

IDENTIFICATION

PRODUCT CODE: MAINDEC-11-DCKTE-B-D
PRODUCT NAME: MFPD/I WITH MEMORY MANAGEMENT
DATE CREATED: APRIL 1975
MAINTAINER: DIAGNOSTIC GROUP
AUTHOR: JOHN ADAMS

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1.0 ABSTRACT

PROGRAM DCKTE TESTS THE MFPD AND MFPI INSTRUCTIONS WITH MEMORY MANAGEMENT ENABLED. (SEE PROG DCKBO FOR TESTS OF THESE INSTRUCTIONS WITHOUT MEM MGMT. THESE INSTRUCTIONS ARE EXECUTED IN ALL COMBINATIONS OF CURRENT MODES AND EQUAL OR LOWER HIERARCHY PREVIOUS MODES.

2.0 REQUIREMENTS

2.1 EQUIPMENT

PDP-11/45 WITH KT11-C (MEM. MGMT) OPTION INSTALLED

2.2 STORAGE

PROGRAM STORAGE - THE ROUTINE USES MEMORY 0-17777

3.0 LOADING AND STARTING PROCEDURE

LOAD PROGRAM INTO MEMORY USING ABS LOADER

LOAD ADDRESS 200

PRESS START.

THE PROGRAM WILL LOOP AND RING BELL ON COMPLETION.
PASS COUNT MAY BE MONITORED IN THE DISPLAY REGISTER.

4.0 SWITCH SETTINGS

SW8 = 1 OR UP LOAD PDP11/45 MICRO BREAK REGISTER
SW7-SW0..... VALUE TO BE LOADED

5.0 SUBROUTINE ABSTRACTS

5.1 HLT

THE HLT (HALT) INSTRUCTION IS EXECUTED WHEN AN ERROR IS DETECTED. THE HLT (HALT) INSTRUCTION TRAPS TO LOC 4 IN SUPERVISORY/USER MODE. IF A HLT (HALT) INSTRUCTION IS EXECUTED IN THESE MODES THE TRAP IS TAKEN AND THE PROGRAM RETURNS TO THE HLT IN KERNEL MODE AND HALTS. PRESSING CONTINUE RESTARTS THE TEST.

NOTE: THE SUPERVISORY/USER STACK POINTERS ARE NOT AFFECTED. FURTHER TESTING SHOULD NOT BE CONTINUED (BY PRESSING CONTINUE). THE PROGRAM SHOULD BE RESTARTED EITHER AT THE PREVIOUS SCOPE OR AT 200.

5.2 SCOPE

THE SCOPE (EMT) SERVICE ROUTINE STORES IN R1 THE PC OF THE LAST TEST SUCCESSFULLY EXECUTED AND MAY BE USED AS AN AID IN DEBUGGING IF THE PROGRAM 'BOMBS' BECAUSE OF A HARDWARE FAILURE. A BRANCH INSTRUCTION MAY BE INSERTED AT THE SCOPE LOCATION TO THE PREVIOUS SCOPE (EMT) INSTRUCTION TO CONTINUOUSLY LOOP A TEST. ADDITIONALLY THE SCOPE ROUTINE SETS ALL STACK POINTERS TO THEIR INITIAL SETTINGS (SEE SEC 8.2) AND ENTERS EACH TEST IN KERNEL MODE, PREVIOUS KERNEL MODE. THE SCOPE ROUTINE ALSO CONTAINS INSTRUCTIONS TO LOAD THE MICRO BREAK REGISTER (SEE SEC 4.0 FOR SWITCH SETTINGS). ALL TESTS MAY BE RESTARTED AT THE PREVIOUS SCOPE.

6.0 ERRORS

THE TEST HALTS WHEN AN ERROR IS DETECTED AND DISPLAYS THE PC+2 OF THE HLT (HALT) INSTRUCTION IN THE ADDRESS LIGHTS.

6.1 ERROR RECOVERY

PRESS CONTINUE OR RESTART AT 200 OR PREVIOUS SCOPE.

6.2 ERROR LOOPING

TO LOOP ON AN ERROR REPLACE THE HLT INSTRUCTION WITH A BRANCH BACK TO THE PREVIOUS SCOPE. NOTE: IF THE ERROR IS INTERMITTENT THE TEST WILL DROP THROUGH THE HLT AND CONTINUE TO THE NEXT TEST.

6.3 MEMORY MANAGEMENT ABORT ERRORS

IF AN ABORT OCCURS (EXCEPT WHEN A TEST EXPECTS AN ABORT) THE PROGRAM WILL TRAP. THE TRAP SERVICE ROUTINE SAVES THE CONTENTS OF SR0 IN LOCATION SSK0T, CLEARS SR0, JUMPS TO LOCATION 252 AND HALTS. TO DETERMINE WHICH TEST CAUSED THE ABORT EITHER EXAMINE THE KERNEL STACK OR EXAMINE R1 (R1 CONTAINS THE PC OF THE FIRST INSTRUCTION IN THE TEST), OR EXAMINE SK2 WHICH CONTAINS THE ADDRESS OF THE INSTRUCTION THAT CAUSED THE ABORT.

7.0 RESTRICTIONS

7.1 STARTING RESTRICTION

NONE

7.2 OPERATIONAL RESTRICTION

NONE

8.0 MISCELLANEOUS

IF THE PROGRAM HALTS IN THE TRAP/INTERRUPT VECTOR AREA (0-100), EXAMINE REGISTER 6 (THE KERNEL STACK PTR). R6 CONTAINS THE ADDRESS WHERE THE PC OF THE INSTRUCTION THAT CAUSED THE TRAP/ABORT IS STORED. SEE ALSO R1 TO DETERMINE THE PC OF THE LAST TEST SUCCESSFULLY COMPLETED.

8.1 NOTE THAT THE PROGRAM TAGS EACH MFPD/I INSTRUCTION UNDER TEST. THE TAG DENOTES CURRENT SPACE, 'PREVIOUS' SPACE AND WHETHER MFPD/I. FOR EXAMPLE:

- 1) KU14:
- 2) SSI7:

DENOTE:

- 1) 'CURRENT' KERNEL MODE, 'PREVIOUS' USER MODE, MFPD
- 2) 'CURRENT' SUPERVISOR MODE, 'PREVIOUS' SUPERVISOR MODE, MFPI

NOTE ALSO THAT MEM. MGMT IS ENABLED ONLY WHEN THE MFPD/I INSTRUCTION BEING TESTED IS EXECUTED AND IS OFF AT ALL OTHER TIMES.

FINAL DATA IS STORED IN 'PREVIOUS' 'I' OR 'D' ADDRESS SPACE.

8.2 STACK POINTER

THE STACK POINTERS ARE INITIALLY SET TO THE FOLLOWING VALUES
 KERNEL = 1060
 SUPERVISOR = 700
 USER = F600

AND ARE RESET TO THESE VALUES AT THE START OF EACH SUBTEST (BY SCOPE).

8.3 PASS COUNT

1000(8) PASSES ARE REQUIRED FOR COMPLETION OF THIS PROGRAM AT WHICH TIME THE BELL WILL RING AT THE TTY. THE PASS COUNT MAY BE OBSERVED BY TURNING THE SWITCH TO THE DISPLAY POSITION. THE PASS COUNT SHOULD BE MONITORED IN THE EVENT THAT THE PROGRAM ENTERS AN UNDEFINED LOOP.

8.4 DEBUGGING TIPS

WHEN THE FAILING SUBTEST HAS BEEN ISOLATED, REPLACE THE FIRST WORD OF THE MFPD/I INSTRUCTION WITH A BR SELF (000777), AND START THE SUBTEST AT THE PREVIOUS SCOPE. STOP THE PROGRAM (SINGLE INSTRUCTION) AND RESTORE THE REPLACED INSTRUCTION USING THE MAINTENANCE CARD SINGLE STEP THE FAILING INSTRUCTION THROUGH EACH MICRO STATE OBSERVING THE FLOW IN THE DATA/ADDRESS LIGHTS. THIS PRACTICE HAS BEEN FOUND TO BE SUCCESSFUL IN FINDING MOST MEMORY MANAGEMENT ERRORS. IN THE BREAD BOARD.

8.5 MEMORY MANAGEMENT MEMORY MAP

THE MAPPING OF THE MEM MGMT REGISTERS IS DONE AT THE BEGINNING OF THE PROGRAM BEFORE ANY TESTING IS STARTED. THIS MAP IS CHANGED TWICE, WHEN THE PROGRAM BEGINS TESTS IN SUPERVISORY MODE, AND AGAIN WHEN THE PROGRAM BEGINS TESTS AT USER MODE. THE USER SHOULD ACQUAINT HIMSELF WITH THE MEM. MGMT MAP BEFORE USING THIS PROGRAM.

.NLIST SEQ
 .LIST ME
 .ABS
 .TITLE PDP11/45 MEMORY MANAGEMENT TEST DCKTE-B
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MEMORY MANAGEMENT TEST-DKTEA, THIS TEST TESTS THE MFPI AND MFPO INST-
 Ructions IN ALL COMBINATIONS OF CURRENT MODE AND EQUAL OR LOWER Hierarchy
 PREVIOUS MODES WITH MEMORY MANAGEMENT ENABLED.

IGENERAL REGISTER ASSIGNMENTS

000000 R0=X0
 000001 R1=X1
 000002 R2=X2
 000003 R3=X3
 000004 R4=X4
 000005 R5=X5
 000007 PC=X7
 000008 R10=X8
 000009 R11=X1
 000010 R12=X2
 000011 R13=X3
 000012 R14=X4
 000013 R15=X5

ISTACK POINTER REGISTERS

000006 KSP=X6 ;KERNEL STACK POINTER
 000006 SSP=X6 ;SUPERVISOR STACK POINTER
 000006 USP=X6 ;USER STACK POINTER

ISTATUS REGISTER BIT ASSIGNMENTS

000001 C=1
 000002 V=2
 000004 Z=4
 000010 N=10
 000020 T=20
 000340 PRTY7=X340 ;IT' BIT
 000200 PRTY4=X200 ;PRIORITY LEVEL 7
 004000 REG=X4000 ;PRIORITY LEVEL 4
 000000 KH=X00000 ;SELECTS R10-R15
 040000 SH=X040000 ;KERNEL MODE
 140000 UM=X140000 ;SUPERVISORY MODE
 000000 PKM=X000000 ;USER MODE
 010000 PSM=X010000 ;PREVIOUS KERNEL MODE
 030000 PUM=X030000 ;PREVIOUS SUPERVISORY MODE
 004000 REG=X004000 ;PREVIOUS USER MODE
 ;SELECT R10-R15

IVECTOR ADDRESSES

000004 ERRVEC=X4 ;ADDRESS OF ERROR VECTOR
 000014 TBIVVEC=X14 ;ADDRESS OF 'T' BIT TRAP VECTOR
 000020 IOTVEC=X20 ;ADDRESS OF IOT VECTOR
 000030 EMTVEC=X30 ;ADDRESS OF EMT VECTOR
 000034 TRAPVEC=X34 ;ADDRESS OF TRAP VECTOR
 000064 TPVEC=X64 ;ADDRESS OF TTY PRINTER INTERRUPT VECTOR
 000240 PIRVEC=X240 ;ADDRESS OF PIRQ VECTOR

000250 MHVEC=X250 ;ADDRESS OF MEMORY ERROR TRAP

IREGISTER ADDRESSES

177776 PSH=X177776 ;ADDRESS OF STATUS REGISTER
 177774 SLR=X177774 ;ADDRESS OF STACK LIMIT REGISTER
 177772 PIR=X177772 ;ADDRESS OF PROGRAM INTERRUPT REQUEST
 177770 UBRCAK=X177770 ;ADDRESS OF MICRO BREAK REGISTER
 177560 TKB=X177560 ;ADDRESS OF KEYBOARD CSR
 177562 TKB=X177562 ;ADDRESS OF KEYBOARD BUFFER
 177564 TPB=X177564 ;ADDRESS OF TELEPRINTER CSR
 177566 TPB=X177566 ;ADDRESS OF TELEPRINTER BUFFER
 177570 SWR=X177570 ;ADDRESS OF CONSOLE SWITCH REGISTER
 177570 LIGHTS=X177570 ;ADDRESS OF CONSOLE LIGHT REGISTER

INITIAL STACK POINTER SETTINGS

001060 KPTR=X1060 ;BOTTOM OF KERNEL STACK
 000700 SPTR=X700 ;SUPERVISORY STACK SETTING
 000600 UPTR=X600 ;USER STACK SETTING

THE KERNEL SUPERVISOR & USER STACK POINTER ARE AT PHYSICAL 1060, 0700 & 0600
 *****NOTE*****

IMISCELLANEOUS BIT ASSIGNMENTS

100000 BIT15=X100000
 040000 BIT14=X040000
 020000 BIT13=X020000
 000400 BIT8=X000400
 000100 BIT6=X000100
 010000 PIR4=X10000 ;LEVEL 4 PROGRAM INT. RQST.

IMEMORY MANAGEMENT REGISTER SR0 BIT ASSIGNMENTS

000001 ENMM=X1 ;ENABLE MEMORY MANAGEMENT
 000000 VP0=X0 ;VIRTUAL PAGE 0
 000002 VP1=X2
 000004 VP2=X4
 000006 VP3=X6
 000010 VP4=X10
 000012 VP5=X12
 000014 VP6=X14
 000016 VP7=X16
 000020 OS=X20 ;I/O SPACE
 000000 IS=X00 ;I/I SPACE
 000140 UPG=X140 ;USER PAGE
 000040 SPG=X040 ;SUPERVISOR PAGE
 000000 KPG=X000 ;KERNEL PAGE
 000200 IC=X200 ;INSTRUCTION COMPLETE
 000400 DM=X400 ;DESTINATION MODE
 001000 TE=X1000 ;TRAP ENABLE
 004000 OST=X4000 ;OST ABORT FLAG
 010000 MMT=X10000 ;MEMORY MANAGEMENT TRAP
 020000 AVA=X20000 ;ACCESS VIOLATION ABORT
 040000 PLA=X40000 ;PAGE LENGTH ABORT
 100000 NRA=X100000 ;NON-RESIDENT ABORT

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ISEGMENT DESCRIPTOR REGISTER (PDR) BIT ASSSIGNMENTS
000010 ED=10 EXPANSION DIRECTION BIT IN PDR
000000 UP=0 EXPAND UP
000010 DHN=10 EXPAND DOWN
000200 ABIT=200 IAI BIT IN PDR
000100 WBIT=100 IWI BIT IN PDR

ISR1 BIT ASSIGNMENTS
000010 INC1=10
000020 INC2=20
000370 DEC1=370
000360 DEC2=360
000000 DR0=000
000400 DR1=400
001000 DR2=1000
001400 DR3=1400
002000 DR4=2000
002400 DR5=2400
003000 DR6=3000
003400 DR7=3400

ISR3 BIT ASSIGNMENTS
000001 UDE=1 USER '0' SPACE ENABLE
000002 SDE=2 SUPERVISOR '0' SPACE ENABLE
000004 KDE=4 KERNEL '0' SPACE ENABLE

ISEGMENTATION REGISTER ADDRESS ASSIGNMENTS
177572 SR0=177572 JADDRESS OF SEGMENTATION REGISTER SR0
177574 SR1=177574 J " " " " SR1
177576 SR2=177576 J " " " " SR2
172516 SR3=172516 J " " " " SR3

177600 UIPDR0=177600
177602 UIPDR1=177602
177604 UIPDR2=177604
177606 UIPDR3=177606
177610 UIPDR4=177610
177612 UIPDR5=177612
177614 UIPDR6=177614
177616 UIPDR7=177616

177620 UDPDR0=177620
177622 UDPDR1=177622
177624 UDPDR2=177624
177626 UDPDR3=177626
177630 UDPDR4=177630
177632 UDPDR5=177632
177634 UDPDR6=177634
177636 UDPDR7=177636

177640 UIPAR0=177640
177642 UIPAR1=177642
177644 UIPAR2=177644
    
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177646 UIPAR3=177646
177650 UIPAR4=177650
177652 UIPAR5=177652
177654 UIPAR6=177654
177656 UIPAR7=177656

177660 UDPAR0=177660
177662 UDPAR1=177662
177664 UDPAR2=177664
177666 UDPAR3=177666
177670 UDPAR4=177670
177672 UDPAR5=177672
177674 UDPAR6=177674
177676 UDPAR7=177676

172200 SIPDR0=172200
172202 SIPDR1=172202
172204 SIPDR2=172204
172206 SIPDR3=172206
172210 SIPDR4=172210
172212 SIPDR5=172212
172214 SIPDR6=172214
172216 SIPDR7=172216

172220 SDPDR0=172220
172222 SDPDR1=172222
172224 SDPDR2=172224
172226 SDPDR3=172226
172230 SDPDR4=172230
172232 SDPDR5=172232
172234 SDPDR6=172234
172236 SDPDR7=172236

172240 SIPAR0=172240
172242 SIPAR1=172242
172244 SIPAR2=172244
172246 SIPAR3=172246
172250 SIPAR4=172250
172252 SIPAR5=172252
172254 SIPAR6=172254
172256 SIPAR7=172256

172260 SDPAR0=172260
172262 SDPAR1=172262
172264 SDPAR2=172264
172266 SDPAR3=172266
172270 SDPAR4=172270
172272 SDPAR5=172272
172274 SDPAR6=172274
172276 SDPAR7=172276

172300 KIPDR0=172300
172302 KIPDR1=172302
172304 KIPDR2=172304
    
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172306	KIPDR3=172306
172310	KIPDR4=172310
172312	KIPDR5=172312
172314	KIPDR6=172314
172316	KIPDR7=172316
172320	KOPDR0=172320
172322	KOPDR1=172322
172324	KOPDR2=172324
172326	KOPDR3=172326
172330	KOPDR4=172330
172332	KOPDR5=172332
172334	KOPDR6=172334
172336	KOPDR7=172336
172340	KIPAR0=172340
172342	KIPAR1=172342
172344	KIPAR2=172344
172346	KIPAR3=172346
172350	KIPAR4=172350
172352	KIPAR5=172352
172354	KIPAR6=172354
172356	KIPAR7=172356
172360	KOPAR0=172360
172362	KOPAR1=172362
172364	KOPAR2=172364
172366	KOPAR3=172366
172370	KOPAR4=172370
172372	KOPAR5=172372
172374	KOPAR6=172374
172376	KOPAR7=172376
177600	UIPDR=177600
177620	UDPDR=177620
177640	UIPAR=177640
177660	UDPARE=177660
172200	SIIPDR=172200
172220	SDIPDR=172220
172240	SIIPARE=172240
172260	SDIPARE=172260
172300	KIPDR=172300
172320	KOPDR=172320
172340	KIPAR=172340
172360	KOPAR=172360

!ACCESS CONTROL FIELD DEFINITIONS (IN PDR)

000000	NR0=0	!NON-RESIDENT ABORT ALL REFS.
000001	ROOT=1	!TRAP ON READ,ABORT ON WRITE
000002	RD0=2	!READ,ABORT ON WRITE
000003	NR3=3	!UNUSED ABORT ALL
000004	RWT=4	!TRAP ON READ & WRITE
000005	RWT=5	!READ,TRAP ON WRITE
000006	RW=6	!READ & WRITE

000007	NR7=7	!ABORT ALL
000240	NOP=240	
000000	HLT=HALT	
104000	SCOPE=EMT	!SCOPE IS AN EMT INSTRUCTION

!LOAD TRAP/INTERRUPT VECTOR AREA 0=1000 WITH

! .+2
 ! HALT
 !CAUSES UNEXPECTED TRAPS/INTERRUPTS TO HALT AT VECTOR ADDRESS +2
 !NOTE: LISTING DOES NOT REFLECT THIS LOAD

				.NLIST MC,MO,BEQ	
				.LIST MC	
				!ERRVEC	
000004	000400			!WORD SHLT	
	000030			!EMTVEC	
	000440			!WORD SCOPEA	
	000046			!46	
000046	015332			!SENDAD	
	000092			!92	
000052	040000			!40000	
	000250			!MMVEC	
000250	000520			!WORD MHERR	
	000200			!200	
000200	000167	000664		JMP START	!GO START TEST
	000400			!400	
				!ROUTINE TO CATCH HLT (HALT) TRAP (IN SUPER & USER MODES) AND RETURN PRO-	
				!GRAM TO HLT INSTRUCTION IN KERNEL MODE.	
000400	042737	000001	177572	SHLT: BIC #1,(KSP)	!DISABLE MEMORY MANAGEMENT
000406	162716	000002		SUB #2,(KSP)	!POINT PC TO INST THAT CAUSED THE TRAP
000412	005776	000000		TST 0(KSP)	!HAS IT THE HLT?
000416	001404			BEQ SHLTA	
000420	062716	000002		ADD #2,(KSP)	!NO
000424	000137	000006		JMP #06	!GO WALT AT 6
000430	042766	140000	000002	SHLTA: BIC #UM,2(KSP)	!SET UP TO RETURN IN KERNEL MODE
000436	000006			RTT	!RETURN IN KERNEL MODE
				!SCOPE (EMT) TRAP SERVICE	
000440	011601			SCOPEA: MOV (KSP),R1	!SAVE ADDRESS OF THIS TEST
000442	012706	001060		MOV #KPTR,KSP	!RESET STACK POINTER
000446	005046			CLR =(KSP)	
000450	010146			MOV R1,=(KSP)	
000452	012746	000700		MOV #SPTR,=(KSP)	!PUSH SUPER STACK PTR ONTO STACK
000456	012746	000600		MOV #UPTR,=(KSP)	!PUSH USER STACK PTR ONTO STACK
000462	012767	030000	177306	MOV #PUM,PSW	!KERNEL MODE!!! PREV USER MODE!!
000470	106606			HTPD USP	!SET USER STACK PTR
000472	006267	177300		ASR PSW	!KERNEL MODE!!! PREV SUPER MODE!!
000476	106606			HTPD SSP	!SET SUPER STACK PTR
000500	032767	000400	177062	BIT #BITS,SWR	!CHECK MICRO BREAK OPTION
000506	001403			BEQ SCOPEX	
000512	116767	177054	177252	MOVB SWR,UBREAK	!MOV SR =07 INTO MICRO BREAK REG.


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000516 000006          SCOPEX: RTT          IRETURN IN KERNEL MODE

000520 013767 177572 000254 IMEMORY MANAGEMENT ERROR TRAP SERVICE
MMERR: MOV    ##SR0,SR0T    ISAVE SR0
000526 042737 177776 177572    BIC    #177776,##SR0
000534 000137 000252    JMP    ##MMVEC+2    IGO WALT AT 252

001000          .#1000

001000 000000          ITAGS
001002 000000          ICNT: 0
001004 001004          SR0T: 0          ICONTAINS PASS COUNT
001012 001012          .#.+6          ICONTAINS SR0 CONTENTS ON ERROR
001070 001070          .#1070
    
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001070 000240          ISTART MEMORY MANAGEMENT TEST
001072 000007 177702    START: NOP
001076 016737 177676 177570    CLR    ICNT          ICLR PASS COUNT
001104 012706 001060    BEGIN: MOV    ICNT,##LIGHTS    IDISPLAY PASS COUNT
001110 104000    MOV    #KPTR,K0P    ISET KERNEL STACK PTR
001112 012737 000520 000250    SCOPE MOV    ##MMERR,##MMVEC
001120 012737 000400 177774    MOV    #400,##SLR    ISET STACK LIMIT #1000
001126 012737 000007 172516    MOV    #UDE+SDE+KDE,##SR3

ROUTINE TO CLEAR MEMORY MANAGEMENT REGISTERS,
001134 000240          SEGB:
001136 000037 177572    NOP
001142 012702 177600    CLR    ##SR0
001146 012703 000040    MOV    #UIPDR0,R2
001152 000022    MOV    #400,R3
001154 077302    CLR    (R2)+
001156 012702 172200    SOB    R3,.-2
001162 012703 000100    MOV    #SIPDR0,R2
001166 000022    MOV    #100,R3
001170 077302    CLR    (R2)+
001170    SOB    R3,.-2

ROUTINE TO SET UP MEMORY MANAGEMENT REGISTERS FOR TESTS
001172          MMK:
001172 012737 073000 172300    MOV    #167*256,-400+UP+RW,##KIPDR0    ILOAD KIPDR0 RW UP 167 BLOCKS
001200 012737 004000 172320    MOV    #11*256,-400+UP+RW,##KOPDR0    ILOAD KOPDR0 RW UP 11 BLOCKS
001206 012737 000000 172334    MOV    #1*256,-400+UP+RW,##KOPDR6    ILOAD KOPDR6 RW UP 1 BLOCKS
001214 012737 077400 172336    MOV    #120*256,-400+UP+RW,##KOPDR7    ILOAD KOPDR7 RW UP 120 BLOCKS
001222 012737 000000 172222    MOV    #1*256,-400+UP+RW,##SOPDR1    ILOAD SOPDR1 RW UP 1 BLOCKS
001230 012737 000000 172204    MOV    #1*256,-400+UP+RW,##SIPDR2    ILOAD SIPDR2 RW UP 1 BLOCKS
001236 012737 000000 177630    MOV    #1*256,-400+UP+RW,##UDPR4    ILOAD UOPDR4 RW UP 1 BLOCKS
001244 012737 000000 177612    MOV    #1*256,-400+UP+RW,##UIPDR5    ILOAD UIPDR5 RW UP 1 BLOCKS
001252 000007 171002    CLR    KIPAR0    IVA0PA#0000-12077
001256 000047 171076    CLR    KOPAR0    IVA0PA#0-1077
001262 012767 000167 171104    MOV    #167,KOPAR6    IVA0140000-140077/PA=16700-16777
001270 012767 007600 171100    MOV    #7600,KOPAR7    IVA0160000-177776/PA=740000-77776
001276          I(1# PAGE)
001276 012767 000170 170740    MOV    #170,SIPAR2    IVA00000-40077/PA=17000-17077 (SUPER I SPACE)
001304 012767 000171 170750    MOV    #171,SOPAR1    IVA020000-20077/PA=17100-17177 (SUPER D SPACE)
001312 012767 000172 176332    MOV    #172,UIPAR5    IVA0120000-120077/PA=17200-17277 (USER I SPACE)
001320 012767 000173 176342    MOV    #173,UDPAR4    IVA0180000-180077/PA=17300-17377 (USER D SPACE)
001326 000400    BR    KK0A    IGO START TEST
    
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140000          )TEST HFPD INSTRUCTION KERNEL MODE PREVIOUS KERNEL MODE.
016700          )KERNEL VIRTUAL '0' ADDRESS FOR THESE TESTS
                )CORRESPONDING KERNEL PHYSICAL '0' ADDRESS

                )TEST THAT HFPD CAN GET DATA FROM A GENRAL REGISTER (R3)
                KK0A1
001330          MOV    #PRTY7,PSW    )KERNEL MODE!!!,PREV KERNEL MODE!!
001330          CLR    -2(KSP)
001336          MOV    #-1,R3        )PRESET GENERAL REGISTER
001342          INC    #SR0         )ENABLE SEG
001346          HFPD   R3           )=(KSP)*R3
001352          MOV    PSW,R2       )SAVE CC'S
001354          CLR    #SR0         )DISABLE SEG
001360          CMPB  #PRTY7*N,R2   )CHECK CC'S
001364          BEQ    ,+4
001370          HLT    #KPTR=2,KSP  )ERROR! INCORRECT CC'S AFTER HFPD
001372          BEQ    ,+4          )CHECK THAT STACK WAS PUSHED
001374          HLT    #KPTR=2,KSP  )ERROR! INCORRECT STACK PTR
001400          BEQ    ,+4          )CHECK RESULT
001402          INC    (KSP)
001404          BEQ    ,+4          )ERROR! INCORRECT RESULT
001406          HLT
001410          SCOPE
001412

                )TEST THAT HFPD CAN GET DATA FROM A KERNEL VIRTUAL '0' ADDRESS
                IDM#1
001414          CLR    PSW          )KERNEL MODE!!!,PREV KERNEL MODE!!
001420          CLR    -2(KSP)
001424          MOV    #VIRT,R2     )R2=VIRTUAL ADDRESS
001430          MOV    #-1,0#PHYS   )PRESET PHYSICAL ADDRESS
001436          INC    #SR0         )ENABLE SEG
001442          SCC    (R2)         )PRESET CC'S
001444          HFPD   (R2)        )=(KSP)*(R2)
001446          MOV    PSW,R3       )SAVE CC'S
001452          CLR    #SR0         )DISABLE SEG
001456          CMPB  #N+C,R3      )CHECK CC'S
001462          BEQ    ,+4
001464          HLT    #KPTR=2,KSP  )ERROR! INCORRECT CC'S
001466          BEQ    ,+4          )CHECK THAT STACK WAS PUSHED
001472          HLT    #KPTR=2,KSP  )ERROR! INCORRECT STACK PTR
001474          BEQ    ,+4          )CHECK RESULT
001476          INC    (KSP)
001500          BEQ    ,+4          )ERROR! INCORRECT RESULT
001502          HLT
001504          SCOPE

                IDM#2
001506          MOV    #REG,PSW    )KERNEL MODE!!!,PREV KERNEL MODE!!
001514          MOV    #-1,-2(KSP)
001522          MOV    #VIRT,R12    )R12=VIRTUAL ADDRESS
001526          CLR    #PHYS        )PRESET PHYSICAL ADDRESS
001532          INC    #SR0         )ENABLE SEG
001536          HFPD   (R12)*     )=(KSP)*VIRT
001540          CLR    #SR0         )DISABLE SEG
    
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001544          TST    (KSP)        )CHECK RESULT
001546          BEQ    ,+4
001550          HLT    #VIRT*2,R12  )ERROR! INCORRECT RESULT ON STACK
001552          CMP    #VIRT*2,R12  )CHECK AUTO INCREMENT
001556          BEQ    ,+4
001560          HLT    #VIRT*2,R12  )ERROR! AUTO INCREMENT FAILED
001562          CLR    PSW
001566          SCOPE

                IDM#3
001570          CLR    PSW          )KERNEL MODE!!!,PREV KERNEL MODE!!
001574          CLR    -2(KSP)
001600          MOV    #VIRT,R2     )LOAD INDIRECT ADDRESS
001604          MOV    #VIRT*2,0#PHYS )LOAD ADDRESS
001612          MOV    #-1,0#PHYS*2 )PRESET DATA
001620          INC    #SR0         )ENABLE SEG
001624          HFPD   0(R2)*      )=(KSP)*VIRT
001626          CLR    #SR0         )DISABLE SEG
001632          INC    (KSP)        )CHECK RESULT
001634          BEQ    ,+4
001636          HLT
001640          SCOPE

                IDM#4
001642          CLR    PSW          )KERNEL MODE!!!,PREV KERNEL MODE!!
001646          MOV    #-1,-2(KSP)
001654          MOV    #VIRT*2,R4   )R4=VIRTUAL ADDRESS*2
001660          CLR    #PHYS        )PRESET PHYSICAL ADDRESS DATA
001664          INC    #SR0         )ENABLE SEG
001670          HFPD   -(R4)       )=(KSP)*VIRT
001672          CLR    #SR0         )DISABLE SEG
001676          CMP    #VIRT,R4     )CHECK AUTO-DECREMENT
001702          BEQ    ,+4
001704          HLT    #KPTR=2,KSP  )ERROR! AUTO-DECREMENT FAILED
001706          TST    (KSP)
001710          BEQ    ,+4          )CHECK RESULT
001712          HLT
                                )ERROR! INCORRECT RESULT

                IDM#5
001714          MOV    #REG,PSW    )KERNEL MODE!!!,PREV KERNEL MODE!!
001722          CLR    -2(KSP)
001726          MOV    #VIRT*2,R10   )R10=INDIRECT ADDRESS
001732          MOV    #VIRT*4,0#PHYS )LOAD ADDRESS
001740          MOV    #-1,0#PHYS*4 )PRESET PHYSICAL ADDRESS DATA
001746          INC    #SR0         )ENABLE SEG
001752          HFPD   0-(R10)    )=(KSP)*VIRT*4
001754          CLR    #SR0         )DISABLE SEG
001760          INC    (KSP)        )CHECK RESULT
001762          BEQ    ,+4
001764          HLT
001766          CLR    PSW
001772          SCOPE

                IDM#6
    
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001774 012767 004000 175774      MOV      #REG,PSW      ;KERNEL MODE!!!,PREV KERNEL MODE!!
002002 012766 177777 177776      MOV      #=-2(KSP)
002010 012702 000002      MOV      #R12        ;LOAD INDEX REGISTER
002014 005037 016702      CLR      #PHYS+2     ;PRESET PHYSICAL ADDRESS DATA
002020 005237 177572      INC      #0BR0       ;ENABLE SEG
002024 106502 140000      KK6:    MFPD      VIRT(R12)    ;=(KSP)+VIRT-2
002030 005037 177572      CLR      #0BR0       ;DISABLE SEG
002034 022706 001056      CMP      #KPTR=2,KSP ;CHECK STACK PTR
002040 001401      BEQ     ,+4
002042 000000      HLT
002044 005716      TST     (KSP)        ;ERROR! INCORRECT STACK PTR
002046 001401      BEQ     ,+4         ;CHECK RESULT
002050 000000      HLT
002052 005067 175720      CLR      PSW         ;ERROR! INCORRECT RESULT
002056 104000      SCOPE

IDM#7
002060 005067 175712      CLR      PSW         ;KERNEL MODE!!!,PREV KERNEL MODE!!
002064 005066 177776      CLR      =2(KSP)
002070 012702 000004      MOV      #4,R2
002074 012737 140000 016704      MOV      #VIRT,#PHYS+4 ;LOAD ADDRESS
002102 012737 177777 016700      MOV      #=-1,#PHYS  ;CLEAR PHYSICAL ADDRESS DATA
002110 005237 177572      INC      #0BR0       ;ENABLE SEG
002114 106572 140000      KK7:    MFPD      #VIRT(R2) ;=(KSP)+VIRT
002120 005037 177572      CLR      #0BR0       ;DISABLE SEG
002124 005216      INC     (KSP)        ;CHECK RESULT
002126 001401      BEQ     ,+4
002130 000000      HLT
002132 104000      SCOPE

;TEST THAT MFPD OPERATES PROPERLY WITH PC USED IN DESTINATION
IDM#8,PC
002134 005067 175636      CLR      PSW         ;KERNEL MODE!!!,PREV KERNEL MODE!!
002140 012706 001000      MOV      #KPTR,KSP  ;SET KERNEL STACK PTR
002144 005066 177776      CLR      =2(KSP)
002150 005237 177572      INC      #0BR0       ;ENABLE SEG
002154 000277      SCC
002156 106507      KK10:  MFPD      PC        ;=(KSP)+PC
002160 016702 175612      MOV      PSW,R2     ;SAVE CC'S
002164 005037 177572      CLR      #0BR0       ;DISABLE SEG
002170 122702 000001      CMPB    #C,R2       ;CHECK CC'S
002174 001401      BEQ     ,+4
002176 000000      HLT
002200 022706 001056      CMP      #KPTR=2,KSP ;CHECK STACK PTR
002204 001401      BEQ     ,+4
002206 000000      HLT
002210 022716 002100      CMP      #KK10=2,(KSP) ;CHECK THAT PS WAS PUSHED ON THE STACK
002214 001401      BEQ     ,+4
002216 000000      HLT
002220 104000      SCOPE

IDM#3

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002222 012767 004000 175546      MOV      #REG,PSW      ;KERNEL MODE!!!,PREV KERNEL MODE!!
002230 005066 177776      CLR      =2(KSP)
002234 012737 177777 016700      MOV      #=-1,#PHYS
002242 005237 177572      INC      #0BR0       ;ENABLE SEG
002246 106537 140000      KK11:  MFPD      #VIRT    ;=(KSP)+VIRT
002252 005037 177572      CLR      #0BR0       ;DISABLE SEG
002256 005216      INC     (KSP)        ;CHECK RESULT
002260 001401      BEQ     ,+4
002262 000000      HLT
002264 104000      SCOPE

IDM#6,PC
002266 012767 000340 175502      MOV      #PRTY7,PSW ;KERNEL MODE!!!,PREV KERNEL MODE!!
002274 012766 177777 177776      MOV      #=-1,-2(KSP)
002302 005037 016700      CLR      #PHYS
002306 005237 177572      INC      #0BR0       ;PRESET PHYSICAL ADDRESS DATA
002312 106507 139402      KK12:  MFPD      VIRT    ;ENABLE SEG
002316 005037 177572      CLR      #0BR0       ;=(KSP)+VIRT
002322 005716      TST     (KSP)        ;DISABLE SEG
002324 001401      BEQ     ,+4         ;CHECK RESULT
002326 000000      HLT
002330 104000      SCOPE

IDM#7,PC
002332 005067 175440      CLR      PSW         ;KERNEL MODE!!!,PREV KERNEL MODE!!
002336 005066 177776      CLR      =2(KSP)
002342 012737 140004 016702      MOV      #VIRT=4,#PHYS+2 ;LOAD ADDRESS
002350 012737 177777 016704      MOV      #=-1,#PHYS+4 ;PRESET DATA
002356 005237 177572      INC      #0BR0       ;ENABLE SEG
002362 000277      SCC
002364 106577 139412      KK13:  MFPD      #VIRT+2  ;=(KSP)+VIRT+4
002370 016702 175402      MOV      PSW,R2     ;SAVE CC'S
002374 005037 177572      CLR      #0BR0       ;DISABLE SEG
002400 122702 000011      CMPB    #N=C,R2     ;CHECK CC'S
002404 001401      BEQ     ,+4
002406 000000      HLT
002410 005216      INC     (KSP)        ;ERROR! INCORRECT CC'S
002412 001401      BEQ     ,+4         ;CHECK RESULT
002414 000000      HLT
002416 104000      SCOPE

IDM#4,PC
002420 012737 002442 000250      MOV      #KK14A,#MHVEC ;SET MEM MGMT ABORT TRAP VECTOR
002426 005066 177776      CLR      =2(KSP)
002432 005237 177572      INC      #0BR0       ;ENABLE SEG
002436 106547      KK14:  MFPD      =(PC)    ;SHOULD ABORT
002440 000000      HLT
002442 022737 040021 175720      KK14A: CMP      #PLA=DS+VPS+1,#0BR0 ;CHECK ABORT CONDITIONS
002450 001401      BEQ     ,+4
002452 000000      HLT
002454 005037 177572      HLT
002460 012737 000520 000250      MOV      #0BR0      ;ERROR! INCORRECT ABORT CONDITIONS
002466 104000      SCOPE

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020000          ITEST MFPD INSTRUCTION KERNEL MODE PREVIOUS SUPERVISOR MODE
017100          VIRT=20000          ISUPER VIRTUAL 'I' ADDRESS FOR THESE TESTS
          PHYS=17100          ICORRESPONDING SUPER PHYSICAL 'I' ADDRESS

002470 012767 014000 175300 ITEST THAT MFPD CAN GET DATA FROM A GENERAL REGISTER (R10)
002476 012766 177777          MOV      #PSH+REG,PSW          IKERNEL MODE!!!,PREV SUPER MODE!!
002504 005000          MOV      #-1,-2(KSP)
002506 005237 177572          CLR      R10          IPRESET REGISTER
002512 000277          INC      #BSR0          IENABLE SEG
002514 106500          SCC          IPRESET CC'S
002516 016704 175254          MFPD   R10          I=(KSP)+(R10)
002522 005037 177572          MOV      PSW,R14          ISAVE CC'S
002526 122704 000003          CLR      #BSR0          IDISABLE SEG
002532 001401          CHPB   #E+C,R14          ICHECK CC'S
002534 000000          BEQ      ,+4
002536 022706 001056          HLT          IERROR! INCORRECT CC'S
002542 001401          CMP      #KPTR=2,KSP          ICHECK THAT STACK PTR WAS PUSHED
002544 000000          BEQ      ,+4
002546 005716          HLT          IERROR! INCORRECT STACK PTR
002550 001401          TST     (KSP)          ICHECK RESULT
002552 000000          BEQ      ,+4
002554 005067 175216          HLT          IERROR! INCORRECT RESULT
002560 104000          CLR      PSW
          SCOPE

          ITEST THAT MFPD CAN GET DATA FROM A SUPERVISOR VIRTUAL 'I' ADDRESS
IDM#1
002562 012767 010000 175200          MOV      #KM+PSH,PSW          IKERNEL MODE!!!,PREV SUPER MODE!!
002570 005066 177776          CLR          =2(KSP)
002574 012702 020000          MOV      #VIRT,R2          IR2=VIRTUAL ADDRESS
002600 012737 177777 017100          MOV      #-1,#PHYS          IPRESET PHYSICAL ADDRESS
002606 005237 177572          INC      #BSR0          IENABLE SEG
002612 000277          SCC          IPRESET CC'S
002614 106512          MFPD   (R2)          I=(KSP)+(R2)
002616 016703 175154          MOV      PSW,R3          ISAVE CC'S
002622 005037 177572          CLR      #BSR0          IDISABLE SEG
002626 122703 000011          CHPB   #N+C,R3          ICHECK CC'S
002632 001401          BEQ      ,+4
002634 000000          HLT          IERROR! INCORRECT CC'S
002636 022706 001056          CMP      #KPTR=2,KSP          ICHECK THAT STACK WAS PUSHED
002642 001401          BEQ      ,+4
002644 000000          HLT          IERROR! INCORRECT STACK PTR
002646 005216          INC     (KSP)          ICHECK RESULT
002650 001401          BEQ      ,+4
002652 000000          HLT          IERROR! INCORRECT RESULT
002654 104000          SCOPE

IDM#2
002656 012767 014000 175112          MOV      #PSH+REG,PSW          IKERNEL MODE!!!,PREV SUPER MODE!!
002664 012766 177777 177776          MOV      #-1,-2(KSP)
002672 012702 020000          MOV      #VIRT,R12          IR12=VIRTUAL ADDRESS
002676 005037 017100          CLR      #PHYS          IPRESET PHYSICAL ADDRESS
002702 005237 177572          INC      #BSR0          IENABLE SEG
    
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002706 106522          KS2: MFPD   (R12)+          I=(KSP)+VIRT
002710 005037 177572          CLR      #BSR0          IDISABLE SEG
002714 005716          TST     (KSP)          ICHECK RESULT
002716 001401          BEQ      ,+4
002720 000000          HLT          IERROR! INCORRECT RESULT ON STACK
002722 022702 020002          CMP      #VIRT+2,R12          ICHECK AUTO INCREMENT
002726 001401          BEQ      ,+4
002730 000000          HLT          IERROR! AUTO INCREMENT FAILED
002732 005067 175040          CLR      PSW
002736 104000          SCOPE

IDM#3
002740 012767 010000 175030          MOV      #KM+PSH,PSW          IKERNEL MODE!!!,PREV SUPER MODE!!
002746 005066 177776          CLR          =2(KSP)
002752 012702 001004          MOV      #TEMP,R2          ILOAD INDIRECT ADDRESS
002756 012737 020002 001004          MOV      #VIRT+2,#TEMP          ILOAD ADDRESS
002764 012737 177777 017100          MOV      #-1,#PHYS+2          IPRESET DATA
002772 005237 177572          INC      #BSR0          IENABLE SEG
002776 106532          KS3: MFPD   0(R2)+          I=(KSP)+VIRT+2
003000 005037 177572          CLR      #BSR0          IDISABLE SEG
003004 005216          INC     (KSP)          ICHECK RESULT
003006 001401          BEQ      ,+4
003010 000000          HLT          IERROR! INCORRECT RESULT
003012 104000          SCOPE

IDM#4
003014 012767 010000 174754          MOV      #KM+PSH,PSW          IKERNEL MODE!!!,PREV SUPER MODE!!
003022 012766 177777 177776          MOV      #-1,-2(KSP)
003030 012704 020002          MOV      #VIRT+2,R4          IR4=VIRTUAL ADDRESS+2
003034 005037 017100          CLR      #PHYS          IPRESET PHYSICAL ADDRESS DATA
003040 005237 177572          INC      #BSR0          IENABLE SEG
003044 106544          KS4: MFPD   -(R4)          I=(KSP)+VIRT
003046 005037 177572          CLR      #BSR0          IDISABLE SEG
003052 022704 020000          CHPB   #VIRT,R4          ICHECK AUTO-DECREMENT
003056 001401          BEQ      ,+4
003060 000000          HLT          IERROR! AUTO-DECREMENT FAILED
003062 005716          TST     (KSP)          ICHECK RESULT
003064 001401          BEQ      ,+4
003066 000000          HLT          IERROR! INCORRECT RESULT
003070 104000          SCOPE

IDM#5
003072 012767 014000 174676          MOV      #PSH+REG,PSW          IKERNEL MODE!!!,PREV SUPER MODE!!
003100 005066 177776          CLR          =2(KSP)
003104 012700 001004          MOV      #TEMP+2,R10          IR10=INDIRECT ADDRESS
003110 012737 020004 001004          MOV      #VIRT+4,#TEMP          ILOAD ADDRESS
003116 012737 177777 017100          MOV      #-1,#PHYS+4          IPRESET PHYSICAL ADDRESS DATA
003124 005237 177572          INC      #BSR0          IENABLE SEG
003130 106530          KS5: MFPD   0-(R10)          I=(KSP)+VIRT+4
003132 005037 177572          CLR      #BSR0          IDISABLE SEG
003136 005216          INC     (KSP)          ICHECK RESULT
003140 001401          BEQ      ,+4
003142 000000          HLT          IERROR! INCORRECT RESULT
003144 005067 174626          CLR      PSW
    
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003150 104000 SCOPE

IDM#6
003152 012767 014000 174616 MOV #PSH+REG,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003160 012766 177777 177776 CLR #=1,-2(KSP)
003166 012762 000002 MOV #2,R12 ;LOAD INDEX REGISTER
003172 005037 017102 CLR #PPHYS+2 ;PRESET PHYSICAL ADDRESS DATA
003176 005237 177572 INC #SR0 ;ENABLE SEG
003202 106562 020000 KS6: HFPD VIRT(R12) ;=(KSP)+VIRT-2
003206 005037 177572 CLR #SR0 ;DISABLE SEG
003212 022786 001056 CMP #KPTR=2,KSP ;CHECK STACK PTR
003216 001401 BEQ ;+4
003220 000000 HLT ;ERROR! INCORRECT STACK PTR
003222 005716 TST (KSP) ;CHECK RESULT
003224 001401 BEQ ;+4
003226 000000 HLT ;ERROR! INCORRECT RESULT
003230 005067 174542 CLR PSH
003234 104000 SCOPE

IDM#7
003236 012767 010000 174532 MOV #KM+PSH,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003244 005066 177776 CLR #=2(KSP)
003250 012762 177774 MOV #=4,R2 ;LOAD INDEX REGISTER
003254 012737 020000 001004 MOV #VIRT,#TEMP ;LOAD ADDRESS
003262 012737 177777 017100 MOV #=-1,#PPHYS ;CLEAR PHYSICAL ADDRESS DATA
003270 005237 177572 INC #SR0 ;ENABLE SEG
003274 106572 001010 KS7: HFPD #TEMP+4(R2) ;=(KSP)+VIRT
003300 005037 177572 CLR #SR0 ;DISABLE SEG
003304 005216 INC (KSP) ;CHECK RESULT
003306 001401 BEQ ;+4
003310 000000 HLT ;ERROR! INCORRECT RESULT
003312 104000 SCOPE

;TEST THAT HFPD OPERATES PROPERLY US PC IN DESTINATION
IDM#8,PC
003314 012767 010000 174454 MOV #KM+PSH,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003322 005066 177776 CLR #=2(KSP)
003326 005237 177572 INC #SR0 ;ENABLE SEG
003332 000277 SCC
003334 106507 KS10: HFPD PC ;=(KSP)+PC
003336 016702 174434 MOV PSH,R2 ;SAVE CC'S
003342 005037 177572 CLR #SR0 ;DISABLE SEG
003346 122702 000001 CHPB #C,R2 ;CHECK CC'S
003352 001401 BEQ ;+4
003354 000000 HLT
003356 022706 001056 CMP #KPTR=2,KSP ;CHECK STACK PTR
003362 001401 BEQ ;+4
003364 000000 HLT ;ERROR! STACK NOT PUSHED
003366 022716 003336 CMP #KS10+2,(KSP) ;CHECK THAT PS WAS PUSHED ON THE STACK
003372 001401 BEQ ;+4
003374 000000 HLT ;ERROR! PC NOT PUSHED ON THE STACK
003376 104000 SCOPE
    
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IDM#3
003400 012767 014000 174370 MOV #PSH+REG,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003406 005066 177776 CLR #=2(KSP)
003412 012737 177777 017100 MOV #=-1,#PPHYS
003420 005237 177572 INC #SR0 ;ENABLE SEG
003424 106537 020000 KS11: HFPD #VIRT ;=(KSP)+VIRT
003430 005037 177572 CLR #SR0 ;DISABLE SEG
003434 005216 INC (KSP) ;CHECK RESULT
003436 001401 BEQ ;+4
003440 000000 HLT ;ERROR! INCORRECT RESULT
003442 104000 SCOPE

IDM#6,PC
003444 012767 010340 174324 MOV #PSH+PTY7,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003452 012766 177777 177776 CLR #=-1,-2(KSP)
003460 005037 017100 CLR #PPHYS ;PRESET PHYSICAL ADDRESS DATA
003464 005237 177572 INC #SR0 ;ENABLE SEG
003470 106567 014304 KS12: HFPD VIRT ;=(KSP)+VIRT
003474 005037 177572 CLR #SR0 ;DISABLE SEG
003500 005716 TST (KSP) ;CHECK RESULT
003502 001401 BEQ ;+4
003504 000000 HLT ;ERROR! INCORRECT RESULT
003506 104000 SCOPE

IDM#7,PC
003510 012767 010000 174260 MOV #KM+PSH,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003516 005066 177776 CLR #=2(KSP)
003522 012737 020000 001004 MOV #VIRT+4,#TEMP ;LOAD ADDRESS
003530 012737 177777 017104 MOV #=-1,#PPHYS+4 ;PRESET DATA
003536 005237 177572 INC #SR0 ;ENABLE SEG
003542 000277 SCC
003544 106577 179234 KS13: HFPD #TEMP ;=(KSP)+VIRT+4
003550 016702 174222 MOV PSH,R2 ;SAVE CC'S
003554 005037 177572 CLR #SR0 ;DISABLE SEG
003560 122702 000011 CHPB #N=C,R2 ;CHECK CC'S
003564 001401 BEQ ;+4
003566 000000 HLT ;ERROR! INCORRECT CC'S
003570 005216 INC (KSP) ;CHECK RESULT
003572 001401 BEQ ;+4
003574 000000 HLT ;ERROR! INCORRECT RESULT ON STACK
003576 104000 SCOPE

;TEST THAT HFPD CAN PUSH SUPERVISOR STACK PTR ONTO KERNEL STACK
003600 012767 010000 174170 MOV #KM+PSH,PSH ;KERNEL MODE!!!,PREV SUPER MODE!!
003606 005016 CLR (KSP) ;PUT #0 ON KERNEL STACK
003610 106506 HFPD SSP ;GET SUPER STACK PTR
003612 012716 177777 MOV #=-1,(KSP) ;PUT #=-1 ON KERNEL STACK
003616 005237 177572 INC #SR0 ;ENABLE SEG
003622 106506 KS14: HFPD SSP ;=(KSP)+SSP
003624 005037 177572 CLR #SR0 ;DISABLE SEG
003630 005716 TST (KSP) ;CHECK THAT SUPER STACK PTR WAS PUSHED
003632 001401 BEQ ;+4 ;ONTO KERNEL STACK
003634 000000 HLT ;ERROR! HFPD FAILED
    
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003636 104000 SCOPE
;TEST HFPD [INSTRUCTION KERNEL MODE PREVIOUS USER MODE
;VIRT=100000 USER VIRTUAL 'I' ADDRESS FOR THESE TESTS
;PHYS=17300 CORRESPONDING USER PHYSICAL 'I' ADDRESS

;TEST THAT HFPD CAN GET DATA FROM A GENERAL REGISTER (R10),
003640 012767 034000 174130 MOV #PUM+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
003646 012766 177777 177776 MOV #=-1,-2(KSP)
003654 005000 CLR R10 ;PRESET REGISTER
003656 005237 177572 INC #0SR0 ;ENABLE SEG
003662 000277 SCC ;PRESET CC'S
003664 106500 KU01 HFPD R10 ;=(KSP)+(R10)
003666 016704 174104 MOV PSW,R14 ;SAVE CC'S
003672 005037 177572 CLR #0SR0 ;DISABLE SEG
003676 122704 000005 CMPB #E+C,R14 ;CHECK CC'S
003702 001401 BEQ ,+4
003704 000000 HLT ;ERROR! INCORRECT CC'S
003706 022706 001056 CMP #KPTR=2,KSP ;CHECK THAT STACK PTR WAS PUSHED
003712 001401 BEQ ,+4
003714 000000 HLT ;ERROR! INCORRECT STACK PTR
003716 005716 TST (KSP) ;CHECK RESULT
003720 001401 BEQ ,+4
003722 000000 HLT ;ERROR! INCORRECT RESULT
003724 005067 174046 CLR PSW
003730 104000 SCOPE

;TEST THAT HFPD CAN GET DATA FROM A KERNEL VIRTUAL 'I' ADDRESS
;DM=1
003732 012767 030000 174036 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
003740 005066 177776 CLR #2(KSP)
003744 012702 100000 MOV #VIRT,R2 ;R2=VIRTUAL ADDRESS
003750 012737 177777 017300 MOV #=-1,#PHYS ;PRESET PHYSICAL ADDRESS
003756 005237 177572 INC #0SR0 ;ENABLE SEG
003762 000277 SCC ;PRESET CC'S
003764 106512 KU11 HFPD (R2) ;=(KSP)+(R2)
003766 016703 174004 MOV PSW,R3 ;SAVE CC'S
003772 005037 177572 CLR #0SR0 ;DISABLE SEG
003776 122703 000011 CMPB #N+C,R3 ;CHECK CC'S
004002 001401 BEQ ,+4
004004 000000 HLT ;ERROR! INCORRECT CC'S
004006 022706 001056 CMP #KPTR=2,KSP ;CHECK THAT STACK WAS PUSHED
004012 001401 BEQ ,+4
004014 000000 HLT ;ERROR! INCORRECT STACK PTR
004016 005216 INC (KSP) ;CHECK RESULT
004020 001401 BEQ ,+4
004022 000000 HLT ;ERROR! INCORRECT RESULT
004024 104000 SCOPE

;DM=2
004026 012767 034000 173742 MOV #PUM+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004034 012766 177777 177776 MOV #=-1,-2(KSP)
004042 012702 100000 MOV #VIRT,R12 ;R12=VIRTUAL ADDRESS
    
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004046 005037 017300 CLR #0PHYS ;PRESET PHYSICAL ADDRESS
004052 005237 177572 INC #0SR0 ;ENABLE SEG
004056 106522 KU21 HFPD (R12)+ ;=(KSP)+VIRT
004060 005037 177572 CLR #0SR0 ;DISABLE SEG
004064 005716 TST (KSP) ;CHECK RESULT
004066 001401 BEQ ,+4
004070 000000 HLT ;ERROR! INCORRECT RESULT ON STACK
004072 022702 100002 CMP #VIRT+2,R12 ;CHECK AUTO INCREMENT
004076 001401 BEQ ,+4
004100 000000 HLT ;ERROR! AUTO INCREMENT FAILED
004102 005067 173670 CLR PSW
004106 104000 SCOPE

;DM=3
004110 012767 030000 173660 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004116 005066 177776 CLR #2(KSP)
004122 012702 001004 MOV #TEMP,R2 ;LOAD INDIRECT ADDRESS
004126 012737 100002 001004 MOV #VIRT+0,#TEMP ;LOAD ADDRESS
004134 012737 177777 017302 MOV #=-1,#PHYS+2 ;PRESET DATA
004142 005237 177572 INC #0SR0 ;ENABLE SEG
004146 106532 KU31 HFPD #R2)+ ;=(KSP)+VIRT+2
004150 005037 177572 CLR #0SR0 ;DISABLE SEG
004154 005216 INC (KSP) ;CHECK RESULT
004156 001401 BEQ ,+4
004160 000000 HLT ;ERROR! INCORRECT RESULT
004162 104000 SCOPE

;DM=4
004164 012767 030000 173604 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004172 012766 177777 177776 MOV #=-1,-2(KSP)
004200 012704 100002 KU41 HFPD #VIRT+0,R4 ;R4=VIRTUAL ADDRESS+2
004204 005037 017300 CLR #0PHYS ;PRESET PHYSICAL ADDRESS DATA
004210 005237 177572 INC #0SR0 ;ENABLE SEG
004214 106544 HFPD =(R4) ;=(KSP)+VIRT
004216 005037 177572 CLR #0SR0 ;DISABLE SEG
004222 022704 100000 CMP #VIRT,R4 ;CHECK AUTO-DECREMENT
004226 001401 BEQ ,+4
004230 000000 HLT ;ERROR! AUTO-DECREMENT FAILED
004232 103716 TST (KSP) ;CHECK RESULT
004234 001401 BEQ ,+4
004236 000000 HLT ;ERROR! INCORRECT RESULT

;DM=5
004240 012767 034000 173530 MOV #PUM+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004246 005066 177776 CLR #2(KSP)
004252 012700 001006 MOV #TEMP+2,R10 ;R10=INDIRECT ADDRESS
004256 012737 100004 001004 MOV #VIRT+4,#TEMP ;LOAD ADDRESS
004264 012737 177777 017304 MOV #=-1,#PHYS+4 ;PRESET PHYSICAL ADDRESS DATA
004272 005237 177572 INC #0SR0 ;ENABLE SEG
004276 106530 KU51 HFPD #=(R10) ;=(KSP)+VIRT+4
004300 005037 177572 CLR #0SR0 ;DISABLE SEG
004304 005216 INC (KSP) ;CHECK RESULT
004306 001401 BEQ ,+4
004310 000000 HLT
    
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004312 005067 173460 CLR PSW
004316 104000 SCOPE

IDM=6
004320 012767 034000 173450 MOV #PUM+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004326 012766 177777 177776 CLR #=1,-2(KSP)
004334 012702 000002 MOV #2,R12 ;LOAD INDEX REGISTER
004340 005037 017302 CLR #PPHYS*2 ;PRESET PHYSICAL ADDRESS DATA
004344 005237 177572 INC #0SR0 ;ENABLE SEG
004350 106562 100000 KU61 VIRT(R12) ;=(KSP)+VIRT-2
004354 005037 177572 CLR #0SR0 ;DISABLE SEG
004360 022706 001056 CMP #KPTR*2,KSP ;CHECK STACK PTR
004364 001401 BEQ ,+4
004366 000000 HLT ;ERROR! INCORRECT STACK PTR
004370 005716 TST (KSP) ;CHECK RESULT
004372 001401 BEQ ,+4
004374 000000 HLT ;ERROR! INCORRECT RESULT
004376 005067 173374 CLR PSW
004402 104000 SCOPE

IDM=7
004404 012767 030000 173364 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004412 005066 177776 CLR #=2(KSP)
004416 012702 177774 MOV #4,R2 ;LOAD INDEX REGISTER
004422 012737 100000 001004 MOV #VIRT,*TEMP ;LOAD INDIRECT ADDRESS
004430 012737 177777 017300 MOV #=-1,*PPHYS ;CLEAR PHYSICAL ADDRESS DATA
004436 005237 177572 INC #0SR0 ;ENABLE SEG
004442 106572 001010 KU71 #TEMP+4(R2) ;=(KSP)+VIRT
004446 005037 177572 CLR #0SR0 ;DISABLE SEG
004452 005216 INC (KSP) ;CHECK RESULT
004454 001401 BEQ ,+4
004456 000000 HLT ;ERROR! INCORRECT RESULT
004460 104000 SCOPE

;TEST THAT MFPD OPERATES PROPERLY US PC IN DESTINATION
IDM=0,PC
004462 012767 030000 173306 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004470 005066 177776 CLR #=2(KSP)
004474 005237 177572 INC #0SR0 ;ENABLE SEG
004500 000277 SCC
004502 106507 KU101 MFPD PC ;=(KSP)+PC
004504 016702 173266 MOV PSW,R2 ;SAVE CC'S
004510 005037 177572 CLR #0SR0 ;DISABLE SEG
004514 122702 000001 CMPB #C,R2 ;CHECK CC'S
004520 001401 BEQ ,+4
004522 000000 HLT
004524 022706 001056 CMP #KPTR*2,KSP ;CHECK STACK PTR
004530 001401 BEQ ,+4
004532 000000 HLT ;ERROR! STACK NOT PUSHED
004534 022716 004504 CMP #KU10*2,(KSP) ;CHECK THAT PS WAS PUSHED ON THE STACK
004540 001401 BEQ ,+4
004542 000000 HLT ;ERROR! PC NOT PUSHED ON THE STACK
004544 104000 SCOPE
    
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IDM=3,PC
004546 012767 034000 173282 MOV #PUM+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004554 005066 177776 CLR #=2(KSP)
004560 012737 177777 017300 MOV #=-1,*PPHYS
004566 005237 177572 INC #0SR0 ;ENABLE SEG
004572 106537 100000 KU111 #VIRT ;=(KSP)+VIRT
004576 005037 177572 CLR #0SR0 ;DISABLE SEG
004602 005216 INC (KSP) ;CHECK RESULT
004604 001401 BEQ ,+4
004606 000000 HLT ;ERROR! INCORRECT RESULT
004610 104000 SCOPE

IDM=6,PC
004612 012767 030340 173156 MOV #PUM+PRTY7,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004620 012766 177777 177776 CLR #=1,-2(KSP)
004626 005037 017300 #PPHYS ;PRESET PHYSICAL ADDRESS DATA
004632 005237 177572 INC #0SR0 ;ENABLE SEG
004636 106567 073136 KU121 VIRT ;=(KSP)+VIRT
004642 005037 177572 CLR #0SR0 ;DISABLE SEG
004646 005716 TST (KSP) ;CHECK RESULT
004650 001401 BEQ ,+4
004652 000000 HLT ;ERROR! INCORRECT RESULT
004654 104000 SCOPE

IDM=7,PC
004656 012767 030000 173112 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004664 005066 177776 CLR #=2(KSP)
004670 012737 100004 001004 MOV #VIRT+4,*TEMP ;LOAD ADDRESS
004676 012737 177777 017304 MOV #=-1,*PPHYS*4 ;PRESET DATA
004704 005237 177572 INC #0SR0 ;ENABLE SEG
004710 000277 SCC
004712 106577 174066 KU131 #TEMP ;=(KSP)+VIRT+4
004716 016702 173054 MOV PSW,R2 ;SAVE CC'S
004722 005037 177572 CLR #0SR0 ;DISABLE SEG
004726 122702 000011 CMPB #N+C,R2 ;CHECK CC'S
004732 001401 BEQ ,+4
004734 000000 HLT ;ERROR! INCORRECT CC'S
004736 005216 INC (KSP) ;CHECK RESULT
004740 001401 BEQ ,+4
004742 000000 HLT ;ERROR! INCORRECT RESULT ON STACK
004744 104000 SCOPE

;TEST THAT MFPD CAN PUSH USER STACK PTR ONTO KERNEL STACK
004746 012767 030000 173022 MOV #KM+PUM,PSW ;KERNEL MODE!!!,PREV USER MODE!!
004754 012716 177777 #=-1,(KSP) ;PUT #=-1 ON KERNEL STACK
004760 106006 MFPD USP
004762 005016 CLR (KSP) ;PUT #0 ON KERNEL STACK
004764 005237 177572 INC #0SR0 ;ENABLE SEG
004770 106506 KU141 USP ;=(KSP)+USP
004772 005037 177572 CLR #0SR0 ;DISABLE SEG
004776 005216 INC (KSP) ;CHECK THAT USER STACK PTR WAS PUSHED
005000 001401 BEQ ,+4 ;ONTO KERNEL STACK
005002 000000 HLT ;ERROR! MFPD FAILED
    
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005004 104000 SCOPE

)TEST MFPI INSTRUCTION KERNEL MODE PREVIOUS KERNEL MODE.
VIRT=16600 )KERNEL VIRTUAL 'I' ADDRESS FOR THESE TESTS
016600 PHYS=16600 )CORRESPONDING KERNEL PHYSICAL 'I' ADDRESS

)TEST THAT MFPI CAN GET DATA FROM A GENERAL REGISTER (R3)
KK10A)
005006 012767 000340 172762 MOV #PRTY7,PSW )KERNEL MODE!!!,PREV KERNEL MODE!!
005006 005066 177776 CLR =2(KSP)
005014 005066 177776 MOV #-1,R3 )PRESET GENERAL REGISTER
005020 012763 177777 #SRO )ENABLE SEG
005024 005237 177572 INC R3 )I=(KSP)+R3
005030 006503 KK10) MFPI R3 )SAVE CC'S
005032 016702 172740 MOV PSW,R2 )DISABLE SEG
005036 005037 177572 CLR #SRO )CHECK CC'S
005042 122702 000350 CHPB #PRTY7+R,R2
005046 001401 BEQ ,+4
005050 000000 HLT )ERROR! INCORRECT CC'S AFTER MFPI
005052 022706 001056 CMP #KPTR=2,KSP )CHECK THAT STACK WAS PUSHED
005056 001401 BEQ ,+4
005060 000000 HLT )ERROR! INCORRECT STACK PTR
005062 005216 INC (KSP) )CHECK RESULT
005064 001401 BEQ ,+4
005066 000000 HLT )ERROR! INCORRECT RESULT
005070 104000 SCOPE

)TEST THAT MFPI CAN GET DATA FROM A KERNEL VIRTUAL 'I' ADDRESS
IDM#1
005072 005067 172700 CLR PSW )KERNEL MODE!!!,PREV KERNEL MODE!!
005076 005066 177776 CLR =2(KSP)
005102 012702 016600 MOV #VIRT,R2 )R2=VIRTUAL ADDRESS
005106 012737 177777 016600 MOV #-1,#PHYS )PRESET PHYSICAL ADDRESS
005114 005237 177572 #SRO )ENABLE SEG
005120 000277 SCC )PRESET CC'S
005122 006512 KK11) MFPI (R2) )I=(KSP)+(R2)
005124 016703 172646 MOV PSW,R3 )SAVE CC'S
005130 005037 177572 CLR #SRO )DISABLE SEG
005134 122703 000011 CHPB #N+C,R3 )CHECK CC'S
005140 001401 BEQ ,+4
005142 000000 HLT )ERROR! INCORRECT CC'S
005144 022706 001056 CMP #KPTR=2,KSP )CHECK THAT STACK WAS PUSHED
005150 001401 BEQ ,+4
005152 000000 HLT )ERROR! INCORRECT STACK PTR
005154 005216 INC (KSP) )CHECK RESULT
005156 001401 BEQ ,+4
005160 000000 HLT )ERROR! INCORRECT RESULT
005162 104000 SCOPE

IDM#2
005164 012767 004000 172604 MOV #REG,PSW )KERNEL MODE!!!,PREV KERNEL MODE!!
005172 012766 177777 177776 MOV #-1,-2(KSP)
005200 012722 016600 MOV #VIRT,R12 )R12=VIRTUAL ADDRESS
    
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005204 005037 016600 CLR #PHYS )PRESET PHYSICAL ADDRESS
005210 005237 177572 INC #SRO )ENABLE SEG
005214 006522 KK12) MFPI (R12)+ )I=(KSP)+VIRT
005216 005037 177572 CLR #SRO )DISABLE SEG
005222 005716 TST (KSP) )CHECK RESULT
005224 001401 BEQ ,+4
005226 000000 HLT )ERROR! INCORRECT RESULT ON STACK
005230 022702 016600 CMP #VIRT+2,R12 )CHECK AUTO INCREMENT
005234 001401 BEQ ,+4
005236 000000 HLT )ERROR! AUTO INCREMENT FAILED
005240 005067 172532 CLR PSW
005244 104000 SCOPE

IDM#3
005246 005067 172524 CLR PSW )KERNEL MODE!!!,PREV KERNEL MODE!!
005252 005066 177776 CLR =2(KSP)
005256 012702 001004 MOV #TEMP,R2 )LOAD INDIRECT ADDRESS
005262 012737 016602 001004 MOV #VIRT+2,#TEMP )LOAD ADDRESS
005270 012737 177777 016602 MOV #-1,#PHYS+2 )PRESET DATA
005276 005237 177572 #SRO )ENABLE SEG
005302 006532 KK13) MFPI #R2)+ )I=(KSP)+VIRT+2
005304 005037 177572 CLR #SRO )DISABLE SEG
005310 005216 INC (KSP) )CHECK RESULT
005312 001401 BEQ ,+4
005314 000000 HLT )ERROR! INCORRECT RESULT
005316 104000 SCOPE

IDM#4
005320 005067 172452 CLR PSW )KERNEL MODE!!!,PREV KERNEL MODE!!
005324 012766 177777 177776 MOV #-1,-2(KSP)
005332 012704 016602 MOV #VIRT+2,R4 )R4=VIRTUAL ADDRESS+2
005336 005037 016600 CLR #PHYS )PRESET PHYSICAL ADDRESS DATA
005342 005237 177572 #SRO )ENABLE SEG
005346 006544 KK14) MFPI -(R4) )I=(KSP)+VIRT
005350 005037 177572 CLR #SRO )DISABLE SEG
005354 022704 016600 CMP #VIRT,R4 )CHECK AUTO-DECREMENT
005360 021431 BEQ ,+4
005362 000000 HLT )ERROR! AUTO-DECREMENT FAILED
005364 005716 TST (KSP) )CHECK RESULT
005366 001401 BEQ ,+4
005370 000000 HLT )ERROR! INCORRECT RESULT
005372 104000 SCOPE

IDM#5
005374 012767 004000 172374 MOV #REG,PSW )KERNEL MODE!!!,PREV KERNEL MODE!!
005402 005066 177776 CLR =2(KSP)
005406 012700 001006 MOV #TEMP+2,R10 )R10=INDIRECT ADDRESS
005412 012737 016604 001004 MOV #VIRT+4,#TEMP )LOAD ADDRESS
005420 012737 177777 016604 MOV #-1,#PHYS+4 )PRESET PHYSICAL ADDRESS DATA
005426 005237 177572 #SRO )ENABLE SEG
005432 006530 KK15) MFPI #-(R10) )I=(KSP)+VIRT+4
005434 005037 177572 CLR #SRO )DISABLE SEG
005440 005216 INC (KSP) )CHECK RESULT
005442 001401 BEQ ,+4
    
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005444 000000
005446 005067 172324
005452 104000
                                HLT
                                CLR      PSH
                                SCOPE

                                ID#6
005454 012767 004000 172314      MOV    #REG,PSH      ;KERNEL MODE!!!,PREV KERNEL MODE!!
005462 012766 177777 177776      MOV    #-1,-2(KSP)
005470 012702 000002                MOV    #2,R12
005474 005037 016600                CLR    #PPHYS#2      ;LOAD INDEX REGISTER
005500 005237 177572                CLR    #SR0          ;PRESET PHYSICAL ADDRESS DATA
005504 006562 016600                HFPFI  VIRT(R12)     ;ENABLE SEG
005510 005037 177572                CLR    #SR0          ;=(KSP)+VIRT-2
005514 022706 001056                CMP    #KPTR=2,KSP   ;DISABLE SEG
005520 001401                BEQ    ,+4           ;CHECK STACK PTR
005522 000000                HLT
005524 005716                TST   (KSP)         ;ERROR! INCORRECT STACK PTR
005526 001401                BEQ    ,+4           ;CHECK RESULT
005530 000000                HLT
005532 005067 172240                CLR    PSH          ;ERROR! INCORRECT RESULT
005536 104000                SCOPE

                                ID#7
005540 005067 172232                CLR    PSH          ;KERNEL MODE!!!,PREV KERNEL MODE!!
005544 005066 177776                CLR    -2(KSP)
005550 012702 177774                MOV    #-4,R2       ;LOAD INDEX REGISTER
005554 012737 016600 001004      MOV    #VIRT,#TEMP  ;LOAD ADDRESS
005562 012737 177777 016600      MOV    #-1,#PPHYS  ;CLEAR PHYSICAL ADDRESS DATA
005570 005237 177572                INC    #SR0         ;ENABLE SEG
005574 006572 001010                HFPFI  #TEMP+4(R2)  ;=(KSP)+VIRT
005600 005037 177572                CLR    #SR0         ;DISABLE SEG
005604 005216                INC    (KSP)        ;CHECK RESULT
005606 001401                BEQ    ,+4
005610 000000                HLT
005612 104000                SCOPE

;TEST THAT HFPFI OPERATES PROPERLY US PC IN DESTINATION
;ID#8,PC
005614 005067 172156                CLR    PSH          ;KERNEL MODE!!!,PREV KERNEL MODE!!
005620 012706 001060                MOV    #KPTR,KSP   ;SET KERNEL STACK PTR
005624 005066 177776                CLR    -2(KSP)
005630 005237 177572                INC    #SR0
005634 000277                SCC
005636 006507                HFPFI  PC           ;=(KSP)+PC
005640 016702 172132                MOV    PSH,R2      ;SAVE CC'S
005644 005037 177572                CLR    #SR0        ;DISABLE SEG
005650 122702 000001                CMPB  #C,R2        ;CHECK CC'S
005654 001401                BEQ    ,+4
005656 000000                HLT
005660 022706 001056                CMP    #KPTR=2,KSP ;CHECK STACK PTR
005664 001401                BEQ    ,+4
005666 000000                HLT
005670 022716 005640                CMP    #KK10=2,(KSP);ERROR! STACK NOT PUSHED
005674 001401                BEQ    ,+4         ;CHECK THAT PS WAS PUSHED ON THE STACK
005676 000000                HLT                ;ERROR! PC NOT PUSHED ON THE STACK
    
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005700 104000                SCOPE

                                ID#3,PC
005702 012767 004000 172066      MOV    #REG,PSH      ;KERNEL MODE!!!,PREV KERNEL MODE!!
005710 005066 177776                CLR    -2(KSP)
005714 012737 177777 016600      MOV    #-1,#PPHYS  ;ENABLE SEG
005722 005237 177572                INC    #SR0         ;=(KSP)+VIRT
005726 005037 016600                HFPFI  #VIRT        ;DISABLE SEG
005732 005037 177572                CLR    #SR0        ;CHECK RESULT
005736 005216                INC    (KSP)
005740 001401                BEQ    ,+4
005742 000000                HLT
005744 104000                SCOPE

                                ID#6,PC
005746 012767 000340 172022      MOV    #PRTY7,PSH   ;KERNEL MODE!!!,PREV KERNEL MODE!!
005754 012766 177777 177776      MOV    #-1,-2(KSP)
005762 005037 016600                CLR    #PPHYS
005766 005237 177572                INC    #SR0
005772 006567 016600                HFPFI  VIRT         ;PRESET PHYSICAL ADDRESS DATA
005776 005037 177572                CLR    #SR0        ;ENABLE SEG
006002 005716                TST   (KSP)        ;=(KSP)+VIRT
006004 001401                BEQ    ,+4           ;DISABLE SEG
006006 000000                HLT                ;CHECK RESULT
006010 104000                SCOPE

                                ID#7,PC
006012 005067 171760                CLR    PSH          ;KERNEL MODE!!!,PREV KERNEL MODE!!
006016 005066 177776                CLR    -2(KSP)
006022 012737 016604 001004      MOV    #VIRT+4,#TEMP;LOAD ADDRESS
006030 012737 177777 016604      MOV    #-1,#PPHYS+4;PRESET DATA
006036 005237 177572                INC    #SR0        ;ENABLE SEG
006042 000277                SCC
006044 006577 172734                HFPFI  #TEMP        ;=(KSP)+VIRT+4
006050 016702 171722                MOV    PSH,R2      ;SAVE CC'S
006054 005037 177572                CLR    #SR0        ;DISABLE SEG
006060 122702 000011                CMPB  #N+C,R2      ;CHECK CC'S
006064 001401                BEQ    ,+4
006066 000000                HLT
006070 005216                INC    (KSP)        ;ERROR! INCORRECT CC'S
006072 001401                BEQ    ,+4           ;CHECK RESULT
006074 000000                HLT
006076 104000                SCOPE

                                ID#1,PC
006100 012766 177777 177776      MOV    #-1,-2(KSP)
006106 005237 177572                INC    #SR0
006112 006517                HFPFI  (PC)        ;ENABLE SEG
006114 000400                BR     ,+2         ;PUSH NEXT WORD ON THE STACK
006116 005037 177572                CLR    #SR0        ;THIS DATA GOES ONTO THE STACK
006122 023716 006114                CMP    #KK114A,(KSP);DISABLE SEG
006126 001401                BEQ    ,+4         ;CHECK DATA ON THE STACK
    
```

006130 000000 HLT ERROR: INCORRECT DATA ON STACK
 006132 104000 SCOPE

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040000          ITEST MFP: INSTRUCTION KERNEL MODE PREVIOUS SUPERVISOR MODE
017000          VIRT=40000          SUPER VIRTUAL 'I' ADDRESS FOR THESE TESTS
          PHYS=17000          CORRESPONDING SUPER PHYSICAL 'I' ADDRESS

006134 012767 014000 171634 ITEST THAT MFP: CAN GET DATA FROM A GENERAL REGISTER (R10)
006142 012766 177777 177776          NOV #PSW+REG,PSW          KERNEL MODE!!!,PREV SUPER MODE!!
006150 005000          NOV #=-1,-2(KSP)
006152 005237 177572          CLR R10          IPRESET REGISTER
006156 000277          INC #SR0          IENABLE SEG
006160 006500          SCC          IPRESET CC'S
006162 016704 171610          MFP: R10          I=(KSP)*(R10)
006166 005037 177572          NOV PSW,R14          ISAVE CC'S
006172 122704 000005          CLR #SR0          IDISABLE SEG
006176 001401          CMPB #N+C,R14          ICHECK CC'S
006200 000000          BEQ          ,+4
006202 022706 001056          HLT          ERROR: INCORRECT CC'S
006206 001401          CMP #KPTR=2,KSP          ICHECK THAT STACK PTR WAS PUSHED
006210 000000          BEQ          ,+4
006212 005716          HLT          ERROR: INCORRECT STACK PTR
006214 001401          TST (KSP)          ICHECK RESULT
006216 000000          BEQ          ,+4
006220 005067 171592          HLT          ERROR: INCORRECT RESULT
006224 104000          CLR PSW
          SCOPE

          ITEST THAT MFP: CAN GET DATA FROM A SUPERVISOR VIRTUAL 'I' ADDRESS
          IDM=1
006226 012767 010000 171542          NOV #KH+PSW,PSW          KERNEL MODE!!!,PREV SUPER MODE!!
006234 005066 177776          CLR          =2(KSP)
006240 012702 040000          NOV #VIRT,R2          IR2=VIRTUAL ADDRESS
006244 012737 177777 017000          NOV #=-1,#PHYS          IPRESET PHYSICAL ADDRESS
006252 005237 177572          INC #SR0          IENABLE SEG
006256 000277          SCC          IPRESET CC'S
006260 006512          MFP: (R2)          I=(KSP)*(R2)
006262 016703 171510          NOV PSW,R3          ISAVE CC'S
006266 005037 177572          CLR #SR0          IDISABLE SEG
006272 122703 000011          CMPB #N+C,R3          ICHECK CC'S
006276 001401          BEQ          ,+4
006300 000000          HLT          ERROR: INCORRECT CC'S
006302 022706 001056          CMP #KPTR=2,KSP          ICHECK THAT STACK WAS PUSHED
006306 001401          BEQ          ,+4
006310 000000          HLT          ERROR: INCORRECT STACK PTR
006312 005216          INC (KSP)          ICHECK RESULT
006314 001401          BEQ          ,+4
006316 000000          HLT          ERROR: INCORRECT RESULT
006320 104000          SCOPE

          IDM=2
006322 012767 014000 171446          NOV #PSW+REG,PSW          KERNEL MODE!!!,PREV SUPER MODE!!
006330 012766 177777 177776          NOV #=-1,-2(KSP)
006336 012702 040000          NOV #VIRT,R12          IR12=VIRTUAL ADDRESS
006342 005037 017000          CLR #PHYS          IPRESET PHYSICAL ADDRESS
    
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006346 005237 177572          INC      #0SR0          IENABLE SEG
006352 006522          MFP1    (R12)+        I=(KSP)+VIRT
006354 005037 177572      KS12:  CLR      #0SR0          IDISABLE SEG
006360 005716          TST     (KSP)         ICHECK RESULT
006362 001401          BEQ     ,+4
006364 000000          HLT     #VIRT+2,R12   IERROR! INCORRECT RESULT ON STACK
006366 022702 040002          CMP     #VIRT+2,R12   ICHECK AUTO INCREMENT
006372 001401          BEQ     ,+4
006374 000000          HLT     #ERROR! AUTO INCREMENT FAILED
006376 005067 171374          CLR     PSW
006402 104000          SCOPE

IDM#3
006404 012767 010000 171364      MOV     #KM+PSM,PSW   IKERNEL MODE!!!,PREV SUPER MODE!!
006412 005066 177776          CLR     =2(KSP)
006416 012702 001004          MOV     #TEMP,R2     ILOAD INDIRECT ADDRESS
006422 012737 040002 001004      MOV     #VIRT+2,#TEMP ILOAD ADDRESS
006430 012737 177777          MOV     #-1,#PHYS+2  IPRESET DATA
006436 005237 177572          INC     #0SR0        IENABLE SEG
006442 005037 177572      KS13:  MFP1    (R2)+        I=(KSP)+VIRT+2
006444 005037          CLR     #0SR0        IDISABLE SEG
006450 005216          INC     (KSP)        ICHECK RESULT
006452 001401          BEQ     ,+4
006454 000000          HLT     IERROR! INCORRECT RESULT
006456 104000          SCOPE

IDM#4
006460 012767 010000 171310      MOV     #KM+PSM,PSW   IKERNEL MODE!!!,PREV SUPER MODE!!
006466 012706 177777 177776      MOV     #1,-2(KSP)
006474 012704 040002          MOV     #VIRT+2,R4   IR4=VIRTUAL ADDRESS+2
006500 005037 017000          CLR     #0PHYS      IPRESET PHYSICAL ADDRESS DATA
006504 005237 177572          INC     #0SR0        IENABLE SEG
006510 006544          MFP1    =(R4)         I=(KSP)+VIRT
006512 005037 177572      KS14:  CLR     #0SR0        IDISABLE SEG
006516 022704 040000          CMP     #VIRT,R4     ICHECK AUTO-DECREMENT
006522 001401          BEQ     ,+4
006524 000000          HLT     IERROR! AUTO-DECREMENT FAILED
006526 005716          TST     (KSP)        ICHECK RESULT
006530 001401          BEQ     ,+4
006532 000000          HLT     IERROR! INCORRECT RESULT
006534 104000          SCOPE

IDM#5
006536 012767 014000 171232      MOV     #PSM+REG,PSW  IKERNEL MODE!!!,PREV SUPER MODE!!
006544 005066 177776          CLR     =2(KSP)
006550 012700 001006          MOV     #TEMP+2,R10  IR10=INDIRECT ADDRESS
006554 012737 040004 001004      MOV     #VIRT+4,#TEMP ILOAD ADDRESS
006562 012737 177777          MOV     #-1,#PHYS+4  IPRESET PHYSICAL ADDRESS DATA
006570 005237 177572          INC     #0SR0        IENABLE SEG
006574 006590          MFP1    =(R10)       I=(KSP)+VIRT+4
006576 005037 177572      KS15:  CLR     #0SR0        IDISABLE SEG
006602 005216          INC     (KSP)        ICHECK RESULT
006604 001401          BEQ     ,+4
006606 000000          HLT
    
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006610 005067 171162          CLR     PSW
006614 104000          SCOPE

IDM#6
006616 012767 014000 171152      MOV     #PSM+REG,PSW  IKERNEL MODE!!!,PREV SUPER MODE!!
006624 012706 177777 177776      MOV     #1,-2(KSP)
006632 012702 000002          MOV     #2,R12       ILOAD INDEX REGISTER
006636 005037 017002          CLR     #0PHYS+2    IPRESET PHYSICAL ADDRESS DATA
006642 005237 177572          INC     #0SR0        IENABLE SEG
006646 006562 040000      KS16:  MFP1    VIRT(R12)    I=(KSP)+VIRT-2
006652 005037 177572          CLR     #0SR0        IDISABLE SEG
006656 022706 001056          CMP     #KPTR-2,KSP  ICHECK STACK PTR
006662 001401          BEQ     ,+4
006664 000000          HLT     IERROR! INCORRECT STACK PTR
006666 005716          TST     (KSP)        ICHECK RESULT
006670 001401          BEQ     ,+4
006672 000000          HLT     IERROR! INCORRECT RESULT
006674 005067 171076          CLR     PSW
006700 104000          SCOPE

IDM#7
006702 012767 010000 171066      MOV     #KM+PSM,PSW   IKERNEL MODE!!!,PREV SUPER MODE!!
006710 005066 177776          CLR     =2(KSP)
006714 012702 177774          MOV     #-4,R2       ILOAD INDEX REGISTER
006720 012737 040000 001004      MOV     #VIRT,#TEMP  ILOAD ADDRESS
006726 012737 177777 017000      MOV     #-1,#PHYS    ICLEAR PHYSICAL ADDRESS DATA
006734 005237 177572          INC     #0SR0        IENABLE SEG

006740 006572 001010      KS17:  MFP1    #TEMP+4(R2)  I=(KSP)+VIRT
006744 005037 177572          CLR     #0SR0        IDISABLE SEG
006750 005216          INC     (KSP)        ICHECK RESULT
006752 001401          BEQ     ,+4
006754 000000          HLT     IERROR! INCORRECT RESULT
006756 104000          SCOPE

ITEST THAT MFP1 OPERATES PROPERLY US PC IN DESTINATION
IDM#8,PC
006760 012767 010000 171010      MOV     #KM+PSM,PSW   IKERNEL MODE!!!,PREV SUPER MODE!!
006766 005066 177776          CLR     =2(KSP)
006772 005237 177572          INC     #0SR0        IENABLE SEG
006774 000277          SCC
007000 006507          MFP1    PC           I=(KSP)+PC
007002 010702 170770          MOV     PSW,R2       ISAVE CC'S
007006 005037 177572          CLR     #0SR0        IDISABLE SEG
007012 122702 000001          CMPB   #C,R2        ICHECK CC'S
007016 001401          BEQ     ,+4
007022 000000          HLT
007024 022706 001056          CMP     #KPTR-2,KSP  ICHECK STACK PTR
007026 001401          BEQ     ,+4
007030 000000          HLT     IERROR! STACK NOT PUSHED
007032 022716 007002          CMP     #KSI10+2,(KSP) ICHECK THAT PC WAS PUSHED ON THE STACK
007036 001401          BEQ     ,+4
007040 000000          HLT     IERROR! PC NOT PUSHED ON THE STACK
007042 104000          SCOPE
    
```

IDM=3,PC
 007044 012767 014000 170724 MOV #PSH+REG,PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
 007052 005066 177776 CLR -2(KSP)
 007056 012737 177777 017000 MOV #=1,0#PHYS
 007064 005237 177572 INC #SR0 ;ENABLE SEG
 007070 006537 040000 KS111: MFPI #VIRT ;=(KSP)+VIRT
 007074 005037 177572 CLR #SR0 ;DISABLE SEG
 007100 005216 INC (KSP) ;CHECK RESULT
 007102 001401 BEQ ,+4
 007104 000000 HLT ;ERROR! INCORRECT RESULT
 007106 104000 SCOPE

IDM=6,PC
 007110 012767 010340 170660 MOV #PSH+PTY7,PSW ;KERNEL MODE!!!, PREV SUPER MODE!!
 007116 012766 177777 177776 MOV #=-1,-2(KSP)
 007124 005037 017000 CLR #PHYS ;PRESET PHYSICAL ADDRESS DATA
 007130 005237 177572 INC #SR0 ;ENABLE SEG
 007134 006547 030640 KS112: MFPI VIRT ;=(KSP)+VIRT
 007140 005037 177572 CLR #SR0 ;DISABLE SEG
 007144 005716 TST (KSP) ;CHECK RESULT
 007146 001401 BEQ ,+4
 007150 000000 HLT ;ERROR! INCORRECT RESULT
 007152 104000 SCOPE

IDM=7,PC
 007154 012767 010000 170614 MOV #KM+PSH,PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
 007162 005066 177776 CLR -2(KSP)
 007166 012737 040004 001004 MOV #VIRT+4,0#TEMP ;LOAD ADDRESS
 007174 012737 177777 017000 MOV #=1,0#PHYS+4 ;PRESET DATA
 007202 005237 177572 INC #SR0 ;ENABLE SEG
 007206 000277 SCC
 007210 006577 171570 KS113: MFPI #TEMP ;=(KSP)+VIRT+4
 007214 016702 170556 MOV PSW,R2 ;SAVE CC'S
 007220 005037 177572 CLR #SR0 ;DISABLE SEG
 007224 122702 000011 CHPB #N+C,R2 ;CHECK CC'S
 007230 001401 BEQ ,+4
 007232 000000 HLT ;ERROR! INCORRECT CC'S
 007234 005216 INC (KSP) ;CHECK RESULT
 007236 001401 BEQ ,+4
 007240 000000 HLT ;ERROR! INCORRECT RESULT ON STACK
 007242 104000 SCOPE

007244 012767 010000 170524 MOV #KM+PSH,PSW ;KERNEL MODE!!!,PREV SUPER MODE!!
 007252 012716 040000 MOV #VIRT,(KSP)
 007256 005037 017000 CLR #PHYS
 007262 005237 177572 INC #SR0 ;ENABLE SEG
 007266 006536 KS114: MFPI #=(KSP)+ ;=(KSP)+VIRT
 007270 005037 177572 CLR #SR0 ;DISABLE SEG
 007274 005737 001060 TST #KPTR ;CHECK DATA ON THE STACK
 007300 001401 BEQ ,+4
 007302 000000 HLT ;ERROR! INCORRECT DATA ON THE STACK

007304 104000 SCOPE
 ;TEST MFPI INSTRUCTION KERNEL MODE PREVIOUS USER MODE
 120000 VIRT=120000 ;USER VIRTUAL 'I' ADDRESS FOR THESE TESTS
 017200 PHYS=17200 ;CORRESPONDING USER PHYSICAL 'I' ADDRESS

;TEST THAT MFPI CAN GET DATA FROM A GENERAL REGISTER (R10).
 007306 012767 034000 170462 MOV #PUN+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
 007314 012766 177777 177776 MOV #=-1,-2(KSP)
 007322 005000 CLR R10 ;PRESET REGISTER
 007324 005237 177572 INC #SR0 ;ENABLE SEG
 007330 000277 SCC ;PRESET CC'S
 007332 006500 KS10: MFPI R10 ;=(KSP)+(R10)
 007334 016704 170436 MOV PSW,R14 ;SAVE CC'S
 007340 005037 177572 CLR #SR0 ;DISABLE SEG
 007344 122704 000005 CHPB #E+C,R14 ;CHECK CC'S
 007350 001401 BEQ ,+4
 007352 000000 HLT ;ERROR! INCORRECT CC'S
 007354 022706 001056 CMP #KPTR=2,KSP ;CHECK THAT STACK PTR WAS PUSHED
 007360 001401 BEQ ,+4
 007362 000000 HLT ;ERROR! INCORRECT STACK PTR
 007364 005716 TST (KSP) ;CHECK RESULT
 007366 001401 BEQ ,+4
 007370 000000 HLT ;ERROR! INCORRECT RESULT
 007372 005067 170400 CLR PSW
 007376 104000 SCOPE

;TEST THAT MFPI CAN GET DATA FROM A KERNEL VIRTUAL 'I' ADDRESS
 IDM=1
 007400 012747 030000 170370 MOV #KM+PUN,PSW ;KERNEL MODE!!!,PREV USER MODE!!
 007406 005066 177776 CLR -2(KSP)
 007412 012702 120000 MOV #VIRT,R2 ;R2=VIRTUAL ADDRESS
 007416 012737 177777 017200 MOV #=1,0#PHYS ;PRESET PHYSICAL ADDRESS
 007424 005237 177572 INC #SR0 ;ENABLE SEG
 007430 000277 SCC ;PRESET CC'S
 007432 006512 KS11: MFPI (R2) ;=(KSP)+(R2)
 007434 016703 170336 MOV PSW,R3 ;SAVE CC'S
 007440 005037 177572 CLR #SR0 ;DISABLE SEG
 007444 122703 000011 CHPB #N+C,R3 ;CHECK CC'S
 007450 001401 BEQ ,+4
 007452 000000 HLT ;ERROR! INCORRECT CC'S
 007454 022706 001056 CMP #KPTR=2,KSP ;CHECK THAT STACK WAS PUSHED
 007460 001401 BEQ ,+4
 007462 000000 HLT ;ERROR! INCORRECT STACK PTR
 007464 005216 INC (KSP) ;CHECK RESULT
 007466 001401 BEQ ,+4
 007470 000000 HLT ;ERROR! INCORRECT RESULT
 007472 104000 SCOPE

IDM=2
 007474 012767 034000 170274 MOV #PUN+REG,PSW ;KERNEL MODE!!!,PREV USER MODE!!
 007502 012766 177777 177776 MOV #=-1,-2(KSP)
 007510 012702 120000 MOV #VIRT,R12 ;R12=VIRTUAL ADDRESS

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007514 005037 017200 CLR #PHYS IPRESET PHYSICAL ADDRESS
007520 005237 177572 INC #SR0 IENABLE SEG
007524 006522 HFFI (R12)+ I=(KSP)+VIRT
007526 005037 177572 CLR #SR0 IDISABLE SEG
007532 005716 TST (KSP) ICHECK RESULT
007534 001401 BEQ ,+4
007536 000000 HLT IERROR! INCORRECT RESULT ON STACK
007540 022702 120002 CMP #VIRT+2,R12 ICHECK AUTO INCREMENT
007544 001401 BEQ ,+4
007546 000000 HLT IERROR! AUTO INCREMENT FAILED
007550 005067 170222 CLR PSW
007554 104000 SCOPE

IDM#3
007556 012767 030000 170212 MOV #KH+PUN,PSW IKERNEL MODE!!!,PREV USER MODE!!
007564 005066 177776 CLR =2(KSP)
007570 012702 001004 MOV #TEMP,R2 ILOAD INDIRECT ADDRESS
007574 012737 120002 001004 MOV #VIRT+2,#TEMP ILOAD ADDRESS
007602 012737 177777 017202 MOV #=1,#PHYS=2 IPRESET DATA
007610 005237 177572 INC #SR0 IENABLE SEG
007614 006532 HFFI @-(R2)+ I=(KSP)+VIRT+2
007616 005037 177572 CLR #SR0 IDISABLE SEG
007622 005216 INC (KSP) ICHECK RESULT
007624 001401 BEQ ,+4
007626 000000 HLT IERROR! INCORRECT RESULT
007630 104000 SCOPE

IDM#4
007632 012767 030000 170136 MOV #KH+PUN,PSW IKERNEL MODE!!!,PREV USER MODE!!
007640 012766 177777 177776 MOV #=-1,-2(KSP)
007646 012704 120002 MOV #VIRT+2,R4 IR4=VIRTUAL ADDRESS=2
007652 005037 017200 CLR #PHYS IPRESET PHYSICAL ADDRESS DATA
007656 005237 177572 INC #SR0 IENABLE SEG
007662 006544 HFFI =(R4) I=(KSP)+VIRT
007664 005037 177572 CLR #SR0 IDISABLE SEG
007670 022704 120000 CMP #VIRT,R4 ICHECK AUTO-DECREMENT
007674 001401 BEQ ,+4
007676 000000 HLT IERROR! AUTO-DECREMENT FAILED
007700 005716 TST (KSP) ICHECK RESULT
007702 001401 BEQ ,+4
007704 000000 HLT IERROR! INCORRECT RESULT
007706 104000 SCOPE

IDM#5
007710 012767 034000 170000 MOV #PUN+REG,PSW IKERNEL MODE!!!,PREV USER MODE!!
007716 005066 177776 CLR =2(KSP)
007722 012700 001006 MOV #TEMP+2,R10 IR10=INDIRECT ADDRESS
007726 012737 120004 001004 MOV #VIRT+4,#TEMP ILOAD ADDRESS
007734 012737 177777 017204 MOV #=1,#PHYS=4 IPRESET PHYSICAL ADDRESS DATA
007742 005237 177572 INC #SR0 IENABLE SEG
007746 006550 HFFI @-(R10) I=(KSP)+VIRT+4
007750 005037 177572 CLR #SR0 IDISABLE SEG
007754 005216 INC (KSP) ICHECK RESULT
007756 001401 BEQ ,+4
    
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007760 000000 HLT PSW
007762 005067 170010 CLR PSW
007766 104000 SCOPE

IDM#6
007770 012767 034000 170000 MOV #PUN+REG,PSW IKERNEL MODE!!!,PREV USER MODE!!
007776 012766 177777 177776 MOV #=-1,-2(KSP)
010004 012702 000002 MOV #2,R12 ILOAD INDEX REGISTER
010010 005037 017202 CLR #PHYS=2 IPRESET PHYSICAL ADDRESS DATA
010014 005237 177572 INC #SR0 IENABLE SEG
010020 006542 120000 HFFI VIRT(R12) I=(KSP)+VIRT-2
010024 005037 177572 CLR #SR0 IDISABLE SEG
010030 022706 001056 CMP #KPTR=2,KSP ICHECK STACK PTR
010034 001401 BEQ ,+4
010036 000000 HLT IERROR! INCORRECT STACK PTR
010040 005716 TST (KSP) ICHECK RESULT
010042 001401 BEQ ,+4
010044 000000 HLT IERROR! INCORRECT RESULT
010046 005067 167724 CLR PSW
010052 104000 SCOPE

IDM#7
010054 012767 030000 167714 MOV #KH+PUN,PSW IKERNEL MODE!!!,PREV USER MODE!!
010062 005066 177776 CLR =2(KSP)
010066 012702 177774 MOV #=4,R2 ILOAD INDEX REGISTER
010072 012737 120000 001004 MOV #VIRT,#TEMP ILOAD ADDRESS
010100 012737 177777 017200 MOV #=1,#PHYS ICLEAR PHYSICAL ADDRESS DATA
010106 005237 177572 INC #SR0 IENABLE SEG
010112 006572 001010 HFFI #TEMP+4(R2) I=(KSP)+VIRT
010116 005037 177572 CLR #SR0 IDISABLE SEG
010122 005216 INC (KSP) ICHECK RESULT
010124 001401 BEQ ,+4
010126 000000 HLT IERROR! INCORRECT RESULT
010130 104000 SCOPE

ITEST THAT HFFI OPERATES PROPERLY US PC IN DESTINATION
IDM#8,PC
010132 012767 030000 167636 MOV #KH+PUN,PSW IKERNEL MODE!!!,PREV USER MODE!!
010140 005066 177776 CLR =2(KSP)
010144 005237 177572 INC #SR0 IENABLE SEG
010150 000277 SCC
010152 006507 HFFI PC I=(KSP)+PC
010154 010702 167616 MOV PSW,R2 ISAVE CC'S
010160 005037 177572 CLR #SR0 IDISABLE SEG
010164 122702 000001 CMPB #C,R2 ICHECK CC'S
010170 001401 BEQ ,+4
010172 000000 HLT
010174 022706 001056 CMP #KPTR=2,KSP ICHECK STACK PTR
010200 001401 BEQ ,+4
010202 000000 HLT IERROR! STACK NOT PUSHED
010204 022716 010154 CMP #KUI10=2,(KSP) ICHECK THAT PC WAS PUSHED ON THE STACK
010210 001401 BEQ ,+4
010212 000000 HLT IERROR! PC NOT PUSHED ON THE STACK
010214 104000 SCOPE
    
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IDM=3,PC
010216 012767 034000 167592      MOV    #PUM+REG,PSW    !KERNEL MODE!!!,PREV USER MODE!!
010224 005066 177776          CLR    =2(KSP)
010230 012737 177777 017200      MOV    #=1,0#PHYS
010236 005237 177572          INC    #SR0
010242 005037 120000      KUI11 HFP!    #VIRT    !=(KSP)+VIRT
010246 005037 177572          CLR    #SR0    !DISABLE SEG
010252 005216          INC    (KSP)    !CHECK RESULT
010254 001401          BEQ    ,+4
010256 000000          HLT
010260 104000          SCOPE    !ERROR! INCORRECT RESULT

IDM=6,PC
010262 012767 030340 167506      MOV    #PUM+PRTY7,PSW !KERNEL MODE!!!,PREV USER MODE!!
010270 012766 177777 177776      MOV    #=-1,-2(KSP)
010276 005037 017200      MOV    #0#PHYS    !PRESET PHYSICAL ADDRESS DATA
010302 005237 177572          INC    #SR0    !ENABLE SEG
010306 005037 107466      KUI12 HFP!    VIRT    !=(KSP)+VIRT
010312 005037 177572          CLR    #SR0    !DISABLE SEG
010316 005716          TST    (KSP)    !CHECK RESULT
010320 001401          BEQ    ,+4
010322 000000          HLT
010324 104000          SCOPE    !ERROR! INCORRECT RESULT

IDM=7,PC
010326 012767 030000 167442      MOV    #KM+PUM,PSW    !KERNEL MODE!!!,PREV USER MODE!!
010334 005066 177776          CLR    =2(KSP)
010340 012737 120000 001004      MOV    #VIRT+4,0#TEMP !LOAD ADDRESS
010346 012737 177777 017204      MOV    #=-1,0#PHYS=4 !PRESET DATA
010354 005237 177572          INC    #SR0    !ENABLE SEG
010360 000277          SCC
010362 006577 170416      KUI13 HFP!    #TEMP    !=(KSP)+VIRT+4
010366 016702 167404      MOV    PSW,R2    !SAVE CC'S
010372 005037 177572          CLR    #SR0    !DISABLE SEG
010376 122702 000011      CMPB  #N+C,R2    !CHECK CC'S
010402 001401          BEQ    ,+4
010404 000000          HLT    !ERROR! INCORRECT CC'S
010406 005216          INC    (KSP)    !CHECK RESULT
010410 001401          BEQ    ,+4
010412 000000          HLT    !ERROR! INCORRECT RESULT ON STACK
010414 104000          SCOPE

010416 012767 030000 167392      MOV    #KM+PUM,PSW    !KERNEL MODE!!!,PREV USER MODE!!
010424 012716 120000      MOV    #VIRT,(KSP)
010430 005037 017200      CLR    #0#PHYS
010434 005237 177572          INC    #SR0
010440 006576 000000      KUI14 HFP!    #=(KSP)    !=(KSP)+VIRT
010444 005037 177572          CLR    #SR0    !DISABLE SEG
010450 005737 001056      TST    #0#PTR=2    !CHECK DATA ON THE STACK
010454 001401          BEQ    ,+4
010456 000000          HLT    !ERROR! INCORRECT DATA ON THE STACK
010460 104000          SCOPE
    
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!BEGIN TESTING IN SUPERVISORY MODE
!NOTE! ALL HLT (HALT) INSTRUCTIONS WILL TRAP TO LOC 4. THE PROGRAM WILL
!ALLOW THE TRAP, ADJUST THE PC AND RETURN TO THE HLT IN KERNEL MODE. THE
!SUPERVISORY STACK POINTER IS NOT AFFECTED BY THIS TRAP. THE SUPERVISORY
!STACK POINTER IS AT PHYSICAL 0700

!START TESTS IN SUPERVISORY MODE
!LOAD SUPERVISORY MEM HGHT REGISTERS AS REQUIRED FOR TESTS.
010462 012737 041416 172200      MOV    #104+250,-400+DHN+RN,0#0!PDR0 !LOAD $!PDR0 RN DWN 104 BLOCKS
010470 012737 004006 172220      MOV    #11+256,-400+UP+RN,0#SDPDR0 !LOAD $DPR0 RN UP 11 BLOCKS
010476 012737 077406 172236      MOV    #200+256,-400+UP+RN,0#SDPDR7 !LOAD $DPR7 RN UP 200 BLOCKS
010504 012767 007600 161564      MOV    #7600,$DPR7 !I/O PAGE

!TEST HFPD INSTRUCTION SUPER MODE PREVIOUS SUPER MODE.
VIRT=20000 !SUPER VIRTUAL 'D' ADDRESS FOR THESE TESTS
PHYS=17100 !CORRESPONDING SUPER PHYSICAL 'D' ADDRESS

010512 012737 000340 177776      MOV    #SM+PSM+PRTY7,0#PSW !SUPER MODE!!!,PREV SUPER MODE!!
010520 005066 177776          CLR    =2(SSP)
010524 012703 177777          MOV    #=-1,R3    !PRESET GENERAL REGISTER
010530 005237 177572          INC    #SR0    !ENABLE SEG
010534 106503          HFPD    R3    !=(SSP)+R3
010536 016702 167234      MOV    PSW,R2    !SAVE CC'S
010542 005037 177572          CLR    #SR0    !DISABLE SEG
010546 122702 000350      CMPB  #PRTY7+N,R2 !CHECK CC'S
010552 001401          BEQ    ,+4
010554 000000          HLT    !ERROR! INCORRECT CC'S AFTER HFPD
010556 022706 000676      CMP    #SPTR=2,$SP !CHECK THAT STACK WAS PUSHED
010562 001401          BEQ    ,+4
010564 000000          HLT    !ERROR! INCORRECT STACK PTR
010566 005216          INC    (KSP)    !CHECK RESULT
010570 001401          BEQ    ,+4
010572 000000          HLT    !ERROR! INCORRECT RESULT
010574 104000          SCOPE

IDM=2
010576 012767 054000 167172      MOV    #SM+PSM+REG,PSW !SUPER MODE!!!,PREV SUPER MODE!!
010604 012766 177777 177776      MOV    #=-1,-2(SSP)
010612 012702 020000      MOV    #VIRT,R12    !R12=VIRTUAL ADDRESS
010616 005037 017100      CLR    #0#PHYS    !PRESET PHYSICAL ADDRESS
010622 005237 177572          INC    #SR0    !ENABLE SEG
010626 106522          HFPD    (R12)+ !=(SSP)+VIRT
010630 005037 177572          CLR    #SR0    !DISABLE SEG
010634 005716          TST    (SSP)    !CHECK RESULT
010636 001401          BEQ    ,+4
010640 000000          HLT    !ERROR! INCORRECT RESULT ON STACK
010642 022702 020002      CMP    #VIRT+2,R12 !CHECK AUTO INCREMENT
010646 001401          BEQ    ,+4
010650 000000          HLT    !ERROR! AUTO INCREMENT FAILED
010652 005067 167120      CLR    PSW
010656 104000          SCOPE

IDM=4
010660 012767 050000 167110      MOV    #SM+PSM,PSW    !SUPER MODE!!!,PREV SUPER MODE!!
    
```

```

010666 012766 177777 177776      MOV      #-1,-2(SSP)
010674 012764 020002              NOV      #VIRT+2,R4      ;R4=VIRTUAL ADDRESS+2
010700 005037 017100              CLR      #PHYS          ;PRESET PHYSICAL ADDRESS DATA
010704 005237 177572              INC      #SR0           ;ENABLE SEG
010710 106544                      HFPD     -(R4)          ;=(SSP)+VIRT
010712 005037 177572              CLR      #SR0           ;DISABLE SEG
010716 022704 020000              CMP      #VIRT,R4      ;CHECK AUTO-DECREMENT
010722 001401                      BEQ      ,+4
010724 000000                      HLT      ;ERROR! AUTO-DECREMENT FAILED
010726 005716                      TST      (SSP)         ;CHECK RESULT
010730 001401                      BEQ      ,+4
010732 000000                      HLT      ;ERROR! INCORRECT RESULT
010734 104000                      SCOPE
    
```

```

010736 012767 054000 167032      IDN#6   MOV      #SM+PSH+REG,PSW ;SUPER MODE!!!,PREV SUPER MODE!!
010744 012766 177777 177776      MOV      #-1,-2(SSP)
010752 012782 000002              NOV      #2,R12        ;LOAD INDEX REGISTER
010756 005037 017102              CLR      #PHYS+2       ;PRESET PHYSICAL ADDRESS DATA
010762 005237 177572              INC      #SR0           ;ENABLE SEG
010766 106562 020000              HFPD     VIRT(R12)     ;=(SSP)+VIRT-2
010772 005037 177572              CLR      #SR0           ;DISABLE SEG
010776 022706 006676              CMP      #SPTR=2,SSP   ;CHECK STACK PTR
010802 001401                      BEQ      ,+4
010804 000000                      HLT      ;ERROR! INCORRECT STACK PTR
010806 005716                      TST      (SSP)         ;CHECK RESULT
010810 001401                      BEQ      ,+4
010812 000000                      HLT      ;ERROR! INCORRECT RESULT
010814 005067 166756              CLR      PSW
010820 104000                      SCOPE
    
```

```

;TEST THAT HFPD OPERATES PROPERLY USING PC IN DESTINATION
IDN#3,PC
011022 012767 054000 166746      IDN#3,PC MOV      #SM+PSH+REG,PSW ;SUPER MODE!!!,PREV SUPER MODE!!
011030 005066 177776              CLR      =2(SSP)
011034 012737 177777 017100      MOV      #-1,#PHYS
011042 005237 177572              INC      #SR0           ;ENABLE SEG
011046 106537 020000              HFPD     #VIRT         ;=(SSP)+VIRT
011052 005037 177572              CLR      #SR0           ;DISABLE SEG
011056 005216                      INC      (SSP)         ;CHECK RESULT
011060 001401                      BEQ      ,+4
011062 000000                      HLT      ;ERROR! INCORRECT RESULT
011064 104000                      SCOPE
    
```

```

IDN#6,PC
011066 012737 050340 177776      IDN#6,PC MOV      #SM+PSH+PTY7,#PSW ;SUPER MODE!!!,PREV SUPER MODE!!
011074 012766 177777 177776      MOV      #-1,-2(SSP)
011102 005037 017100              CLR      #PHYS          ;PRESET PHYSICAL ADDRESS DATA
011106 005237 177572              INC      #SR0           ;ENABLE SEG
011112 106567 006662              HFPD     VIRT          ;=(SSP)+VIRT
011116 005037 177572              CLR      #SR0           ;DISABLE SEG
011122 005716                      TST      (SSP)         ;CHECK RESULT
011124 001401                      BEQ      ,+4
011126 000000                      HLT      ;ERROR! INCORRECT RESULT
    
```

```

011130 104000                      SCOPE

IDN#7,PC
011132 012767 050000 166636      IDN#7,PC MOV      #SM+PSH,PSW    ;SUPER MODE!!!,PREV SUPER MODE!!
011140 005066 177776              CLR      =2(SSP)
011144 012737 020004 017102      MOV      #VIRT+4,#PHYS+2 ;LOAD ADDRESS
011152 012737 177777 017104      MOV      #-1,#PHYS+4   ;PRESET DATA
011160 005237 177572              INC      #SR0           ;ENABLE SEG
011164 000277                      BCC
011166 106577 006610              HFPD     #VIRT+2       ;=(SSP)+VIRT+4
011172 016702 166600              NOV      PSW,R2        ;SAVE CC'S
011176 005037 177572              CLR      #SR0           ;DISABLE SEG
011202 122702 000011              CMPB    #N+C,R2       ;CHECK CC'S
011206 001401                      BEQ      ,+4
011210 000000                      HLT      ;ERROR! INCORRECT CC'S
011212 005216                      INC      (SSP)         ;CHECK RESULT
011214 001401                      BEQ      ,+4
011216 000000                      HLT      ;ERROR! INCORRECT RESULT ON STACK
011220 104000                      SCOPE
    
```

```

    100000
    017300

    ITEST HFPD INSTRUCTION SUPER MODE PREVIOUS USER MODE.
    VIRT=100000      ;USER VIRTUAL '0' ADDRESS FOR THESE TESTS
    PHYS=17300      ;CORRESPONDING USER PHYSICAL ADDRESS

    ITEST THAT HFPD CAN GET DATA FROM A GENERAL REGISTER (R10)
    011222 012767 074000 166546      MOV      #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
    011230 012766 177777 177776      MOV      #-1,-2(SSP)
    011236 005000      CLR      R10              ;PRESET REGISTER
    011240 005237 177572      INC      @#SR0           ;ENABLE SEG
    011244 000277      SCC      ;PRESET CC'S
    011246 106500      SUB#1  HFPD  R10         ;=(SSP)+(R10)
    011250 016704 166522      MOV      PSW,R14         ;SAVE CC'S
    011254 005037 177572      CLR      @#SR0           ;DISABLE SEG
    011260 122704 000005      CHPB    #Z+C,R14        ;CHECK CC'S
    011264 001401      BEQ     ,+4
    011266 000000      HLT     ;ERROR! INCORRECT CC'S
    011270 022706 000676      CHP     #SPTR=2,SSP     ;CHECK THAT STACK PTR WAS PUSHED
    011274 001401      BEQ     ,+4
    011276 000000      HLT     ;ERROR! INCORRECT STACK PTR
    011300 005716      TST     (SSP)           ;CHECK RESULT
    011302 001401      BEQ     ,+4
    011304 000000      HLT     ;ERROR! INCORRECT RESULT
    011306 005067 166464      CLR     PSW
    011312 104000      SCOPE

    ITEST THAT HFPD CAN GET DATA FROM A USER VIRTUAL '0' ADDRESS
    ID#1
    011314 012767 070000 166454      MOV      #SM+PUM,PSW    ;SUPER MODE!!!,PREV USER MODE!!
    011322 005066 177776      CLR     -2(SSP)
    011326 012702 100000      MOV     #VIRT,R2        ;R2=VIRTUAL ADDRESS
    011332 012737 177777 017300      MOV     #-1,@#PHYS      ;PRESET PHYSICAL ADDRESS
    011340 005237 177572      INC     @#SR0           ;ENABLE SEG
    011344 000277      SCC     ;PRESET CC'S
    011346 106512      SUB#1  HFPD  (R2)       ;=(SSP)+(R2)
    011350 016703 166422      MOV     PSW,R3          ;SAVE CC'S
    011354 005037 177572      CLR     @#SR0           ;DISABLE SEG
    011360 122703 000011      CHPB    #N+C,R3        ;CHECK CC'S
    011364 001401      BEQ     ,+4
    011366 000000      HLT     ;ERROR! INCORRECT CC'S
    011370 022706 000676      CHP     #SPTR=2,SSP     ;CHECK THAT STACK WAS PUSHED
    011374 001401      BEQ     ,+4
    011376 000000      HLT     ;ERROR! INCORRECT STACK PTR
    011400 005216      INC     (SSP)           ;CHECK RESULT
    011402 001401      BEQ     ,+4
    011404 000000      HLT     ;ERROR! INCORRECT RESULT
    011406 104000      SCOPE

    ID#3
    011410 012767 070000 166300      MOV      #SM+PUM,PSW    ;SUPER MODE!!!,PREV USER MODE!!
    011416 005066 177776      CLR     -2(SSP)
    011422 012702 001004      MOV     #TEMP,R2        ;LOAD INDIRECT ADDRESS
    011426 012737 100000 001004      MOV     #VIRT+2,@TEMP    ;LOAD ADDRESS
    011434 012737 177777 017302      MOV     #-1,@#PHYS+2    ;PRESET DATA
    011442 005237 177572      INC     @#SR0           ;ENABLE SEG
    
```

```

    011446 106532      SUB#1  HFPD  0(R2)+    ;=(SSP)+VIRT+2
    011450 005037 177572      CLR     @#SR0           ;DISABLE SEG
    011454 005216      INC     (SSP)           ;CHECK RESULT
    011456 001401      BEQ     ,+4
    011460 000000      HLT     ;ERROR! INCORRECT RESULT
    011462 104000      SCOPE

    ID#5
    011464 012767 074000 166304      MOV      #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
    011472 005066 177776      CLR     -2(SSP)
    011476 012700 001006      MOV     #TEMP+2,R10     ;R10=INDIRECT ADDRESS
    011502 012737 100004 001004      MOV     #VIRT+4,@TEMP    ;LOAD ADDRESS
    011510 012737 177777 017304      MOV     #-1,@#PHYS+4    ;PRESET PHYSICAL ADDRESS DATA
    011516 005237 177572      INC     @#SR0           ;ENABLE SEG
    011522 106550      SUB#1  HFPD  0-(R10)   ;=(SSP)+VIRT+4
    011524 005037 177572      CLR     @#SR0           ;DISABLE SEG
    011530 005216      INC     (SSP)           ;CHECK RESULT
    011532 001401      BEQ     ,+4
    011534 000000      HLT     ;ERROR! INCORRECT STACK PTR
    011536 005067 166234      CLR     PSW
    011542 104000      SCOPE

    ID#6
    011544 012767 074000 166224      MOV      #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
    011552 012766 177777 177776      MOV     #-1,-2(SSP)
    011560 012702 000002      MOV     #2,R12          ;LOAD INDEX REGISTER
    011564 005037 017302      CLR     @#PHYS+2       ;PRESET PHYSICAL ADDRESS DATA
    011570 005237 177572      INC     @#SR0           ;ENABLE SEG
    011574 106562      SUB#1  HFPD  VIRT(R12) ;=(SSP)+VIRT-2
    011600 005037 177572      CLR     @#SR0           ;DISABLE SEG
    011604 022706 000676      CHP     #SPTR=2,SSP     ;CHECK STACK PTR
    011610 001401      BEQ     ,+4
    011612 000000      HLT     ;ERROR! INCORRECT STACK PTR
    011614 005716      TST     (SSP)           ;CHECK RESULT
    011616 001401      BEQ     ,+4
    011620 000000      HLT     ;ERROR! INCORRECT RESULT
    011622 005067 166150      CLR     PSW
    011626 104000      SCOPE

    ID#7
    011630 012767 070000 166140      MOV      #SM+PUM,PSW    ;SUPER MODE!!!,PREV USER MODE!!
    011636 005066 177776      CLR     -2(SSP)
    011642 012702 177774      MOV     #4,R2           ;LOAD INDEX REGISTER
    011646 012737 100000 001004      MOV     #VIRT,@TEMP      ;LOAD ADDRESS
    011654 012737 177777 017300      MOV     #-1,@#PHYS      ;CLEAR PHYSICAL ADDRESS DATA
    011662 005237 177572      INC     @#SR0           ;ENABLE SEG
    011666 106572      SUB#1  HFPD  @TEMP+4(R2);=(SSP)+VIRT
    011672 005037 177572      CLR     @#SR0           ;DISABLE SEG
    011676 005216      INC     (SSP)           ;CHECK RESULT
    011700 001401      BEQ     ,+4
    011702 000000      HLT     ;ERROR! INCORRECT RESULT
    011704 104000      SCOPE

    ITEST THAT HFPD OPERATES PROPERLY US PC IN DESTINATION
    
```



```

IDM=0,PC
011706 012767 070000 166062      MOV    #SM+PUM,PSW    ;SUPER MODE!!!,PREV USER MODE!!
011714 009066 177776      CLR    =2(SSP)
011720 009237 177572      INC    #SR0
011724 000277      SCC
011726 100507      SU10:  HFPD    PC        ;=(SSP)*PC
011730 010702 166042      MOV    PSW,R2        ;SAVE CC'S
011734 009037 177572      CLR    #SR0          ;DISABLE SEG
011740 122702 000001      CMPB   #C,R2        ;CHECK CC'S
011744 001401      BEQ    ,+4
011746 000000      HLT
011750 022706 000676      CMP    #SPTR=2,SSP  ;CHECK STACK PTR
011754 001401      BEQ    ,+4
011756 000000      HLT
011760 022716 011730      CMP    #SU10+2,(SSP) ;ERROR! STACK NOT PUSHED
011764 001401      BEQ    ,+4          ;CHECK THAT PS WAS PUSHED ON THE STACK
011766 000000      HLT
011770 104000      SCOPE
    
```

```

IDM=3,PC
011772 012767 074000 165776      MOV    #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
012000 009066 177776      CLR    =2(SSP)
012004 012737 177777 019300      MOV    #=-1,#PHYS
012012 009237 177572      INC    #SR0
012016 100537 100000      SU11:  HFPD    #VIRT    ;=(SSP)+VIRT
012022 009037 177572      CLR    #SR0          ;DISABLE SEG
012026 009216      INC    (SSP)         ;CHECK RESULT
012030 001401      BEQ    ,+4
012032 000000      HLT
012034 104000      SCOPE
    
```

```

IDM=6,PC
012036 012737 070340 177776      MOV    #SM+PUM+PRTY7,#PSW ;SUPER MODE!!!,PREV USER MODE!!
012044 012766 177777 177776      MOV    #=-1,-2(SSP)
012052 009037 017300      CLR    #PHYS
012056 009237 177572      INC    #SR0
012062 100567 069712      SU12:  HFPD    VIRT    ;=(SSP)+VIRT
012066 009037 177572      CLR    #SR0          ;DISABLE SEG
012072 009716      TST   (SSP)         ;CHECK RESULT
012074 001401      BEQ    ,+4
012076 000000      HLT
012100 104000      SCOPE
    
```

```

012102 012767 070000 165666      MOV    #SM+PUM,PSW    ;SUPER MODE!!!,PREV USER MODE!!
012110 012766 177777 177776      MOV    #=-1,-2(SSP)
012116 012726 100000      MOV    #VIRT,(SSP)+
012122 009037 017300      CLR    #PHYS
012126 009237 177572      INC    #SR0
012132 100596      SU14:  HFPD    #=(SSP) ;=(SSP)+VIRT
012134 009037 177572      CLR    #SR0          ;DISABLE SEG
012140 009737 000676      TST   #SPTR=2
012144 001401      BEQ    ,+4          ;CHECK DATA ON THE STACK
012146 000000      HLT
012150 104000      SCOPE
    
```

```

;TEST MFPI INSTRUCTION SUPER MODE PREVIOUS SUPER MODE.
040000      VIRT=40000          ;SUPER VIRTUAL 'I' ADDRESS FOR THESE TESTS
017000      PHYS=17000       ;CORRESPONDING SUPER PHYSICAL 'I' ADDRESS

012152 012767 054000 165616      MOV    #SM+PSM+REG,PSW ;SUPER MODE!!!,PREV SUPER MODE!!
012160 009066 177776      CLR    =2(SSP)
012164 012700 177777      MOV    #=-1,R13
012170 009237 177572      INC    #SR0
012174 009037      SS10:  HFPD    R13    ;=(SSP)+R13
012176 010702 165574      MOV    PSW,R12        ;SAVE CC'S
012202 009037 177572      CLR    #SR0          ;DISABLE SEG
012206 022702 054010      CMP    #SM+PSM+REG+N,R12 ;CHECK STATUS AFTER MFPI
012212 001401      BEQ    ,+4
012214 000000      HLT
012216 022706 000676      CMP    #SPTR=2,SSP  ;ERROR! INCORRECT CC'S AFTER MFPI
012222 001401      BEQ    ,+4          ;CHECK THAT STACK WAS PUSHED
012224 000000      HLT
012226 009216      INC    (KSP)         ;ERROR! INCORRECT STACK PTR
012230 001401      BEQ    ,+4          ;CHECK RESULT
012232 000000      HLT
012234 104000      SCOPE
    
```

```

;TEST THAT MFPI CAN GET DATA FROM A SUPERVISOR VIRTUAL 'I' ADDRESS
IDM=1
012236 012767 050000 165532      MOV    #SM+PSM,PSW    ;SUPER MODE!!!,PREV SUPER MODE!!
012244 009066 177776      CLR    =2(SSP)
012250 012702 040000      MOV    #VIRT,R2        ;R2=VIRTUAL ADDRESS
012254 012737 177777 017000      MOV    #=-1,#PHYS     ;PRESET PHYSICAL ADDRESS
012262 009237 177572      INC    #SR0
012266 000277      SCC
012270 000512      SS11:  HFPD    (R2)    ;=(SSP)+(R2)
012272 010703 165500      MOV    PSW,R3        ;SAVE CC'S
012276 009037 177572      CLR    #SR0          ;DISABLE SEG
012302 122703 000011      CMPB   #N+C,R3
012306 001401      BEQ    ,+4          ;CHECK CC'S
012310 000000      HLT
012312 022706 000676      CMP    #SPTR=2,SSP  ;ERROR! INCORRECT CC'S
012316 001401      BEQ    ,+4          ;CHECK THAT STACK WAS PUSHED
012320 000000      HLT
012322 009216      INC    (SSP)         ;ERROR! INCORRECT STACK PTR
012324 001401      BEQ    ,+4          ;CHECK RESULT
012326 000000      HLT
012330 104000      SCOPE
    
```

```

IDM=3
012332 012767 050000 165436      MOV    #SM+PSM,PSW    ;SUPER MODE!!!,PREV SUPER MODE!!
012340 009066 177776      CLR    =2(SSP)
012344 012702 001004      MOV    #TEMP,R2
012350 012737 040002 001004      MOV    #VIRT+2,#TEMP  ;LOAD INDIRECT ADDRESS
012356 012737 177777 017002      MOV    #=-1,#PHYS+2  ;LOAD ADDRESS
012364 009237 177572      INC    #SR0
012370 000532      SS13:  HFPD    #R2)    ;=(SSP)+VIRT+2
012372 009037 177572      CLR    #SR0          ;DISABLE SEG
012376 009216      INC    (SSP)         ;CHECK RESULT
    
```

```

012400 001401          BEQ      ,+4
012402 000000          HLT
012404 104000          SCOPE

                                IDN#5
012406 012767 054000 165362  MOV     #SM+PSH+REG,PSW  ;SUPER MODE!!!,PREV SUPER MODE!!
012414 005066 177776          CLR     =2(SSP)
012420 012700 001006          MOV     #TEMP+2,R10  ;R10=INDIRECT ADDRESS
012424 012737 040004 001004  MOV     #VIRT+4,#TEMP ;LOAD ADDRESS
012432 012737 177777 017004  MOV     #-1,#PHYS+4  ;PRESET PHYSICAL ADDRESS DATA
012440 005237 177572          INC     #SR0        ;ENABLE SEG
012444 006590          SSI5:  MFP:    0-(R10) ;=(SSP)+VIRT+4
012446 005037 177572          CLR     #SR0        ;DISABLE SEG
012452 005216          INC     (SSP)       ;CHECK RESULT
012454 001401          BEQ     ,+4
012456 000000          HLT
012460 005067 169312          CLR     PSW
012464 104000          SCOPE

                                IDN#7
012466 012767 050000 169302  MOV     #SM+PSH,PSW  ;SUPER MODE!!!,PREV SUPER MODE!!
012474 005066 177776          CLR     =2(SSP)
012500 012702 177774          MOV     #-4,R2      ;LOAD INDEX REGISTER
012504 012737 040000 001004  MOV     #VIRT,#TEMP  ;LOAD ADDRESS
012512 012737 177777 017000  MOV     #-1,#PHYS   ;CLEAR PHYSICAL ADDRESS DATA
012520 005237 177572          INC     #SR0        ;ENABLE SEG
012524 006572 001010          SSI7:  MFP:    #TEMP+4(R2) ;=(SSP)+VIRT
012530 005037 177572          CLR     #SR0        ;DISABLE SEG
012534 005216          INC     (SSP)       ;CHECK RESULT
012536 001401          BEQ     ,+4
012540 000000          HLT
012542 104000          SCOPE

                                ;TEST THAT MFP: OPERATES PROPERLY USING PC IN DESTINATION
                                IDN#8,PC
012544 012767 050000 165224  MOV     #SM+PSH,PSW  ;SUPER MODE!!!,PREV SUPER MODE!!
012552 005066 177776          CLR     =2(SSP)
012556 005237 177572          INC     #SR0        ;ENABLE SEG
012562 000277          SCC
012564 006507          SSI10: MFP:    PC        ;=(SSP)+PC
012566 016702 165204          MOV     PSW,R2      ;SAVE CC'S
012572 005037 177572          CLR     #SR0        ;DISABLE SEG
012576 122702 000001          CNPB  #C,R2        ;CHECK CC'S
012602 001401          BEQ     ,+4
012604 000000          HLT
012606 022706 000676          CHP     #SPTR-2,SSP ;CHECK STACK PTR
012612 001401          BEQ     ,+4
012614 000000          HLT
012616 022716 012566          CHP     #SSI10+2,(SSP) ;CHECK THAT PS WAS PUSHED ON THE STACK
012622 001401          BEQ     ,+4
012624 000000          HLT
012626 104000          SCOPE
    
```

```

                                IDN#6,PC
012630 012737 050340 177776  MOV     #SM+PSH+PRTY7,#PSW ;SUPER MODE!!!,PREV SUPER MODE!!
012636 012766 177777 177776  MOV     #-1,-2(SSP)
012644 005037 017000          CLR     #PHYS      ;PRESET PHYSICAL ADDRESS DATA
012650 005237 177572          INC     #SR0        ;ENABLE SEG
012654 006567 025120          SSI12: MFP:    VIRT     ;=(SSP)+VIRT
012660 005037 177572          CLR     #SR0        ;DISABLE SEG
012664 005716          TST    (SSP)       ;CHECK RESULT
012666 001401          BEQ     ,+4
012670 000000          HLT
012672 104000          SCOPE

                                IDN#7,PC
012674 012767 050000 169074  MOV     #SM+PSH,PSW  ;SUPER MODE!!!,PREV SUPER MODE!!
012702 005066 177776          CLR     =2(SSP)
012706 012737 040004 001004  MOV     #VIRT+4,#TEMP ;LOAD ADDRESS
012714 012737 177777 017004  MOV     #-1,#PHYS+4  ;PRESET DATA
012722 005237 177572          INC     #SR0        ;ENABLE SEG
012726 000277          SCC
012730 006577 166050          SSI13: MFP:    #TEMP     ;=(SSP)+VIRT+4
012734 016702 165036          MOV     PSW,R2      ;SAVE CC'S
012740 005037 177572          CLR     #SR0        ;DISABLE SEG
012744 122702 000011          CNPB  #N+C,R2      ;CHECK CC'S
012750 001401          BEQ     ,+4
012752 000000          HLT
012754 005216          INC     (SSP)       ;ERROR! INCORRECT CC'S
012756 001401          BEQ     ,+4
012760 000000          HLT
012762 104000          SCOPE

                                IDN#8,PC
012764 012767 050000 165004  MOV     #SM+PSH,PSW  ;SUPER MODE!!!,PREV SUPER MODE!!
012772 012766 177777 177776  MOV     #-1,-2(SSP)
013000 005237 177572          INC     #SR0        ;ENABLE SEG
013004 006527          SSI14: MFP:    (PC)+   ;PUSH NEXT WORD ON THE STACK
013006 000000          HLT                ;THIS IS THE DATA, IF PROG HALTS
                                ;HERE THEN AUTO-INC PC FAILED
013010 005716          TST    (SSP)       ;CHECK DATA ON THE STACK
013012 001401          BEQ     ,+4
013014 000000          HLT
013016 005037 177572          CLR     #SR0        ;ERROR! INCORRECT DATA ON THE STACK.
013022 104000          SCOPE
    
```

```

120000          ;TEST MFP1 INSTRUCTION SUPER MODE PREVIOUS USER MODE.
017200          VIRT=120000      ;USER VIRTUAL '!' ADDRESS FOR THESE TESTS
                PHYS=17200      ;CORRESPONDING USER PHYSICAL ADDRESS

;TEST THAT MFP1 CAN GET DATA FROM A GENERAL REGISTER (R10)
;TEST THAT MFP1 CAN GET DATA FROM A USER VIRTUAL ADDRESS
IDM#2
013024 012767 074000 164744      MOV      #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
013032 012766 177777 177776      MOV      #-1,-2(SSP)
013040 012702 120002              MOV      #VIRT,R12      ;R12=VIRTUAL ADDRESS
013044 005037 017200              CLR      #PHYS         ;PRESET PHYSICAL ADDRESS
013050 005237 177572              INC      #SR0          ;ENABLE SEG
013054 006522                      MFP1     (R12)+         ;I=(SSP)+VIRT
013056 005037 177572              CLR      #SR0          ;DISABLE SEG
013062 005716                      TST     (SRP)         ;CHECK RESULT
013064 001401                      BEQ     ,+4
013066 000000                      HLT
013070 022702 120002              CMP     #VIRT+2,R12   ;ERROR! INCORRECT RESULT ON STACK
013074 001401                      BEQ     ,+4           ;CHECK AUTO INCREMENT
013076 000000                      HLT
013100 005067 164672              CLR     PSW           ;ERROR! AUTO INCREMENT FAILED
013104 104000                      SCOPE

IDM#3
013106 012767 070000 164662      MOV      #SM+PUM,PSW   ;SUPER MODE!!!,PREV USER MODE!!
013114 005066 177776              CLR     =2(SSP)
013120 012702 001004              MOV     #TEMP,R2      ;LOAD INDIRECT ADDRESS
013124 012737 120002 001004      MOV     #VIRT+2,#TEMP ;LOAD ADDRESS
013132 012737 177777 017202      MOV     #-1,#PHYS+2  ;PRESET DATA
013140 005237 177572              INC     #SR0          ;ENABLE SEG
013144 006532                      MFP1     @R2)+         ;I=(SSP)+VIRT+2
013146 005037 177572              CLR     #SR0          ;DISABLE SEG
013152 005216                      INC     (SRP)         ;CHECK RESULT
013154 001401                      BEQ     ,+4
013156 000000                      HLT
013160 104000                      SCOPE ;ERROR! INCORRECT RESULT

IDM#4
013162 012767 070000 164686      MOV      #SM+PUM,PSW   ;SUPER MODE!!!,PREV USER MODE!!
013170 012766 177777 177776      MOV      #-1,-2(SSP)
013176 012704 120002              MOV     #VIRT+2,R4    ;R4=VIRTUAL ADDRESS+2
013202 005037 017200              CLR     #PHYS         ;PRESET PHYSICAL ADDRESS DATA
013206 005237 177572              INC     #R4           ;ENABLE SEG
013212 006544                      MFP1     -(R4)         ;I=(SSP)+VIRT
013214 005037 177572              CLR     #SR0          ;DISABLE SEG
013220 022704 120000              CMP     #VIRT,R4     ;CHECK AUTO-DECREMENT
013224 001401                      BEQ     ,+4
013226 000000                      HLT
013230 005716                      TST     (SSP)         ;ERROR! AUTO-DECREMENT FAILED
013232 001401                      BEQ     ,+4           ;CHECK RESULT
013234 000000                      HLT
013236 104000                      SCOPE ;ERROR! INCORRECT RESULT
    
```

```

IDM#5
013240 012767 074000 164530      MOV      #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
013246 005066 177776              CLR     =2(SSP)
013252 012700 001006              MOV     #TEMP+2,R10   ;R10=INDIRECT ADDRESS
013256 012737 120004 001004      MOV     #VIRT+4,#TEMP ;LOAD ADDRESS
013264 012737 177777 017204      MOV     #-1,#PHYS+4  ;PRESET PHYSICAL ADDRESS DATA
013272 005237 177572              INC     #SR0          ;ENABLE SEG
013276 006550                      MFP1     @-(R10)      ;I=(SSP)+VIRT+4
013300 005037 177572              CLR     #SR0          ;DISABLE SEG
013304 005216                      INC     (SRP)         ;CHECK RESULT
013306 001401                      BEQ     ,+4
013310 000000                      HLT
013312 005067 164460              CLR     PSW
013316 104000                      SCOPE

IDM#6
013320 012767 074000 164450      MOV      #SM+PUM+REG,PSW ;SUPER MODE!!!,PREV USER MODE!!
013326 012766 177777 177776      MOV      #-1,-2(SSP)
013334 012702 000002              MOV     #2,R12        ;LOAD INDEX REGISTER
013340 005037 017202              CLR     #PHYS+2      ;PRESET PHYSICAL ADDRESS DATA
013344 005237 177572              INC     #SR0          ;ENABLE SEG
013350 006562 120000              MFP1     VIRT(R12)    ;I=(SSP)+VIRT-2
013354 005037 177572              CLR     #SR0          ;DISABLE SEG
013360 022706 000676              CMP     #SPTR+2,SSP  ;CHECK STACK PTR
013364 001401                      BEQ     ,+4
013366 000000                      HLT
013370 005716                      TST     (SRP)         ;ERROR! INCORRECT STACK PTR
013372 001401                      BEQ     ,+4           ;CHECK RESULT
013374 000000                      HLT
013376 005067 164374              CLR     PSW           ;ERROR! INCORRECT RESULT
013402 104000                      SCOPE

IDM#7
013404 012767 070000 164364      MOV      #SM+PUM,PSW   ;SUPER MODE!!!,PREV USER MODE!!
013412 005066 177776              CLR     =2(SSP)
013416 012702 177774              MOV     #-4,R2        ;LOAD INDEX REGISTER
013422 012737 120000 001004      MOV     #VIRT,#TEMP   ;LOAD ADDRESS
013430 012737 177777 017200      MOV     #-1,#PHYS    ;CLEAR PHYSICAL ADDRESS DATA
013436 005237 177572              INC     #SR0          ;ENABLE SEG
013442 006572 001010              MFP1     @TEMP+4(R2)  ;I=(SSP)+VIRT
013446 005037 177572              CLR     #SR0          ;DISABLE SEG
013452 005216                      INC     (SSP)         ;CHECK RESULT
013454 001401                      BEQ     ,+4
013456 000000                      HLT
013460 104000                      SCOPE ;ERROR! INCORRECT RESULT
    
```

```

;TEST THAT MFP1 OPERATES PROPERLY US PC IN DESTINATION
IDM#8,PC
013462 012767 070000 164366      MOV      #SM+PUM,PSW   ;SUPER MODE!!!,PREV USER MODE!!
013470 005066 177776              CLR     =2(SSP)
013474 005237 177572              INC     #SR0          ;ENABLE SEG
013500 000277                      SCC
013502 005007                      MFP1     PC           ;I=(SSP)+PC
    
```

```

013504 016702 164266          MOV    PSH,R2          ;SAVE CC'S
013510 005037 177572          CLR    #SR0          ;DISABLE SEG
013514 122702 000001          CHPB  #C,R2          ;CHECK CC'S
013520 001401          BEQ    ,+4
013522 000000          HLT
013524 022706 000676          CMP    #SPTR=2,ESP   ;CHECK STACK PTR
013530 001401          BEQ    ,+4
013532 000000          HLT          ;ERROR! STACK NOT PUSHED
013534 022716 013504          CMP    #SUI10=2,(SSP) ;CHECK THAT PC WAS PUSHED ON THE STACK
013540 001401          BEQ    ,+4
013542 000000          HLT          ;ERROR! PC NOT PUSHED ON THE STACK
013544 104000          SCOPE
    
```

```

IDM#3,PC
013546 012767 074000 164222          MOV    #SM+PUN+REG,PSH ;SUPER MODE!!!,PREV USER MODE!!
013554 005066 177776          CLR    =2(SSP)
013560 012737 177777 019200          MOV    #=1,0#PHYS
013566 005237 177572          INC    #SR0          ;ENABLE SEG
013572 006537 120000          SUI11i MFPI          ;=(SSP)+VIRT
013574 005037 177572          CLR    #SR0          ;DISABLE SEG
013602 005216          INC    (SSP)          ;CHECK RESULT
013604 001401          BEQ    ,+4
013606 000000          HLT          ;ERROR! INCORRECT RESULT
013610 104000          SCOPE
    
```

```

IDM#6,PC
013612 012737 070340 177776          MOV    #SM+PUN+PRTY7,0#PSH ;SUPER MODE!!!,PREV USER MODE!!
013620 012766 177777 177776          MOV    #=-1,-2(SSP)
013626 005037 017200          CLR    #PHYS          ;PRESET PHYSICAL ADDRESS DATA
013632 005237 177572          INC    #SR0          ;ENABLE SEG
013636 006567 104136          SUI12i MFPI          ;=(SSP)+VIRT
013642 005037 177572          CLR    #SR0          ;DISABLE SEG
013644 005716          TST    (SSP)          ;CHECK RESULT
013650 001401          BEQ    ,+4
013652 000000          HLT          ;ERROR! INCORRECT RESULT
013654 104000          SCOPE
    
```

```

IDM#7,PC
013656 012767 070000 164112          MOV    #SM+PUN,PSH    ;SUPER MODE!!!,PREV USER MODE!!
013664 005066 177776          CLR    =2(SSP)
013670 012737 120004 001004          MOV    #VIRT+4,0#TEMP ;LOAD ADDRESS
013676 012737 177777 017204          MOV    #=-1,0#PHYS+4 ;PRESET DATA
013704 005237 177572          INC    #SR0          ;ENABLE SEG
013710 000277          SCC
013712 006577 165066          SUI13i MFPI          ;=(SSP)+VIRT+4
013716 016702 164054          MOV    PSH,R2          ;SAVE CC'S
013722 005037 177572          CLR    #SR0          ;DISABLE SEG
013726 122702 000011          CHPB  #N+C,R2          ;CHECK CC'S
013732 001401          BEQ    ,+4
013734 000000          HLT          ;ERROR! INCORRECT CC'S
013736 005216          INC    (SSP)          ;CHECK RESULT
013740 001401          BEQ    ,+4
013742 000000          HLT          ;ERROR! INCORRECT RESULT ON STACK
013744 104000          SCOPE
    
```

```

IDM#2,PC
013746 012767 070000 164022          MOV    #SM+PUN,PSH    ;SUPER MODE!!!,PREV USER MODE!!
013754 012766 177777 177776          MOV    #=-1,-2(SSP)
013762 012737 014004 000250          MOV    #SUI14A,0#MHVEC
013770 012737 040000 000252          MOV    #SM,0#MHVEC+2 ;WILL BE IN SUPER MODE ON A30RT
013776 005237 177572          INC    #SR0          ;ENABLE SEG
014002 006517          SUI14i MFPI          ;PC
014004 000000          HLT          ;ABORTS WHEN NEXT WORD IS PUSHED
014006 042737 000001 177572          SUI14Ai BIC          ;ERROR! FAILED TO ABORT
014014 022737 140140 177572          CHPB  #NRA-PLA+UPC+15+VPO,0#SR0 ;TURN SEG OFF
014022 001401          BEQ    ,+4          ;CHECK ABORT CONDITIONS
014024 000000          HLT          ;ERROR! INCORRECT ABORT CONDITIONS
014026 022737 014002 177576          CMP    #SUI14,0#SR2  ;CHECK PC OF ABORTED INST
014034 001401          BEQ    ,+4
014036 000000          HLT          ;INCORRECT PC STORED IN SR2
014040 005037 177572          CLR    #SR0          ;DISABLE SEG
014044 022706 000674          CMP    #SPTR=4,ESP   ;CHECK STACK PTR
014050 001401          BEQ    ,+4
014052 000000          HLT          ;ERROR! INCORRECT STACK PTR
014054 012737 000520 000250          MOV    #MHERR,0#MHVEC
014062 005037 000252          CLR    #MHVEC+2
014066 104000          SCOPE
    
```

IBEGIN TESTING IN USER MODE
 INOTE! ALL HLT (HALT) INSTRUCTIONS WILL TRAP TO LOC 4. THE PROGRAM WILL
 ALLOW THE TRAP, ADJUST THE PC AND RETURN TO THE HLT IN KERNEL MODE. THE
 USER STACK POINTER IS NOT AFFECTED BY THIS TRAP, THE USER STACK POINTER
 IS AT PHYSICAL 0600.

```

ISETUP USER MEM MGMT REGISTERS FOR THE TEST,
MOV #137*256,-400*DNH*RH,#UJDPDR0 ILOAD UJDPDR0 RH DNH 137 BLOCKS
MOV #14*256,-400*UP*RH,#UDPDR0 ILOAD UDPDR0 RH UP 11 BLOCKS
MOV #200*256,-400*UP*RH,#UDPDR7 ILOAD UDPDR7 RH UP 200 BLOCKS
MOV #7600,UDPAR7
VIRT=100000 USER VIRTUAL 'D' ADDRESS FOR THESE TESTS
PHYS=17300 I CORRESPONDING USER PHYSICAL ADDRESS
    
```

ITEST THAT MFPD CAN GET DATA FROM A USER VIRTUAL 'D' ADDRESS

```

IDM#1
MOV #UM*PUM,PSW IUSER MODE!!!,PREV USER MODE!!
CLR =2(USP)
MOV #VIRT,R2 IR2=VIRTUAL ADDRESS
MOV #-1,#PHYS IPRESET PHYSICAL ADDRESS
INC #SR0 IENABLE SEG
SCC IPRESET CC'S
UUI: MFPD (R2) I=(USP)*R2
MOV PSW,R3 ISAVE CC'S
CLR #SR0 IDISABLE SEG
CMPB #N+C,R3 ICHECK CC'S
BEQ ,+4
HLT IERROR! INCORRECT CC'S
CMP #UPTR=2,USP ICHECK THAT STACK WAS PUSHED
BEQ ,+4
HLT IERROR! INCORRECT STACK PTR
INC (USP) ICHECK RESULT
BEQ ,+4
HLT IERROR! INCORRECT RESULT
SCOPE
    
```

```

IDM#3
MOV #UM*PUM,PSW IUSER MODE!!!,PREV USER MODE!!
CLR =2(USP)
MOV #VIRT,R2 ILOAD INDIRECT ADDRESS
MOV #-1,#PHYS ILOAD ADDRESS
MOV #SR0=2 IPRESET DATA
INC #SR0 IENABLE SEG
UUS: MFPD (R2)* I=(USP)*VIRT
CLR #SR0 IDISABLE SEG
INC (USP) ICHECK RESULT
BEQ ,+4
HLT IERROR! INCORRECT RESULT
SCOPE
    
```

```

IDM#5
MOV #UM*PUM+REG,PSW IUSER MODE!!!,PREV USER MODE!!
CLR =2(USP)
MOV #VIRT+2,R10 IR10=INDIRECT ADDRESS
MOV #VIRT+4,#PHYS ILOAD ADDRESS
MOV #-1,#PHYS+4 IPRESET PHYSICAL ADDRESS DATA
INC #SR0 IENABLE SEG
UUS: MFPD (R10) I=(USP)*VIRT+4
CLR #SR0 IDISABLE SEG
INC (USP) ICHECK RESULT
BEQ ,+4
HLT
CLR PSW
SCOPE
    
```

```

IDM#7
MOV #UM*PUM,PSW IUSER MODE!!!,PREV USER MODE!!
CLR =2(USP)
MOV #4,R2 ILOAD INDEX REGISTER
MOV #VIRT,#PHYS+4 ILOAD ADDRESS
MOV #-1,#PHYS ICLEAR PHYSICAL ADDRESS DATA
INC #SR0 IENABLE SEG
UUI: MFPD (VIRT) I=(USP)*VIRT
CLR #SR0 IDISABLE SEG
INC (USP) ICHECK RESULT
BEQ ,+4
HLT IERROR! INCORRECT RESULT
SCOPE
    
```

ITEST THAT MFPD OPERATES PROPERLY US PC IN DESTINATION

```

IDM#2,PC
MOV #UM*PUM,PSW IUSER MODE!!!,PREV USER MODE!!
CLR =2(USP)
INC #SR0 IENABLE SEG
SCC
UUI: MFPD PC I=(USP)*PC
MOV PSW,R2 ISAVE CC'S
CLR #SR0 IDISABLE SEG
CMPB #C,R2 ICHECK CC'S
BEQ ,+4
HLT
CMP #UPTR=2,USP ICHECK STACK PTR
BEQ ,+4
HLT IERROR! STACK NOT PUSHED
CMP #UUI=2,(USP) ICHECK THAT PS WAS PUSHED ON THE STACK
BEQ ,+4
HLT IERROR! PC NOT PUSHED ON THE STACK
SCOPE
    
```

014512	012767	174000	163256	NOV	#UH+PUM+REG,PSW	USER MODE!!!,PREV USER MODE!!
014520	005066	177776		CLR	=2(USP)	
014524	012737	177777	017300	NOV	#-1,0#PHYS	
014532	005237	177572		INC	0#SR0	ENABLE SEG
014536	105537	100000		MFPD	0#VIRT	=(USP)+VIRT
014542	005037	177572		CLR	0#SR0	DISABLE SEG
014546	005216			INC	(USP)	CHECK RESULT
014550	001401			BEQ	,+4	
014552	000000			HLT		ERROR! INCORRECT RESULT
014554	104000			SCOPE		

IDM=7,PC

014556	012767	170000	163212	NOV	#UH+PUM,PSW	USER MODE!!!,PREV USER MODE!!
014564	005066	177776		CLR	=2(USP)	
014570	012737	100004	017302	NOV	#VIRT+4,0#PHYS+2	LOAD ADDRESS
014576	012737	177777	017304	NOV	#-1,0#PHYS+4	PRESET DATA
014604	005237	177572		INC	0#SR0	ENABLE SEG
014610	000277			SCC		
014612	104577	063164		MFPD	0#VIRT+2	=(USP)+VIRT+4
014616	016702	163154		NOV	PSW,R2	SAVE CC'S
014622	005037	177572		CLR	0#SR0	DISABLE SEG
014626	122702	000011		CHPB	#N+C,R2	CHECK CC'S
014632	001401			BEQ	,+4	
014634	000000			HLT		ERROR! INCORRECT CC'S
014636	005216			INC	(USP)	CHECK RESULT
014640	001401			BEQ	,+4	
014642	000000			HLT		ERROR! INCORRECT RESULT ON STACK
014644	104000			SCOPE		

TEST MFPI INSTRUCTION USER MODE PREVIOUS USER MODE
 NOTE: MFPI IN USER MODE, PREVIOUS USER MODE OPERATES AS A MFPD INSTRUCTION
 VIRT=100000 USER VIRTUAL 'DI' ADDRESS FOR THESE TESTS
 PHYS=17300 CORRESPONDING USER PHYSICAL ADDRESS

014646	012767	174000	163122	NOV	#UH+PUM+REG,PSW	USER MODE!!!,PREV USER MODE!!
014654	005066	177776		CLR	=2(SSP)	
014660	012703	177777		NOV	#-1,R13	PRESET GENERAL REGISTER
014664	005237	177572		INC	0#SR0	ENABLE SEG
014670	005003			MFPD	R13	=(USP)+R13
014672	016702	163100		NOV	PSW,R12	SAVE STATUS AFTER MFPI
014676	005037	177572		CLR	0#SR0	DISABLE SEG
014702	022702	174010		CHP	#UH+PUM+REG+N,R12	CHECK STATUS AFTER MFPI
014706	001401			BEQ	,+4	
014710	000000			HLT		ERROR! INCORRECT STATUS AFTER MFPI
014712	022706	000576		CHP	#UPTR=2,USP	CHECK THAT STACK WAS PUSHED
014716	001401			BEQ	,+4	
014720	000000			HLT		ERROR! INCORRECT STACK PTR
014722	005216			INC	(USP)	CHECK RESULT
014724	001401			BEQ	,+4	
014726	000000			HLT		ERROR! INCORRECT RESULT
014730	104000			SCOPE		

TEST THAT MFPI CAN GET DATA FROM A USER VIRTUAL 'DI' ADDRESS

IDM=2

014732	012767	174000	163036	NOV	#UH+PUM+REG,PSW	USER MODE!!!,PREV USER MODE!!
014740	012766	177777	177776	NOV	#-1,-2(USP)	
014746	012702	100000		NOV	#VIRT,R12	R12=VIRTUAL ADDRESS
014752	005037	017300		CLR	0#PHYS	PRESET PHYSICAL ADDRESS
014756	005237	177572		INC	0#SR0	ENABLE SEG
014762	000522			MFPD	(R12)+	=(USP)+VIRT
014764	005037	177572		CLR	0#SR0	DISABLE SEG
014770	005716			TST	(USP)	CHECK RESULT
014772	001401			BEQ	,+4	
014774	000000			HLT		ERROR! INCORRECT RESULT ON STACK
014776	022702	100002		CHP	#VIRT+2,R12	CHECK AUTO INCREMENT
015002	001401			BEQ	,+4	
015004	000000			HLT		ERROR! AUTO INCREMENT FAILED
015006	005067	162764		CLR	PSW	
015012	104000			SCOPE		

IDM=4

015014	012767	170000	162754	NOV	#UH+PUM,PSW	USER MODE!!!,PREV USER MODE!!
015022	012766	177777	177776	NOV	#-1,-2(USP)	
015030	012704	100002		NOV	#VIRT+2,R4	R4=VIRTUAL ADDRESS+2
015034	005037	017300		CLR	0#PHYS	PRESET PHYSICAL ADDRESS DATA
015040	005237	177572		INC	0#SR0	ENABLE SEG
015044	000544			MFPD	=(R4)	=(USP)+VIRT
015046	005037	177572		CLR	0#SR0	DISABLE SEG
015052	022704	100000		CHP	#VIRT,R4	CHECK AUTO-DECREMENT
015056	001401			BEQ	,+4	
015060	000000			HLT		ERROR! AUTO-DECREMENT FAILED
015062	005716			TST	(USP)	CHECK RESULT

```

015064 001401          BEQ    ,+4
015066 000000          HLT
015070 104000          SCOPE          ;ERROR! INCORRECT RESULT

                                ;DM#6
015072 012767 174000 162676      MOV    #UM+PUM+REG,PSW  ;USER MODE!!!,PREV USER MODE!!
015100 012766 177777 177776      MOV    #-1,-2(USP)
015106 012702 000002          MOV    #2,R12          ;LOAD INDEX REGISTER
015112 005037 017302          CLR    #PHYS#2        ;PRESET PHYSICAL ADDRESS DATA
015116 005237 177572          INC    #SR0          ;ENABLE SEG
015122 006562 100000          UUI6: MFPI  VIRT(R12)  ;=(USP)+VIRT-2
015126 005037 177572          CLR    #SR0          ;DISABLE SEG
015132 022706 000576          CMP    #UPTR=2,USP   ;CHECK STACK PTR
015136 001401          BEQ    ,+4
015140 000000          HLT
015142 005716          TST   (USP)          ;ERROR! INCORRECT STACK PTR
015144 001401          BEQ    ,+4          ;CHECK RESULT
015146 000000          HLT
015150 005067 162622          CLR    PSW          ;ERROR! INCORRECT RESULT
015154 104000          SCOPE

                                ;TEST THAT MFPI OPERATES PROPERLY US PC IN DESTINATION
                                ;DM#3,PC
015156 012767 174000 162612      MOV    #UM+PUM+REG,PSW  ;USER MODE!!!,PREV USER MODE!!
015164 005066 177776          CLR    #2(USP)
015170 012737 177777 017300      MOV    #-1,#PHYS
015176 005237 177572          INC    #SR0          ;ENABLE SEG
015202 006537 100000          UUI11: MFPI  #VIRT   ;=(USP)+VIRT
015206 005037 177572          CLR    #SR0          ;DISABLE SEG
015212 005216          INC    (USP)        ;CHECK RESULT
015214 001401          BEQ    ,+4
015216 000000          HLT
015220 104000          SCOPE          ;ERROR! INCORRECT RESULT

                                ;DM#6,PC
015222 012767 170340 162546      MOV    #UM+PUM+PRTY7,PSW ;USER MODE!!!,PREV USER MODE!!
015230 012766 177777 177776      MOV    #-1,-2(USP)
015236 005037 017300          CLR    #PHYS        ;PRESET PHYSICAL ADDRESS DATA
015242 005237 177572          INC    #SR0          ;ENABLE SEG
015246 006567 062526          UUI12: MFPI  VIRT    ;=(USP)+VIRT
015252 005037 177572          CLR    #SR0          ;DISABLE SEG
015256 005716          TST   (USP)        ;CHECK RESULT
015260 001401          BEQ    ,+4
015262 000000          HLT
015264 104000          SCOPE          ;ERROR! INCORRECT RESULT

                                ;*****IMPORTANT NOTE*****
                                ;NO CODE ALLOWED BETWEEN 16600-17776
015266 005267 163506          END:  INC    ICNT    ;INC PASS COUNT
015272 026727 163502 005000      CMP    ICNT,#5000
015300 001402          BEQ    DONE
015302 000167 163570          JMP    BEGIN        ;RESTART TEST
015306 012767 000007 162252      DONE: MOV    #7,TPB   ;RING BELL
    
```

```

015314 105767 162244          TSTB  TPB          ;WAIT FOR BELL
015320 100375          BPL    ,+4          ;TO RING
015322 013700 000042          MOV    #042,R0     ;RETURN TO MONITOR
015326 001405          BEQ    HERE
015330 000005          RESET
015332 004710          SENDAD: JBR    PC,0R0
015334 000240          NOP
015336 000240          NOP
015340 000240          NOP
015342 000167 163522          HERE: JMP    START   ;RESTART TEST

                                .END
000001
    
```

ABIT = 000200	AVA = 020000	BEGIN = 001076	BIT13 = 020000
BIT14 = 040000	BIT15 = 100000	BIT6 = 000100	BIT8 = 000400
C = 000001	DEC1 = 000370	DEC2 = 000360	DM = 000400
DONE = 015306	DR0 = 000000	DR1 = 000400	DR2 = 001000
DR3 = 001400	DR4 = 002000	DR5 = 002400	DR6 = 003000
DR7 = 003400	DS = 000020	DWN = 000010	ED = 000010
EMTVEC = 000030	END = 015266	ENHM = 000001	ERRVEC = 000004
HERE = 015342	HL7 = 000000	IC = 000200	ICNT = 001000
INC1 = 000010	INC2 = 000020	IOTVEC = 000020	IS = 000000
KDE = 000004	KOPAR = 172360	KOPAR0 = 172360	KOPAR1 = 172362
KOPAR2 = 172364	KOPAR3 = 172366	KOPAR4 = 172370	KOPAR5 = 172372
KOPAR6 = 172374	KOPAR7 = 172376	KOPDR = 172320	KOPDR0 = 172320
KOPDR1 = 172322	KOPDR2 = 172324	KOPDR3 = 172326	KOPDR4 = 172330
KOPDR5 = 172332	KOPDR6 = 172334	KOPDR7 = 172336	KIPAR = 172340
KIPAR0 = 172340	KIPAR1 = 172342	KIPAR2 = 172344	KIPAR3 = 172346
KIPAR4 = 172350	KIPAR5 = 172352	KIPAR6 = 172354	KIPAR7 = 172356
KIPDR = 172300	KIPDR0 = 172300	KIPDR1 = 172302	KIPDR2 = 172304
KIPDR3 = 172306	KIPDR4 = 172310	KIPDR5 = 172312	KIPDR6 = 172314
KIPDR7 = 172316	KKI0 = 005030	KKI0A = 005006	KKI1 = 005122
KKI10 = 005636	KKI11 = 005726	KKI12 = 005772	KKI13 = 006404
KKI14 = 006112	KKI14A = 006114	KKI2 = 005214	KKI3 = 005302
KKI4 = 005346	KKI5 = 005432	KKI6 = 005504	KKI7 = 005574
KK0 = 001352	KK0A = 001330	KK1 = 001444	KK10 = 002156
KK11 = 002246	KK12 = 002312	KK13 = 002364	KK14 = 002436
KK14A = 002442	KK2 = 001536	KK3 = 001624	KK4 = 001670
KK5 = 001752	KK6 = 002024	KK7 = 002114	KM = 000000
KPG = 000000	KPTR = 001060	KS10 = 006160	KS11 = 006260
KS110 = 007000	KS111 = 007070	KS112 = 007134	KS113 = 007210
KS114 = 007266	KS12 = 006352	KS13 = 006442	KS14 = 006510
KS15 = 006574	KS16 = 006646	KS17 = 006740	KSP = %000006
KS0 = 002514	KS1 = 002614	KS10 = 003334	KS11 = 003424
KS12 = 003470	KS13 = 003544	KS14 = 003622	KS2 = 002706
KS3 = 002776	KS4 = 003044	KS5 = 003130	KS6 = 003202
KS7 = 003274	KUI0 = 007332	KUI1 = 007432	KUI10 = 010152
KUI11 = 010242	KUI12 = 010306	KUI13 = 010362	KUI14 = 010440
KUI2 = 007524	KUI3 = 007614	KUI4 = 007662	KUI5 = 007746
KUI6 = 010020	KUI7 = 010112	KU0 = 003664	KU1 = 003764
KU10 = 004502	KU11 = 004572	KU12 = 004636	KU13 = 004712
KU14 = 004778	KU2 = 004056	KU3 = 004146	KU4 = 004214
KU5 = 004276	KU6 = 004150	KU7 = 004442	LIGHTS = 177570
MHERR = 000520	NMK = 001172	MNT = 010000	MNVEC = 000250
N = 000010	NOP = 000240	NRA = 100000	NRC = 000000
NR3 = 000003	NR7 = 000007	OST = 004000	PC = %000007
PHYS = 017300	PIRQ = 177772	PIRVEC = 000240	PIR4 = 010000
PKM = 000000	PLA = 040000	PRTY4 = 000200	PRTY7 = 000340
PSM = 010000	PSW = 177776	PUH = 030000	R00 = 000002
RDOT = 000001	REG = 004000	RW = 000006	RNT = 000004
RMTW = 000005	R0 = %000000	R1 = %000001	R10 = %000000
R11 = %000001	R12 = %000002	R13 = %000003	R14 = %000004
R15 = %000005	R2 = %000002	R3 = %000003	R4 = %000004
R5 = %000005	SCOPE = 004000	SCOPEA = 000440	SCOPEX = 000516
SDE = 000002	SDPAR = 172260	SDPAR0 = 172260	SDPAR1 = 172262
SDPAR2 = 172264	SDPAR3 = 172266	SDPAR4 = 172270	SDPAR5 = 172272
SDPAR6 = 172274	SDPAR7 = 172276	SDPDR = 172220	SDPDR0 = 172220

SDPDR1 = 172222	SDPDR2 = 172224	SDPDR3 = 172226	SDPDR4 = 172230
SDPDR5 = 172232	SDPDR6 = 172234	SDPDR7 = 172236	SEGO = 001134
SMLT = 000400	SMLTA = 000430	SIPAR = 172240	SIPAR0 = 172240
SIPAR1 = 172242	SIPAR2 = 172244	SIPAR3 = 172246	SIPAR4 = 172250
SIPAR5 = 172252	SIPAR6 = 172254	SIPAR7 = 172256	SIPDR = 172200
SIPDR0 = 172200	SIPDR1 = 172202	SIPDR2 = 172204	SIPDR3 = 172206
SIPDR4 = 172210	SIPDR5 = 172212	SIPDR6 = 172214	SIPDR7 = 172216
SLR = 177774	SH = 040000	SP = %000006	SPG = 000040
SPTX = 000700	SR0 = 177572	SR0T = 010002	SR1 = 177574
SR2 = 177576	SR3 = 177516	SSI0 = 012174	SSI1 = 012270
SSI10 = 012564	SSI12 = 012654	SSI13 = 012730	SSI14 = 013004
SSI3 = 012370	SSI5 = 012444	SSI7 = 012524	SSP = %000006
SS0 = 010534	SSI1 = 011046	SSI2 = 011112	SSI3 = 011166
SS2 = 010626	SS4 = 010710	SS6 = 010766	START = 001070
SUI10 = 013502	SUI11 = 013572	SUI12 = 013636	SUI13 = 013712
SUI14 = 014002	SUI14A = 014006	SUI2 = 013054	SUI3 = 013144
SUI4 = 013212	SUI5 = 013276	SUI6 = 013350	SUI7 = 013442
SU0 = 011246	SU1 = 011346	SU10 = 011726	SUI11 = 012016
SU12 = 012062	SU14 = 012132	SU3 = 011446	SU5 = 011522
SU6 = 011574	SU7 = 011666	SWR = 177570	T = 000020
TBITVE = 000014	TE = 001000	TEMP = 001004	TKB = 177562
TKS = 177560	TPB = 177566	TPS = 177544	TPVEC = 000064
TRAPVE = 000034	UBREAK = 177770	UDE = 000001	UDPAR = 177660
UDPAR0 = 177660	UDPAR1 = 177662	UDPAR2 = 177664	UDPAR3 = 177666
UDPAR4 = 177670	UDPAR5 = 177672	UDPAR6 = 177674	UDPAR7 = 177676
UDPDR = 177620	UDPDR0 = 177620	UDPDR1 = 177622	UDPDR2 = 177624
UDPDR3 = 177626	UDPDR4 = 177630	UDPDR5 = 177632	UDPDR6 = 177634
UDPDR7 = 177636	UIPAR = 177640	UIPAR0 = 177640	UIPAR1 = 177642
UIPAR2 = 177644	UIPAR3 = 177646	UIPAR4 = 177650	UIPAR5 = 177652
UIPAR6 = 177654	UIPAR7 = 177656	UIPDR = 177600	UIPDR0 = 177600
UIPDR1 = 177602	UIPDR2 = 177604	UIPDR3 = 177606	UIPDR4 = 177610
UIPDR5 = 177612	UIPDR6 = 177614	UIPDR7 = 177616	UM = 140000
UP = 000000	UPG = 000140	UPTR = 000600	USP = %000006
UU10 = 014670	UU11 = 015202	UU12 = 015246	UU12 = 014762
UU14 = 015044	UU16 = 015122	UU1 = 014152	UU10 = 014446
UU11 = 014536	UU13 = 014612	UU3 = 014252	UU5 = 014326
UU7 = 014406	V = 000002	VIRT = 100000	VPO = 000000
VF1 = 000002	VP2 = 000004	VP3 = 000006	VP4 = 000010
VP5 = 000012	VP6 = 000014	VP7 = 000016	WBIT = 000100
Z = 000004	SENDAD = 015332		