW
                                ;USER MODE,MFPI
                                T51:    SCOPE
                                        CLR     R5
004210  012737  140000  177776        MOV     #UM,@#PSW       ;USER MODE!!!
004216  012706  000700                MOV     #UPTR,USP       ;SET USER STACK POINTER
004222  012716  177777                MOV     #-1,(USP)       ;PRESET USER STACK
004226  012705  000700                MOV     #UPTR,R5        ;PRESET R5
004232  000277                        SCC                     ;PRESET CONDITION CODES
004234  006505                        MFPI    R5              ;-(USP)←R5

004236  013700  177776                MOV     @#PSW,R0                ;GET STATUS RESULT
004242  010602                        MOV     USP,R2          ;GET USER STACK POINTER
004244  042737  140000  177776        BIC     #UM,@#PSW               ;KERNEL MODE!!!
004252  022700  140001                CMP     #UM+C,R0        ;CHECK STATUS RESULT AFTER MFPI INST
004256  001401                        BEQ     .+4
004260  000000                        HLT                     ;ERROR! INCORRECT STATUS AFTER MFPI
004262  022702  000676                CMP     #UPTR-2,R2
004266  001401                        BEQ     .+4
004270  000000                        HLT
004272  022712  000700                CMP     #UPTR,(R2)
004276  001401                        BEQ     .+4
004300  000000                        HLT
                                ;TEST THAT MFPD/I PUSHES DESTINATION MEMORY DATA ONTO THE APPROPRIATE
                                ;STACK.
                                ;KERNEL MODE,MFPD
004302  010701                T52:    SCOPE
004304  005037  177776                CLR     @#PSW           ;KERNEL MODE!!!
004310  012700  001002                MOV     #TEMP,R0        ;PRESET R0
004314  052737  000000  177776        BIS     #REG,@#PSW      ;SELECT R0-R5
004322  012700  001004                MOV     #TEMP+2,R0      ;PRESET R0
004326  012767  177777  174446        MOV     #-1,TEMP
004334  005067  174444                CLR     TEMP+2
004340  012706  000500                MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
004344  012716  125252                MOV     #125252,(KSP)   ;PRESET KERNEL STACK
004350  006520                        MFPI    (R0)+           ;-(KSP)←(R0)+,R0=TEMP+2,TEMP+2=0

004352  013702  177776                MOV     @#PSW,R2
004356  022702  000004                CMP     #REG+2,R2
004362  001401                        BEQ     .+4
004364  000000                        HLT
004366  022706  000476                CMP     #KPTR-2,KSP
004372  001401                        BEQ     .+4
004374  000000                        HLT
004376  005716                        TST     (KSP)
004400  001401                        BEQ     .+4
004402  000000                        HLT

                                ;USER MODE MFPI
004404  010701                T54:    SCOPE
004406  012737  140000  177776        MOV     #UM,@#PSW
004414  012703  001004                MOV     #TEMP+2,R3
004420  052737  000340  177776        BIS     #REG+PRTY7,@#PSW
004426  012703  001006                MOV     #TEMP+4,R3
004432  005067  174344                CLR     TEMP
004436  012767  177777  174340        MOV     #-1,TEMP+2
```

```
1008  004444  012706  000700                  MOV     #UPTR,USP
1009  004450  012716  125252                  MOV     #125252,(USP)
1010  004454  006563  177776                  MFPI    -2(R3)          ;-(USP)←-2(R3),R3=#TEMP+4,TEMP+2=-1
1011
1012  004460  013700  177776                  MOV     @#PSW,R0
1013  004464  010602                          MOV     USP,R2
1014  004466  042737  140000  177776          BIC     #UM,@#PSW
1015  004474  022700  140350                  CMP     #UM!PRTY7+N,R0
1016  004500  001401                          BEQ     .+4
1017  004502  000000                          HLT
1018  004504  022702  000676                  CMP     #UPTR-2,R2
1019  004510  001401                          BEQ     .+4
1020  004512  000000                          HLT
1021  004514  005112                          COM     (R2)
1022  004516  001401                          BEQ     .+4
1023  004520  000000                          HLT
1024                                  ;TEST OVERFLOW (YELLOW) USING MFPD INSTRUCTION
1025  004522  010701                  T55:    SCOPE
1026  004524  012737  030000  177775          MOV     #PUM,@#PSW      ;KERNEL MODE!!!,PREV USER MODE!!
1027  004532  012706  001000                  MOV     #YELPTR,KSP     ;SET STACK PTR AT TOP OF YELLOW ZONE
1028  004536  012767  177777  174236          MOV     #-1,TEMP        ;PRESET DATA
1029  004544  005066  177776                  CLR     -2(KSP)         ;PRESET STACK DATA
1030  004550  012737  004576  000004          MOV     #T55A,@#ERRVEC  ;LOAD ERROR TRAP VECTOR
1031  004556  005037  000006                  CLR     @#ERRVEC+2
1032  004562  012737  000400  177774          MOV     #400,@#SLR      ;SET STACK LIMIT =1000
1033  004570  006567  174206                  MFPI    TEMP            ;PUSH TEMP ONTO KERNEL STACK
1034                                                                  ;SHOULD OVERFLOW STACK
1035  004574  000000                  T55AA:  HLT                     ;ERROR! FAILED TO TRAP ON OVERFLOW
1036  004576  022767  177777  174172  T55A:   CMP     #-1,YELPTR-2    ;CHECK THAT MFPD PUSHED DATA
1037  004604  001401                          BEQ     .+4             ;ONTO STACK
1038  004606  000000                          HLT                     ;ERROR! MTPD FAILED TO PUSH DATA
1039  004610  022767  030010  174156          CMP     #PUM+N,YELPTR-4 ;CHECK SAVED STATUS ON TRAP
1040  004616  001401                          BEQ     .+4
1041  004620  000000                          HLT                     ;ERROR! INCORRECT STATUS SAVED
1042  004622  022767  004574  174142          CMP     #T55AA,YELPTR-6 ;CHECK SAVED PC ON STACK
1043  004630  001401                          BEQ     .+4
1044  004632  000000                          HLT                     ;ERROR! INCORRECCT PC SAVED ON STACK
1045  004634  005037  177774                  CLR     @#SLR           ;CLEAR STACK LIMIT REGISTER
1046
1047                                  ;TEST OVERFLOW (RED) USING MFPI INSTRUCTION
1048  004640  010701                  T56:    SCOPE
1049  004642  012737  004714  000004          MOV     #T56A,@#ERRVEC  ;SET ERROR TRAP VECTOR
1050  004650  012737  030340  177776          MOV     #PUM+PRTY7,@#PSW        ;KERNEL MODE!!!, PREV USER MODE!!
1051  004656  012706  000736                  MOV     #REDPTR,KSP     ;SET STACK PTR TO TOP OF RED ZONE
1052  004662  012766  177777  177776          MOV     #-1,-2(KSP)     ;PRESET RED LOCATION=-1
1053  004670  005067  174106                  CLR     TEMP            ;(TEMP)WILL BE THE DATA MOVED
1054                                                                  ;TO RED LOCATION
1055  004674  012703  001004                  MOV     #TEMP+2,R3      ;LOAD INDEX REGISTER
1056  004700  012737  000400  177774          MOV     #400,@#SLR      ;SET STACK LIMIT=1000
1057  004706  006563  177776                  MFPI    -2(R3)          ;-(KSP)←TEMP SHOULD OVER
1058                                                                  ;FLOW (RED)
1059  004712  000000                  T56AA:  HLT                     ;ERROR! FAILED TO TRAP ON 'RED'
1060                                                                  ;OVERFLOW
1061  004714  022737  177777  000734  T56A:   CMP     #-1,@#REDPTR-2  ;TEST THAT MFPI DID NOT WRITE
1062  004722  001401                          BEQ     .+4             ;INTO 'RED' LOCATION
1063  004724  000000                          HLT                     ;ERROR!
```

```
1064  004726  005706                          TST     KSP             ;STACK SHOULD HAVE GONE TO 0
1065  004730  001401                          BEQ     .+4
1066  004732  000000                          HLT
1067  004734  022737  030344  000002         CMP     #PUM+PRTY7+Z,@#2 ;OLD STATUS SHOULD BE IN 2
1068  004742  001401                          BEQ     .+4
1069  004744  000000                          HLT                     ;ERROR!
1070  004746  022737  004712  000000         CMP     #T56AA,@#0      ;AND RETURN IN 0
1071  004754  001401                          BEQ     .+4
1072  004756  000000                          HLT                     ;ERROR! INCORRECT PC IN 0
1073  004760  005037  177774                 CLR     @#SLR
1074  004764  012737  000006  000004         MOV     #ERRVEC+2,@#ERRVEC;RESTORE ERROR VECTOR
1075
1076                                  ;TEST TRAP & RETURN USER-KERNEL-USER
1077  004772  010701                  T57:    SCOPE
1078  004774  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1079  005000  012737  000340  000036         MOV     #PRTY7,@#TRAPVEC+2
1080  005006  012737  005076  000034         MOV     #T57A,@#TRAPVEC
1081  005014  012737  140000  177776         MOV     #UM,@#PSW       ;USER MODE!!!
1082  005022  005002                          CLR     R2
1083  005024  104400                          TRAP                    ;TRAP & ENTER KERNEL MODE
1084  005026  013767  177776  173746 T57AA:  MOV     @#PSW,TEMP
1085  005034  042737  140000  177776         BIC     #UM,@#PSW               ;KERNEL MODE!!!
1086  005042  022767  005026  173424         CMP     #T57AA,KPTR-4   ;CHECK THAT RETURN ADDRESS IS ON
1087  005050  001401                          BEQ     .+4             ;KERNEL STACK
1088  005052  000000                          HLT                     ;ERROR!RETURN ADDRESS NOT ON STACK
1089  005054  022767  140004  173720         CMP     #UM+Z,TEMP      ;CHECK THAT CORRECT @#PSW WAS
1090  005062  001401                          BEQ     .+4             ;RESTORED ON THE RETURN
1091  005064  000000                          HLT                     ;ERROR! INCORRECT STATUS WAS RETURNED
1092                                                                  ;BY KERNEL FROM TRAP
1093  005066  005102                          COM     R2              ;CHECK THAT TRAP ROUTINE WAS EXECUTED
1094  005070  001401                          BEQ     .+4
1095  005072  000000                          HLT                     ;ERROR! KERNEL DID NOT DO COM R2
1096                                                                  ;(AT T57A)
1097  005074  000402                          BR      T57EX           ;EXIT TEST
1098  005076  005102                  T57A:   COM     R2              ;COMPLEMENT R2
1099  005100  000002                          RTI                     ;AND EXIT
1100  005102  000240                  T57EX:  NOP
1101
1102                                  ;TEST THAT MFPD/I CAN PUSH ONTO CURRENT STACK (AS DETERMINED BY PS15 &
1103                                  ;PS14) THE PREVIOUS MODES STACK POINTER (AS DETERMINED BY PS13 &PS12)
1104                                  ;-(KSP)←KSP,MFPD
1105  005104  010701                  T60:    SCOPE
1106  005106  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!, PREV KERNEL MODE!!
1107  005112  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1108  005116  006506                          MFPI    KSP             ;-(KSP)←KSP
1109  005120  022767  000500  173350         CMP     #KPTR,KPTR-2    ;TEST THAT VALUE OF KERNEL STACK POINTER
1110  005126  001401                          BEQ     .+4             ;WAS PUSHED ONTO KERNEL STACK
1111  005130  000000                          HLT                     ;ERROR!
1112
1113                                  ;-(KSP)←USP,MFPD
1114  005132  010701                  T62:    SCOPE
1115  005134  012737  030000  177776         MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
1116  005142  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1117  005146  012716  177777                  MOV     #-1,(KSP)
1118  005152  006606                          MTPI    USP             ;SET USER STACK POINTER USP←(KSP)+
1119  005154  005166  177776                  COM     -2(KSP)         ;PRESET KERNEL STACK
```

```
1120  005160  006506                          MFPI    USP             ;-(KSP)←USP
1121  005162  022716  177777                  CMP     #-1,(KSP)       ;CHECK THAT USER STACK POINTER WAS
1122  005166  001401                          BEQ     .+4             ;PUSHED ONTO KERNEL STACK
1123  005170  000000                          HLT                     ;ERROR!
1124
1125                                  ;-(USP)←USP,MFPD
1126  005172  010701                  T65:    SCOPE
1127  005174  012737  030000  177776          MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
1128  005202  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1129  005206  012716  000700                  MOV     #UPTR,(KSP)
1130  005212  006606                          MTPI    USP             ;SET USER STACK POINTER
1131  005214  005067  173456                  CLR     UPTR-2
1132  005220  052737  140000  177776          BIS     #UM,@#PSW               ;USER MODE!!!, PREV USER MODE!!!
1133  005226  006506                          MFPI    USP             ;PUSH USER STACK POINTER ONTO USER STACK
1134  005230  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!, PREV USER MODE!!
1135  005236  006506                          MFPI    USP             ;PUSH USER STACK POINTER ONTO KERNEL STACK
1136  005240  022716  000676                  CMP     #UPTR-2,(KSP)   ;CHECK THAT USER STACK POITER WAS
1137  005244  001401                          BEQ     .+4             ;PUSHED PROPERLY (ONCE)
1138  005246  000000                          HLT                     ;ERROR!
1139  005250  022767  000700  173420          CMP     #UPTR,UPTR-2    ;CHECK THAT USER STACK POINTER IS ON THE
1140  005256  001401                          BEQ     .+4             ;USERS STACK
1141  005260  000000                          HLT                     ;ERROR!
1142
1143                                  ;-(KSP)←KSP,MFPI
1144  005262  010701                  T66:    SCOPE
1145  005264  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!, PREV KERNEL MODE!!
1146  005270  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1147  005274  006506                          MFPI    KSP             ;PUSH KERNEL STACK POINTER ONTO KERNEL
1148                                                                  ;STACK
1149  005276  022767  000500  173172          CMP     #KPTR,KPTR-2    ;CHECK RESULT
1150  005304  001401                          BEQ     .+4
1151  005306  000000                          HLT                     ;ERROR!
1152
1153                                  ;-(KSP)←USP,MFPI
1154  005310  010701                  T70:    SCOPE
1155  005312  012737  030000  177776          MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
1156  005320  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1157  005324  012716  177777                  MOV     #-1,(KSP)
1158  005330  006606                          MTPI    USP             ;SET USER STACK POINTER
1159  005332  005166  177776                  COM     -2(KSP)         ;PRESET KERNEL STACK
1160  005336  006506                          MFPI    USP             ;PUSH USER STACK POINTER ONTO KERNEL STACK
1161  005340  022716  177777                  CMP     #-1,(KSP)       ;CHECK RESULT
1162  005344  001401                          BEQ     .+4
1163  005346  000000                          HLT                     ;ERROR! USER STACK POINTER NOT ON KERNEL STACK
1164
1165                                  ;-(USP)←USP,MFPI
1166  005350  010701                  T73:    SCOPE
1167  005352  012737  030000  177776          MOV     #PUM,@#PSW      ;KERNEL MODE!!!, PREV USER MODE!!
1168  005360  012706  000500                  MOV     #KPTR,KSP               ;SET KERNEL STACK POINTER
1169  005364  012716  000700                  MOV     #UPTR,(KSP)
1170  005370  006606                          MTPI    USP             ;SET USER STACK POINTER
1171  005372  005067  173300                  CLR     UPTR-2          ;PRESET USER STACK
1172  005376  052737  140000  177776          BIS     #UM,@#PSW               ;USER MODE!!!, PREV USER MODE!!
1173  005404  006506                          MFPI    USP             ;-(USP)←USP
1174  005406  042737  140000  177776          BIC     #UM,@#PSW               ;KERNEL MODE!!!
1175  005414  006506                          MFPI    USP             ;GET USER STACK POINTER
```

```
1176  005416  022716  000676                    CMP     #UPTR-2,(KSP)   ;CHECK THAT USER STACK POINTER WAS
1177  005422  001401                            BEQ     .+4             ;PUSHED ONCE
1178  005424  000000                            HLT                     ;ERROR!
1179  005426  022767  000700  173242            CMP     #UPTR,UPTR-2    ;CHECK THAT USER STACK POINTER WAS PUSHED
1180  005434  001401                            BEQ     .+4             ;ONTO USER STACK
1181  005436  000000                            HLT                     ;ERROR!
1182
1183                                    ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
1184  005440  010701                    T74:    SCOPE
1185  005442  012737  100000  177776            MOV     #IM,@#PSW               ;ILLEGAL MODE!!!
1186  005450  013700  177776                    MOV     @#PSW,R0                ;GET ILLEGAL MODE
1187  005454  005037  177776                    CLR     @#PSW           ;KERNEL MODE!!
1188  005460  022700  100000                    CMP     #IM,R0          ;CHECK THAT ILLEGAL MODE WAS SET
1189  005464  001401                            BEQ     .+4             ;INTO STATUS
1190  005466  000000                            HLT
1191
1192                                    ;TEST THAT ILLEGAL MODE DOES NOT HANG BUS.
1193  005470  010701                    T75:    SCOPE
1194  005472  012737  040000  177775            MOV     #IM1,@#PSW              ;ILLEGAL MODE!!!
1195  005500  013700  177776                    MOV     @#PSW,R0                ;GET ILLEGAL MODE
1196  005504  005037  177776                    CLR     @#PSW           ;KERNEL MODE!!
1197  005510  022700  040000                    CMP     #IM1,R0         ;CHECK THAT ILLEGAL MODE WAS SET
1198  005514  001401                            BEQ     .+4             ;INTO STATUS
1199  005516  000000                            HLT
1200
1201                                    ;TEST THAT KERNEL CAN GET DATA FROM USER STACK
1202  005520  010701                    T76:    SCOPE
1203  005522  012737  030000  177776            MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
1204  005530  012706  000500                    MOV     #KPTR,KSP       ;SET KERNEL STACK POINTER
1205  005534  012716  000700                    MOV     #UPTR,(KSP)
1206  005540  006606                            MTPI    USP             ;SET USER STACK POINTER
1207  005542  005067  173132                    CLR     UPTR            ;PRESET USER STACK
1208  005546  005016                            CLR     (KSP)           ;PRESET KERNEL STACK
1209  005550  012766  177777  177776            MOV     #-1,-2(KSP)
1210  005556  006506                            MFPI    USP             ;-(KSP)←USP
1211  005560  006576  000000                    MFPI    @(KSP)          ;LIKE MOV  @(6),-(6)
1212  005564  000240                            NOP
1213  005566  013703  177776                    MOV     @#PSW,R3                ;SAVE STATUS RESULT
1214  005572  022767  000700  172700            CMP     #UPTR,KPTR      ;CHECK THAT USER STACK POINTER WAS
1215  005600  001401                            BEQ     .+4             ;PUSHED ONTO KERNEL STACK
1216  005602  000000                            HLT                     ;ERROR!
1217  005604  022706  000476                    CMP     #KPTR-2,KSP     ;CHECK THAT KERNEL STACK POINTER IS POS-
1218  005610  001401                            BEQ     .+4             ;ITIONED PROPERLY
1219  005612  000000                            HLT                     ;ERROR! INCORRECT KERNEL STACK POINTER
1220  005614  005716                            TST     (KSP)           ;CHECK THAT CORRECT DATA
1221  005616  001401                            BEQ     .+4             ;WAS PUSHED ONTO KERNEL STACK
1222  005620  000000                            HLT                     ;ERROR!
1223  005622  022703  030004                    CMP     #KM+PUM+Z,R3    ;CHECK STATUS
1224  005626  001401                            BEQ     .+4
1225  005630  000000                            HLT                     ;ERROR! INCORRECT STATUS
1226
1227                                    ;CHECK THAT MTPD CAN LOAD MEMORY ADDRESS DM=7,PC
1228  005632  010701                    T102:   SCOPE
1229  005634  012737  030000  177776            MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
1230  005642  012706  000500                    MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1231  005646  005016                            CLR     (KSP)           ;PUT DATA ON STACK
```

```
1232  005650  012737  001002  001004          MOV     #TEMP,@#TEMP+2  ;LOAD ADDRESS
1233  005656  012767  177777  173116          MOV     #-1,TEMP        ;PRESET DATA
1234  005664  000277                          SCC                     ;PRESET CC'S
1235  005666  006677  173112                  MTPI    @TEMP+2         ;TEMP←(KSP)+
1236  005672  013703  177776                  MOV     @#PSW,R3                ;CHECK CC'S
1237  005676  022703  030005                  CMP     #PUM+Z+C,R3     ;CHECK CC'S
1238  005702  001401                          BEQ     .+4
1239  005704  000000                          HLT                     ;ERROR! INCORRECT CC'S AFTER MTPD
1240  005706  005737  001002                  TST     @#TEMP          ;CHECK RESULT
1241  005712  001401                          BEQ     .+4
1242  005714  000000                          HLT                     ;ERROR! INCORRECT RESULT
1243
1244                                  ;CHECK THAT MTPI CAN LOAD MEMORY ADDRESS DM=7
1245  005716  010701                  T103:   SCOPE
1246  005720  012737  030000  177776          MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!
1247  005726  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1248  005732  012716  177777                  MOV     #-1,(KSP)       ;LOAD DATA ONTO STACK
1249  005736  012704  177776                  MOV     #-2,R4          ;LOAD INDEX REGISTER
1250  005742  005067  173034                  CLR     TEMP            ;PRESET DATA
1251  005746  012767  001002  173030          MOV     #TEMP,TEMP+2
1252  005754  006674  001006                  MTPI    @TEMP+4(R4)     ;TEMP←(KSP)+
1253  005760  013703  177776                  MOV     @#PSW,R3                ;SAVE STATUS RESULT
1254  005764  022706  000502                  CMP     #KPTR+2,KSP     ;CHECK THAT KSP POPPED
1255  005770  001401                          BEQ     .+4
1256  005772  000000                          HLT                     ;ERROR! INCORRECT STACK PTR
1257  005774  022703  030010                  CMP     #PUM+N,R3       ;CHECK STATUS RESULT
1258  006000  001401                          BEQ     .+4
1259  006002  000000                          HLT                     ;ERROR! INCORRECT STATUS
1260  006004  005267  172772                  INC     TEMP            ;CHECK RESULT
1261  006010  001401                          BEQ     .+4
1262  006012  000000                          HLT                     ;ERROR! INCORRECT RESULT
1263
1264                                  ;TEST THAT MTPD/I CAN LOAD PC
1265  006014  010701                  T104:   SCOPE
1266  006016  012737  000000  177776          MOV     #KM,@#PSW       ;KERNEL MODE!!!
1267  006024  012706  000500                  MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1268  006030  012716  006042                  MOV     #T104A,(KSP)    ;PUT NEW PC ON STACK
1269  006034  000277                          SCC                     ;PRESET CC'S
1270  006036  006607                          MTPI    PC              ;PC←(KSP)+
1271  006040  000000                          HLT                     ;ERROR! MTPD FAILED TO SET PC
1272  006042  100001                  T104A:  BPL     .+4
1273  006044  000000                          HLT                     ;ERROR! 'N' FAILED TO CLEAR IN STATUS
1274  006046  103401                          BCS     .+4
1275  006050  000000                          HLT                     ;ERROR! 'C' WAS CLEARED BY MTPD
1276
1277                                  ;USER MODE
1278  006052  010701                  T106:   SCOPE
1279  006054  012737  170000  177776          MOV     #UM+PUM,@#PSW   ;USER MODE!!!
1280  006062  012706  000700                  MOV     #UPTR,USP       ;SET USER STACK PTR
1281  006066  012716  006104                  MOV     #T106A,(USP)    ;PUT NEW PC ON STACK
1282  006072  000277                          SCC                     ;PRESET CC'S
1283  006074  006607                          MTPI    PC              ;PC←(USP)+
1284  006076  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
1285  006102  000000                          HLT                     ;ERROR! MTPD FAILED TOMLOAD PC
1286  006104  013705  177776          T106A:  MOV     @#PSW,R5                ;SAVE STATUS
1287  006110  005037  177776                  CLR     @#PSW           ;KERNEL MODE!!!
```

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

```
1344  006370  022713  006342            CMP     #T111AA,(R3)    ;CHECK RETURN SDDRESS ON USER STACK
1345  006374  001401                    BEQ     .+4
1346  006376  000000                    HLT                     ;ERROR! RETURN PC NOT ON USER STACK
1347  006400  012737  000006  000004    MOV     #ERRVEC+2,@#ERRVEC;RESTORE ERROR TRAP TO HALT
1348  006406  005067  171374            CLR     ERRVEC+2
1349
1350                                    ;TEST THAT MTPD INSTRUCTION CAN LOAD DATA TO AN ADDRESS VIA THE STACK
1351                                    ;KERNEL MODE,PREVIOUS USER MODE
1352  006412  010701                    T112:   SCOPE
1353  006414  012737  030000  177776            MOV     #KM+PUM,@#PSW   ;KERNEL MODE!!!, PREV USER MODE!!
1354  006422  012706  000500                    MOV     #KPTR,KSP       ;SET KERNEL STACK PTR
1355  006426  012746  000700                    MOV     #UPTR,-(KSP)
1356  006432  006606                    MTPI    USP                     ;SET USER STACK PTR
1357  006434  012746  001002                    MOV     #TEMP,-(KSP)    ;PUT ADDRESS ON THE STACK
1358  006440  012746  177777                    MOV     #-1,-(KSP)      ;PUT DATA ON THE STAK
1359  006444  005037  001002                    CLR     @#TEMP          ;PRESET DATA
1360  006450  006636                    MTPI    @(KSP)+                 ;MOVE #-1 TO TEMP
1361  006452  022706  000500                    CMP     #KPTR,KSP       ;CHECK STACK PTR AFTER MTPD
1362  006456  001401                    BEQ     .+4
1363  006460  000000                    HLT                             ;ERROR! INCORRECT STACK PTR AFTER MTPD
1364  006462  005267  172314                    INC     TEMP            ;CHECK THAT DATA WAS MOVED TO TEMP
1365  006466  001401                    BEQ     .+4
1366  006470  000000                    HLT                             ;ERROR! DATA NOT IN TEMP
1367  006472  006506                    MFPI    USP                     ;GET USER STACK PTR
1368  006474  022716  000700                    CMP     #UPTR,(KSP)     ;CHECK THAT USER STACK PTR NOT CHANGED
1369  006500  001401                    BEQ     .+4                     ;BY MTPD INSTRUCTION
1370  006502  000000                    HLT                             ;ERROR! USP WAS CHANGED BY MTPD INST.
1371
1372  006504  005767  172304            END:    TST     PASCNT          ;FIRST PASS?
1373  006510  001410                    BEQ     DONE                    ;YES, SKIP ITERATIONS THIS TIME
1374  006512  005267  172262                    INC     ICNT            ;INCREMENT PASS COUNT
1375  006516  026727  172256  000144            CMP     ICNT,#100.      ;100 PASSES COMPLETED?
1376  006524  001402                    BEQ     DONE
1377  006526  000167  172432                    JMP     BEGIN
1378  006532  005267  172256            DONE:   INC     PASCNT          ;TO ENABLE ITERATIONS ON LATER PASSES
1379  006536  032767  010000  171024            BIT     #10000,SWR      ;INHIBIT BELL AND '*'?
1380  006544  001401                    BEQ     .+4
1381  006546  000422                    BR      LOGICT
1382  006550  012767  000007  171010            MOV     #7,TPB          ;RING BELL
1383  006556  105767  171002                    TSTB    TPS
1384  006562  100375                    BPL     .-4
1385  006564  012767  000052  170774            MOV     #52,TPB         ;PRINT '*' FOR PASS INDICATION
1386  006572  105767  170766                    TSTB    TPS
1387  006576  100375                    BPL     .-4
1388  006600  012767  000177  170760            MOV     #177,TPB
1389  006606  105767  170752                    TSTB    TPS
1390  006612  100375                    BPL     .-4
1391  006614  013701  000042            LOGICT: MOV     @#42,%1         ;RETURN TO MONITOR?
1392  006620  001405                    BEQ     LOGICE
1393  006622  000005                    RESET
1394  006624  004711                    $ENDAD: JSR     7,(1)           ;RETURN!
1395  006626  000240                    NOP
1396  006630  000240                    NOP
1397  006632  000240                    NOP
1398  006634  005000                    LOGICE: CLR     R0      ;DELAY FOR ACT11
1399  006636  005200                    INC     R0
```

```
1400  006640  001376                          BNE     .-2
1401  006642  000167  172150                  JMP     START
1402          000001                          .END
```

```
BEGIN   001164          REDPTR= 000736          T110A   006246          T26     002662          T56     004640
BIT13 = 020000          REG   = 000000          T110AA  006240          T30     002752          T56A    004714
BIT14 = 040000          RESVEC= 000010          T111    006306          T31     003046          T56AA   004712
BIT15 = 100000          SCOPE = 010701          T111A   006350          T31C    003072          T57     004772
BIT6  = 000100          SLR   = 177774          T111AA  006342          T32A    003144          T57A    005076
C     = 000001          START   001016          T112    006412          T35     003214          T57AA   005026
DONE    006532          SWR   = 177570          T12     001504          T36     003254          T57EX   005102
EMTVEC= 000030          TBIT  = 000020          T12A    001542          T36A    003312          T60     005104
END     006504          TBITVE= 000014          T12AA   001534          T36AA   003310          T62     005132
ERRVEC= 000004          TEMP    001002          T13     001574          T40     003334          T65     005172
FTITLE  001012          TITLE   001076          T13A    001626          T40A    003404          T66     005262
HLT   = 000000          TKB   = 177562          T13AA   001620          T40AA   003376          T7      001374
ICNT    001000          TKS   = 177560          T15     001772          T41     003460          T7A     001434
IM    = 100000          TPB   = 177566          T15A    002052          T41A    003526          T7AA    001426
IM1   = 040000          TPS   = 177564          T15AA   002044          T41B    003546          T70     005310
IOTVEC= 000020          TPVEC = 000064          T17     002134          T41BB   003576          T73     005350
KM    = 000000          TRAPVE= 000034          T17A    002170          T43     003624          T74     005440
KPTR  = 000500          TRT   = 000003          T17B    002202          T43A    003676          T75     005470
KSP   =%000006          TRTVEC= 000014          T17C    002222          T44     003744          T76     005520
LOGICE  006634          T1      001170          T17D    002260          T45     004020          UM    = 140000
LOGICT  006614          T102    005632          T17E    002302          T5      001222          UPTR  = 000700
N     = 000010          T103    005716          T17ERR  002402          T5A     001266          USP   =%000006
PASCNT  001014          T104    006014          T17F    002322          T5AA    001260          V     = 000002
PKM   = 000000          T104A   006042          T17G    002354          T50     004104          YELPTR= 001000
PRTY3 = 000140          T106    006052          T17X    002410          T51     004204          Z     = 000004
PRTY4 = 000200          T106A   006104          T18     001666          T52     004302          $ENDAD  006624
PRTY7 = 000340          T107    006124          T19     001730          T54     004404          .     = 006646
PSW   = 177776          T107A   006154          T21     002426          T55     004522
PUM   = 030000          T107AA  006132          T22     002510          T55A    004576
PWRUP   001154          T110    006204          T25     002572          T55AA   004574

. ABS.  006646      000

 ERRORS DETECTED:  0
 DEFAULT GLOBALS GENERATED:  0

 MULE:DBKTDC,MULE:DBKTDC/SOL=DSKZ:SYSMAC.SML,MULE:DBKTDC.P11
 RUN-TIME: 7 8 .1 SECONDS
 RUN-TIME RATIO: 251/15=16.0
 CORE USED:  31K  (61 PAGES)
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