H 5

```
EEEEEEEEEEEEEEE MMM         MMM UUU         UUU LLL                AAAAAAAAA    TTTTTTTTTTTTTTT
EEEEEEEEEEEEEEE MMM         MMM UUU         UUU LLL                AAAAAAAAA    TTTTTTTTTTTTTTT
EEEEEEEEEEEEEEE MMM         MMM UUU         UUU LLL                AAAAAAAAA    TTTTTTTTTTTTTTT
EEE             MMMMMM   MMMMMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMMMMM   MMMMMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMMMMM   MMMMMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMM   MMM   MMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMM   MMM   MMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMM   MMM   MMM UUU         UUU LLL             AAA         AAA       TTT
EEEEEEEEEEEE    MMM         MMM UUU         UUU LLL             AAA         AAA       TTT
EEEEEEEEEEEE    MMM         MMM UUU         UUU LLL             AAA         AAA       TTT
EEEEEEEEEEEE    MMM         MMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMM         MMM UUU         UUU LLL             AAAAAAAAAAAAAAA       TTT
EEE             MMM         MMM UUU         UUU LLL             AAAAAAAAAAAAAAA       TTT
EEE             MMM         MMM UUU         UUU LLL             AAAAAAAAAAAAAAA       TTT
EEE             MMM         MMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMM         MMM UUU         UUU LLL             AAA         AAA       TTT
EEE             MMM         MMM UUU         UUU LLL             AAA         AAA       TTT
EEEEEEEEEEEEEEE MMM         MMM UUUUUUUUUUUUUUU LLLLLLLLLLLLLLL AAA         AAA       TTT
EEEEEEEEEEEEEEE MMM         MMM UUUUUUUUUUUUUUU LLLLLLLLLLLLLLL AAA         AAA       TTT
EEEEEEEEEEEEEEE MMM         MMM UUUUUUUUUUUUUUU LLLLLLLLLLLLLLL AAA         AAA       TTT
```

```
_$2

Sym
---
CMP
DEC
DEC
DEC
DEC

DEC
EXE
EXE
EXE
MMG
MMG
MOV
PRS
SYS
VAX
VAX
VAX
VAX
VAX
VAX
VAX
VAX
VAX
VAX
VAX
VAX
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```

FILEID**VAXEMULAT

```
VV      VV    AAAAAA    XX      XX  EEEEEEEEEE  MM      MM  UU      UU  LL            AAAAAA    TTTTTTTTTT
VV      VV    AAAAAA    XX      XX  EEEEEEEEEE  MM      MM  UU      UU  LL            AAAAAA    TTTTTTTTTT
VV      VV  AA      AA  XX      XX  EE          MMMM  MMMM  UU      UU  LL          AA      AA      TT
VV      VV  AA      AA  XX      XX  EE          MMMM  MMMM  UU      UU  LL          AA      AA      TT
VV      VV  AA      AA    XX  XX    EE          MM  MM  MM  UU      UU  LL          AA      AA      TT
VV      VV  AA      AA    XX  XX    EE          MM  MM  MM  UU      UU  LL          AA      AA      TT
VV      VV  AA      AA      XX      EEEEEEEE    MM      MM  UU      UU  LL          AA      AA      TT
VV      VV  AA      AA      XX      EEEEEEEE    MM      MM  UU      UU  LL          AA      AA      TT
VV      VV  AAAAAAAAAA    XX  XX    EE          MM      MM  UU      UU  LL          AAAAAAAAAA      TT
VV      VV  AAAAAAAAAA    XX  XX    EE          MM      MM  UU      UU  LL          AAAAAAAAAA      TT
  VV  VV    AA      AA  XX      XX  EE          MM      MM  UU      UU  LL          AA      AA      TT        ....
  VV  VV    AA      AA  XX      XX  EE          MM      MM  UU      UU  LL          AA      AA      TT        ....
    VV      AA      AA  XX      XX  EEEEEEEEEE  MM      MM  UUUUUUUUUU  LLLLLLLLLL  AA      AA      TT        ....
    VV      AA      AA  XX      XX  EEEEEEEEEE  MM      MM  UUUUUUUUUU  LLLLLLLLLL  AA      AA      TT        ....


LL            IIIIII      SSSSSSSS
LL            IIIIII      SSSSSSSS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II      SS
LL              II        SSSSSS
LL              II        SSSSSS
LL              II              SS
LL              II              SS
LL              II              SS
LL              II              SS
LLLLLLLLLL    IIIIII    SSSSSSSS
LLLLLLLLLL    IIIIII    SSSSSSSS
```

VAX
V04

Table of contents

```
0000            .NOSHOW CONDITIONALS
0000            .TITLE  VAX$EMULATE - VAX-11 Instruction Emulator
0000            .IDENT  /V04-000/
0000
0000    ;
0000    ;****************************************************************************
0000    ;*                                                                          *
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0000    ;*                                                                          *
0000    ;*                                                                          *
0000    ;****************************************************************************
0000    ;
0000
0000    ;++
0000    ; Facility:
0000    ;
0000    ;       VAX-11 Instruction Emulator
0000    ;
0000    ; Abstract:
0000    ;
0000    ;       This is the main body of the instruction emulator that supports
0000    ;       the instructions that are not a part of the microVAX architecture.
0000    ;       The current design calls for support of the string instructions
0000    ;       (including CRC), the decimal instructions, and EDITPC.
0000    ;
0000    ;       This routine performs the following steps.
0000    ;
0000    ;       o Moves operands from the exception stack to registers in an
0000    ;         instruction-specific manner
0000    ;
0000    ;       o Calls an instruction-specific subroutine to do the actual work
0000    ;
0000    ;       If errors occur along the way, those errors are reflected to the
0000    ;       user as exceptions.
0000    ;
0000    ; Environment:
0000    ;
0000    ;       These routines run at any access mode, at any IPL, and are AST
0000    ;       reentrant. The routine starts execution in the access mode and
0000    ;       at the IPL at which the instruction executed.
0000    ;
```

```
0000    ; Author:
0000    ;
0000    ;       Lawrence J. Kenah
0000    ;
0000    ; Creation Date
0000    ;
0000    ;       17 August 1982
0000    ;
0000    ; Modified by:
0000    ;
0000    ;       V01-011 LJK0041         Lawrence J. Kenah       16-Jul-1984
0000    ;               Clear FPD in saved PSL at VAX$EMULATE_FPD entry so that
0000    ;               next instruction can execute correctly.
0000    ;
0000    ;       V01-010 LJK0031         Lawrence J. Kenah       5-Jul-1984
0000    ;               Set R2 and R4 unconditionally to zero in EDITPC routine
0000    ;               to allow the storage of FPD flags and similar data.
0000    ;
0000    ;       V01-009 LJK0026         Lawrence J. Kenah       19-Mar-1984
0000    ;               Perform final cleanup pass. Eliminate xxx_UNPACK routine
0000    ;               references. Add C-bit optimization to MOVP.
0000    ;
0000    ;       V01-008 LJK0010         Lawrence J. Kenah       8-Nov-1983
0000    ;               Eliminate code in EXIT_EMULATOR path that unconditionally
0000    ;               clears the T-bit and conditionally sets the TP-bit. The
0000    ;               TP-bit is handled by the base hardware.
0000    ;
0000    ;       V01-007 KDM0088         Kathleen D. Morse       20-Oct-1983
0000    ;               Make branches to VAX$REFLECT_TO_VMS into jumps, so that
0000    ;               the bootstrap emulator will link without truncation errors
0000    ;               until that routine is finished.
0000    ;
0000    ;       V01-006 KDM0003         Kathleen D. Morse       18-Apr-1983
0000    ;               Generate abbreviated VAX$EMULATE_FPD for the bootstrap
0000    ;               emulator.
0000    ;
0000    ;       V01-005 LJK0006         Lawrence J. Kenah       16-Mar-1983
0000    ;               Generate case tables with macros. Allow subset emulator
0000    ;               for bootstrap instruction emulation.
0000    ;
0000    ;       V01-004 KDM0002         Kathleen D. Morse       16-Mar-1983
0000    ;               Fix fourth and fifth operand fetches for SUBP6, ADDP6,
0000    ;               MULP and DIVP.
0000    ;
0000    ;       V01-003 KDM0001         Kathleen D. Morse       04-Mar-1983
0000    ;               Longword align the exception handler entry points.
0000    ;
0000    ;       V01-002 LJK0005         Lawrence J. Kenah       15-Nov-1982
0000    ;               Use hardware aids provided by microVAX architecture revision.
0000    ;               Exception is now reported in caller's mode. Operands are parsed
0000    ;               and placed on the exception stack as exception parameters.
0000    ;
0000    ;       V01-001 LJK0002         Lawrence J. Kenah       17-Aug-1982
0000    ;               Original version using kernel mode exception through OPCDEC
0000    ;               exception vector.
0000    ;--
```

```
0000            .SUBTITLE       DECLARATIONS
0000
0000    ; Include files:
0000
0000            $OPDEF                          ; Values for instruction opcodes
0000            $PSLDEF                         ; Define bit fields in PSL
0000
0000            .NOCROSS                        ; No cross reference for these
0000            .ENABLE         SUPPRESSION     ; No symbol table entries either
0000
0000            PACK_DEF                        ; Stack usage when restarting instructions
0000            STACK_DEF                       ; Stack usage for original exception
0000
0000            .DISABLE        SUPPRESSION     ; Turn on symbol table again
0000            .CROSS                          ; Cross reference is OK now
0000
0000    ; Macro definitions
0000
0000            .MACRO  INIT_CASE_TABLE         SIZE,BASE,ERROR_EXIT
0000    BASE:
0000            .REPT   SIZE
0000            .WORD   ERROR_EXIT-BASE
0000            .ENDR
0000            .ENDM   INIT_CASE_TABLE
0000
0000            .MACRO  CASE_TABLE_ENTRY        OPCODE,-
0000                                            ROUTINE,-
0000                                            FPD_ROUTINE,-
0000                                            BOOT_FLAG
0000                    SIGN_EXTEND     OP$_'OPCODE , ...OPCODE
0000                    ...OFFSET = ...OPCODE - OPCODE_BASE
0000                    .IF     NOT_DEFINED     BOOT_SWITCH
0000                            INCLUDE_'OPCODE = 0
0000                            .EXTERNAL       VAX$'OPCODE
0000                            .EXTERNAL       FPD_ROUTINE
0000                            . = CASE_TABLE_BASE + <2 * ...OFFSET>
0000                            .WORD   ROUTINE - CASE_TABLE_BASE
0000                            . = FPD_CASE_TABLE_BASE + <2 * ...OFFSET>
0000                            .WORD   FPD_ROUTINE - FPD_CASE_TABLE_BASE
0000                    .IF_FALSE
0000                            .IF     IDENTICAL       <BOOT_FLAG>,BOOT
0000                            INCLUDE_'OPCODE = 0
0000                            .EXTERNAL       VAX$'OPCODE
0000                            . = CASE_TABLE_BASE + <2 * ...OFFSET>
0000                            .WORD   ROUTINE - CASE_TABLE_BASE
0000                            .ENDC
0000                    .ENDC
0000                    .ENDM   CASE_TABLE_ENTRY
0000
0000    ; External declarations for exception handling
0000
0000            .DISABLE        GLOBAL
0000
0000            .EXTERNAL       VAX$AL_DELTA_PC_TABLE
0000            .EXTERNAL       VAX$REFLECT_TO_VMS
0000
0000            .EXTERNAL       VAX$_OPCDEC, -
```

```
    0000                           VAX$_OPCDEC_FPD
    0000
    0000     ; PSECT Declarations:
    0000
    0000              .DEFAULT     DISPLACEMENT , WORD
    0000
00000000              .PSECT _VAX$CODE PIC, USR, CON, REL, LCL, SHR, EXE, RD, NOWRT, QUAD
    0000
    0000              .NOSHOW      CONDITIONALS
```

```
0000          .SUBTITLE       VAX$EMULATE - Entry Path into Emulator
0000    ;+
0000    ; Functional Description:
0000    ;
0000    ;       There are two different entries into this module. When a reserved
0000    ;       instruction is first encountered, its operands are parsed by the
0000    ;       hardware (or microcode, if you will) and placed on the stack as
0000    ;       exception parameters. The code at address VAX$EMULATE is then entered
0000    ;       through the ^XC8(SCB) exception vector. That routine dispatches to an
0000    ;       instruction-specific routine called VAX$xxxxxx (xxxxxx represents the
0000    ;       name of the reserved instruction) after placing the operands into
0000    ;       registers as required by VAX$xxxxxx.
0000    ;
0000    ;       If an exception occurred during instruction emulation such that a
0000    ;       reserved instruction executed again, this time with FPD set, then a
0000    ;       different exception path is taken. The stack has a different (smaller)
0000    ;       set of parameters for the FPD exception. A different
0000    ;       instruction-specific routine executes to unpack saved intermediate
0000    ;       state before resuming instruction emulation.
0000    ;
0000    ;       The access mode and IPL are preserved across either exception.
0000    ;
0000    ; Input Parameters:
0000    ;
0000    ;       00(SP) - Opcode of reserved instruction
0000    ;       04(SP) - PC of reserved instruction (old PC)
0000    ;       08(SP) - First operand specifier
0000    ;       12(SP) - Second operand specifier
0000    ;       16(SP) - Third operand specifier
0000    ;       20(SP) - Fourth operand specifier
0000    ;       24(SP) - Fifth operand specifier
0000    ;       28(SP) - Sixth operand specifier
0000    ;       32(SP) - Seventh operand specifier (currently unused)
0000    ;       36(SP) - Eight operand specifier (currently unused)
0000    ;       40(SP) - PC of instruction following reserved instruction (new PC)
0000    ;       44(SP) - PSL at time of exception
0000    ;
0000    ; Notes on input parameters:
0000    ;
0000    ;   1.  The information that appears on the stack for each operand depends
0000    ;       on the nature of the operand.
0000    ;
0000    ;       .rx - Operand value
0000    ;       .ax - Operand address
0000    ;       .wx - Operand address (Register destination is stored in one's
0000    ;             complement form. See VAX$CVTPL for details.)
0000    ;
0000    ;   2.  The old PC value is not used unless an exception such as an access
0000    ;       violation occurs and the instruction has to be backed up.
0000    ;
0000    ;   3.  The seventh and eighth operands are not used for any existing VAX-11
0000    ;       instructions. Those slots in the exception stach frame are reserved
0000    ;       for future expansion.
0000    ;
0000    ;   4.  The two PC parameters and the PSL are the only data that needs to
0000    ;       be preserved once the instruction-specific routine is entered.
0000    ;
```

```
                                   0000  ; Output Parameters:
                                   0000  ;
                                   0000  ;         The operands are moved from the stack to general registers in a way
                                   0000  ;         that varies from instruction to instruction. Control is transferred
                                   0000  ;         to a specific routine for each opcode.
                                   0000  ;
                                   0000  ; Notes:
                                   0000  ;
                                   0000  ;         There are several tables in the emulator that use the opcode as an
                                   0000  ;         index. We choose to interpret the opcode as a signed quantity because
                                   0000  ;         this reduces the amount of wasted space in the tables. In either case,
                                   0000  ;         there are 27 useful entries.
                                   0000  ;
                                   0000  ;         Unsigned opcode
                                   0000  ;
                                   0000  ;                 OPCODE_BASE = CVTPS (value of 8)
                                   0000  ;                 OPCODE_MAX = CVTLP (value of F9)
                                   0000  ;
                                   0000  ;                 TABLE_SIZE = 241 decimal bytes
                                   0000  ;
                                   0000  ;         Signed opcode
                                   0000  ;
                                   0000  ;                 OPCODE_BASE = ASHP (value of F8 or -8)
                                   0000  ;                 OPCODE_MAX = SKPC (value of 3B)
                                   0000  ;
                                   0000  ;                 TABLE_SIZE = 67 decimal bytes
                                   0000  ;
                                   0000  ;         The savings of more than 170 entries in each table justifies all
                                   0000  ;         of the machinations that we go through to treat opcodes as signed
                                   0000  ;         quantities.
                                   0000  ;-
                                   0000
                                   0000  ; Because the assembler does not understand sign extension of byte and
                                   0000  ; word quantities, we must accomplish this sign extension with macros. The
                                   0000  ; assignment statements that appear as comments illustrate the sense of the
                                   0000  ; macro invocations that immediately follow.
                                   0000
                                   0000  ;         OPCODE_MAX = OP$_SKPC            ; Largest opcode in this emulator
                                   0000
                                   0000          SIGN_EXTEND     OP$_SKPC , OPCODE_MAX
                                   0000
                                   0000  ; We further restrict the table size and supported operations when we are
                                   0000  ; building the bootstrap subset of the emulator. We only allow certain string
                                   0000  ; instructions to contribute to the emulator.
                                   0000
                                   0000  ;         OPCODE_BASE = OP$_ASHP           ; Smallest (in signed sense) opcode
                                   0000
                                   0000          SIGN_EXTEND     OP$_ASHP , OPCODE_BASE
                                   0000
                        00000044   0000  CASE_TABLE_SIZE = <OPCODE_MAX - OPCODE_BASE> + 1        ; Define table size
                                   0000
                                   0000          .ALIGN  LONG                     ; Alignment for exception vector
                                   0000
                                   0000  VAX$EMULATE::
                                   0000
        43 8F    F8 8F    6E    8F 0000          CASEB   OPCODE(SP),#OPCODE_BASE,#<OPCODE_MAX-OPCODE_BASE>
                                   0006
```

```
                          0006   308             INIT_CASE_TABLE CASE_TABLE_SIZE,CASE_TABLE_BASE,10$
                          008E   309
                          008E   310 ; If we drop through the case dispatcher, then the fault was not caused
                          008E   311 ; by executing one of the instructions supported by this emulator. Such
                          008E   312 ; exceptions will simply be passed through to VMS. (In the bootstrap emulator,
                          008E   313 ; there is no operating system to reflect the exception. We simply HALT.)
                          008E   314
       00000000'8F   DD   008E   315 10$:    PUSHL   #VAX$_OPCDEC                ; Store signal name
                0D   DD   0094   316         PUSHL   #13                         ; Total of 13 longwords in signal array
                          0096   317
             FF67'   31   0096   321         BRW     VAX$REFLECT_TO_VMS          ; Use common exit to VMS
```

```
0099            .SUBTITLE       VAX$EMULATE_FPD - Alternate Entry Path into Emulator
0099    ;+
0099    ; Functional Description:
0099    ;
0099    ;       This routine is entered through the ^XCC(SCB) exception vector when an
0099    ;       instruction that is not a part of the microVAX architecture executes
0099    ;       and the FPD bit is set in the PSL. The software state that was
0099    ;       preserved by each instruction must be restored and instruction
0099    ;       execution resumed. Access mode and IPL are preserved across the
0099    ;       exception occurrence.
0099    ;
0099    ;       Before the various VAX$xxxxxx (or VAX$xxxxxx_RESTART) routines regain
0099    ;       control, this dispatcher must retrieve the delta PC from wherever
0099    ;       it was stored and place the stack in the same state that it is in
0099    ;       when the normal (FPD bit not set) instruction dispatcher passes
0099    ;       control to the various VAX$xxxxxx routines. The pictures below explain
0099    ;       this.
0099    ;
0099    ; Input Parameters:
0099    ;
0099    ;       00(SP) - PC of reserved instruction
0099    ;       04(SP) - PSL at time of exception
0099    ;
0099    ; Output Parameters:
0099    ;
0099    ;       The following picture shows the state of the stack after the dispatcher
0099    ;       has executed its preliminary code but before control is passed back to
0099    ;       instruction-specific  execution. Note that this routine makes the
0099    ;       stack look like it does when a reserved instruction executes and FPD
0099    ;       is not yet set. This is done to make the exception exit code independent
0099    ;       of whether a different exception exception occurred while the emulator
0099    ;       was running.
0099    ;
0099    ;       00(SP) - Return PC (Address of EXIT routine in this module)
0099    ;       04(SP) - Unused placeholder (OPCODE)
0099    ;       08(SP) - PC of reserved instruction (old PC)
0099    ;       12(SP) - Unused placeholder (OPERAND_1)
0099    ;       16(SP) - Unused placeholder (OPERAND_2)
0099    ;       20(SP) - Unused placeholder (OPERAND_3)
0099    ;       24(SP) - Unused placeholder (OPERAND_4)
0099    ;       28(SP) - Unused placeholder (OPERAND_5)
0099    ;       32(SP) - Unused placeholder (OPERAND_6)
0099    ;       36(SP) - Unused placeholder (OPERAND_7)
0099    ;       40(SP) - Unused placeholder (OPERAND_8)
0099    ;       44(SP) - PC of instruction following reserved instruction (new PC)
0099    ;       48(SP) - PSL at time of exception
0099    ;
0099    ;       Before this routine dispatches to opcode-specific code, it calculates
0099    ;       the PC of the next instruction based on the PC of the reserved
0099    ;       instruction and the delta-PC quantity that was stored as part of the
0099    ;       instruction's intermediate state. Note that the delta PC quantity
0099    ;
0099    ;               delta PC = new PC - old PC
0099    ;
0099    ;       is stored in the upper bytes of one of the general registers, usually
0099    ;       bits <31:24> of R0 or R2. The registers R0 through R3 are stored on
0099    ;       the stack (in the space used for the first four operands when the
                               0099  ;       reserved instruction is first encountered) so that the same offsets
                               0099  ;       that were used to store the delta-PC can be used to retrieve it.
                               0099  ;-
                               0099
                               0099          .ALIGN  LONG                            ; Alignment for exception vector
                               009C
                               009C  VAX$EMULATE_FPD::
                               009C
                               009C
          00 04 AE    1B   E5  009C          BBCC    #PSL$V_FPD,4(SP),5$             ; Clear FPD in exception PSL
                 5E   28   C2  00A1  5$:     SUBL2   #NEW_PC,SP                      ; Create extra stack space
          04 AE    28 AE   D0  00A4          MOVL    NEW_PC(SP),OLD_PC(SP)           ; Make second copy of old PC
             08 AE    50   7D  00A9          MOVQ    R0,OPERAND_1(SP)                ; Save R0 and R1 in some extra space
             10 AE    52   7D  00AD          MOVQ    R2,OPERAND_3(SP)                ; Do the same for R2 and R3
             50    04 BE   98  00B1          CVTBL   @OLD_PC(SP),R0                  ; Get opcode from instruction stream
          51   0000'CF40   9A  00B5          MOVZBL  VAX$AL_DELTA_PC_TABLE[R0],R1 ; Get offset to byte with delta-PC
            51    08 AE41  9A  00BB          MOVZBL  OPERAND_1(SP)[R1],R1        ; Get delta-PC
             28 AE    51   C0  00C0          ADDL    R1,NEW_PC(SP)                   ; Convert old PC to new PC
                6E    50   D0  00C4          MOVL    R0,OPCODE(SP)                   ; Store opcode in other than a register
             50    08 AE   7D  00C7          MOVQ    OPERAND_1(SP),R0                ; Restore R0 and R1
                               00CB                                                  ; (R2 and R3 were not changed)
              0425'CF      9F  00CB          PUSHAB  VAX$EXIT_EMULATOR               ; Create return PC to make CASE like BSB
                               00CF
43 8F     F8 8F    04 AE   8F  00CF          CASEB   <OPCODE+4>(SP),#OPCODE_BASE,#<OPCODE_MAX-OPCODE_BASE>
                               00D6
                               00D6          INIT_CASE_TABLE CASE_TABLE_SIZE,FPD_CASE_TABLE_BASE,10$
                               015E
                               015E  ; If we drop through the case dispatcher, then the fault was not caused
                               015E  ; by executing one of the instructions supported by this emulator. The
                               015E  ; exception will be passed to VMS with the following stack.
                               015E  ;
                               015E  ;       00(SP) - Signal array size (always 4)
                               015E  ;       04(SP) - Signal name (VAX$_OPCDEC_FPD)
                               015E  ;       08(SP) - Opcode that is not supported
                               015E  ;       12(SP) - PC of that opcode
                               015E  ;       16(SP) - PSL of exception
                               015E  ;
                               015E  ; (In the bootstrap emulator, we simply halt with the stack containing
                               015E  ; these data.)
                               015E
                 5E   04   C0  015E  10$:    ADDL    #4,SP                           ; Discard return PC
          28 AE    04 AE   D0  0161          MOVL    OLD_PC(SP),NEW_PC(SP)           ; Use PC of opcode and not new PC
             24 AE    6E   D0  0166          MOVL    OPCODE(SP),OPERAND_8(SP)   ; Include opcode in signal array
             5E    24 AE   DE  016A          MOVAL   OPERAND_8(SP),SP                ; Discard rest of stack
                               016E
                               016E
        00000000'8F        DD  016E          PUSHL   #VAX$_OPCDEC_FPD                ; This is the signal name
                      04   DD  0174          PUSHL   #4                              ; Signal array has four longwords
                               0176
                FE87'      31  0176          BRW     VAX$REFLECT_TO_VMS              ; Use common exit to VMS
```

```
0179            .SUBTITLE       Dispatch Tables
0179    ;+
0179    ; Functional Description:
0179    ;
0179    ;       The case tables for the two CASEB instructions are built with the
0179    ;       macros that are invoked here. Macros are used to guarantee that both
0179    ;       tables contain correct entries for a selected opcode at the same
0179    ;       offset.
0179    ;
0179    ; Assumptions:
0179    ;
0179    ;       The CASE_TABLE_ENTRY macro assumes that the names of the respective
0179    ;       case tables are CASE_TABLE_BASE and FPD_CASE_TABLE_BASE.
0179    ;
0179    ; Notes:
0179    ;
0179    ;       In the following lists, those FPD routines that do not have _FPD in
0179    ;       their names use the same JSB entry point for initial entry and after
0179    ;       restarting the instruction. In most of these cases, the register state
0179    ;       is the same for both starting and restarting. For the remaining cases,
0179    ;       there is not enough difference between the two cases to justify an
0179    ;       additional entry point. (See VAX$MOVTC for an example of this latter
0179    ;       situation.)
0179    ;
0179    ;       The FPD routines that include _RESTART in their names have to do a
0179    ;       certain amount of work to restore the intermediate state from the
0179    ;       canonical registers before they can resume instruction execution.
0179    ;-
0179
0179            .SAVE                           ; Remember current location counter
0179
0179    ; First generate table entries for the string instructions
0179
0179            CASE_TABLE_ENTRY        OPCODE=MOVTC,-
0179                                    ROUTINE=MOVTC,-
0179                                    FPD_ROUTINE=VAX$MOVTC
0144
0144            CASE_TABLE_ENTRY        OPCODE=MOVTUC,-
0144                                    ROUTINE=MOVTUC,-
0144                                    FPD_ROUTINE=VAX$MOVTUC
0146
0146            CASE_TABLE_ENTRY        OPCODE=CMPC3,-
0146                                    ROUTINE=CMPC3,-
0146                                    FPD_ROUTINE=VAX$CMPC3,-
0146                                    BOOT_FLAG=BOOT
013A
013A            CASE_TABLE_ENTRY        OPCODE=CMPC5,-
013A                                    ROUTINE=CMPC5,-
013A                                    FPD_ROUTINE=VAX$CMPC5,-
013A                                    BOOT_FLAG=BOOT
0142
0142            CASE_TABLE_ENTRY        OPCODE=LOCC,-
0142                                    ROUTINE=LOCC,-
0142                                    FPD_ROUTINE=VAX$LOCC,-
0142                                    BOOT_FLAG=BOOT
015C
015C            CASE_TABLE_ENTRY        OPCODE=SKPC,-
```

```
015C                                    ROUTINE=SKPC,-
015C                                    FPD_ROUTINE=VAX$SKPC
015E
015E        CASE_TABLE_ENTRY            OPCODE=SCANC,-
015E                                    ROUTINE=SCANC,-
015E                                    FPD_ROUTINE=VAX$SCANC
013C
013C        CASE_TABLE_ENTRY            OPCODE=SPANC,-
013C                                    ROUTINE=SPANC,-
013C                                    FPD_ROUTINE=VAX$SPANC
013E
013E        CASE_TABLE_ENTRY            OPCODE=MATCHC,-
013E                                    ROUTINE=MATCHC,-
013E                                    FPD_ROUTINE=VAX$MATCHC
015A
015A        CASE_TABLE_ENTRY            OPCODE=CRC,-
015A                                    ROUTINE=CRC,-
015A                                    FPD_ROUTINE=VAX$CRC
00FE
00FE  ; Now generate table entries for the decimal instructions
00FE
00FE        CASE_TABLE_ENTRY            OPCODE=ADDP4,-
00FE                                    ROUTINE=ADDP4,-
00FE                                    FPD_ROUTINE=VAX$ADDP4
0128
0128        CASE_TABLE_ENTRY            OPCODE=ADDP6,-
0128                                    ROUTINE=ADDP6,-
0128                                    FPD_ROUTINE=VAX$ADDP6
012A
012A        CASE_TABLE_ENTRY            OPCODE=ASHP,-
012A                                    ROUTINE=ASHP,-
012A                                    FPD_ROUTINE=VAX$ASHP
00D8
00D8        CASE_TABLE_ENTRY            OPCODE=CMPP3,-
00D8                                    ROUTINE=CMPP3,-
00D8                                    FPD_ROUTINE=VAX$CMPP3
0152
0152        CASE_TABLE_ENTRY            OPCODE=CMPP4,-
0152                                    ROUTINE=CMPP4,-
0152                                    FPD_ROUTINE=VAX$CMPP4
0156
0156        CASE_TABLE_ENTRY            OPCODE=CVTLP,-
0156                                    ROUTINE=CVTLP,-
0156                                    FPD_ROUTINE=VAX$CVTLP_RESTART
00DA
00DA        CASE_TABLE_ENTRY            OPCODE=CVTPL,-
00DA                                    ROUTINE=CVTPL,-
00DA                                    FPD_ROUTINE=VAX$CVTPL_RESTART
0154
0154        CASE_TABLE_ENTRY            OPCODE=CVTPS,-
0154                                    ROUTINE=CVTPS,-
0154                                    FPD_ROUTINE=VAX$CVTPS
00F8
00F8        CASE_TABLE_ENTRY            OPCODE=CVTPT,-
00F8                                    ROUTINE=CVTPT,-
00F8                                    FPD_ROUTINE=VAX$CVTPT_RESTART
0130
```

```
    0130                CASE_TABLE_ENTRY        OPCODE=CVTSP,-
    0130                                        ROUTINE=CVTSP,-
    0130                                        FPD_ROUTINE=VAX$CVTSP
    00FA
    00FA                CASE_TABLE_ENTRY        OPCODE=CVTTP,-
    00FA                                        ROUTINE=CVTTP,-
    00FA                                        FPD_ROUTINE=VAX$CVTTP_RESTART
    0134
    0134                CASE_TABLE_ENTRY        OPCODE=DIVP,-
    0134                                        ROUTINE=DIVP,-
    0134                                        FPD_ROUTINE=VAX$DIVP
    0136
    0136                CASE_TABLE_ENTRY        OPCODE=MOVP,-
    0136                                        ROUTINE=MOVP,-
    0136                                        FPD_ROUTINE=VAX$MOVP
    0150
    0150                CASE_TABLE_ENTRY        OPCODE=MULP,-
    0150                                        ROUTINE=MULP,-
    0150                                        FPD_ROUTINE=VAX$MULP
    0132
    0132                CASE_TABLE_ENTRY        OPCODE=SUBP4,-
    0132                                        ROUTINE=SUBP4,-
    0132                                        FPD_ROUTINE=VAX$SUBP4
    012C
    012C                CASE_TABLE_ENTRY        OPCODE=SUBP6,-
    012C                                        ROUTINE=SUBP6,-
    012C                                        FPD_ROUTINE=VAX$SUBP6
    012E
    012E      ; EDITPC always seems to find itself in last place
    012E
    012E                CASE_TABLE_ENTRY        OPCODE=EDITPC,-
    012E                                        ROUTINE=EDITPC,-
    012E                                        FPD_ROUTINE=VAX$EDITPC_RESTART
    0158
00000179                .RESTORE                                ; Reset current location counter
```

```
0179           .SUBTITLE       Description of instruction-specific routines
0179
0179   ;++
0179   ; The instruction-specific routines do similar things. Rather than clutter up
0179   ; each routine with the same comments, we will describe the steps that each
0179   ; routine takes in this section.
0179   ;
0179   ; The input parameters to each routine are identical.
0179   ;
0179   ;                       Contents of exception stack
0179   ;                       ---------------------------
0179   ;
0179   ;       OPCODE(SP)      - Opcode of reserved instruction
0179   ;       OLD_PC(SP)      - PC of reserved instruction
0179   ;       OPERAND_1(SP) - First operand specifier
0179   ;       OPERAND_2(SP) - Second operand specifier
0179   ;       OPERAND_3(SP) - Third operand specifier
0179   ;       OPERAND_4(SP) - Fourth operand specifier
0179   ;       OPERAND_5(SP) - Fifth operand specifier
0179   ;       OPERAND_6(SP) - Sixth operand specifier
0179   ;       OPERAND_7(SP) - Seventh operand specifier (currently unused)
0179   ;       OPERAND_8(SP) - Eight operand specifier (currently unused)
0179   ;       NEW_PC(SP)      - PC of instruction following reserved instruction
0179   ;       EXCEPTION_PSL(SP) - PSL at time of exception
0179   ;
0179   ;       The routine headers for the instruction-specific routines in this
0179   ;       module will list the input and output parameters in symbolic form
0179   ;       only. The VAX$xxxxxx routines in other modules in the emulator contain
0179   ;       the exact meanings of the various operands (parameters) to the
0179   ;       routines.
0179   ;
0179   ; Outline of execution:
0179   ;
0179   ;       The operands are loaded into registers as required by the instruction
0179   ;       specific routines. Routine headers for each routine contain detailed
0179   ;       descriptions.
0179   ;
0179   ;       A routine of the form VAX$xxxxxx (where xxxxxx is the instruction
0179   ;       name) is called to perform the actual work indicated by each
0179   ;       instruction.
0179   ;
0179   ;       Common exit code executes to allow the condition codes returned by the
0179   ;       VAX$xxxxxx routines to be passed back to the code that generated the
0179   ;       original exception.
0179   ;
0179   ; Notes:
0179   ;
0179   ;       The following routines are constructed to be reasonably fast. In
0179   ;       particular, each instruction has its own separate routine, even though
0179   ;       several instructions differ only in the instruction-specific routine
0179   ;       to which final control is passed. Rather than share this common code
0179   ;       at the expense of another dispatch on opcode, we shoose to duplicate
0179   ;       the common code.
0179   ;--
0179
```

```
                           0179           .SUBTITLE       MOVTC - Exception handler for MOVTC instruction
                           0179     ;+
                           0179     ; Input Parameters:
                           0179     ;
                           0179     ;       OPCODE(SP)
                           0179     ;       OLD_PC(SP)
                           0179     ;       OPERAND_1(SP) - srclen.rw
                           0179     ;       OPERAND_2(SP) - srcaddr.ab
                           0179     ;       OPERAND_3(SP) - fill.rb
                           0179     ;       OPERAND_4(SP) - tbladdr.ab
                           0179     ;       OPERAND_5(SP) - dstlen.rw
                           0179     ;       OPERAND_6(SP) - dstaddr.ab
                           0179     ;       OPERAND_7(SP)
                           0179     ;       OPERAND_8(SP)
                           0179     ;       NEW_PC(SP)
                           0179     ;       EXCEPTION_PSL(SP)
                           0179     ;
                           0179     ; Output Parameters:
                           0179     ;
                           0179     ;       R0<15:0> - srclen.rw
                           0179     ;       R1       - srcaddr.ab
                           0179     ;       R2<7:0>  - fill.rb
                           0179     ;       R3       - tbladdr.ab
                           0179     ;       R4<15:0> - dstlen.rw
                           0179     ;       R5       - dstaddr.ab
                           0179     ;
                           0179     ; Implicit Output:
                           0179     ;
                           0179     ;       R0<31:16> - 0
                           0179     ;       R2<31:8>  - 0
                           0179     ;       R4<31:16> - 0
                           0179     ;-
                           0179
                           0179     MOVTC:
                           0179
     50    08 AE     3C    0179           MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- srclen.rw
     51    0C AE     D0    017D           MOVL    OPERAND_2(SP),R1        ; R1       <- srcaddr.ab
     52    10 AE     9A    0181           MOVZBL  OPERAND_3(SP),R2        ; R2<7:0>  <- fill.rb
     53    14 AE     D0    0185           MOVL    OPERAND_4(SP),R3        ; R3       <- tbladdr.ab
     54    18 AE     3C    0189           MOVZWL  OPERAND_5(SP),R4        ; R4<15:0> <- dstlen.rw
     55    1C AE     D0    018D           MOVL    OPERAND_6(SP),R5        ; R5       <- dstaddr.ab
                           0191
                           0191     ; Now that the operands have been loaded, the only exception parameter
                           0191     ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                           0191     ; there is no reason why the state of the stack needs to be altered and we
                           0191     ; save two instructions if we leave the stack alone.
                           0191
        0425'CF      9F    0191           PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
           FE68'     31    0195           BRW     VAX$MOVTC               ; Do the actual work
```

```
                         0198          .SUBTITLE       MOVTUC - Exception handler for MOVTUC instruction
                         0198   ;+
                         0198   ; Input Parameters:
                         0198   ;
                         0198   ;       OPCODE(SP)
                         0198   ;       OLD_PC(SP)
                         0198   ;       OPERAND_1(SP) - srclen.rw
                         0198   ;       OPERAND_2(SP) - srcaddr.ab
                         0198   ;       OPERAND_3(SP) - esc.rb
                         0198   ;       OPERAND_4(SP) - tbladdr.ab
                         0198   ;       OPERAND_5(SP) - dstlen.rw
                         0198   ;       OPERAND_6(SP) - dstaddr.ab
                         0198   ;       OPERAND_7(SP)
                         0198   ;       OPERAND_8(SP)
                         0198   ;       NEW_PC(SP)
                         0198   ;       EXCEPTION_PSL(SP)
                         0198   ;
                         0198   ; Output Parameters:
                         0198   ;
                         0198   ;       R0<15:0> - srclen.rw
                         0198   ;       R1       - srcaddr.ab
                         0198   ;       R2<7:0>  - esc.rb
                         0198   ;       R3       - tbladdr.ab
                         0198   ;       R4<15:0> - dstlen.rw
                         0198   ;       R5       - dstaddr.ab
                         0198   ;
                         0198   ; Implicit Output:
                         0198   ;
                         0198   ;       R0<31:16> - 0
                         0198   ;       R2<31:8>  - 0
                         0198   ;       R4<31:16> - 0
                         0198   ;-
                         0198
                         0198   MOVTUC:
                         0198
 50    08 AE       3C    0198           MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- srclen.rw
 51    0C AE       D0    019C           MOVL    OPERAND_2(SP),R1        ; R1       <- srcaddr.ab
 52    10 AE       9A    01A0           MOVZBL  OPERAND_3(SP),R2        ; R2<7:0>  <- esc.rb
 53    14 AE       D0    01A4           MOVL    OPERAND_4(SP),R3        ; R3       <- tbladdr.ab
 54    18 AE       3C    01A8           MOVZWL  OPERAND_5(SP),R4        ; R4<15:0> <- dstlen.rw
 55    1C AE       D0    01AC           MOVL    OPERAND_6(SP),R5        ; R5       <- dstaddr.ab
                         01B0
                         01B0   ; Now that the operands have been loaded, the only exception parameter
                         01B0   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                         01B0   ; there is no reason why the state of the stack needs to be altered and we
                         01B0   ; save two instructions if we leave the stack alone.
                         01B0
      0425'CF      9F    01B0           PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
         FE49'     31    01B4           BRW     VAX$MOVTUC              ; Do the actual work
```

```
                       01B7          .SUBTITLE      CMPC3 - Exception handler for CMPC3 instruction
                       01B7   ;+
                       01B7   ; Input Parameters:
                       01B7   ;
                       01B7   ;      OPCODE(SP)
                       01B7   ;      OLD_PC(SP)
                       01B7   ;      OPERAND_1(SP) - len.rw
                       01B7   ;      OPERAND_2(SP) - src1addr.ab
                       01B7   ;      OPERAND_3(SP) - src2addr.ab
                       01B7   ;      OPERAND_4(SP)
                       01B7   ;      OPERAND_5(SP)
                       01B7   ;      OPERAND_6(SP)
                       01B7   ;      OPERAND_7(SP)
                       01B7   ;      OPERAND_8(SP)
                       01B7   ;      NEW_PC(SP)
                       01B7   ;      EXCEPTION_PSL(SP)
                       01B7   ;
                       01B7   ; Output Parameters:
                       01B7   ;
                       01B7   ;      R0<15:0> - len.rw
                       01B7   ;      R1       - src1addr.ab
                       01B7   ;      R3       - src2addr.ab
                       01B7   ;
                       01B7   ; Implicit Output:
                       01B7   ;
                       01B7   ;      R0<31:16> - 0
                       01B7   ;      R2        - UNPREDICTABLE
                       01B7   ;-
                       01B7
                       01B7   CMPC3:
                       01B7
  50    08 AE    3C    01B7          MOVZWL  OPERAND_1(SP),R0         ; R0<15:0> <- srclen.rw
  51    0C AE    D0    01BB          MOVL    OPERAND_2(SP),R1         ; R1       <- src1addr.ab
  53    10 AE    D0    01BF          MOVL    OPERAND_3(SP),R3         ; R3       <- src2addr.ab
                       01C3
                       01C3   ; Now that the operands have been loaded, the only exception parameter
                       01C3   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                       01C3   ; there is no reason why the state of the stack needs to be altered and we
                       01C3   ; save two instructions if we leave the stack alone.
                       01C3
     0425'CF     9F    01C3          PUSHAB  VAX$EXIT_EMULATOR        ; Store the return PC
        FE36'    31    01C7          BRW     VAX$CMPC3                ; Do the actual work
```

```
                        01CA          .SUBTITLE      CMPC5 - Exception handler for CMPC5 instruction
                        01CA    ;+
                        01CA    ; Input Parameters:
                        01CA    ;
                        01CA    ;       OPCODE(SP)
                        01CA    ;       OLD_PC(SP)
                        01CA    ;       OPERAND_1(SP) - src1len.rw
                        01CA    ;       OPERAND_2(SP) - src1addr.ab
                        01CA    ;       OPERAND_3(SP) - fill.rb
                        01CA    ;       OPERAND_4(SP) - src2len.rw
                        01CA    ;       OPERAND_5(SP) - src2addr.ab
                        01CA    ;       OPERAND_6(SP)
                        01CA    ;       OPERAND_7(SP)
                        01CA    ;       OPERAND_8(SP)
                        01CA    ;       NEW_PC(SP)
                        01CA    ;       EXCEPTION_PSL(SP)
                        01CA    ;
                        01CA    ; Output Parameters:
                        01CA    ;
                        01CA    ;       R0<15:0>    - srclen.rw
                        01CA    ;       R0<23:16>   - fill.rb
                        01CA    ;       R1          - srcaddr.ab
                        01CA    ;       R2<15:0>    - src2len.rw
                        01CA    ;       R3          - src2addr.ab
                        01CA    ;
                        01CA    ; Implicit Output:
                        01CA    ;
                        01CA    ;       R0<31:24> - UNPREDICTABLE
                        01CA    ;       R2<31:16> - 0
                        01CA    ;-
                        01CA
                        01CA    CMPC5:
                        01CA
50   10 AE   10   9C    01CA          ROTL    #16,OPERAND_3(SP),R0      ; R0<23:16> <- fill.rb
     50   08 AE   B0    01CF          MOVW    OPERAND_1(SP),R0          ; R0<15:0>  <- src1len.rw
     51   0C AE   D0    01D3          MOVL    OPERAND_2(SP),R1          ; R1        <- src1addr.ab
     52   14 AE   3C    01D7          MOVZWL  OPERAND_4(SP),R2          ; R2<15:0>  <- src2len.rw
     53   18 AE   D0    01DB          MOVL    OPERAND_5(SP),R3          ; R3        <sca- src2addr.ab
                        01DF
                        01DF    ; Now that the operands have been loaded, the only exception parameter
                        01DF    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        01DF    ; there is no reason why the state of the stack needs to be altered and we
                        01DF    ; save two instructions if we leave the stack alone.
                        01DF
        0425'CF   9F    01DF          PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
           FE1A'  31    01E3          BRW     VAX$CMPC5                 ; Do the actual work
```

```
                        01E6          .SUBTITLE      SCANC - Exception handler for SCANC instruction
                        01E6    ;+
                        01E6    ; Input Parameters:
                        01E6    ;
                        01E6    ;     OPCODE(SP)
                        01E6    ;     OLD_PC(SP)
                        01E6    ;     OPERAND_1(SP) - len.rw
                        01E6    ;     OPERAND_2(SP) - addr.ab
                        01E6    ;     OPERAND_3(SP) - tbladdr.ab
                        01E6    ;     OPERAND_4(SP) - mask.ab
                        01E6    ;     OPERAND_5(SP)
                        01E6    ;     OPERAND_6(SP)
                        01E6    ;     OPERAND_7(SP)
                        01E6    ;     OPERAND_8(SP)
                        01E6    ;     NEW_PC(SP)
                        01E6    ;     EXCEPTION_PSL(SP)
                        01E6    ;
                        01E6    ; Output Parameters:
                        01E6    ;
                        01E6    ;     R0<15:0> - len.rw
                        01E6    ;     R1       - addr.ab
                        01E6    ;     R2<7:0>  - mask.rb
                        01E6    ;     R3       - tbladdr.ab
                        01E6    ;
                        01E6    ; Implicit Output:
                        01E6    ;
                        01E6    ;     R0<31:16> - 0
                        01E6    ;     R2<31:8>  - 0
                        01E6    ;-
                        01E6
                        01E6    SCANC:
                        01E6
    50    08 AE    3C   01E6          MOVZWL  OPERAND_1(SP),R0          ; R0<15:0> <- len.rw
    51    0C AE    D0   01EA          MOVL    OPERAND_2(SP),R1          ; R1       <- addr.ab
    53    10 AE    D0   01EE          MOVL    OPERAND_3(SP),R3          ; R3       <- tbladdr.ab
    52    14 AE    9A   01F2          MOVZBL  OPERAND_4(SP),R2          ; R2<7:0>  <- mask.ab
                        01F6
                        01F6    ; Now that the operands have been loaded, the only exception parameter
                        01F6    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        01F6    ; there is no reason why the state of the stack needs to be altered and we
                        01F6    ; save two instructions if we leave the stack alone.
                        01F6
       0425'CF     9F   01F6          PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
          FE03'    31   01FA          BRW     VAX$SCANC                 ; Do the actual work
```

```
                           01FD        .SUBTITLE       SPANC - Exception handler for SPANC instruction
                           01FD   ;+
                           01FD   ; Input Parameters:
                           01FD   ;
                           01FD   ;       OPCODE(SP)
                           01FD   ;       OLD_PC(SP)
                           01FD   ;       OPERAND_1(SP) - len.rw
                           01FD   ;       OPERAND_2(SP) - addr.ab
                           01FD   ;       OPERAND_3(SP) - tbladdr.ab
                           01FD   ;       OPERAND_4(SP) - mask.ab
                           01FD   ;       OPERAND_5(SP)
                           01FD   ;       OPERAND_6(SP)
                           01FD   ;       OPERAND_7(SP)
                           01FD   ;       OPERAND_8(SP)
                           01FD   ;       NEW_PC(SP)
                           01FD   ;       EXCEPTION_PSL(SP)
                           01FD   ;
                           01FD   ; Output Parameters:
                           01FD   ;
                           01FD   ;       R0<15:0> - len.rw
                           01FD   ;       R1       - addr.ab
                           01FD   ;       R2<7:0>  - mask.rb
                           01FD   ;       R3       - tbladdr.ab
                           01FD   ;
                           01FD   ; Implicit Output:
                           01FD   ;
                           01FD   ;       R0<31:16> - 0
                           01FD   ;       R2<31:8>  - 0
                           01FD   ;-
                           01FD
                           01FD   SPANC:
                           01FD
      50   08 AE     3C    01FD           MOVZWL  OPERAND_1(SP),R0          ; R0<15:0> <- len.rw
      51   0C AE     D0    0201           MOVL    OPERAND_2(SP),R1          ; R1       <- addr.ab
      53   10 AE     D0    0205           MOVL    OPERAND_3(SP),R3          ; R3       <- tbladdr.ab
      52   14 AE     9A    0209           MOVZBL  OPERAND_4(SP),R2          ; R2<7:0>  <- mask.ab
                           020D
                           020D   ; Now that the operands have been loaded, the only exception parameter
                           020D   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                           020D   ; there is no reason why the state of the stack needs to be altered and we
                           020D   ; save two instructions if we leave the stack alone.
                           020D
        0425'CF      9F    020D           PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
           FDEC'     31    0211           BRW     VAX$SPANC                 ; Do the actual work
```

```
                          0214          .SUBTITLE       LOCC - Exception handler for LOCC instruction
                          0214  ;+
                          0214  ; Input Parameters:
                          0214  ;
                          0214  ;       OPCODE(SP)
                          0214  ;       OLD_PC(SP)
                          0214  ;       OPERAND_1(SP) - char.rb
                          0214  ;       OPERAND_2(SP) - len.rw
                          0214  ;       OPERAND_3(SP) - addr.ab
                          0214  ;       OPERAND_4(SP)
                          0214  ;       OPERAND_5(SP)
                          0214  ;       OPERAND_6(SP)
                          0214  ;       OPERAND_7(SP)
                          0214  ;       OPERAND_8(SP)
                          0214  ;       NEW_PC(SP)
                          0214  ;       EXCEPTION_PSL(SP)
                          0214  ;
                          0214  ; Output Parameters:
                          0214  ;
                          0214  ;       R0<15:0>  - len.rw
                          0214  ;       R0<23:16> - char.rb
                          0214  ;       R1        - addr.ab
                          0214  ;
                          0214  ; Implicit Output:
                          0214  ;
                          0214  ;       R0<31:24> - UNPREDICTABLE
                          0214  ;-
                          0214
                          0214  LOCC:
                          0214
50   08 AE    10     9C   0214          ROTL    #16,OPERAND_1(SP),R0    ; R0<23:16> <- char.ab
     50    0C AE     B0   0219          MOVW    OPERAND_2(SP),R0        ; R0<15:0>  <- len.rw
     51    10 AE     D0   021D          MOVL    OPERAND_3(SP),R1        ; R1        <- addr.ab
                          0221
                          0221  ; Now that the operands have been loaded, the only exception parameter
                          0221  ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                          0221  ; there is no reason why the state of the stack needs to be altered and we
                          0221  ; save two instructions if we leave the stack alone.
                          0221
         0425'CF     9F   0221          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
           FDD8'     31   0225          BRW     VAX$LOCC                ; Do the actual work
```

```
                         0228            .SUBTITLE       SKPC - Exception handler for SKPC instruction
                         0228      ;+
                         0228      ; Input Parameters:
                         0228      ;
                         0228      ;         OPCODE(SP)
                         0228      ;         OLD_PC(SP)
                         0228      ;         OPERAND_1(SP) - char.rb
                         0228      ;         OPERAND_2(SP) - len.rw
                         0228      ;         OPERAND_3(SP) - addr.ab
                         0228      ;         OPERAND_4(SP)
                         0228      ;         OPERAND_5(SP)
                         0228      ;         OPERAND_6(SP)
                         0228      ;         OPERAND_7(SP)
                         0228      ;         OPERAND_8(SP)
                         0228      ;         NEW_PC(SP)
                         0228      ;         EXCEPTION_PSL(SP)
                         0228      ;
                         0228      ; Output Parameters:
                         0228      ;
                         0228      ;         R0<15:0>  - len.rw
                         0228      ;         R0<23:16> - char.rb
                         0228      ;         R1        - addr.ab
                         0228      ;
                         0228      ; Implicit Output:
                         0228      ;
                         0228      ;         R0<31:24> - UNPREDICTABLE
                         0228      ;-
                         0228
                         0228      SKPC:
                         0228
 50   08 AE   10    9C   0228              ROTL    #16,OPERAND_1(SP),R0      ; R0<23:16> <- char.ab
      50   0C AE    B0   022D              MOVW    OPERAND_2(SP),R0          ; R0<15:0>  <- len.rw
      51   10 AE    D0   0231              MOVL    OPERAND_3(SP),R1          ; R1        <- addr.ab
                         0235
                         0235      ; Now that the operands have been loaded, the only exception parameter
                         0235      ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                         0235      ; there is no reason why the state of the stack needs to be altered and we
                         0235      ; save two instructions if we leave the stack alone.
                         0235
         0425'CF    9F   0235              PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
            FDC4'   31   0239              BRW     VAX$SKPC                  ; Do the actual work
```

```
                                023C          .SUBTITLE       MATCHC - Exception handler for MATCHC instruction
                                023C   ;+
                                023C   ; Input Parameters:
                                023C   ;
                                023C   ;       OPCODE(SP)
                                023C   ;       OLD_PC(SP)
                                023C   ;       OPERAND_1(SP) - objlen.rw
                                023C   ;       OPERAND_2(SP) - objaddr.ab
                                023C   ;       OPERAND_3(SP) - srclen.rw
                                023C   ;       OPERAND_4(SP) - srcaddr.ab
                                023C   ;       OPERAND_5(SP)
                                023C   ;       OPERAND_6(SP)
                                023C   ;       OPERAND_7(SP)
                                023C   ;       OPERAND_8(SP)
                                023C   ;       NEW_PC(SP)
                                023C   ;       EXCEPTION_PSL(SP)
                                023C   ;
                                023C   ; Output Parameters:
                                023C   ;
                                023C   ;       R0<15:0>   - objlen.rw
                                023C   ;       R1         - objaddr.ab
                                023C   ;       R2<15:0>   - srclen.rw
                                023C   ;       R3         - srcaddr.ab
                                023C   ;
                                023C   ; Implicit Output:
                                023C   ;
                                023C   ;       R0<31:16> - 0
                                023C   ;       R2<31:16> - 0
                                023C   ;-
                                023C
                                023C   MATCHC:
                                023C
50    08 AE     3C              023C           MOVZWL  OPERAND_1(SP),R0          ; R0<15:0>   <- objlen.rw
51    0C AE     D0              0240           MOVL    OPERAND_2(SP),R1          ; R1         <- objaddr.ab
52    10 AE     3C              0244           MOVZWL  OPERAND_3(SP),R2          ; R2<15:0>   <- srclen.rw
53    14 AE     D0              0248           MOVL    OPERAND_4(SP),R3          ; R3         <- srcaddr.ab
                                024C
                                024C   ; Now that the operands have been loaded, the only exception parameter
                                024C   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                                024C   ; there is no reason why the state of the stack needs to be altered and we
                                024C   ; save two instructions if we leave the stack alone.
                                024C
     0425'CF    9F              024C           PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
        FDAD'   31              0250           BRW     VAX$MATCHC                ; Do the actual work
```

```
                        0253          .SUBTITLE       CRC - Exception handler for CRC instruction
                        0253  ;+
                        0253  ; Input Parameters:
                        0253  ;
                        0253  ;       OPCODE(SP)
                        0253  ;       OLD_PC(SP)
                        0253  ;       OPERAND_1(SP) - tbl.ab
                        0253  ;       OPERAND_2(SP) - inicrc.rl
                        0253  ;       OPERAND_3(SP) - strlen.rw
                        0253  ;       OPERAND_4(SP) - stream.ab
                        0253  ;       OPERAND_5(SP)
                        0253  ;       OPERAND_6(SP)
                        0253  ;       OPERAND_7(SP)
                        0253  ;       OPERAND_8(SP)
                        0253  ;       NEW_PC(SP)
                        0253  ;       EXCEPTION_PSL(SP)
                        0253  ;
                        0253  ; Output Parameters:
                        0253  ;
                        0253  ;       R0            - inicrc.rl
                        0253  ;       R1            - tbl.ab
                        0253  ;       R2<15:0>      - strlen.rw
                        0253  ;       R3            - stream.ab
                        0253  ;
                        0253  ; Implicit Output:
                        0253  ;
                        0253  ;       R2<31:16> - 0
                        0253  ;-
                        0253
                        0253  CRC:
                        0253
   51    08 AE    D0    0253          MOVL    OPERAND_1(SP),R1        ; R1          <- tbl.ab
   50    0C AE    D0    0257          MOVL    OPERAND_2(SP),R0        ; R0          <- inicrc.rl
   52    10 AE    3C    025B          MOVZWL  OPERAND_3(SP),R2        ; R2<15:0>    <- strlen.rw
   53    14 AE    D0    025F          MOVL    OPERAND_4(SP),R3        ; R3          <- stream.ab
                        0263
                        0263  ; Now that the operands have been loaded, the only exception parameter
                        0263  ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        0263  ; there is no reason why the state of the stack needs to be altered and we
                        0263  ; save two instructions if we leave the stack alone.
                        0263
      0425'CF     9F    0263          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
         FD96'    31    0267          BRW     VAX$CRC                 ; Do the actual work
```

```
                        026A          .SUBTITLE       ADDP4 - Exception handler for ADDP4 instruction
                        026A    ;+
                        026A    ; Input Parameters:
                        026A    ;
                        026A    ;         OPCODE(SP)
                        026A    ;         OLD_PC(SP)
                        026A    ;         OPERAND_1(SP) - addlen.rw
                        026A    ;         OPERAND_2(SP) - addaddr.ab
                        026A    ;         OPERAND_3(SP) - sumlen.rw
                        026A    ;         OPERAND_4(SP) - sumaddr.ab
                        026A    ;         OPERAND_5(SP)
                        026A    ;         OPERAND_6(SP)
                        026A    ;         OPERAND_7(SP)
                        026A    ;         OPERAND_8(SP)
                        026A    ;         NEW_PC(SP)
                        026A    ;         EXCEPTION_PSL(SP)
                        026A    ;
                        026A    ; Output Parameters:
                        026A    ;
                        026A    ;         R0<15:0> - addlen.rw
                        026A    ;         R1       - addaddr.ab
                        026A    ;         R2<15:0> - sumlen.rw
                        026A    ;         R3       - sumaddr.ab
                        026A    ;
                        026A    ; Implicit Output:
                        026A    ;
                        026A    ;         R0<31:16> - 0
                        026A    ;         R2<31:16> - 0
                        026A    ;-
                        026A
                        026A    ADDP4:
                        026A
 50    08 AE    3C      026A              MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- addlen.rw
 51    0C AE    D0      026E              MOVL    OPERAND_2(SP),R1        ; R1       <- addaddr.ab
 52    10 AE    3C      0272              MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- sumlen.rw
 53    14 AE    D0      0276              MOVL    OPERAND_4(SP),R3        ; R3       <- sumaddr.ab
                        027A
                        027A    ; Now that the operands have been loaded, the only exception parameter
                        027A    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        027A    ; there is no reason why the state of the stack needs to be altered and we
                        027A    ; save two instructions if we leave the stack alone.
                        027A
   0425'CF      9F      027A              PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
      FD7F'     31      027E              BRW     VAX$ADDP4               ; Do the actual work
```

```
                         0281            .SUBTITLE       ADDP6 - Exception handler for ADDP6 instruction
                         0281       ;+
                         0281       ; Input Parameters:
                         0281       ;
                         0281       ;       OPCODE(SP)
                         0281       ;       OLD_PC(SP)
                         0281       ;       OPERAND_1(SP) - add1len.rw
                         0281       ;       OPERAND_2(SP) - add1addr.ab
                         0281       ;       OPERAND_3(SP) - add2len.rw
                         0281       ;       OPERAND_4(SP) - add2addr.ab
                         0281       ;       OPERAND_5(SP) - sumlen.rw
                         0281       ;       OPERAND_6(SP) - sumaddr.ab
                         0281       ;       OPERAND_7(SP)
                         0281       ;       OPERAND_8(SP)
                         0281       ;       NEW_PC(SP)
                         0281       ;       EXCEPTION_PSL(SP)
                         0281       ;
                         0281       ; Output Parameters:
                         0281       ;
                         0281       ;       R0<15:0> - add1len.rw
                         0281       ;       R1       - add1addr.ab
                         0281       ;       R2<15:0> - add2len.rw
                         0281       ;       R3       - add2addr.ab
                         0281       ;       R4<15:0> - sumlen.rw
                         0281       ;       R5       - sumaddr.ab
                         0281       ;
                         0281       ; Implicit Output:
                         0281       ;
                         0281       ;       R0<31:16> - 0
                         0281       ;       R2<31:16> - 0
                         0281       ;       R4<31:16> - 0
                         0281       ;-
                         0281
                         0281       ADDP6:
                         0281
 50    08 AE      3C     0281               MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- add1len.rw
 51    0C AE      D0     0285               MOVL    OPERAND_2(SP),R1        ; R1       <- add1addr.ab
 52    10 AE      3C     0289               MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- add2len.rw
 53    14 AE      D0     028D               MOVL    OPERAND_4(SP),R3        ; R3       <- add2addr.ab
 54    18 AE      3C     0291               MOVZWL  OPERAND_5(SP),R4        ; R4<15:0> <- sumlen.rw
 55    1C AE      D0     0295               MOVL    OPERAND_6(SP),R5        ; R5       <- sumaddr.ab
                         0299
                         0299       ; Now that the operands have been loaded, the only exception parameter
                         0299       ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                         0299       ; there is no reason why the state of the stack needs to be altered and we
                         0299       ; save two instructions if we leave the stack alone.
                         0299
    0425'CF       9F     0299               PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
       FD60'      31     029D               BRW     VAX$ADDP6               ; Do the actual work
```

```
                              02A0            .SUBTITLE       ASHP - Exception handler for ASHP instruction
                              02A0    ;+
                              02A0    ; Input Parameters:
                              02A0    ;
                              02A0    ;       OPCODE(SP)
                              02A0    ;       OLD_PC(SP)
                              02A0    ;       OPERAND_1(SP) - cnt.rb
                              02A0    ;       OPERAND_2(SP) - srclen.rw
                              02A0    ;       OPERAND_3(SP) - srcaddr.ab
                              02A0    ;       OPERAND_4(SP) - round.rb
                              02A0    ;       OPERAND_5(SP) - dstlen.rw
                              02A0    ;       OPERAND_6(SP) - dstaddr.ab
                              02A0    ;       OPERAND_7(SP)
                              02A0    ;       OPERAND_8(SP)
                              02A0    ;       NEW_PC(SP)
                              02A0    ;       EXCEPTION_PSL(SP)
                              02A0    ;
                              02A0    ; Output Parameters:
                              02A0    ;
                              02A0    ;       R0<15:0>  - srclen.rw
                              02A0    ;       R0<31:16> - count.rb
                              02A0    ;       R1        - srcaddr.ab
                              02A0    ;       R2<15:0>  - dstlen.rw
                              02A0    ;       R2<31:16> - round.rb
                              02A0    ;       R3        - dstaddr.ab
                              02A0    ;
                              02A0    ; Implicit Output:
                              02A0    ;
                              02A0    ;       R0<31:24> - UNPREDICTABLE
                              02A0    ;       R2<31:24> - UNPREDICTABLE
                              02A0    ;-
                              02A0
                              02A0    ASHP:
                              02A0
 50  08 AE    10    9C        02A0            ROTL    #16,OPERAND_1(SP),R0     ; R0<31:16> <- count.rb
      50  0C AE    B0         02A5            MOVW    OPERAND_2(SP),R0         ; R0<15:0>  <- srclen.rw
      51  10 AE    D0         02A9            MOVL    OPERAND_3(SP),R1         ; R1        <- srcaddr.ab
 52  14 AE    10    9C        02AD            ROTL    #16,OPERAND_4(SP),R2     ; R2<31:16> <- round.rb
      52  18 AE    B0         02B2            MOVW    OPERAND_5(SP),R2         ; R2<15:0>  <- dstlen.rw
      53  1C AE    D0         02B6            MOVL    OPERAND_6(SP),R3         ; R3        <- dstaddr.ab
                              02BA
                              02BA    ; Now that the operands have been loaded, the only exception parameter
                              02BA    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                              02BA    ; there is no reason why the state of the stack needs to be altered and we
                              02BA    ; save two instructions if we leave the stack alone.
                              02BA
        0425'CF    9F         02BA            PUSHAB  VAX$EXIT_EMULATOR        ; Store the return PC
           FD3F'   31         02BE            BRW     VAX$ASHP                 ; Do the actual work
```

```
                          02C1          .SUBTITLE       CMPP3 - Exception handler for CMPP3 instruction
                          02C1  ;+
                          02C1  ; Input Parameters:
                          02C1  ;
                          02C1  ;       OPCODE(SP)
                          02C1  ;       OLD_PC(SP)
                          02C1  ;       OPERAND_1(SP) - len.rw
                          02C1  ;       OPERAND_2(SP) - src1addr.ab
                          02C1  ;       OPERAND_3(SP) - src2addr.ab
                          02C1  ;       OPERAND_4(SP)
                          02C1  ;       OPERAND_5(SP)
                          02C1  ;       OPERAND_6(SP)
                          02C1  ;       OPERAND_7(SP)
                          02C1  ;       OPERAND_8(SP)
                          02C1  ;       NEW_PC(SP)
                          02C1  ;       EXCEPTION_PSL(SP)
                          02C1  ;
                          02C1  ; Output Parameters:
                          02C1  ;
                          02C1  ;       R0<15:0> - len.rw
                          02C1  ;       R1       - src1addr.ab
                          02C1  ;       R3       - src2addr.ab
                          02C1  ;
                          02C1  ; Implicit Output:
                          02C1  ;
                          02C1  ;       R0<31:16> - 0
                          02C1  ;       R2        - UNPREDICTABLE
                          02C1  ;-
                          02C1
                          02C1  CMPP3:
                          02C1
      50    08 AE    3C   02C1          MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- len.rw
      51    0C AE    D0   02C5          MOVL    OPERAND_2(SP),R1        ; R1       <- src1addr.ab
      53    10 AE    D0   02C9          MOVL    OPERAND_3(SP),R3        ; R3       <- src2addr.ab
                          02CD
                          02CD  ; Now that the operands have been loaded, the only exception parameter
                          02CD  ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                          02CD  ; there is no reason why the state of the stack needs to be altered and we
                          02CD  ; save two instructions if we leave the stack alone.
                          02CD
          0425'CF    9F   02CD          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
             FD2C'   31   02D1          BRW     VAX$CMPP3               ; Do the actual work
```

```
                         02D4          .SUBTITLE       CMPP4 - Exception handler for CMPP4 instruction
                         02D4   ;+
                         02D4   ; Input Parameters:
                         02D4   ;
                         02D4   ;      OPCODE(SP)
                         02D4   ;      OLD_PC(SP)
                         02D4   ;      OPERAND_1(SP) - src1len.rw
                         02D4   ;      OPERAND_2(SP) - src1addr.ab
                         02D4   ;      OPERAND_3(SP) - src2len.rw
                         02D4   ;      OPERAND_4(SP) - src2addr.ab
                         02D4   ;      OPERAND_5(SP)
                         02D4   ;      OPERAND_6(SP)
                         02D4   ;      OPERAND_7(SP)
                         02D4   ;      OPERAND_8(SP)
                         02D4   ;      NEW_PC(SP)
                         02D4   ;      EXCEPTION_PSL(SP)
                         02D4   ;
                         02D4   ; Output Parameters:
                         02D4   ;
                         02D4   ;      R0<15:0> - src1len.rw
                         02D4   ;      R1       - src1addr.ab
                         02D4   ;      R2<15:0> - src2len.rw
                         02D4   ;      R3       - src2addr.ab
                         02D4   ;
                         02D4   ; Implicit Output:
                         02D4   ;
                         02D4   ;      R0<31:16> - 0
                         02D4   ;      R2<31:16> - 0
                         02D4   ;-
                         02D4
                         02D4   CMPP4:
                         02D4
  50    08 AE    3C      02D4          MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- src1len.rw
  51    0C AE    D0      02D8          MOVL    OPERAND_2(SP),R1        ; R1       <- src1addr.ab
  52    10 AE    3C      02DC          MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- src2len.rw
  53    14 AE    D0      02E0          MOVL    OPERAND_4(SP),R3        ; R3       <- src2addr.ab
                         02E4
                         02E4   ; Now that the operands have been loaded, the only exception parameter
                         02E4   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                         02E4   ; there is no reason why the state of the stack needs to be altered and we
                         02E4   ; save two instructions if we leave the stack alone.
                         02E4
      0425'CF    9F      02E4          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
        FD15'    31      02E8          BRW     VAX$CMPP4               ; Do the actual work
```

```
                    02EB          .SUBTITLE       CVTLP - Exception handler for CVTLP instruction
                    02EB   ;+
                    02EB   ; Input Parameters:
                    02EB   ;
                    02EB   ;       OPCODE(SP)
                    02EB   ;       OLD_PC(SP)
                    02EB   ;       OPERAND_1(SP) - src.rl
                    02EB   ;       OPERAND_2(SP) - dstlen.rw
                    02EB   ;       OPERAND_3(SP) - dstaddr.ab
                    02EB   ;       OPERAND_4(SP)
                    02EB   ;       OPERAND_5(SP)
                    02EB   ;       OPERAND_6(SP)
                    02EB   ;       OPERAND_7(SP)
                    02EB   ;       OPERAND_8(SP)
                    02EB   ;       NEW_PC(SP)
                    02EB   ;       EXCEPTION_PSL(SP)
                    02EB   ;
                    02EB   ; Output Parameters:
                    02EB   ;
                    02EB   ;       R0          - src.rl
                    02EB   ;       R2<15:0> - dstlen.rw
                    02EB   ;       R3          - dstaddr.ab
                    02EB   ;
                    02EB   ; Implicit Output:
                    02EB   ;
                    02EB   ;       R1          - explicitly set to zero
                    02EB   ;       R2<31:16> - 0
                    02EB   ;-
                    02EB
                    02EB   CVTLP:
                    02EB
50   08 AE   D0     02EB          MOVL    OPERAND_1(SP),R0          ; R0        <- src.rl
        51   D4     02EF          CLRL    R1                        ; R1        <- 0
52   0C AE   3C     02F1          MOVZWL  OPERAND_2(SP),R2          ; R2<15:0> <- dstlen.rw
53   10 AE   D0     02F5          MOVL    OPERAND_3(SP),R3          ; R3        <- dstaddr.ab
                    02F9
                    02F9   ; Now that the operands have been loaded, the only exception parameter
                    02F9   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                    02F9   ; there is no reason why the state of the stack needs to be altered and we
                    02F9   ; save two instructions if we leave the stack alone.
                    02F9
   0425'CF   9F     02F9          PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
     FD00'   31     02FD          BRW     VAX$CVTLP                 ; Do the actual work
```

```
                       0300             .SUBTITLE       CVTPL - Exception handler for CVTPL instruction
                       0300       ;+
                       0300       ; Input Parameters:
                       0300       ;
                       0300       ;     OPCODE(SP)
                       0300       ;     OLD_PC(SP)
                       0300       ;     OPERAND_1(SP) - srclen.rw
                       0300       ;     OPERAND_2(SP) - srcaddr.ab
                       0300       ;     OPERAND_3(SP) - dst.wl
                       0300       ;     OPERAND_4(SP)
                       0300       ;     OPERAND_5(SP)
                       0300       ;     OPERAND_6(SP)
                       0300       ;     OPERAND_7(SP)
                       0300       ;     OPERAND_8(SP)
                       0300       ;     NEW_PC(SP)
                       0300       ;     EXCEPTION_PSL(SP)
                       0300       ;
                       0300       ; Output Parameters:
                       0300       ;
                       0300       ;     R0<15:0> - srclen.rw
                       0300       ;     R1       - srcaddr.ab
                       0300       ;     R3       - dst.wl
                       0300       ;
                       0300       ; Notes:
                       0300       ;
                       0300       ;     The routine header for VAX$CVTPL describes how the destination is
                       0300       ;     encoded in a register. Basically, OPERAND_3 contains the effective
                       0300       ;     address of the operand. If the destination is a general register, then
                       0300       ;     OPERAND_3 contains the ones complement of the register number.
                       0300       ;
                       0300       ; Implicit Output:
                       0300       ;
                       0300       ;     R0<31:16> - 0
                       0300       ;     R2        - explicitly set to zero
                       0300       ;-
                       0300
                       0300       CVTPL:
                       0300
     50   08 AE   3C   0300             MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- srclen.rw
     51   0C AE   D0   0304             MOVL    OPERAND_2(SP),R1        ; R1       <- srcaddr.ab
             52   D4   0308             CLRL    R2                      ; R2       <- 0
     53   10 AE   D0   030A             MOVL    OPERAND_3(SP),R3        ; R3       <- dst.wl
                       030E
                       030E       ; Now that the operands have been loaded, the only exception parameter
                       030E       ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                       030E       ; there is no reason why the state of the stack needs to be altered and we
                       030E       ; save two instructions if we leave the stack alone.
                       030E
        0425'CF   9F   030E             PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
          FCEB'   31   0312             BRW     VAX$CVTPL               ; Do the actual work
```

```
                         0315        .SUBTITLE       CVTPS - Exception handler for CVTPS instruction
                         0315  ;+
                         0315  ; Input Parameters:
                         0315  ;
                         0315  ;          OPCODE(SP)
                         0315  ;          OLD_PC(SP)
                         0315  ;          OPERAND_1(SP) - srclen.rw
                         0315  ;          OPERAND_2(SP) - srcaddr.ab
                         0315  ;          OPERAND_3(SP) - dstlen.rw
                         0315  ;          OPERAND_4(SP) - dstaddr.ab
                         0315  ;          OPERAND_5(SP)
                         0315  ;          OPERAND_6(SP)
                         0315  ;          OPERAND_7(SP)
                         0315  ;          OPERAND_8(SP)
                         0315  ;          NEW_PC(SP)
                         0315  ;          EXCEPTION_PSL(SP)
                         0315  ;
                         0315  ; Output Parameters:
                         0315  ;
                         0315  ;          R0<15:0> - srclen.rw
                         0315  ;          R1       - srcaddr.ab
                         0315  ;          R2<15:0> - dstlen.rw
                         0315  ;          R3       - dstaddr.ab
                         0315  ;
                         0315  ; Implicit Output:
                         0315  ;
                         0315  ;          R0<31:16> - 0
                         0315  ;          R2<31:16> - 0
                         0315  ;-
                         0315
                         0315  CVTPS:
                         0315
50    08 AE   3C         0315             MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- srclen.rw
51    0C AE   D0         0319             MOVL    OPERAND_2(SP),R1        ; R1       <- srcaddr.ab
52    10 AE   3C         031D             MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- dstlen.rw
53    14 AE   D0         0321             MOVL    OPERAND_4(SP),R3        ; R3       <- dstaddr.ab
                         0325
                         0325  ; Now that the operands have been loaded, the only exception parameter
                         0325  ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                         0325  ; there is no reason why the state of the stack needs to be altered and we
                         0325  ; save two instructions if we leave the stack alone.
                         0325
     0425'CF   9F        0325             PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
        FCD4'  31        0329             BRW     VAX$CVTPS               ; Do the actual work
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                         032C          .SUBTITLE       CVTPT - Exception handler for CVTPT instruction
                         032C    ;+
                         032C    ; Input Parameters:
                         032C    ;
                         032C    ;       OPCODE(SP)
                         032C    ;       OLD_PC(SP)
                         032C    ;       OPERAND_1(SP) - srclen.rw
                         032C    ;       OPERAND_2(SP) - srcaddr.ab
                         032C    ;       OPERAND_3(SP) - tbladdr.ab
                         032C    ;       OPERAND_4(SP) - dstlen.rw
                         032C    ;       OPERAND_5(SP) - dstaddr.ab
                         032C    ;       OPERAND_6(SP)
                         032C    ;       OPERAND_7(SP)
                         032C    ;       OPERAND_8(SP)
                         032C    ;       NEW_PC(SP)
                         032C    ;       EXCEPTION_PSL(SP)
                         032C    ;
                         032C    ; Output Parameters:
                         032C    ;
                         032C    ;       R0<15:0>  - srclen.rw
                         032C    ;       R0<31:16> - dstlen.rw
                         032C    ;       R1        - srcaddr.ab
                         032C    ;       R2        - tbladdr.ab
                         032C    ;       R3        - dstaddr.ab
                         032C    ;-
                         032C
                         032C    CVTPT:
                         032C
50   14 AE    10    9C   032C           ROTL    #16,OPERAND_4(SP),R0     ; R0<31:16> <- dstlen.rw
     50    08 AE    B0   0331           MOVW    OPERAND_1(SP),R0         ; R0<15:0>  <- srclen.rw
     51    0C AE    D0   0335           MOVL    OPERAND_2(SP),R1         ; R1        <- srcaddr.ab
     52    10 AE    D0   0339           MOVL    OPERAND_3(SP),R2         ; R2        <- tbladdr.ab
     53    18 AE    D0   033D           MOVL    OPERAND_5(SP),R3         ; R3        <- dstaddr.ab
                         0341
                         0341    ; Now that the operands have been loaded, the only exception parameter
                         0341    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                         0341    ; there is no reason why the state of the stack needs to be altered and we
                         0341    ; save two instructions if we leave the stack alone.
                         0341
          0425'CF   9F   0341           PUSHAB  VAX$EXIT_EMULATOR        ; Store the return PC
             FCB8'  31   0345           BRW     VAX$CVTPT                ; Do the actual work
```

```
                        0348          .SUBTITLE     CVTSP - Exception handler for CVTSP instruction
                        0348 ;+
                        0348 ; Input Parameters:
                        0348 ;
                        0348 ;        OPCODE(SP)
                        0348 ;        OLD_PC(SP)
                        0348 ;        OPERAND_1(SP) - srclen.rw
                        0348 ;        OPERAND_2(SP) - srcaddr.ab
                        0348 ;        OPERAND_3(SP) - dstlen.rw
                        0348 ;        OPERAND_4(SP) - dstaddr.ab
                        0348 ;        OPERAND_5(SP)
                        0348 ;        OPERAND_6(SP)
                        0348 ;        OPERAND_7(SP)
                        0348 ;        OPERAND_8(SP)
                        0348 ;        NEW_PC(SP)
                        0348 ;        EXCEPTION_PSL(SP)
                        0348 ;
                        0348 ; Output Parameters:
                        0348 ;
                        0348 ;        R0<15:0> - srclen.rw
                        0348 ;        R1       - srcaddr.ab
                        0348 ;        R2<15:0> - dstlen.rw
                        0348 ;        R3       - dstaddr.ab
                        0348 ;
                        0348 ; Implicit Output:
                        0348 ;
                        0348 ;        R0<31:16> - 0
                        0348 ;        R2<31:16> - 0
                        0348 ;-
                        0348
                        0348 CVTSP:
                        0348
   50   08 AE   3C      0348          MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- srclen.rw
   51   0C AE   D0      034C          MOVL    OPERAND_2(SP),R1        ; R1       <- srcaddr.ab
   52   10 AE   3C      0350          MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- dstlen.rw
   53   14 AE   D0      0354          MOVL    OPERAND_4(SP),R3        ; R3       <- dstaddr.ab
                        0358
                        0358 ; Now that the operands have been loaded, the only exception parameter
                        0358 ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        0358 ; there is no reason why the state of the stack needs to be altered and we
                        0358 ; save two instructions if we leave the stack alone.
                        0358
      0425'CF   9F      0358          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
        FCA1'   31      035C          BRW     VAX$CVTSP               ; Do the actual work
```

```
                        035F            .SUBTITLE       CVTTP - Exception handler for CVTTP instruction
                        035F    ;+
                        035F    ; Input Parameters:
                        035F    ;
                        035F    ;       OPCODE(SP)
                        035F    ;       OLD_PC(SP)
                        035F    ;       OPERAND_1(SP) - srclen.rw
                        035F    ;       OPERAND_2(SP) - srcaddr.ab
                        035F    ;       OPERAND_3(SP) - tbladdr.ab
                        035F    ;       OPERAND_4(SP) - dstlen.rw
                        035F    ;       OPERAND_5(SP) - dstaddr.ab
                        035F    ;       OPERAND_6(SP)
                        035F    ;       OPERAND_7(SP)
                        035F    ;       OPERAND_8(SP)
                        035F    ;       NEW_PC(SP)
                        035F    ;       EXCEPTION_PSL(SP)
                        035F    ;
                        035F    ; Output Parameters:
                        035F    ;
                        035F    ;       R0<15:0>  - srclen.rw
                        035F    ;       R0<31:16> - dstlen.rw
                        035F    ;       R1        - srcaddr.ab
                        035F    ;       R2        - tbladdr.ab
                        035F    ;       R3        - dstaddr.ab
                        035F    ;-
                        035F
                        035F    CVTTP:
                        035F
 50   14 AE   10   9C   035F            ROTL    #16,OPERAND_4(SP),R0    ; R0<31:16> <- dstlen.rw
      50   08 AE   B0   0364            MOVW    OPERAND_1(SP),R0        ; R0<15:0>  <- srclen.rw
      51   0C AE   D0   0368            MOVL    OPERAND_2(SP),R1        ; R1        <- srcaddr.ab
      52   10 AE   D0   036C            MOVL    OPERAND_3(SP),R2        ; R2        <- tbladdr.ab
      53   18 AE   D0   0370            MOVL    OPERAND_5(SP),R3        ; R3        <- dstaddr.ab
                        0374
                        0374    ; Now that the operands have been loaded, the only exception parameter
                        0374    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        0374    ; there is no reason why the state of the stack needs to be altered and we
                        0374    ; save two instructions if we leave the stack alone.
                        0374
          0425'CF  9F   0374            PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
            FC85'  31   0378            BRW     VAX$CVTTP               ; Do the actual work
```

```
                    037B          .SUBTITLE       DIVP - Exception handler for DIVP instruction
                    037B     ;+
                    037B     ; Input Parameters:
                    037B     ;
                    037B     ;        OPCODE(SP)
                    037B     ;        OLD_PC(SP)
                    037B     ;        OPERAND_1(SP) - divrlen.rw
                    037B     ;        OPERAND_2(SP) - divraddr.ab
                    037B     ;        OPERAND_3(SP) - divdlen.rw
                    037B     ;        OPERAND_4(SP) - divdaddr.ab
                    037B     ;        OPERAND_5(SP) - quolen.rw
                    037B     ;        OPERAND_6(SP) - quoaddr.ab
                    037B     ;        OPERAND_7(SP)
                    037B     ;        OPERAND_8(SP)
                    037B     ;        NEW_PC(SP)
                    037B     ;        EXCEPTION_PSL(SP)
                    037B     ;
                    037B     ; Output Parameters:
                    037B     ;
                    037B     ;        R0<15:0> - divrlen.rw
                    037B     ;        R1       - divraddr.ab
                    037B     ;        R2<15:0> - divdlen.rw
                    037B     ;        R3       - divdaddr.ab
                    037B     ;        R4<15:0> - quolen.rw
                    037B     ;        R5       - quoaddr.ab
                    037B     ;
                    037B     ; Implicit Output:
                    037B     ;
                    037B     ;        R0<31:16> - 0
                    037B     ;        R2<31:16> - 0
                    037B     ;        R4<31:16> - 0
                    037B     ;-
                    037B
                    037B     DIVP:
                    037B
50    08 AE    3C   037B          MOVZWL  OPERAND_1(SP),R0         ; R0<15:0> <- divrlen.rw
51    0C AE    D0   037F          MOVL    OPERAND_2(SP),R1         ; R1       <- divraddr.ab
52    10 AE    3C   0383          MOVZWL  OPERAND_3(SP),R2         ; R2<15:0> <- divdlen.rw
53    14 AE    D0   0387          MOVL    OPERAND_4(SP),R3         ; R3       <- divdaddr.ab
54    18 AE    3C   038B          MOVZWL  OPERAND_5(SP),R4         ; R4<15:0> <- quolen.rw
55    1C AE    D0   038F          MOVL    OPERAND_6(SP),R5         ; R5       <- quoaddr.ab
                    0393
                    0393     ; Now that the operands have been loaded, the only exception parameter
                    0393     ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                    0393     ; there is no reason why the state of the stack needs to be altered and we
                    0393     ; save two instructions if we leave the stack alone.
                    0393
     0425'CF   9F   0393          PUSHAB  VAX$EXIT_EMULATOR        ; Store the return PC
        FC66'  31   0397          BRW     VAX$DIVP                 ; Do the actual work
```

```
                    039A        .SUBTITLE       MOVP - Exception handler for MOVP instruction
                    039A  ;+
                    039A  ; Input Parameters:
                    039A  ;
                    039A  ;         OPCODE(SP)
                    039A  ;         OLD_PC(SP)
                    039A  ;         OPERAND_1(SP) - len.rw
                    039A  ;         OPERAND_2(SP) - srcaddr.ab
                    039A  ;         OPERAND_3(SP) - dstaddr.ab
                    039A  ;         OPERAND_4(SP)
                    039A  ;         OPERAND_5(SP)
                    039A  ;         OPERAND_6(SP)
                    039A  ;         OPERAND_7(SP)
                    039A  ;         OPERAND_8(SP)
                    039A  ;         NEW_PC(SP)
                    039A  ;         EXCEPTION_PSL(SP)
                    039A  ;
                    039A  ; Output Parameters:
                    039A  ;
                    039A  ;         R0<15:0> - len.rw
                    039A  ;         R1       - srcaddr.ab
                    039A  ;         R3       - dstaddr.ab
                    039A  ;
                    039A  ; Implicit Output:
                    039A  ;
                    039A  ;         R0<31:16> - 0
                    039A  ;         R2        - UNPREDICTABLE
                    039A  ;-
                    039A
                    039A  MOVP:
                    039A
 50   08 AE     3C  039A            MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- len.rw
 51   0C AE     D0  039E            MOVL    OPERAND_2(SP),R1        ; R1       <- srcaddr.ab
 53   10 AE     D0  03A2            MOVL    OPERAND_3(SP),R3        ; R3       <- dstaddr.ab
                    03A6
                    03A6  ; Now that the operands have been loaded, the only exception parameter
                    03A6  ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                    03A6  ; there is no reason why the state of the stack needs to be altered and we
                    03A6  ; save two instructions if we leave the stack alone.
                    03A6
                    03A6  ; The MOVP instruction is the only instruction in this entire set that
                    03A6  ; preserves the setting of the C-bit. The C-bit setting in the saved PSL
                    03A6  ; is propogated into the current PSL because the current PSL forms the
                    03A6  ; initial setting for the final settings of the condition codes.
                    03A6
           01   B9  03A6            BICPSW  #PSL$M_C                ; Assume C bit is clear
                    03A8
                    03A8            ASSUME PSL$V_C EQ 0             ; Make sure that BLBC is OK
                    03A8
   02 2C AE     E9  03A8            BLBC    EXCEPTION_PSL(SP),10$   ; Skip next if saved C-bit is clear
           01   B8  03AC            BISPSW  #PSL$M_C                ; Otherwise, set the C-bit
                    03AE
                    03AE  ; Note that it is crucial that no instructions that alter the C-bit can
                    03AE  ; execute until the PSL is saved in VAX$MOVP. PUSHAB preserves the C-bit.
                    03AE
      0425'CF   9F  03AE  10$:      PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
        FC4B'   31  03B2            BRW     VAX$MOVP                ; Do the actual work
```

```
                        03B5          .SUBTITLE       MULP - Exception handler for MULP instruction
                        03B5    ;+
                        03B5    ; Input Parameters:
                        03B5    ;
                        03B5    ;       OPCODE(SP)
                        03B5    ;       OLD_PC(SP)
                        03B5    ;       OPERAND_1(SP) - mulrlen.rw
                        03B5    ;       OPERAND_2(SP) - mulraddr.ab
                        03B5    ;       OPERAND_3(SP) - muldlen.rw
                        03B5    ;       OPERAND_4(SP) - muldaddr.ab
                        03B5    ;       OPERAND_5(SP) - prodlen.rw
                        03B5    ;       OPERAND_6(SP) - prodaddr.ab
                        03B5    ;       OPERAND_7(SP)
                        03B5    ;       OPERAND_8(SP)
                        03B5    ;       NEW_PC(SP)
                        03B5    ;       EXCEPTION_PSL(SP)
                        03B5    ;
                        03B5    ; Output Parameters:
                        03B5    ;
                        03B5    ;       R0<15:0> - mulrlen.rw
                        03B5    ;       R1       - mulraddr.ab
                        03B5    ;       R2<15:0> - muldlen.rw
                        03B5    ;       R3       - muldaddr.ab
                        03B5    ;       R4<15:0> - prodlen.rw
                        03B5    ;       R5       - prodaddr.ab
                        03B5    ;
                        03B5    ; Implicit Output:
                        03B5    ;
                        03B5    ;       R0<31:16> - 0
                        03B5    ;       R2<31:16> - 0
                        03B5    ;       R4<31:16> - 0
                        03B5    ;-
                        03B5
                        03B5    MULP:
                        03B5
   50    08 AE    3C    03B5          MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- mulrlen.rw
   51    0C AE    D0    03B9          MOVL    OPERAND_2(SP),R1        ; R1       <- mulraddr.ab
   52    10 AE    3C    03BD          MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- muldlen.rw
   53    14 AE    D0    03C1          MOVL    OPERAND_4(SP),R3        ; R3       <- muldaddr.ab
   54    18 AE    3C    03C5          MOVZWL  OPERAND_5(SP),R4        ; R4<15:0> <- prodlen.rw
   55    1C AE    D0    03C9          MOVL    OPERAND_6(SP),R5        ; R5       <- prodaddr.ab
                        03CD
                        03CD    ; Now that the operands have been loaded, the only exception parameter
                        03CD    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        03CD    ; there is no reason why the state of the stack needs to be altered and we
                        03CD    ; save two instructions if we leave the stack alone.
                        03CD
      0425'CF     9F    03CD          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
         FC2C'    31    03D1          BRW     VAX$MULP                ; Do the actual work
```

```
                             03D4          .SUBTITLE       SUBP4 - Exception handler for SUBP4 instruction
                             03D4   ;+
                             03D4   ; Input Parameters:
                             03D4   ;
                             03D4   ;       OPCODE(SP)
                             03D4   ;       OLD_PC(SP)
                             03D4   ;       OPERAND_1(SP) - sublen.rw
                             03D4   ;       OPERAND_2(SP) - subaddr.ab
                             03D4   ;       OPERAND_3(SP) - diflen.rw
                             03D4   ;       OPERAND_4(SP) - difaddr.ab
                             03D4   ;       OPERAND_5(SP)
                             03D4   ;       OPERAND_6(SP)
                             03D4   ;       OPERAND_7(SP)
                             03D4   ;       OPERAND_8(SP)
                             03D4   ;       NEW_PC(SP)
                             03D4   ;       EXCEPTION_PSL(SP)
                             03D4   ;
                             03D4   ; Output Parameters:
                             03D4   ;
                             03D4   ;       R0<15:0> - sublen.rw
                             03D4   ;       R1       - subaddr.ab
                             03D4   ;       R2<15:0> - diflen.rw
                             03D4   ;       R3       - difaddr.ab
                             03D4   ;
                             03D4   ; Implicit Output:
                             03D4   ;
                             03D4   ;       R0<31:16> - 0
                             03D4   ;       R2<31:16> - 0
                             03D4   ;-
                             03D4
                             03D4   SUBP4:
                             03D4
        50   08 AE     3C    03D4          MOVZWL  OPERAND_1(SP),R0        ; R0<15:0> <- sublen.rw
        51   0C AE     D0    03D8          MOVL    OPERAND_2(SP),R1        ; R1       <- subaddr.ab
        52   10 AE     3C    03DC          MOVZWL  OPERAND_3(SP),R2        ; R2<15:0> <- diflen.rw
        53   14 AE     D0    03E0          MOVL    OPERAND_4(SP),R3        ; R3       <- difaddr.ab
                             03E4
                             03E4   ; Now that the operands have been loaded, the only exception parameter
                             03E4   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                             03E4   ; there is no reason why the state of the stack needs to be altered and we
                             03E4   ; save two instructions if we leave the stack alone.
                             03E4
           0425'CF     9F    03E4          PUSHAB  VAX$EXIT_EMULATOR       ; Store the return PC
              FC15'    31    03E8          BRW     VAX$SUBP4               ; Do the actual work
```

```
                        03EB          .SUBTITLE       SUBP6 - Exception handler for SUBP6 instruction
                        03EB   ;+
                        03EB   ; Input Parameters:
                        03EB   ;
                        03EB   ;       OPCODE(SP)
                        03EB   ;       OLD_PC(SP)
                        03EB   ;       OPERAND_1(SP) - sublen.rw
                        03EB   ;       OPERAND_2(SP) - subaddr.ab
                        03EB   ;       OPERAND_3(SP) - minlen.rw
                        03EB   ;       OPERAND_4(SP) - minaddr.ab
                        03EB   ;       OPERAND_5(SP) - diflen.rw
                        03EB   ;       OPERAND_6(SP) - difaddr.ab
                        03EB   ;       OPERAND_7(SP)
                        03EB   ;       OPERAND_8(SP)
                        03EB   ;       NEW_PC(SP)
                        03EB   ;       EXCEPTION_PSL(SP)
                        03EB   ;
                        03EB   ; Output Parameters:
                        03EB   ;
                        03EB   ;       R0<15:0> - sublen.rw
                        03EB   ;       R1       - subaddr.ab
                        03EB   ;       R2<15:0> - minlen.rw
                        03EB   ;       R3       - minaddr.ab
                        03EB   ;       R4<15:0> - diflen.rw
                        03EB   ;       R5       - difaddr.ab
                        03EB   ;
                        03EB   ; Implicit Output:
                        03EB   ;
                        03EB   ;       R0<31:16> - 0
                        03EB   ;       R2<31:16> - 0
                        03EB   ;       R4<31:16> - 0
                        03EB   ;-
                        03EB
                        03EB   SUBP6:
                        03EB
50    08 AE    3C       03EB           MOVZWL  OPERAND_1(SP),R0         ; R0<15:0> <- sublen.rw
51    0C AE    D0       03EF           MOVL    OPERAND_2(SP),R1         ; R1       <- subaddr.ab
52    10 AE    3C       03F3           MOVZWL  OPERAND_3(SP),R2         ; R2<15:0> <- minlen.rw
53    14 AE    D0       03F7           MOVL    OPERAND_4(SP),R3         ; R3       <- minaddr.ab
54    18 AE    3C       03FB           MOVZWL  OPERAND_5(SP),R4         ; R4<15:0> <- diflen.rw
55    1C AE    D0       03FF           MOVL    OPERAND_6(SP),R5         ; R5       <- difaddr.ab
                        0403
                        0403   ; Now that the operands have been loaded, the only exception parameter
                        0403   ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                        0403   ; there is no reason why the state of the stack needs to be altered and we
                        0403   ; save two instructions if we leave the stack alone.
                        0403
   0425'CF     9F       0403           PUSHAB  VAX$EXIT_EMULATOR        ; Store the return PC
      FBF6'    31       0407           BRW     VAX$SUBP6                ; Do the actual work
```

```
                     040A              .SUBTITLE       EDITPC - Exception handler for EDITPC instruction
                     040A    ;+
                     040A    ; Input Parameters:
                     040A    ;
                     040A    ;         OPCODE(SP)
                     040A    ;         OLD_PC(SP)
                     040A    ;         OPERAND_1(SP) - srclen.rw
                     040A    ;         OPERAND_2(SP) - srcaddr.ab
                     040A    ;         OPERAND_3(SP) - pattern.ab
                     040A    ;         OPERAND_4(SP) - dstaddr.ab
                     040A    ;         OPERAND_5(SP)
                     040A    ;         OPERAND_6(SP)
                     040A    ;         OPERAND_7(SP)
                     040A    ;         OPERAND_8(SP)
                     040A    ;         NEW_PC(SP)
                     040A    ;         EXCEPTION_PSL(SP)
                     040A    ;
                     040A    ; Output Parameters:
                     040A    ;
                     040A    ;         R0<15:0> - srclen.rw
                     040A    ;         R1       - srcaddr.ab
                     040A    ;         R3       - pattern.ab
                     040A    ;         R5       - dstaddr.ab
                     040A    ;
                     040A    ; Implicit Output:
                     040A    ;
                     040A    ;         R0<31:16> - 0
                     040A    ;         R2        - explicitly set to zero
                     040A    ;         R4        - explicitly set to zero
                     040A    ;-
                     040A
                     040A    EDITPC:
                     040A
 50    08 AE    3C   040A              MOVZWL  OPERAND_1(SP),R0          ; R0<15:0> <- srclen.rw
 51    0C AE    D0   040E              MOVL    OPERAND_2(SP),R1          ; R1       <- srcaddr.ab
          52    D4   0412              CLRL    R2                        ; R2       <- 0
 53    10 AE    D0   0414              MOVL    OPERAND_3(SP),R3          ; R3       <- pattern.ab
          54    D4   0418              CLRL    R4                        ; R4       <- 0
 55    14 AE    D0   041A              MOVL    OPERAND_4(SP),R5          ; R5       <- dstaddr.ab
                     041E
                     041E    ; Now that the operands have been loaded, the only exception parameter
                     041E    ; other than the PC/PSL pair that needs to be saved is the old PC. However,
                     041E    ; there is no reason why the state of the stack needs to be altered and we
                     041E    ; save two instructions if we leave the stack alone.
                     041E
    0425'CF     9F   041E              PUSHAB  VAX$EXIT_EMULATOR         ; Store the return PC
      FBDB'     31   0422              BRW     VAX$EDITPC                ; Do the actual work
```

```
                     0425          .SUBTITLE        Common Exit Path for VAX$xxxxxx Routines
                     0425   ;+
                     0425   ; Functional Description:
                     0425   ;
                     0425   ;       This is the common exit path for all instruction-specific routines.
                     0425   ;       The condition codes returned by the VAX$xxxxxx routine are stored in
                     0425   ;       the exception PSL and control is passed back to the instruction stream
                     0425   ;       that executed the reserved instruction.
                     0425   ;
                     0425   ; Input Parameters:
                     0425   ;
                     0425   ;       PSL contains condition code settings from VAX$xxxxxx routine.
                     0425   ;
                     0425   ;       OPCODE(SP)     - Opcode of reserved instruction
                     0425   ;       OLD_PC(SP)     - PC of reserved instruction
                     0425   ;       OPERAND_1(SP) - First operand specifier
                     0425   ;       OPERAND_2(SP) - Second operand specifier
                     0425   ;       OPERAND_3(SP) - Third operand specifier
                     0425   ;       OPERAND_4(SP) - Fourth operand specifier
                     0425   ;       OPERAND_5(SP) - Fifth operand specifier
                     0425   ;       OPERAND_6(SP) - Sixth operand specifier
                     0425   ;       OPERAND_7(SP) - Seventh operand specifier (currently unused)
                     0425   ;       OPERAND_8(SP) - Eight operand specifier (currently unused)
                     0425   ;       NEW_PC(SP)     - PC of instruction following reserved instruction
                     0425   ;       EXCEPTION_PSL(SP) - PSL at time of exception
                     0425   ;
                     0425   ; Implicit Input:
                     0425   ;
                     0425   ;       General registers contain architecturally specified values according
                     0425   ;       to specific instruction that was emulated.
                     0425   ;
                     0425   ; Implicit Output:
                     0425   ;
                     0425   ;       Control is passed to the location designated by "new PC" with the
                     0425   ;       condition codes as determined by VAX$xxxxxx. The EXIT routine also
                     0425   ;       preserves general registers.
                     0425   ;-
                     0425
                     0425   VAX$EXIT_EMULATOR::
           7E   DC   0425          MOVPSL  -(SP)                    ; Save the new PSL on the stack
                     0427
                     0427   ; Note that the next instruction makes no assumptions about the condition
                     0427   ; codes in the saved PSL.
                     0427
04    00   8E   F0   0427          INSV    (SP)+,#0,#4,-
        2C AE        042B           EXCEPTION_PSL(SP)        ; Replace saved condition codes
      5E   28   C0   042D          ADDL    #NEW_PC,SP               ; Adjust stack pointer (discard old PC)
                02   0430          REI                              ; Return
                     0431
                     0431          .END
```

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VAX$EMULATE                      - VAX-11 Instruction Emulator          16-SEP-1984 01:29:10  VAX/VMS Macro V04-00       Page  42
Symbol table                                                             5-SEP-1984 00:45:28  [EMULAT.SRC]VAXEMULAT.MAR;1     (34)

...OFFSET                        = 00000040                   OP$_ADDP4                        = 00000020
...OPCODE                        = 00000038                   OP$_ADDP6                        = 00000021
ADDP4                              0000026A R     02          OP$_ASHP                         = 000000F8
ADDP6                              00000281 R     02          OP$_CMPC3                        = 00000029
ASHP                               000002A0 R     02          OP$_CMPC5                        = 0000002D
CASE_TABLE_BASE                    00000006 R     02          OP$_CMPP3                        = 00000035
CASE_TABLE_SIZE                  = 00000044                   OP$_CMPP4                        = 00000037
CMPC3                              000001B7 R     02          OP$_CRC                          = 0000000B
CMPC5                              000001CA R     02          OP$_CVTLP                        = 000000F9
CMPP3                              000002C1 R     02          OP$_CVTPL                        = 00000036
CMPP4                              000002D4 R     02          OP$_CVTPS                        = 00000008
CRC                                00000253 R     02          OP$_CVTPT                        = 00000024
CVTLP                              000002EB R     02          OP$_CVTSP                        = 00000009
CVTPL                              00000300 R     02          OP$_CVTTP                        = 00000026
CVTPS                              00000315 R     02          OP$_DIVP                         = 00000027
CVTPT                              0000032C R     02          OP$_EDITPC                       = 00000038
CVTSP                              00000348 R     02          OP$_LOCC                         = 0000003A
CVTTP                              0000035F R     02          OP$_MATCHC                       = 00000039
DIVP                               0000037B R     02          OP$_MOVP                         = 00000034
EDITPC                             0000040A R     02          OP$_MOVTC                        = 0000002E
EXCEPTION_PSL                    = 0000002C                   OP$_MOVTUC                       = 0000002F
FPD_CASE_TABLE_BASE                000000D6 R     02          OP$_MULP                         = 00000025
INCLUDE_ADDP4                    = 00000000                   OP$_SCANC                        = 0000002A
INCLUDE_ADDP6                    = 00000000                   OP$_SKPC                         = 0000003B
INCLUDE_ASHP                     = 00000000                   OP$_SPANC                        = 0000002B
INCLUDE_CMPC3                    = 00000000                   OP$_SUBP4                        = 00000022
INCLUDE_CMPC5                    = 00000000                   OP$_SUBP6                        = 00000023
INCLUDE_CMPP3                    = 00000000                   OPCODE                           = 00000000
INCLUDE_CMPP4                    = 00000000                   OPCODE_BASE                      = FFFFFFF8
INCLUDE_CRC                      = 00000000                   OPCODE_MAX                       = 0000003B
INCLUDE_CVTLP                    = 00000000                   OPERAND_1                        = 00000008
INCLUDE_CVTPL                    = 00000000                   OPERAND_2                        = 0000000C
INCLUDE_CVTPS                    = 00000000                   OPERAND_3                        = 00000010
INCLUDE_CVTPT                    = 00000000                   OPERAND_4                        = 00000014
INCLUDE_CVTSP                    = 00000000                   OPERAND_5                        = 00000018
INCLUDE_CVTTP                    = 00000000                   OPERAND_6                        = 0000001C
INCLUDE_DIVP                     = 00000000                   OPERAND_8                        = 00000024
INCLUDE_EDITPC                   = 00000000                   PSL$M_C                          = 00000001
INCLUDE_LOCC                     = 00000000                   PSL$V_C                          = 00000000
INCLUDE_MATCHC                   = 00000000                   PSL$V_FPD                        = 0000001B
INCLUDE_MOVP                     = 00000000                   SCANC                              000001E6 R     02
INCLUDE_MOVTC                    = 00000000                   SKPC                               00000228 R     02
INCLUDE_MOVTUC                   = 00000000                   SPANC                              000001FD R     02
INCLUDE_MULP                     = 00000000                   SUBP4                              000003D4 R     02
INCLUDE_SCANC                    = 00000000                   SUBP6                              000003EB R     02
INCLUDE_SKPC                     = 00000000                   VAX$ADDP4                          ********   X  02
INCLUDE_SPANC                    = 00000000                   VAX$ADDP6                          ********   X  02
INCLUDE_SUBP4                    = 00000000                   VAX$AL_DELTA_PC_TABLE              ********   X  00
INCLUDE_SUBP6                    = 00000000                   VAX$ASHP                           ********   X  02
LOCC                               00000214 R     02          VAX$CMPC3                          ********   X  02
MATCHC                             0000023C R     02          VAX$CMPC5                          ********   X  02
MOVP                               0000039A R     02          VAX$CMPP3                          ********   X  02
MOVTC                              00000179 R     02          VAX$CMPP4                          ********   X  02
MOVTUC                             00000198 R     02          VAX$CRC                            ********   X  02
MULP                               000003B5 R     02          VAX$CVTLP                          ********   X  02
NEW_PC                           = 00000028                   VAX$CVTLP_RESTART                  ********   X  02
OLD_PC                           = 00000004                   VAX$CVTPL                          ********   X  02
```

```
                                                   M 14
VAX$EMULATE                 - VAX-11 Instruction Emulator        16-SEP-1984 01:29:10  VAX/VMS Macro V04-00        Page  43
Symbol table                                                      5-SEP-1984 00:45:28  [EMULAT.SRC]VAXEMULAT.MAR;1      (34)

VAX$CVTPL_RESTART               ********     X   02
VAX$CVTPS                       ********     X   02
VAX$CVTPT                       ********     X   02
VAX$CVTPT_RESTART               ********     X   02
VAX$CVTSP                       ********     X   02
VAX$CVTTP                       ********     X   02
VAX$CVTTP_RESTART               ********     X   02
VAX$DIVP                        ********     X   02
VAX$EDITPC                      ********     X   02
VAX$EDITPC_RESTART              ********     X   02
VAX$EMULATE                     00000000 RG      02
VAX$EMULATE_FPD                 0000009C RG      02
VAX$EXIT_EMULATOR               00000425 RG      02
VAX$LOCC                        ********     X   02
VAX$MATCHC                      ********     X   02
VAX$MOVP                        ********     X   02
VAX$MOVTC                       ********     X   02
VAX$MOVTUC                      ********     X   02
VAX$MULP                        ********     X   02
VAX$REFLECT_TO_VMS              ********     X   00
VAX$SCANC                       ********     X   02
VAX$SKPC                        ********     X   02
VAX$SPANC                       ********     X   02
VAX$SUBP4                       ********     X   02
VAX$SUBP6                       ********     X   02
VAX$_OPCDEC                     ********     X   00
VAX$_OPCDEC_FPD                 ********     X   00

                                            +----------------+
                                            ! Psect synopsis !
                                            +----------------+

PSECT name                      Allocation          PSECT No.  Attributes
----------                      ----------          ---------  ----------
.  ABS  .                       00000000  (     0.)  00 (  0.)  NOPIC   USR   CON   ABS   LCL NOSHR NOEXE NORD   NOWRT NOVEC BYTE
$ABS$                           00000000  (     0.)  01 (  1.)  NOPIC   USR   CON   ABS   LCL NOSHR   EXE   RD     WRT NOVEC BYTE
_VAX$CODE                       00000431  (  1073.)  02 (  2.)    PIC   USR   CON   REL   LCL   SHR   EXE   RD   NOWRT NOVEC QUAD

                                         +------------------------+
                                         ! Performance indicators !
                                         +------------------------+

Phase                     Page faults    CPU Time       Elapsed Time
-----                     -----------    --------       ------------
Initialization                      9    00:00:00.05    00:00:00.76
Command processing                 84    00:00:00.57    00:00:05.27
Pass 1                            271    00:00:09.05    00:00:29.52
Symbol table sort                   0    00:00:00.71    00:00:03.06
Pass 2                            316    00:00:04.15    00:00:12.58
Symbol table output                16    00:00:00.12    00:00:00.39
Psect synopsis output               2    00:00:00.02    00:00:00.02
Cross-reference output              0    00:00:00.00    00:00:00.00
Assembler run totals              698    00:00:14.67    00:00:51.60

The working set limit was 1500 pages.
66591 bytes (131 pages) of virtual memory were used to buffer the intermediate code.
There were 30 pages of symbol table space allocated to hold 532 non-local and 4 local symbols.
```

```
2002 source lines were read in Pass 1, producing 21 object records in Pass 2.
16 pages of virtual memory were used to define 14 macros.

                                        +----------------------------+
                                        ! Macro library statistics !
                                        +----------------------------+

Macro library name                      Macros defined
------------------                      --------------
_$255$DUA28:[EMULAT.OBJ]VAXMACROS.MLB;1               3
_$255$DUA28:[SYSLIB]STARLET.MLB;2                     6
TOTALS (all libraries)                                9

524 GETS were required to define 9 macros.

There were no errors, warnings or information messages.

MACRO/LIS=LIS$:VAXEMULAT/OBJ=OBJ$:VAXEMULAT MSRC$:VAXEMULAT/UPDATE=(ENH$:VAXEMULAT)+LIB$:VAXMACROS/LIB
```

0144 AH-BT13A-SE
VAX/VMS V4.0

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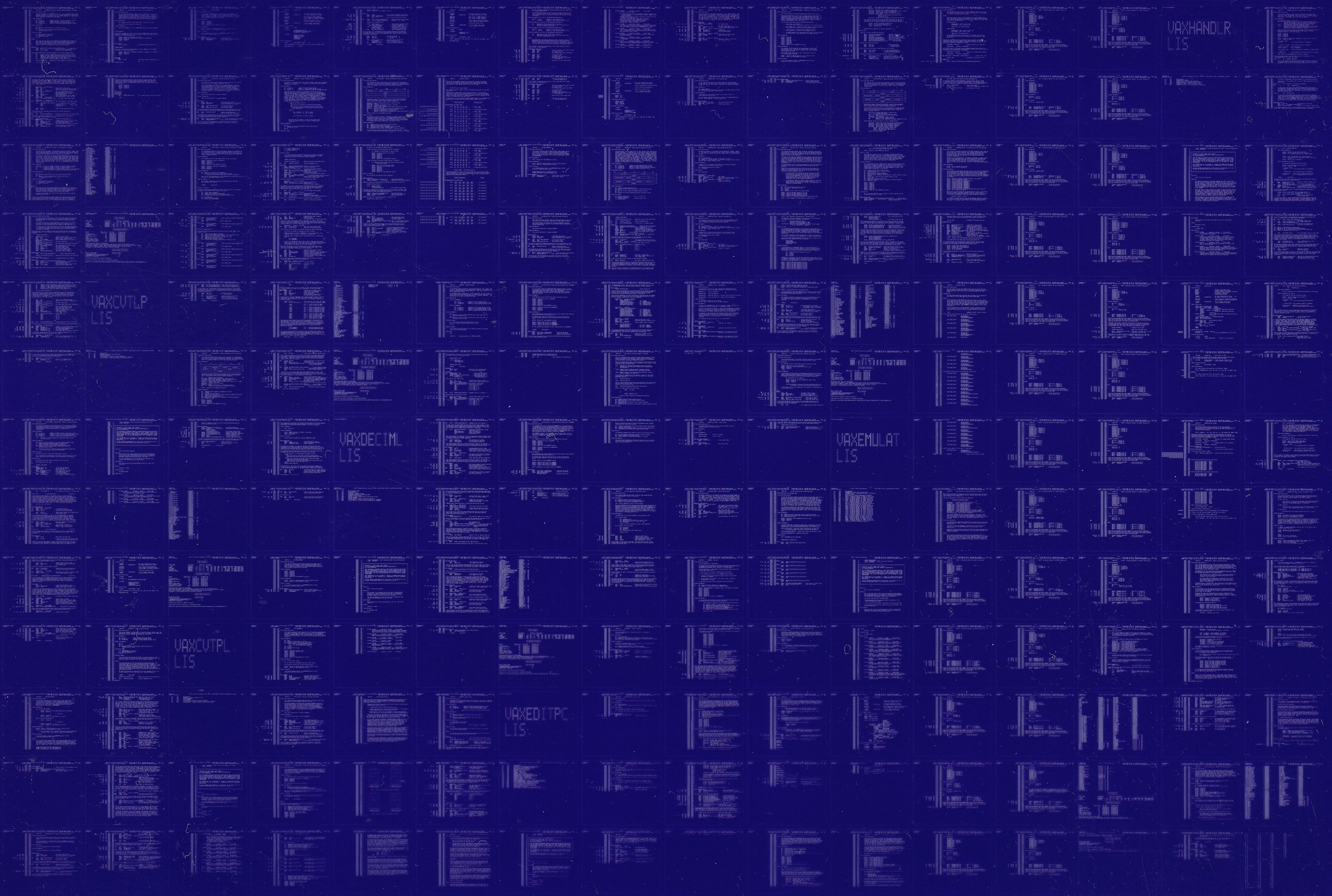

VAXHANDLR
LIS

VAXCVTLP
LIS

VAXDECIML
LIS

VAXEMULAT
LIS

VAXCVTPL
LIS

VAXEDITPC
LIS