UNIVERSAL ASSEMBLER VERSION 2.2.B JULY 29, 1979 (IN-HOUSE)

3802

Matches 143 r/s'd Code.

except BLKIN @977 @ 177 Trim!

not 171 where it should be.

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COMMAND LINE WAS: SNAP3 PROC14G3.PROC,,,PROC14G3:GBIPLX

INCLUSION A: PROCINC/TXT:DR0
INCLUSION B: PROC14G3/LIB:DR0.PMACMIC
INCLUSION C: PROC14G3/LIB:DR0.GMACROZ
INCLUSION D: PROC14G3/LIB:DR0.PROCEQUS
INCLUSION E: PROC14G3/LIB:DR0.BDEF1800
INCLUSION F: PROC14G3/LIB:DR0.MDEF1800
INCLUSION G: PROC14G3/LIB:DR0.PORTEQUS
INCLUSION H: PROC14G3/LIB:DR0.PORTASGN
INCLUSION I: PROC14G3/LIB:DR0.PROCPARM

PROGRAM NAME: PROC

PROGRAM ADDRESS BLOCKS:      010000   /ABSOLUTE/  SIZE=000000  (ABS)
                             167400   /SYSIVR/    SIZE=000400  (ABS)
                             170000   /SYSROM/    SIZE=000047  (ABS)
                             000000   /PROCL/     SIZE=002000  (REL)
                             000000   /PROCP/     SIZE=004000  (REL)

PRIMARY TRANSFER ADDRESS:    000000   /PROCL/

EXTERNAL DEFINITIONS:

POR       000000 /PROCL/   DL$DO     000051 /PROCL/   SCDON     001351 /PROCL/   SCLST     001341 /PROCL/
IVIOL$    001333 /PROCL/   UDOP      001335 /PROCL/   SYSTAT    000400 /PROCL/   INFO      000410 /PROCL/
LODCF     000431 /PROCL/   DMPOUT    000602 /PROCL/   DMPSOUT   000616 /PROCL/   DMPIN     000635 /PROCL/
DMPSIN    000654 /PROCL/   BLKOUT    000675 /PROCL/   BLKIN     000751 /PROCL/   PIN       001000 /PROCL/
INPUT     001007 /PROCL/   EXADR     001032 /PROCL/   EXSTAT    001053 /PROCL/   EXDATA    001064 /PROCL/
EXWRITE   001074 /PROCL/   EXCOM4    001105 /PROCL/   OUTPUT    001115 /PROCL/   EXCOM1    001122 /PROCL/
MIN       001171 /PROCL/   MOUT      001234 /PROCL/   SCROMLI   001307 /PROCL/   BP        001312 /PROCL/
SC        001314 /PROCL/   SCRAMI    001321 /PROCL/   UDPOP     001330 /PROCL/   BETA      001400 /PROCL/
ALPHA     001417 /PROCL/   SYSRET1   001514 /PROCL/   REGS      001564 /PROCL/   STL       001651 /PROCL/

EXTERNAL REFERENCES (UNDEFINED SYMBOLS):

RETS      SRVNXT    MEMPF$    FETCHN    FETCH     SRVRPT    FETCHW    PSHST0    PCMOD     SRVDO     POPST0    SYSRET0
FETCHRW   RIND
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1.                . 2.14.G  HJS  79 NOV  27    INSERT TIMING & DMP I/O INTERFACE
2.                . 2.14.F  HJS  79 OCT  10    CHANGE TO HONEYWELL NOISEMAKER (SOUNDS BETTER)
3.                . 2.14.E  HJS  79 AUG  13    FINAL CLEANUP (& BUG FIX) BEFORE RELEASE
4.                . 2.14.D  HJS  79 AUG  10    FOUND BUGS AND FIXED THEM
5.                . 2.14.C  HJS  79 AUG   6    FINAL CLEANUP BEFORE TRY THIS VERSION
6.                . 2.14.B  HJS  79 APR  17    RE-ORGANIZE ROUTINES TO MAKE IT FIT
7.                . 2.14.A  HJS  79 APR   4    START MODIFICATIONS FOR INTERNAL RIM 3800
8.                *
9.                . 2.13.A  HJS  79 JAN  22    FIX REGS TO WORK WITH ACCESS PROTECTED STACK
10.               *
11.               . 2.12    HJS  78 OCT  16    FINAL RELEASE
12.               . 2.12.D  HJS  78 OCT  15    CHANGE SYSTAT SO CAN TELL THE PRE-RELEASE LEVEL
13.               . 2.12.C  HJS  78 OCT  12    CORRECT THE PC FOR MEMORY FAULTS TO MATCH 6600 PC
14.               . 2.12.A  HJS  78 SEP  05    REFORMAT, RECOMMENT & FIX STACK FOR ACCESS ENABLE
15.               .   12                       THE NUMBER IS OCTAL!! TO MATCH DEBGU ? DISPLAY
16.               *
17.               . 2.9   HJS    78 JUL  20    FINAL RELEASE OF VERSION 9
18.               . 2.9.K HJS    78 APR  23    SPLIT PROC, MAKE RELOCATABLE, CHANGE APF, ADD AML
19.               . 2.9.J HJS    78 MAR  20    RESTRUCTURE INTERRUPT SEQUENCE & MINOR MODS
20.               . 2.9.I HJS    78 FEB  27    CORRECT 9.H FOR FAULT CLEANUP
21.               . 2.9.H HJS    78 FEB  16    EVERYBODY MEMPF'S, KEYBOARD SCAN, & SIR CHANGE
22.               . 2.9.G HJS    78 FEB   3    CORRECT TIMING, COMMENTS, & ADD POR TIMEOUT
23.               . 2.9.F HJS    78 JAN  11    FIXING MIN/MOUT TIMINGS
24.               . 2.9.E HJS    78 JAN   4    TESTING REPEATED KEYIN CONTROLS
25.               . 2.9.D HJS    77 DEC  21    CORRECT STL INSTRUCTION
26.               . 2.9.C HJS    77 DEC  13    BACK OFF FROM KBD RPT & RE-DO STL FOR TIMING
27.               . 2.9.B HJS    77 NOV  20    INCLUDE TIMINGS AS CALCULATED & FIX MINOR BUGS
28.               . 2.9.A HJS    77 NOV  14    CHANGE KEYBOARD CODE TO AID REPEATED KEY CONTROL
29.               *
30.               . 2.8.B HJS    77 SEP  22    MTI CHANGE SO LENGTH IS 2 BYTE NUMBER
31.               . 2.8.A HJS    77 SEP  19    MTI CHANGE TO ALLOW MFRPT ON ANY INTERRUPT
32.               *
33.               . 2.7.  HJS    77 SEP   7    MINOR BUG-FIX AND OPTIMIZATION FOR RELEASE
34.               *
35.               . 2.H.B HJS    77 AUG  31    MTI SPECIAL VERSION
36.               *
37.               . 2.5.C HJS    77 AUG  16    UPDATE COMMENTS ON THE CODE
38.               . 2.5.B HJS    77 JULY 13    CORRECTED NAMES FOR COM REGISTERS
39.               . 2.5.A HJS    77 JULY 12    UP TO NEXT NEW VERSION NUMBER
40.               *
41.               . 2.4.B HJS    77 JULY 12    FIXED ILLEGAL MAR CHANGE IN REGL RETURN TO FETCH
42.               .                            FIXED FILE TO CONFORM TO VRP FORMAT (A LITTLE)
43.               . 2.4.A HJS    77 JULY 7     INITIAL PRE-RELEASE OF THE MICRO-CODE
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44.                                    *
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45.                     +
46.                     . USEFUL INFORMATION TO BE PASSED ON:
47.                     *
48.                     . ************************************************************************
49.                     . IF SECTOR CONTAINING SEKBS1 IS WRITE PROTECTED THEN CAN NOT DO A RESTART!!!!
50.                     . ************************************************************************
51.                     . THE FOLLOWING TIMING RESTRICTIONS APPLY TO MEMORY OPERATIONS:
52.                     . SMR & MDW   TO  MWAIT      : 100 NS MINIMUM BEFORE THE MWAIT TEST PERFORMED
53.                     . SMR & MDW   ->  MWAIT      : 450 NS WITH NO INTERVENING IMAR, DMAR, OR XX2MR
54.                     . IMAR & DMAR ->  SMR & MDW  : 200 NS
55.                     . MAROH       ->  SMR & MDW  : 100 NS
56.                     . MAROL       ->  SMR & MDW  : 000 NS
57.                     . MWAIT       ->  MDR        : 100 NS  (THIS DONE BY MEMPF CHECK!)
58.                     . ************************************************************************
59.                     . ALL SMR'S AND MDW'S MUST HAVE FOLLOWING   MWAIT ,MEMPFX    EVERYWHERE
60.                     . IN THE CODE EVEN IF  MWAIT ,$+1 IS USED (IGNORING MEMORY FAULT)
61.                     . ************************************************************************
62.                     . FOR TESTING MEMPF, CHANGE MWAIT MACRO TO BE JT,MP  $+1  <<<
63.                     . CODE THERE, TESTABLE AS USED BUT NO EFFECT!!
64.                     . ************************************************************************
65.                     . EACH SERVICE ROUTINE THAT USES THE MAR MUST HAVE A MWAIT ,$+1 BEFORE THE
66.                     . MAR CHANGED, AND MUST CLEAR (TEMPORARILY) SWUSER IF USED.
67.                     . RETURN THROUGH SRVNXT.
68.                     . ************************************************************************
69.                     . ALL INPUTS FROM A PORT INSTRUCTION SHOULD BE LOGICAL (OUTPUT CAN ONLY BE
70.                     . LOGICAL OR 'IT').
71.                     . ARITHMETICS MAY BE DONE ON INPUTS WITH CAUTION. ONLY IF THE DATA HAS NO SETUP
72.                     . TIME, i.e. MDR IS OK, BUT IMPI OR URI ARE NO-NO'S.
73.                     . ************************************************************************
74.                     . DELAY AROUND SECTOR TABLE WRITES IS NOT NECESSARY.
75.                     . ************************************************************************
76.                     . FOR A FONT LOAD MUST DO: 1) SDLM, 2) SKCH'S AS NEEDED, 3) THREE WAISTED
77.                     . SLDCH - RLDCH PAIRS TO SET UP COUNTER CORRECTLY, 4) SEVEN SETS OF SLDCH -
78.                     . RLDCH WITH THE DATA IN MAROL, 5) FINALLY RLDM AT THE END
79.                     . NOTE: THE DELAY FROM SLDCH TO RLDCH MUST BE AT LEAST 200 NSEC. IN ALL CASES
80.                     . AND MAROL MUST NOT CHANGE DURING THIS TIME. EXTRA RLDCH'S DO NOT HURT.
81.                     . ************************************************************************
82.                     .
83.                             INC       PROCINC
 1.A                            SNAPOPT    -X
10.A                            SNAPOPT    X
11.A                            INC        PROC14G3.PORTASGN      PORT ASSIGNMENT DISPLAY
```

```
. THE PORT ASSIGNMENTS, ORGANIZED BY PORT - SUBPORT NUMBER IN IN/OUT PAIRS

*
.PORT
.    SUB   0       1       2       3       4       5       6       7
.
. 0     0 LIREG   LIMP            BASW    MODW    STW     LUF     LUCF
.     0 I
.
. 0     0 IIMP    DIMP    COMF    CHUF    IMAR    DMAR
.    10 I
.
. 1     0
.     0 I SRVREQ  STATUS          IDCODL  IDCODH  UCFLG   MDR     STEK
.
. 1     0 RIMDATO MDW     LSPKR           RIMADRO LDRIMBP SLDCH   RLDCH
.    10 I
.
. 2     0         LDMAP   SKCH    SDLM    KBSC    RDLM    CMPF    SMR
.     0 I KBDD    EXCOM17 RIMDATI RIMSTAI EXCOM11 EXCOM12 EXCOM14 EXCOM15
.
. 2     0 DMPADH  DMPADL  DMPDTO
.    10 I DMPRDS  DMPDTI  ???STS??
.
. 3     0 URFO
.       I
.
. 4     0 URO (MR2XXL)
.       I MARIL
.
. 5     0 URO (MR2XXH)
.       I MARIH
.
. 6     0 MAROL (XX2MRL)
.       I URI
.
. 7     0 MAROH (XX2MRH)
.       I URI
.
.
. USER IO PORTS 4-7
. REGS  0 URA     URB     URC     URD     URE     URH     URL     URX
.      10 PCH     PCL     SPH     SPL     PSW     I35     I02     IMP
```

```
. THE PORT ASSIGNMENTS, ORGANIZED BY PORT - SUBPORT NUMBER IN IN/OUT PAIRS

*
.SUBITS    0       1       2       3       4       5       6       7
.
.SRVREQ:   SCPMEM                          SCDSPNL SCONMS  SCHUMS
.
.STATUS:   STUSCP                          STKBKC  STKBNS  STKBRDY STBOTLN
.
.MODW:     SWINTE  SWBASD  SWUSER  SWIRIM  SWSTDT  SWRPT           SWALBT
.
.STEK:     STLA                                               STLW    STLSP
.
*
. JUMP INPUT CONDITION CODES ARE:
.
.SELECT    0       1       2       3       4       5       6       7
.
.          CARRY   ZERO    MEMRDY  PARITY  IMPZERO IMPODD  DMPRDY  TRUE
.                                                          ******
.
*
. DOUBLY NAMED (SUB)PORTS ARE:
.
.          URO     <>  MR2XXL
.          URO     <>  MR2XXH
.          MAROL   <>  XX2MRL
.          MAROH   <>  XX2MRH
.
12.A                   INC     PROC14G3.PROCPARM     INDIRECT TO PARAMETER FILE
 1.I 000002    VER     EQU     2                     1800 - INFO INSTRUCTION PROCESSOR NUMBER
 2.I 000014    REV     EQU     014                   INFO INST. MICRO-CODE REVISION NUMBER
 3.I 000107    PRE     EQU     'G'                   PRE-RELEASE VERSION (IF NOT ZERO!!)
 4.I                   .
 5.I 000003    TYPE    EQU     3                     =0 FOR 3800 PROCESSOR CODE
 6.I                   .                             =1 FOR 1800 PROCESSOR CODE
 7.I                   .                             =3 FOR 38XX (INTERNAL RIM)
 8.I                   .
 9.I                   *
```

```
12.I                        *
13.I                        . CONDITION CODES
14.I                        .
15.I 020002                 MO          EQU     F6+2            MEMORY READY
16.I 020003                 MP          EQU     F6+3            MEMORY FAILURE (OF ANY SORT!)
17.I 020004                 IZ          EQU     F6+4            IMPLICIT REGISTER ZERO
18.I 020005                 IO          EQU     F6+5            IMPLICIT REGISTER ODD
19.I 020006                 BR          EQU     F6+6            BUS READY (MICRO-BUS ONLY)
20.I                        *
21.I                        . REGISTER ALLOCATION
22.I                        .
23.I 010002                 Q           EQU     F5+02           NOBODY SHOULD DO WRITE'S TO Q
24.I                        .
25.I 010000                 PDLNP       EQU     F5+0            DISPLAY LINE POINTER
26.I 010001                 KBSCNT      EQU     F5+01           KEYBOARD SCAN COUNTER
27.I 010002                 SCANSV      EQU     F5+02           KEYBOARD SAVED SCAN NUMBER, REPEATED AI
28.I                        *
29.I                        . DISKETTE INTERFACE
30.I                        .                   F5+03 .. F5+013
31.I                        .                   F5+014 (FREE)
32.I                        *
33.I                        . AUDIO CHANNEL CONTROL REGISTER
34.I                        .
35.I 010015                 ACD         EQU     F5+015          AUDIO CHANNEL ATTEN/VALUE
36.I                        .ACPL       EQU     F5+016
37.I                        .ACPH       EQU     F5+017          AUDIO CHANNEL CONTROL & MSB POINTER
38.I                        *
39.I                        . TEMPORARIES - AVAILABLE IN ANY ROUTINE, LOST BETWEEN ROUTINES
40.I                        .
41.I 030000                 LINK        EQU     F5+F6+00        SUBROUTINE CALL AND RETURN LINKAGE REGS
42.I 030001                 TEMP1       EQU     F5+F6+01        PROCESSOR EMULATION TEMPORARIES
43.I 030002                 TEMP2       EQU     F5+F6+02
44.I 030001                 TEMPH       EQU     TEMP1           H & L ONLY FOR DOUBLE H/L MACROS
45.I 030002                 TEMPL       EQU     TEMP2
46.I                        *
47.I                        . COMMUNICATION PORT REGISTER ALLOCATIONS
48.I                        .
49.I                        .                   F5+F6+03 .. 017
50.I                        *
51.I                        . CAPABILITY BITS:
52.I                        .   THESE BITS DEFINE THE VERSION OF THE 1800/3800 PROCESSOR THAT THIS IS FOR
53.I                        .
54.I                        .   XX XXX XXX
55.I                        .            0 --- MICRO I/O BUS AVAILABLE
56.I                        .           1 ---- COMMUNICATIONS INTERFACE (MULTIPORT) ASYNC.
57.I                        .          2 ----- 1800 SINGLE/DOUBLE DISKETTE DRIVE AVAILABLE
58.I                        .         3 ------ APF SPECIAL MICRO-BUS INTERFACE AVAILABLE
59.I                        .        4 ------- DMP I/O INTERFACE INSTRUCTIONS AVAILABLE
60.I                        .       5 -------- INBOARD RIM AVAILABLE
61.I                        .      6 ---------- 5500 I/O BUS AVALIABLE
62.I                        .   7 ------------ COMMUNICATIONS INTERFACE AVAILABLE (ASYNC, BISYNC, & SDLC)
63.I                        .
```

. EXTENDED CONDITIONS, AND SYSTEM REGISTER DEFINITIONS

```
64.I 000000                CAPMICR  EQU    B0-B0            NOT AVAILABLE
65.I 000000                CAPIMA   EQU    B1-B1            IMA BIT HERE !!
66.I 000000                CAPBLUE  EQU    B2-B2            NOT AVAILABLE
67.I 000000                CAPAPF   EQU    B3-B3            NOT AVAILABLE
68.I 000020                CAPDMPIO EQU    B4               SPECIAL CODE FOR DMP BUS INCLUDED
69.I 000040                CAPRIM   EQU    B5               ONLY INBOARD RIM AVAILABLE
70.I 000000                CAP55IO  EQU    B6-B6            NOT AVAILABLE (EXCEPT INBOARD RIM)
71.I 000000                CAPCOM   EQU    B7-B7            NOT AVAILABLE
72.I                       .
73.I 000060                CAPABILI EQU  CAPCOM+CAP55IO+CAPRIM+CAPDMPIO+CAPAPF+CAPBLUE+CAPIMA+CAPMICR
74.I                       *
75.I                       . LOCATION OF THE CODE IN ROMS IS A FOLLOWS   (MSB & LSB OF COURSE)
76.I                       .
77.I 000000                PROC     EQU    00<9             EMULATION SUPPORT CODE IN ROMS 0 & 1
78.I 002000                PROD     EQU    02<9             EMULATION SUPPORT CODE IN ROMS 2 & 3
79.I 004000                FLEX     EQU    04<9             MICRO-BUS CODE IN ROMS 4 & 5
80.I 006000                CDOX     EQU    06<9             COMM TRANSMIT CODE IN ROM 6
81.I 007000                CDOR     EQU    07<9             COMM RECEIVE CODE IN ROM 7
82.I                       .
84.                                IFNE   TYPE,3
86.                                XIF
87.                        .
88.  000000                PROCL    ORG    PROC             LOGICAL SPACE IN ROM'S
89.  000000                PROCP    ORG    0                PHYSICAL SPACE DONE AT LINK TIME
90.  000000                PROCL    USE    PROCL            ENABLE BOTH ADDRESS SPACES
91.  000000                         USE    PROCP            BUILD CODE IN PHYSICAL SPACE
92.  000000L               PROCP    LOC    PROCL,2          LOC'ING TO LOGICAL ADDRESSES
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```
                                    . POWER ON RESTART, INITIALIZE THE WORLD
 95.
 96.  000000L                       *
                                    POR:
 97.
 98.                                . INITIALIZE ALL CONTROL TABLES THAT CAN NOT BE INIT'D BY POR MACRO CODE
 99.
100.  000000L 01011001 11111111            BPGX    $
101.                                .       STB     RDLM            DO NOT CLEAR UP THE DISPLAY
102.  000001L 11000100 11111110            MWAIT   ,IGNORE         TIMEOUT SAFETY (IGNORE MEMORY FAULT)
103.  000002L 00110111 01000110            STB     CMPF            (INSTEAD OF FAULT JUMP)
104.                                .               T-REG IS ZERO FOR THE FOLLOWING
105.  000003L 01010001 00000000            LDPI    PSW0,0          SET EMULATION PSW
      000004L 00110111 10001100
106.  000005L 00110111 00000100            LDPT    MODW            PORT CONTROLS APPROPRIATLY
107.  000006L 00110111 00000011            LDPT    BASW            BASE REGISTER IS INITIALLY ZERO
108.  000007L 00000111 11111101            LDRT    ACD             NO AUDIO CHANNEL INITIALLY
109.  000010L 00000111 11110001            LDRT    KBSCNT          SAVE THE SCAN NUMBER AND
110.  000011L 00110111 01000100            LDPT    KBSC            START THE FIRST KEY SCAN
111.                                                LDRT  SMOD4 MS
112.  000012L 01010001 10011100            LDRI    PDLNP,SEDLBOT,CC POINT TO THE BOTTOM LINE
      000013L 00000111 10110000
113.  000014L 01010001 00100100            LDPI    PCOL,SRTMOUT    ASSUME THAT A TIMEOUT WILL HAPPEN
      000015L 00110111 10001001
114.  000016L 00110001 00110111            TSTIP   ,STLIMOUT,STEK  CHECK IF IT DID
      000017L 01000101 00000010
115.  000020L 11000010 11011010            BRA     POROUT,FZ       YES, DON'T INIT STL OR MEMORY
116.
117.                                . MUST INIT SECTOR TABLE & ZERO SYSESR OR IMMEDIATE RESTART OR MEMPF
118.
119.  000021L 01010001 00001100            LDTI    STAE+STWE       INIT WHOLE SECTOR TABLE
120.  000022L 00110111 11100000 PORLST     LDPT    MAROH,STW
      000023L 00110111 00000101
121.  000024L 01010010 00010000            DOTI    ,AC,16          LOOP TILL ALL ARE ACCESS & WRITE ENABLE
122.  000025L 11000000 11101101            BRA     PORLST,FC
123.
124.  000026L 01010001 11110000            LDPI    STW,SYSROM>8.AND.0360 SECTOR 017 IS SYSTEM ROM, PROTECT IT
      000027L 00110111 00000101
125.  000030L 01010001 11101111            LDPI    MAROH,SYSESR>8  POINT TO THE EMULATION SUPPORT PAGE
      000031L 00110111 11100000
126.  000032L 01010001 00000000            LDPI    MAROL,SYSESR    START OF IT (T-REG IS ZERO)
      000033L 00110111 11000000
127.  000034L 01101111 11110010            ~~LDRT    TEMPL~~               ~~INITIALIZE THE COUNTER~~
128.
129.  000035L 00110111 00101001 PORZRO     ~~STB~~ LDPI  MDW, 0          ZERO THE NEXT BYTE (T-REG IS ZERO)
130.  000036L 01110001 11110010            ~~INCR    TEMPL,TEMPL~~       COUNT ALL OF THE BYTES IN THE PAGE
      000037L 01101110 01110010
131.  000040L 01010001 00000000            ~~LDTI    0~~                 DATA TO BE WRITTEN IS ZERO
132.  000041L 11000100 11011110            MWAIT   ,IGNORE         !! IGNORE ANY AND ALL FAULTS !!
133.  000042L 00110111 00001100            STB     IMAR,  LDTP MAR/L
134.  000043L 11000000 11100010            BRA     PORZRO,~~FC~~
                                                    FZ
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```
                                . POWER ON RESTART, INITIALIZE THE WORLD

135.                            *
136.  000044L 00110111 10001001   FETPC    LDPT     PCOL              LOAD THE PC LSB ADDRESS
137.
138.  000045L 01010001 11110000   POROUT   LDPI     PCOH,SYSROM>8
      000046L 00110111 10001000
139.                                        LDPT   MARO+1,ST W
140.                            . NOTE:  NORMALLY HERE, PCL IS ZERO AND PCH = SYSROM>8
141.                            .        THIS GENERATES A POINTER TO SRPOWER-UP VECTOR ENTRY
142.
143. >000047L 01011001 11111111            BRAX     RETS              OK, MICRO-POR DONE, DO MACRO POR
     >000050L 11001111 11111111
144.                            .                                       (OR TIMEOUT) (OR SC ERROR)
```

```
147.
148.  000051L                                    *
149.
150.  000051L 01010001 11001110                  DL$DO:
      000052L 01101111 11110000                  . 4.80 + 2.10 ON BOTLINE
                                                         BAL     LINK,DLNL          SET UP RETURN FROM KEY SERVICE
151.  000053L 11000100 11010100                           MWAIT   ,MEMPFDL           WAIT ON WAISTED IFETCH
      000054L 11000111 00100111
152.  000055L 00110001 11011100                           DOPIP   MODW,ND,-1-SWUSER,PSWI DISABLE USER MODE FOR READ/WRITES
      000056L 01010101 11111011
      000057L 00110111 00000100
153.  000060L 11001111 10100100                           BRA     KBD$DO             GO DO FIRST KEYBOARD SERVICE
154.
155.  000061L 00110001 00110001                DLNL       TSTIP   AC,STBOTLN,STATUS  SET CARRY IF BOTTOM LINE STATUS
      000062L 01000010 10000000
156.  000063L 00010001 11110000                           LDTR    PDLNP
157.  000064L 11000000 10111100                           BRA     DLNXT,FC           NOT YET
158.
159.  000065L 11000100 11001010                           MWAIT   ,MEMPFDL           WAIT ON KBD STATUS BIT WRITE
      000066L 11000111 00100111
160.  000067L 01010001 01101011                           LDPI    MAROL,SELFREQ,SMR  GET FREQ COUNTER, SAME PAGE AS KBD STUF
      000070L 00110111 11000000
      000071L 00110111 01000111
161.  000072L 01010001 00000000                           TCLR                       SET T-REG ZERO (NOTE: CARRY IS TRUE!!)
162.  000073L 11000100 11000100                           MWAIT   ,MEMPFDL
      000074L 11000111 00100111
163.  000075L 00110010 00110110                           DOPP    MDW,AC,MDR         ADD ONE AND RESTORE IT
      000076L 00110111 00101001
164.  000077L 00010001 10111101                           LDTR    ACD,CC             ** HONEYWELL AUDIO CHANNEL TIMER **
165.  000100L 11000011 10111101                           BRA     DLACNINC,TZ        DO NOT INCREMENT OF CHANNEL OFF
166.  000101L 00000110 01111101                           INCR    ACD
167.  000102L                                  DLACNINC
168.  000102L 01010001 10011100                           LDTI    SEDLBOT            POINT TO THE BOTTOM LINE ON THE SCREEN
169.
170.  000103L 11000100 10111100                DLNXT      MWAIT   ,MEMPFDL
      000104L 11000111 00100111
171.  000105L 00110111 11000000                           LDPT    MAROL,SMR          SET LSB OF ADDRESS AND READ ADDRESS LSB
      000106L 00110111 01000111
172.  000107L 01010100 00000010                           DOTI    ,SB,2              SUBTRACT 2 FROM LIST POINTER
173.  000110L 01000100 01101110                           TSTIT   SB,SEDLN01         HAVE WE GONE OVER THE TOP?
174.  000111L 11000000 10110100                           BRA     DLINEOK,FC
175.  000112L 01010001 10011100                           LDTI    SEDLBOT            IF SO, GO BACK TO THE BOTTOM (SAFETY!)
176.  000113L 00000111 11110000                DLINEOK    LDRT    PDLNP
177.  000114L 11000100 10110011                           MWAIT   ,MEMPFDL
      000115L 11000111 00100111
178.  000116L 00110111 00001100                           STB     IMAR
179.  000117L 00110001 00110110                           LDRP    TEMP1,MDR          GET LSB OF DATA POINTER
      000120L 01101111 11110001
180.  000121L 00110111 01000111                           STB     SMR                GET MSB ALSO
181.  000122L 01010001 00101101                           BAL     LINK,DLNLR         SET UP RETURN ADDRESS (VERY EARLY!)
      000123L 01101111 11110000
182.  000124L 11000100 10101011                           MWAIT   ,MEMPFDL
      000125L 11000111 00100111
```

```
TSTIT ,SW61K
BRH   KBD$DO,TZ
LDPI  MAROH,SYSRAM>8
LDPR  STW,SSTI6E
LDPI  MAROH,SYSCOM>8
LDPR  STW,SSTI5E
BRH   KBD$DO
```

```
183.  000126L 00110001 00110110          LDPP    MAROH,MDR          GET MSB POINTER
      000127L 00110111 11100000
184.  000130L 01110001 11110001          LDPR    MAROL,TEMP1,LDMAP AND LSB, AND STROBE TO LOAD THE DMA PNT
      000131L 00110111 11000000
      000132L 00110111 01000001
185.                                .    BRA     KBD$DO             GO DO THE SECOND KEYBOARD SCAN
```

```
186.                                +
187.  000133L                      KBD$DO
188.                               . * * *  4.75   * * *  NEW KEY JUST WENT DOWN
189.                               .        2.95          THE KEY IS UP AND WAS NOT LAST TO GO DOWN
190.                               .        4.85          REPEATED KEY UP
191.                               .        4.65          REPEATED KEY DOWN
192.                               .      + 0.60          IF <SPACE>, <CANCEL>, <.>, <BACKSPACE>
193.                               .   OR + 0.40          IF <ENTER>
194.
195.                               . * * *  4.20   * * *  KBKS1 STATUS BIT (UP OR DOWN)
196.                               .      + 0.15          IF KBKS2
197.                               .      + 0.20          IF STATUS BIT DOWN
198.                               .     OR 4.35          KBREINT STATUS BIT DOWN
199.                               .     OR 5.50          KBREINT STATUS BIT UP
200.                               .     OR 5.50          RESTART - IMP ZERO TO SCROM
201.                               .     OR 5.85          RESTART - NON-RPT'D INST. TO SCROM
202.                               .     OR 6.70          RESTART - RPT'D & IMP NON-ZERO TO SCROM
203.
204.                               . SCAN THE KEYBOARD BY:
205.                               . 1) WAIT FOR THE LAST SCAN TO COMPLETE
206.                               . 2) IF SPECIAL KEY, DO IT'S TYPE OF SERVICE (SET OR CLEAR STATUS BIT)
207.                               . 3) IF NEW CLOSURE GET KEYCODE, SAVE IT, AND SAVE THE SCAN NUMBER
208.                               . 4) IF NOT THE SAME KEY AS SPECIFIED BY LAST SCAN NUMBER THEN DONE
209.                               . 5) IF SAME, AND STILL DOWN, SET STATUS BIT ELSE, CLEAR IT
210.
211.  000133L 01010001 01101001                DLDPI    MARO,SEKBS1        MIDDLE OF 3 BYTES THAT WILL WORK WITH
      000134L 00110111 11000000
      000135L 01010001 11101111
      000136L 00110111 11100000
212.  000137L 00110001 00110001   KBDWAIT     TSTIP    ,STKBRDY,STATUS
      000140L 01000101 01000000
213.  000141L 11000011 10100000               BRA      KBDWAIT,TZ         (LOOPS ONCE ON SECOND SERVICE, MAYBE)
214.                               .                                      (NOT READY TILL 5.3 MICRO-S FROM KBSC)
215.  000142L 00010001 10110001               TSTIR    SB,16,KBSCNT,CC    IS IT FUNCTION KEY (OR THAT GROUP?)
      000143L 01000100 00010000
216.  000144L 11000000 01111000               BRA      KBKEY,FC           NO, REGULAR KEY
217.
218.  000145L 00010010 00110001               DOTR     ,AC,KBSCNT,,C0     DOUBLE THE NUMBER FOR JUMP TABLE
219.  000146L 01010010 01111000               DORA     TEMP1,AC,KBTBL     PUSH A BACKWARDS TABLE OFFSET
      000147L 01101111 11110001
220.  000150L 11101111 00000001               BRR      TEMP1              RETURN
221.                               .                                      INTO THE TABLE THIS IS TOP OF
222.
223.  000151L 01010001 00000010               LDTI     SEKBDKY            17 KEYBOARD KEY
224.  000152L 11001111 01101101               BRA      KBKS1
225.  000153L 01010001 00000001               LDTI     SEDSPKY            16 DISPLAY KEY
226.  000154L 11001111 01101101               BRA      KBKS1
227.  000155L 01010001 00000010               LDTI     SEFUNC2            15 F2 KEY
228.  000156L 11001111 01101110               BRA      KBKS2
229.  000157L 01010001 00001000               LDTI     SEFUNC4            14 F4 KEY
230.  000160L 11001111 01101110               BRA      KBKS2
231.  000161L 01010001 10000000               LDTI     SEINTKY            13 INTERRUPT KEY
```

```
232.  000162L 11001111 01001011          BRA     KBREINT
233.  000163L 01010001 00010000          LDTI    SEFUNC5         12 F5 KEY
234.  000164L 11001111 01101110          BRA     KBKS2
235.  000165L 01010001 00000100          LDTI    SEFUNC3         11 F3 KEY
236.  000166L 11001111 01101110          BRA     KBKS2
237.  000167L 01010001 00000100          LDTI    SEKBRDY         10 . (POINT) KEY
238.  000170L 11001111 01110111          BRA     KBREG
239.  000171L 01010001 00000100          LDTI    SEKBRDY         7 NO-KEY
240.  000172L 11001111 01110111          BRA     KBREG
241.  000173L 01010001 00000001          LDTI    SEFUNC1         6 F1 KEY
242.  000174L 11001111 01101110          BRA     KBKS2
243.  000175L 01010001 01000000          LDTI    SEATTKY         5 ATTENTION KEY
244.  000176L 11001111 01101110          BRA     KBKS2
245.  000177L 01010001 00100000          LDTI    SERSTKY         4 RESTART KEY
246.  000200L 11001111 01001011          BRA     KBREINT
247.  000201L 01010001 00000100          LDTI    SEKBRDY         3 SPACE BAR
248.  000202L 11001111 01110111          BRA     KBREG
249.  000203L 01010001 00000100          LDTI    SEKBRDY         2 BACKSPACE KEY
250.  000204L 11001111 01110111          BRA     KBREG
251.  000205L 01010001 00000100          LDTI    SEKBRDY         1 CANCEL KEY
252.  000206L 11001111 01110111          BRA     KBREG
253.  000207L                    KBTBL
254.  000207L 01010001 00000100 KBKEY    LDTI    SEKBRDY         0 ENTER KEY
255.                           .        BRA     KBREG
```

```
256.                                    +
257.  000210L 01101111 11110001  KBREG   LDRT    TEMP1
258.  000211L 00110001 00110001          TSTIP   ,STKBKC,STATUS    NEW CLOSURE?
      000212L 01000101 00010000
259.  000213L 11000010 01100001          BRA     KBGET,FZ          YES, DO IT
260.  000214L 00010001 11110001          TSTRR   XR,SCANSV,KBSCNT  SAME AS THE LAST KEY?
      000215L 00010000 11000010
261.  000216L 11000010 01010001          BRA     KBDON,FZ          NO, FINISHED
262.  000217L 01010001 00001000          LDTI    SEKBDWN           YES, SAME KEY
263.  000220L 11001111 01101101          BRA     KBKS1             CONTINUOUSLY SET THE BIT IF STILL DOWN
264.                                    .                         CLEAR BIT CONTINUOUSLY IF UP
265.                                    .                         IF GOES DOWN AGAIN GET NEW CLOSURE
266.                                    .                         RATHER THAN REPEATED CLOSURE!
267.
268.                                    *
269.  000221L 00110111 00001101  KBKS2   STB     DMAR              POINT TO SEKBKS2
270.
271.  000222L 01101111 11110001  KBKS1   LDRT    TEMP1             SAVE THE STATUS BITS
272.  000223L 00110001 00110001          LDTP    STATUS
273.  000224L 00110111 01000111          STB     SMR               GET THE STATUS BYTE
274.  000225L 01000101 00100000          TSTIT   ,STKBNS           KEY CLOSED?
275.  000226L 11000010 01010110          BRA     KBCLS,FZ          YES
276.
277.  000227L 01110001 11110001  KBOPN   DOTIR   ,XR,0377,TEMP1    NO, OPEN, TURN THE BIT OFF
      000230L 01010000 11111111
278.  000231L 11000100 01100110          MWAIT   ,MEMPFDL
      000232L 11000111 00100111
279.  000233L 00110101 00110110          DOPP    MDW,ND,MDR        BY ANDING IT OUT
      000234L 00110111 00101001
280.  000235L 11001111 01010001          BRA     KBDON
281.
282.  000236L 00110111 00001100  KBGET   STB     IMAR              KEYBOARD CHARACTER SAVE AREA
283.  000237L 11001110 11111111          DELAY   1
284.  000240L 00110001 01010000          LDPP    MDW,KBDD          OUTPUT THE DATA
      000241L 00110111 00101001
285.  000242L 00010001 11110001          LDRR    SCANSV,KBSCNT     SAVE THE SCAN NUMBER (FOR REPEATS)
      000243L 00000111 11110010
286.  000244L 11000100 01011011          MWAIT   ,MEMPFDL          ** WHAT IF 2ND SCAN SERVICE & LDMAP'D
      000245L 11000111 00100111
287.                                    .                            ALREADY, IS AN EXTRA ONE OK?
288.  000246L 00110111 00001101          STB     DMAR              POINT BACK TO SEKBS1
289.  000247L 11001111 01010111          DELAY   2
290.  000250L 00110111 01000111          STB     SMR
291.  000251L 01110001 11110001  KBCLS   LDTR    TEMP1             GET BIT TO SET
292.  000252L 11000100 01010101          MWAIT   ,MEMPFDL
      000253L 11000111 00100111
293.  000254L 00110011 00110110          DOPP    MDW,OR,MDR        SET IT
      000255L 00110111 00101001
294.  000256L 00010001 11110001  KBDON   DOTRR   ,IT,Q,KBSCNT,C1    POINT TO THE NEXT SCAN ENTRY (CLEAR)
      000257L 00010110 01110010
295.  000260L 01010101 00111111          DOPI    KBSC,ND,077       KEEPING THE NUMBER IN RANGE (CARRY ALSO
      000261L 00110111 01000100
```

```
296.  000262L 00000111 11110001          LDRT    KBSCNT,CC       (5.3 MICRO-SEC TIME TILL READY FROM NOW
297.  000263L 11101111 00000000          BRR     LINK            AND RETURN FROM KEY SERVICE ON ERROR TO
```

```
298.                                        +
299.  000264L 00110111 00001101   KBREINT   STB     DMAR
300.  000265L 01101111 11110001             LDRT    TEMP1               SAVE THE BIT
301.  000266L 00110001 00110001             LDTP    STATUS
302.  000267L 00110111 01000111             STB     SMR                 IN SEKBKS2
303.  000270L 01000101 00110000             TSTIT   ,STKBKC+STKBNS      NEW CLOSURE OR STILL CLOSED?
304.  000271L 11000010 01010110             BRA     KBCLS,FZ            YES, ITS DOWN, SO SET IT!
305.
306.  000272L 01010001 10100000             LDTI    SEINTKY+SERSTKY
307.  000273L 11000100 01000100             MWAIT   ,MEMPFDL            IT IS UP! SEE IF BOTH KEYS WERE DOWN
      000274L 11000111 00100111
308.  000275L 00110101 00110110             DOTP    ,ND,MDR             SELECT RESTART AND INTERRUPT KEYS
309.  000276L 01000000 10100000             TSTIT   XR,SEINTKY+SERSTKY WERE BOTH SET?
310.  000277L 11000010 01101000             BRA     KBOPN,FZ            NO, ONLY ONE
311.  000300L 00110001 00110110             DOPRP   MDW,XR,TEMP1,MDR    YES, TURN THE BIT OFF & DO A RESTART
      000301L 01110000 11110001
      000302L 00110111 00101001
312.  000303L 01010001 00000001             DOPRI   KBSC,AC,KBSCNT,1,C0 FINISH LIKE REGULAR, BUT INLINE
      000304L 00010010 00110001
      000305L 00110111 01000100
313.  000306L 00000111 11110001             LDRT    KBSCNT              ONLY KEYBOARD INVOLVED (INLINE SRVRTN)
314.
315.                                        . SPECIAL SERVICE REQUESTED INSTRUCTION LEVEL SYSTEM CALL INTERRUPT
316.                                        . THE P.C. MUST BE BACKED UP IF IMP NON-ZERO, TO THE IMP SPEC.
317.                                        . ELSE IT IS POINTING TO THE INSTRUCTION TO EXECUTE NEXT
318.                                        . OR BEING EXECUTED IF REPEATED.
319.                                        . NOTE: THE PRESENT WAY CODE WORKS IF NOT REPEATED (OR NOT STARTED YET)
320.                                        . THEN IMP MUST BE ZERO BECAUSE CAN'T INTERRUPT BETWEEN IMP. SPEC & OPCODE
321.                                        . BUT CODE BELOW WILL WORK ANYWAY (TOO GENERALIZED)
322.                                        . I.E. IF IMP-NON-ZERO MUST BE REPEATED THEREFORE MUST BACK IT UP.
323.
324.  000307L 01010001 00000011                     DLDRI   TEMP,SRRSTRT        SET RESTART ADDRESS
      000310L 01101111 11110010
      000311L 01010001 11110000
      000312L 01101111 11110001
325.  000313L 11000100 00110100                     MWAIT   ,MEMPFDL
      000314L 11000111 00100111
326.  000315L 01011001 11111101                     BPGX    SCDON
327.  000316L 00110001 11011100                     TSTIP   ,SWRPT,PSWI         IS IT REPEATED?
      000317L 01000101 00100000
328.  000320L 11000011 00010110                     BRA     SCDON,TZ            NO, THEN P.C. POINTS TO INSTRUCTION
329.  000321L 11001111 00011110                     BRA     SCLST               YES, THEN MAY BACKUP THE PC (TO IMP SPEC)
```

```
330.
331.  >000322L 01011001 11111111   *
       >000323L 11001111 11111111   DLNLR     BRAX    SRVNXT          DISPLAY SERVICE FINALLY DONE
332.   000324L 01011001 11111101   IVIOL0    BRAX    IVIOL$
       000325L 11001111 00100100
333.   000326L 01011001 11111101   UDOP0     BRAX    UDOP
       000327L 11001111 00100010
334.                                .
335.   000330L 00110111 01000001   MEMPFDL   STB     LDMAP           CLEAR INTERRUPT ON ANY MEMORY FAULT
336.   000331L 00110111 01000101   MEMPFCF   STB     RDLM            TURN OFF LOAD MODE FOR LODCF MEMORY FAULT
337.  >000332L 01011001 11111111   MEMPF0    BRAX    MEMPF$
       >000333L 11001111 11111111
338.   000334L 11111111 11111111            TABPAGE PROCL
       000335L 11111111 11111111
       000336L 11111111 11111111
       000337L 11111111 11111111
       000340L 11111111 11111111
       000341L 11111111 11111111
       000342L 11111111 11111111
       000343L 11111111 11111111
       000344L 11111111 11111111
       000345L 11111111 11111111
       000346L 11111111 11111111
       000347L 11111111 11111111
       000350L 11111111 11111111
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       000357L 11111111 11111111
       000360L 11111111 11111111
       000361L 11111111 11111111
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       000363L 11111111 11111111
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       000373L 11111111 11111111
       000374L 11111111 11111111
       000375L 11111111 11111111
       000376L 11111111 11111111
       000377L 11111111 11111111
```

DLNLR BRAX SRVNXT
TSTIP ,SW64K,RSWI
BRAM SRVNXT,T2
LDRI RAMCH,SYSMW178
LDRR STW,USTIGE
LDRI RAMCH,SYSMW178
LDRR STW,USTISE
BRA SRVNXT

```
                                        *
000400L                                 SYSTAT:
                                        . 8.55  (    157)  UDOP          UNDEFINED OP-CODE
                                        .
                                        . 1.30  (111 157)  SYSTAT1       PROCESSOR STATUS WORD
                                        .
                                        . 1.50  (062 157)  SYSTAT2
                                        . 1.50  (113 157)  SYSTAT3       SYSTEM STATUS (UNUSED - 0)
                                        . 1.50  (174 157)  SYSTAT4       C <- 0; B <- 0
                                        . 1.50  (115 157)  SYSTAT5
                                        . 1.50  (176 157)  SYSTAT6       (IF PRE-RELEASE, C <- PRE-RELEASE CODE)
                                        . 1.50  (117 157)  SYSTAT7       (SO CAN TELL PRE-RELEASE LEVEL)
                                        . 1.50  (022 157)  SYSTAT8

000400L 11001001 00101001                BRA     UDOP0,T@,IZ      157 ALONE IS UNDEFINED
000401L 00110111 00001001                STB     DIMP             CHECK 111
000402L 01010001 01000111                LDPI    URO+URC,PRE      WHATEVER ELSE, C=PRE-RELEASE LEVEL
000403L 00110111 10000010
000404L 00110001 11011100                LDTP    PSWI             (ASSUME 1)
000405L 11011001 11101001                BRA     SYSTND,T@,IZ
000406L 01010001 00000000                TCLR                     WILL BE 062 - 022
000407L 11011111 11101001                BRA     SYSTND
                                        *
000410L                                 INFO:
                                        . 0.50  (    010)  NOP             NO-OP (STROBE ON 2200)
                                        . 1.35  (111 010)  INFO            A = VERSION #, B = REVISION #
                                        . 1.90  (062 010)  INFO2           B = CAPABILITIES, CDE=0
                                        . 1.90  (113 010)  INFO3           BCDE = 0 (CAPABILITIES)
                                        . 1.90  (174 010)  INFO4           BCDE = 0
                                        . 1.90  (115 010)  INFO5           BCDE = 0
                                        . 1.90  (176 010)  INFO6           BCDE = 0
                                        . 1.90  (117 010)  INFO7           BCDE = 0
                                        . 1.90  (022 010)  INFO8           BCDE = 0
000410L 11011001 11101000                BRA     INFNO,T@,IZ
000411L 00110111 00001001                STB     DIMP             CHECK IF ITS 1 (111)
000412L 01010001 00000010                LDTI    VER              (ASSUME SO)
000413L 11011000 11110000                BRA     INFEXT,F@,IZ     NO SEE IF 2 OR ABOVE
000414L 00110111 10000000                LDPT    URO+URA
000415L 01010001 00001100                LDTI    REV              SET PROCESSOR VERSION AND REVISION LEVE
000416L 11011111 11101001                BRA     INFEND
000417L 00110111 00001001   INFEXT       STB     DIMP             CHECK IF ITS 2 (062)
000420L 01010001 00000000                LDPI    URO+URC,0
000421L 00110111 10000010
000422L 00110111 10000011                LDPT    URO+URD          SET CDE = 0 IN ANY CASE
000423L 00110111 10000100                LDPT    URO+URE
000424L 11011000 11101001                BRA     INFEND,F@,IZ     WAS IT 062 OR OTHER?
000425L 01010001 00110000                LDTI    CAPABILI         YES, 062 SET CAPABILITIES
000426L                     SYSTND
000426L 00110111 10000001   INFEND       LDPT    URO+URB          SET B-REGISTER
>000427L 01011001 11111111  INFNO        BRAX    FETCHN           AND DONE
>000430L 11001111 11111111
```

```
                                . LOAD CHARACTER FONT
391.                            *
392.  000431L                   LODCF:
393.                            .       (    155)  LODCF            LOAD CHARACTER FONT
394.                            . 18.90 + A * 0.15 + 0.40 IF A > 64
395.                            .   - 1.0 IF A = 64
396.                            .                                   FONT (A) <- (HL-6 | HL)
397.
398.  000431L 00110001 11011100          TSTIP    ,SWUSER,PSWI
      000432L 01000101 00000100
399.  000433L 11000010 00101011          BRA      IVIOL0,FZ
400.  000434L 00110111 01000011          STB      SDLM               PUT IT IN LOAD FONT MODE
401.  000435L 00110001 11010000          DOTIP    ,ND,0177,URI+URA   ONLY 7 BITS OF DATA!
      000436L 01010101 01111111
402.  000437L 00010111 10110010          CCLR
403.  000100                    LODSTEP   EQU      64                 ** SET BY HOW MUCH ROOM THERE IS **
404.  000440L 01010100 01000000 LDCFPT    DOTI     ,SB,LODSTEP        COUNT IN STEPS OF "LODSTEP"
405.  000441L 11010001 10000001          BRA      LDCFNL,TC          IF AT END, DO FINAL STUFF
406.                                     LIST     -G
407.                            LDCFLP    RPT      LODSTEP/2          THERE ARE "LODSTEP" STROBES IN THE SPEEDUP
408.  000442L 00110111 01000010          STB      SKCH,SKCH
409.                                     LIST     G
410.  000542L 11010010 11011111          BRA      LDCFPT,FZ          DONE AND DONE WELL (I HOPE)
411.  000543L 00110111 00101110          STB      SLDCH              DO INITIAL THREE COUNTS
412.  000544L 11011111 10011010          DELAY    2                  YAWN - YAWN
413.  000545L 00110111 00101111          STB      RLDCH,SLDCH        END FIRST CHARACTER-SCAN LEVEL STEP
      000546L 00110111 00101110
414.  000547L 01010001 00000111          LDPI     LIMP,7             SET UP FOR 7 ROWS PER FONT
      000550L 00110111 00000001
415.  000551L 00110111 00101111          STB      RLDCH,SLDCH        END THE SECOND AND DO THE THIRD
      000552L 00110111 00101110
416.  000553L 11001110 11111111          DELAY    1                  YAWN
417.  000554L 00110001 11100101          LDX      HL2MRH             INIT MARH TO FONT STRING
418.  000555L 00110111 00101111 LDCFLD    STB      RLDCH              RESET FONT LOAD BEFORE CHANGE MAROL
419.  000556L 00110001 11000110          LDX      HL2MRL,SMR         NOW CAN FINALLY START ACTUAL FONT LOAD
      000557L 00110111 01000111
420.  000560L 00110111 00001001          STB      DIMP               LOADING MARL >400 nS AFTER LDCH
421.  000561L 11010100 10001110          MWAIT    ,MEMPFCF           IF ERROR, RESET LOAD MODE
      000562L 11000111 00100110
422.  000563L 00110111 00001100          STB      IMAR
423.  000564L 00110001 10000110          LDX      MR2XXL+URL         UPDATE HL THE FASTEST WAY
424.  000565L 00110001 00110110          LDPP     MAROL,MDR,SLDCH    GET THE CHARACTER OUT AND LOAD THE FONT
      000566L 00110111 11000000
      000567L 00110111 00101110
425.  000570L 11011000 10010010          BRA      LDCFLD,F@,IZ       LOOP TILL ALL SEVEN ROWS DONE
426.  000571L 00110001 10100101          LDX      MR2XXH+URH         GET NEW HL CAUSE L UPDATED
427.  000572L 00110111 00101111          STB      RLDCH              RESET FONT LOAD
428.  000573L 00110111 01000101          STB      RDLM               RESET LOAD MODE (>400 nS AFTER LDCH)
429. >000574L 01011001 11111111          BRAX     FETCH
     >000575L 11001111 11111111
```

```
                                    . LOAD CHARACTER FONT
430.                                *
431.  000576L                       LDCFNL
432.                                . FOR THE FINAL STEP ONLY GO PARTIALLY THROUGH THE LOOP
433.                                .            T  >=0=10 STEPS, -1=9 STEPS, -2=8 STEPS, ... -9=1 STEP
434.                                .        SKIPS       0 STEPS,    1 STEP      2 STEPS, ...    9 STEPS
435.
436.  000576L 01010010 11011100            DOTA     ,AC,LDCFLP+1      ADDS ADDRESS TO NEGATIVE VALUE (CRY SET
437.  000577L 01101111 10110000            BAS      LINK,CC           MOVES FORWARD FROM LDCFSK (1 TO 9 STEPS
438.  000600L 01010001 00000000            TCLR                       MARK ENDED
439.  000601L 11101111 00000000            BRR      LINK              DO AS MANY STEPS AS NEEDED
```

. DMP I/O INTERFACE INSTRUCTIONS

```
                                                *
000602L                                         DMPOUT:
                                                . 1.65   (IMP 145)  DMPOUT          (DE) <- (R); ONTO THE DMP BUS
                                                .
000602L 00110001 11010011                               LDPP     DMPADH,URI+URD    SELECT DEVICE
000603L 00110111 01001000
000604L 00110001 11011100                               TSTIP    ,SWUSER,PSWI
000605L 01000101 00000100
000606L 11000010 00101011                               BRA      IVIOLO,FZ         BUT, MUST BE PRIV'D
000607L 11011101 01111000                               BRA      $,T@,BR           WAIT FOR BUS READY
000610L 00110001 11010100                               LDPP     DMPADL,URI+URE    SELECT ADDRESS/FUNCTION
000611L 00110111 01001001
000612L 00110001 11011111                               LDPP     DMPDTO,IMPI       OUTPUT DATA & PERFORM FUNCTION
000613L 00110111 01001010
>000614L 01011001 11111111                             BRAX     FETCHN
>000615L 11001111 11111111
                                                *
000616L                                         DMPSOUT:
                                                . 2.00   (IMP 147)  DMPSO  PPP      (PPP) <- (R); OUTPUT TO DMP BUS
                                                .
000616L 00110111 01000111                               STB      SMR               GET THE ADDRESS LSB
000617L 00110001 11011100                               TSTIP    ,SWUSER,PSWI,TW
000620L 01010101 00000100
000621L 00110111 01001000                               LDPT     DMPADH            SELECTED MSB ADDRESS IS ZERO
000622L 11000010 00101011                               BRA      IVIOLO,FZ         BUT, MUST BE PRIV'D
000623L 11011101 01101100                               BRA      $,T@,BR           WAIT FOR DEVICE READY TOO
000624L 11010100 01101011                               MWAIT    ,MEMPFO
000625L 11000111 00100101
000626L 00110001 00110110                               LDPP     DMPADL,MDR
000627L 00110111 01001001
000630L 00110001 11011111                               LDPP     DMPDTO,IMPI,IMAR  OUTPUT THE DATA & GO FOR NEXT INSTRUCTION
000631L 00110111 01001010
000632L 00110111 00001100
>000633L 01011001 11111111                             BRAX     FETCHN
>000634L 11001111 11111111
                                                *
000635L                                         DMPIN:
                                                . 2.00   (IMP 141)  DMPIN           (R) <- (DE); INPUT FROM THE DMP BUS
                                                .
000635L 00110001 11010011                               LDPP     DMPADH,URI+URD    SELECT DESIRED DEVICE
000636L 00110111 01001000
000637L 00110001 11011100                               TSTIP    ,SWUSER,PSWI
000640L 01000101 00000100
000641L 11000010 00101011                               BRA      IVIOLO,FZ         ONLY IF ALLOWED TO
000642L 11011101 01011101                               BRA      $,T@,BR            AND WAIT FOR IT TO BE READY
000643L 00110001 11010100                               LDPP     DMPADL,URI+URE,DMPRDS  SELECT ADDRESS/FUNCTION TO BE INPUT
000644L 00110111 01001001
000645L 00110111 01011000
000646L 11001110 11111111                               NOOP
000647L 11011101 01011000                               BRA      $,T@,BR
000650L 00110001 01011001                               LDPP     IMPO,DMPDTI       FINALLY GET THE DATA
000651L 00110111 10001111
```

```
                                . DMP I/O INTERFACE INSTRUCTIONS

478. >000652L 01011001 11111111          BRAX    FETCHN
     >000653L 11001111 11111111
479.
480.  000654L                           *
481.                                    DMPSIN:
482.                                    . 2.20   (IMP 143)  DMPSIN PPP      (R) <- (PPP); FROM DMP BUS
483.                                    .
483.  000654L 00110111 01000111          STB     SMR                 GET THE PORT ADDRESS
484.  000655L 00110001 11011100          TSTIP   ,SWUSER,PSWI,TW
      000656L 01010101 00000100
485.  000657L 00110111 01001000          LDPT    DMPADH              ZERO TO MSB ADDRESS
486.  000660L 11000010 00101011          BRA     IVIOL0,FZ           ONLY IF ALLOWED TO
487.  000661L 11011101 01001110          BRA     $,T@,BR              AND WAIT FOR IT TO BE READY
488.  000662L 11010100 01001101          MWAIT   ,MEMPF0
      000663L 11000111 00100101
489.  000664L 00110001 00110110          LDPP    DMPADL,MDR,DMPRDS   SELECT ADDRESS/FUNCTION TO BE INPUT
      000665L 00110111 01001001
      000666L 00110111 01011000
490.  000667L 11001110 11111111          NOOP
491.  000670L 11011101 01000111          BRA     $,T@,BR
492.  000671L 00110001 01011001          LDPP    IMP0,DMPDTI         FINALLY GET THE DATA
      000672L 00110111 10001111
493. >000673L 01011001 11111111          BRAX    FETCHN
     >000674L 11001111 11111111
494.                                    *
495.  000675L                           BLKOUT:
496.                                    .       (    173)  BLKOUT           T <- (DE) <- (HL); OUTPUT TO DMP BUS
497.                                    .                                   DE <+ 1; HL <+ 1; C <- C - 1
498.                                    .                                   UNTIL (T + B = 0400) OR (C = 0)
499.                                    . 0.10 + 5.05 * C - 0.6 IF MATCH
500.
501.  000675L 00110001 11000110          DLDX    HL2MR               GET DATA TO OUTPUT
      000676L 00110001 11100101
502.  000677L 00110001 11010011          LDPP    DMPADH,URI+URD      SELECT DEVICE TO OUTPUT IT TO
      000700L 00110111 01001000
503.  000701L 00110111 01000111          STB     SMR
504.  000702L 00110001 11011100          TSTIP   ,SWUSER,PSWI
      000703L 01000101 00000100
505.  000704L 11000010 00101011          BRA     IVIOL0,FZ           ONLY IF PRIV'D
506.  000705L 11011101 00111010          BRA     $,T@,BR              WAIT FOR BUS READY
507.  000706L 00110001 11010100          LDPP    DMPADL,URI+URE      FINISH ADDRESS SELECT
      000707L 00110111 01001001
508.  000710L 11010100 00110111          MWAIT   ,MEMPF0
      000711L 11000111 00100101
509.  000712L 00110001 00110110          LDPP    DMPDTO,MDR          OUTPUT THE DATA & SAVE IT TOO
      000713L 00110111 01001010
510.  000714L 01101111 11110001          LDRT    TEMP1
511.  000715L                           BLKLOOP
512.                                    . 2.95 (RPT), 2.45 (MATCH), 3.05 (END)
513.  000715L 00110111 00001100          STB     IMAR
514.  000716L 00110001 10000110          DLDX    MR2HL               UPDATE HL & DE ADDRESS POINTERS
      000717L 00110001 10100101
515.  000720L 00110001 11000100          DLDX    DE2MR,,IMAR
```

```
                000721L 00110001 11100011
                000722L 00110111 00001100
          516.  000723L 00110001 10000100          DLDX    MR2DE
                000724L 00110001 10100011
          517.  000725L 00110001 11010001          TSTRP   AC,TEMP1,URI+URB,C0  TEST B-COMPLETION
                000726L 01110010 00000001
          518.  000727L 11010000 00100101          BRA     BLKGO,FC
          519.  000730L 11010011 00011011          BRA     BLKEND,TZ
          520.  000731L 00010111 10110010          CCLR
          521.  000732L 00110001 11010010  BLKGO   DOPIP   URO+URC,SB,1,URI+URC    COUNT DOWN IN C
                000733L 01010100 00000001
                000734L 00110111 10000010
          522.  000735L 11010011 00011011          BRA     BLKEND,TZ
          523.  000736L 00110001 00110000          TSTPT   FI,SRVREQ          CAN WE REPEAT QUICKLY?
          524.  000737L 11010010 00011101          BRA     BLKRPT,FZ          NO
          525.  000740L 00111001 00110100          BRPX    IDCOD              YES
                000741L 10101111 00110011
          526. >000742L 01011001 11111111  BLKRPT  BRAX    SRVRPT             DO SERVICE AS NEEDED
               >000743L 11001111 11111111
          527.  000744L 00110001 11011100  BLKEND  DOPIP   PSWO,ND,-1-SWRPT,PSWI
                000745L 01010101 11011111
                000746L 00110111 10001100
          528. >000747L 01011001 11111111          BRAX    FETCH
               >000750L 11001111 11111111
          529.                                    *
          530.  000751L                           BLKIN:
          531.                                    .       (    177)  BLKIN          T <- (HL) <- (DE); FROM DMP BUS
          532.                                    .                                 HL <+ 1; DE <+ 1; C <-- 1
          533.                                    .                                 UNTIL (T + B = 0400) OR (C = 0)
          534.                                    . 0.10 + 5.75 * C - 0.60 IF MATCH
          535.
          536.  000751L 00110001 11010011          LDPP    DMPADH,URI+URD     SELECT DEVICE
                000752L 00110111 01001000
          537.  000753L 00110001 11011100          TSTIP   ,SWUSER,PSWI
                000754L 01000101 00000100
          538.  000755L 11000010 00101011          BRA     IVIOLO,FZ          CONTINUE ONLY IF PRIV'D
          539.  000756L 11011101 00010001          BRA     $,T@,BR
          540.  000757L 00110001 11010100          LDPP    DMPADL,URI+URE,DMPRDS  SELECT ADDRESS/FUNCTION AND READ
                000760L 00110111 01001001
                000761L 00110111 01011000
          541.  000762L 00110001 11000110          DLDX    HL2MR
                000763L 00110001 11100101
          542.  000764L 11011101 00001011          BRA     $,T@,BR
          543.  000765L 00110001 01011001          LDPP    MDW,DMPDTI         GET THAT DATA & WRITE IT TO MEMORY
                000766L 00110111 00101001
          544.  000767L 01101111 11110001          LDRT    TEMP1
          545.  000770L 11010100 00000111          MWAIT   ,MEMPF0            WAIT FOR COMPLETION
                000771L 11000111 00100101
          546.  000772L 11011111 00110010          BRA     BLKLOOP
          547.  000773L 11111111 11111111          TABPAGE PROCL
                000774L 11111111 11111111
                000775L 11111111 11111111
```

```
000776L 11111111 11111111
000777L 11111111 11111111
```

```
                                . INPUT OUTPUT OPERATIONS

                                *
001000L                         PIN:
                                .       (    103)  PIN              PARITY CHECKING INPUT
                                .       (IMP 103)  PINR             (R) <- INBUS; PARITY CHECK
                                . 1.45 (DATA); 1.55 (STATUS); 1.30 (NON-RIM)

001000L 00110001 11011100               TSTIP    ,SWUSER,PSWI       CONTINUE ONLY IN PRIV'D MODE
001001L 01000101 00000100
001002L 11000010 00100100               BRA      IVIOL$,FZ
001003L 01000101 00001000               TSTIT    ,SWIRIM            ONLY OPERATE IF RIM DEFINED
001004L 11000010 11110011               BRA      INPRIM,FZ
001005L 01010001 00000110       PFMIN   LDTI     SVINP              PIN OR MIN TO NON RIM IS PARITY FAULT
001006L 11001111 00100001               BRA      SCLSTW

                                *
001007L                         INPUT:
                                .       (    101)  IN               INPUT FROM 5500 BUS
                                .       (IMP 101)  INR              (R) <- INBUS
                                . 1.35 (DATA); 1.45 (STATUS); 1.20 (NON-RIM)

001007L 00110001 11011100               TSTIP    ,SWUSER,PSWI       CONTINUE ONLY IN PRIV'D MODE
001010L 01000101 00000100
001011L 11000010 00100100               BRA      IVIOL$,FZ
001012L 01000101 00001000               TSTIT    ,SWIRIM            ONLY OPERATE IF RIM DEFINED
001013L 11000011 11101001               BRA      INPZRO,TZ
001014L 01000101 00010000       INPRIM  TSTIT    ,SWSTDT            WANT STATUS OR DATA?
001015L 11000011 11101101               BRA      INSTAT,TZ
001016L 00110001 01010010               LDPP     IMPO,RIMDATI       GET RIM DATA
001017L 00110111 10001111
>001020L 01011001 11111111              BRAX     FETCHN
>001021L 11001111 11111111
                                .
001022L 00110001 01010011       INSTAT  LDPP     IMPO,RIMSTAI       GET RIM STATUS
001023L 00110111 10001111
>001024L 01011001 11111111              BRAX     FETCHN
>001025L 11001111 11111111
                                .
001026L 01010001 00000000       INPZRO  LDPI     IMPO,0             GET DATA OF ZERO - THERE IS NO I/O BUS!
001027L 00110111 10001111
>001030L 01011001 11111111              BRAX     FETCHN
>001031L 11001111 11111111
```

```
                                . INPUT OUTPUT OPERATIONS

                                +
                                EXADR:
                                .       (    121)  EX ADR          SELECT DEVICE (AND PUT IN STATUS MODE)
                                .       (IMP 121)  EX ADR          (SEXADR) <- OUTBUS <- (R)
                                . 2.50 (RIM); 2.75 (NON-RIM)

001032L 00110001 11011100               TSTIP    ,SWUSER,PSWI      SHOULD I HAVE DONE THAT?
001033L 01000101 00000100
001034L 11000010 00100100               BRA      IVIOL$,FZ
001035L 01010101 11101111               DOPI     PSWO,ND,-1-SWSTDT MARK IN STATUS MODE
001036L 00110111 10001100
001037L 01010001 10101010               DLDPI    MARO,SEXADR
001040L 00110111 11000000
001041L 01010001 11101111
001042L 00110111 11100000
001043L 00110001 11011111               LDPP     MDW,IMPI          OUTPUT ADDRESS TO ITS SAVE AREA
001044L 00110111 00101001
001045L 01000000 10011100               TSTIT    XR,RIMADR         IS THE RIM BEING ADDRESSED?
001046L 11000010 11010110               BRA      ADRNON,FZ
001047L 01010001 00001000               LDTI     SWIRIM            YES, MARK AS ADDRESSED
001050L 11001111 11000111               BRA      PSWOR
                                .
001051L 01010001 11110111 ADRNON        LDTI     -1-SWIRIM         NO, CLEAR MARKINGS
001052L 11001111 11010000               BRA      PSWND
                                *
001053L                         EXSTAT:
                                . 1.20   (    123)  EX STATUS      PUT IN STATUS MODE
                                . 1.20   (IMP 123)  EX STATUS      OUTBUS <- (R)

001053L 00110001 11011100               TSTIP    ,SWUSER,PSWI      SHOULD I HAVE DONE THAT?
001054L 01000101 00000100
001055L 11000010 00100100               BRA      IVIOL$,FZ
001056L 01010001 11101111               LDTI     -1-SWSTDT         CLEAR STATUS (SET DATA) MODE
001057L 00110101 11011100 PSWND         DOPP     PSWO,ND,PSWI      MARK IN STATUS MODE
001060L 00110111 10001100
001061L 00110111 00000100               LDPT     MODW
>001062L 010.11001 11111111             BRAX     FETCHW5           ** FETCHW5 FOR EX ADR ONLY **
>001063L 11001111 11111111
                                *
001064L                         EXDATA:
                                . 1.05   (    125)  EX DATA        PUT IN DATA MODE
                                . 1.05   (IMP 125)  EX DATA        OUTBUS <- (R)

001064L 00110001 11011100               TSTIP    ,SWUSER,PSWI      SHOULD I HAVE DONE THAT?
001065L 01000101 00000100
001066L 11000010 00100100               BRA      IVIOL$,FZ
001067L 01010001 00010000 COM4X         LDTI     SWSTDT            MARK IN DATA MODE
001070L 00110011 11011100 PSWOR         DOPP     PSWO,OR,PSWI
001071L 00110111 10001100
>001072L 010.11001 11111111             BRAX     FETCHW5           ** FETCHW5 FOR EX ADR ONLY **
>001073L 11001111 11111111
```

. INPUT OUTPUT OPERATIONS

```
                                        *
001074L                                 EXWRITE:
                                        .       (    127)  EX WRITE         WRITE DATA TO THE DEVICE
                                        .       (IMP 127)  EXr WRITE
                                        . 1.15 (RIM): 0.95 (NON-RIM)
                                        *
001074L 00110001 11011100                       TSTIP    ,SWUSER,PSWI
001075L 01000101 00000100
001076L 11000010 00100100                       BRA      IVIOL$,FZ
001077L 01000101 00001000                       TSTIT    ,SWIRIM
001100L 11000011 10101111                       BRA      IRIMF,TZ
001101L 00110001 11011111                       LDPP     RIMDATO,IMPI      OUTPUT THAT DATA TO THE RIM
001102L 00110111 00101000
>001103L 01011001 11111111                      BRAX     FETCHN
>001104L 11001111 11111111
                                        *
001105L                                 EXCOM4:
                                        .       (    137)  EX COM4          DO CONTROL STROBE 4
                                        .       (IMP 137)  EXr COM4
                                        . 1.75 (RIM): 0.95 (NON-RIM)
                                        *
001105L 00110001 11011100                       TSTIP    ,SWUSER,PSWI
001106L 01000101 00000100
001107L 11000010 00100100                       BRA      IVIOL$,FZ
001110L 01000101 00001000                       TSTIT    ,SWIRIM
001111L 11000011 10101111                       BRA      IRIMF,TZ
001112L 00110001 11011111                       LDPP     RIMADRO,IMPI      OUTPUT THAT ADDRESS TO THE RIM
001113L 00110111 00101100
001114L 11001111 11001000                       BRA      COM4X
                                        *
001115L                                 OUTPUT:
                                        . 0.65   (Ixy: x=2,3: y ODD)        EX COM OUTPUT TO 5500 BUS
                                        . 0.65   (IMP Ixy)  EXr COM         OUTBUS <- (R)
                                        *
                                        .       (IMP 133)  EXr COM2         ** NO-OP **
                                        .       (    133)  EX COM2          DO CONTROL STROBE 2
                                        *
                                        .       (    135)  EX COM3          DO CONTROL STROBE 3
                                        .       (IMP 135)  EXr COM3         ** NO-OP **
                                        *
001115L 00110001 11011100                       TSTIP    ,SWUSER,PSWI
001116L 01000101 00000100
001117L 11000010 00100100                       BRA      IVIOL$,FZ         ONLY CONTINUE IF PRIVED
>001120L 01011001 11111111      IRIMF           BRAX     FETCHN            ELSE IT IS A NO-OP
>001121L 11001111 11111111
```

. INPUT OUTPUT OPERATIONS

```
                                                +
                                                EXCOM1:
                                                .       (    131)  EX COM1          DO CONTROL STROBE 1
                                                .       (IMP 131)  EXr COM1
                                                . 1.60..2.95 (RIM); 0.95 (NON-RIM)

001122L 00110001 11011100                               TSTIP    ,SWUSER,PSWI
001123L 01000101 00000100
001124L 11000010 00100100                               BRA      IVIOL$,FZ      ONLY CONTINUE IF PRIVED
001125L 01000101 00001000                               TSTIT    ,SWIRIM
001126L 11000011 10010100                               BRA      EXCOMJ,TZ
001127L 00110001 11011111                               LDTP     IMPI           GET DATA TO BE STROBED TO THE RIM
001130L 00010111 10100010                               SHIFT    SL,CC
001131L 01010101 00001110                               DOTI     ,ND,07<1       SELECT LOWER 3 BITS (SHIFTED UP ONE)
001132L 01010010 10010100                               DORA     LINK,AC,EXCOMJ ADDRESS INTO FUNCTION TABLE
001133L 0110.1111 11110000
001134L 11101111 00000000                               BRR      LINK           AND GO DO IT!

001135L 00110111 01010001                               STB      EXCOM17        7 (1.85) RESET CONFIG
001136L 11001110 11111111                               NOOP
>001137L 01011001 11111111                              BRAX     FETCHN         6 (1.60) NO POR ANY MORE
>001140L 11001111 11111111
001141L 01010001 10001001                               BRC      XBUFP,,XC15    5 (2.95) SET BUFFER PNTR FOR RCVR
001142L 11001111 10010010
001143L 01010001 10001100                               BRC      XBUFP,,XC14    4 (2.95) SET BUFFER PNTR FOR XMTR
001144L 11001111 10010010
001145L 01010001 10010100                               BRC      XBUFP,,EXCOMJ  3 (2.80) SET BUFFER PNTR FOR PROCESSOR
001146L 11001111 10010010
001147L 00110111 01010101                               STB      EXCOM12        2 (1.95) DISABLE RECEIVER
001150L 11001111 10010100                               BRA      EXCOMJ
001151L 00110111 01010100                               STB      EXCOM11        1 (1.85) DISABLE TRANSMITTER
001152L 11001110 11111111                               NOOP
001153L                                         FTCHIAB                          (FOR ALPHA/BETA/STL DOING A NO-OP)
>001153L 01011001 11111111                      EXCOMJ  BRAX     FETCHN         0 (1.60) NO IPE (TO BE CLEARED) ANY MORE
>001154L 11001111 11111111

001155L 01101111 11110000                       XBUFP   BAS      LINK
001156L 00110001 10001001                               LDX      MR2PCL         DON'T LOSE UPDATED PC
001157L 00110001 11001111                               LDX      IM2MRL,LDRIMBP LOAD BUFFER POINTER TO THE RIM
001160L 00110111 00101101
001161L 00110001 11001001                               LDX      PC2MRL         RESTORE PC
001162L 11101111 00000000                               BRR      LINK           NOW DO OPERATION (IF NEEDED)

001163L 00110111 01010110                       XC14    STB      EXCOM14        BUFFER SELECTED, START TRANSMITTER
>001164L 01011001 11111111                              BRAX     FETCHN
>001165L 11001111 11111111

001166L 00110111 01010111                       XC15    STB      EXCOM15        BUFFER SELECTED, START RECEIVER
>001167L 01011001 11111111                              BRAX     FETCHN
>001170L 11001111 11111111
```

. INPUT OUTPUT OPERATIONS

```
699.                                    +
700.  001171L                          MIN:
701.                                   .        (111 061)  MIN              MULTIPLE INPUT
702.                                   . 1.70 + C * 1.60 (+0.10 IF STATUS)  (HL) <- INBUS; HL <- HL + 1
703.                                   .                                    C <- C - 1; RPT UNTIL C=0 (16)
704.
705.  001171L 00110001 11100101              DLRX    HL2MR                 PRELOAD MAR WITH WHERE TO SAVE DATA
      001172L 00110001 11000110
706.  001173L 00110001 11011100              TSTIP   ,SWUSER,PSWI
      001174L 01000101 00000100
707.  001175L 11000010 00100100              BRA     IVIOL$,FZ             ONLY CONTINUE IF PRIVED
708.  001176L 01000101 00001000              TSTIT   ,SWIRIM
709.  001177L 11000011 11111010              BRA     PEMIN,TZ              IF NOT RIM THEN PARITY FAULT
710.  001200L 01000101 00010000              TSTIT   ,SWSTDT               IF STATUS MODE THEN DO STATUS MIN??
711.  001201L 11000011 01110000              BRA     MINST,TZ
712.  001202L                          MINDT                               ** LOOP IS 1.60 MICRO-SECONDS!!!
713.  001202L 00110001 01010010              LDPP    MDW,RIMDATI           GET RIM DATA & WRITE TO MEMORY
      001203L 00110111 00101001
714.  001204L 00110001 00110000              LDTP    SRVREQ                ** DELAY 150 NS **
715.  001205L 00010111 10110010              CCLR
716.  001206L 00110001 11010010              DOPIP   URFO+URC,SB,1,URI+URC   DECREMENT COUNT IN C
      001207L 01010100 00000001
      001210L 00110111 01100010
717.  001211L 11000100 01110110              MWAIT   ,MEMPFI               WAIT FOR MEMORY OP
      001212L 11010111 00010001
718.  001213L 00110111 00001100              STB     IMAR
719.  001214L 01000101 00001111              TSTIT   ,017                  AT THE END?
720.  001215L 11000010 01111101              BRA     MINDT,FZ
721.  001216L 11011111 00001111              BRA     MIOEND                YES
722.
723.  001217L                          MINST
724.  001217L 00110001 01010011              LDPP    MDW,RIMSTAI           GET RIM STATUS & WRITE TO MEMORY
      001220L 00110111 00101001
725.  001221L 00110001 00110000              LDTP    SRVREQ                ** DELAY 150 NS **
726.  001222L 00010111 10110010              CCLR
727.  001223L 00110001 11010010              DOPIP   URFO+URC,SB,1,URI+URC   DECREMENT COUNT IN C
      001224L 01010100 00000001
      001225L 00110111 01100010
728.  001226L 11000100 01101001              MWAIT   ,MEMPFI               WAIT FOR MEMORY OP
      001227L 11010111 00010001
729.  001230L 00110111 00001100              STB     IMAR
730.  001231L 01000101 00001111              TSTIT   ,017                  AT THE END?
731.  001232L 11000010 01110000              BRA     MINST,FZ
732.  001233L 11011111 00001111              BRA     MIOEND                YES
```

```
733.
734.  001234L                              +
735.                                       MOUT:
736.                                       .        (111 071)  MOUT            MULTIPLE OUTPUT
737.                                       . 1.45 + C * 1.60; OR               OUTBUS <- (HL); HL <- HL + 1
738.                                       . 2.65 (IF NON-RIM)                 C <- C - 1; RPT UNTIL C=0 (16)
739.  001234L 00110001 11000110                    DLDX    HL2MR              GET DATA AS SOON AS POSSIBLE
      001235L 00110001 11100101
740.  001236L 00110001 11011100                    TSTIP   ,SWUSER,PSWI       ONLY CONTINUE IF PRIVED
      001237L 01000101 00000100
741.  001240L 11000010 00100100                    BRA     IVIOL$,FZ
742.  001241L 00110111 01000111                    STB     SMR
743.  001242L 01000101 00001000                    TSTIT   ,SWIRIM
744.  001243L 11000010 01000111                    BRA     MOUTOUT,FZ         DO MOUT OR DO NOTHING
745.
746.  001244L 00110001 11010010                    DOTIP   ,ND,017,URI+URC    UPDATE HL & C FOR MOUT
      001245L 01010101 00001111
747.  001246L 11000010 01010111                    BRA     MOUTN16,FZ         TO NON-EXISTANT DEVICE
748.  001247L 01010001 00010000                    LDTI    16                 IF C IS ZERO, USE 16
749.  001250L 0110.1111 11110001    MOUTN16 LDRT    TEMP1
750.  001251L 00110001 11010010                    DOPRP   URFO+URC,SB,TEMP1,URI+URC,C0   COUNT DOWN C
      001252L 01110100 00110001
      001253L 00110111 01100010
751.  001254L 00110001 11010110                    DOPRP   URO+URL,SB,TEMP1,URI+URL,C0   COUNT DOWN HL
      001255L 01110100 00110001
      001256L 00110111 10000110
752. >001257L 01011001 11111111                    BRAX    FETCHW,FC          (NO CARRY TO H)
     >001260L 11000000 11111111
753.  001261L 00110001 11010101                    DOPIP   URO+URH,SB,0,URI+URH   COUNT DOWN HL
      001262L 01010100 00000000
      001263L 00110111 10000101
754. >001264L 11001111 11111111                    BRA     FETCHW             (FETCHW FOR THE WASTED SMR!)
755.
756.  001265L                        MOUTLP                                   ** LOOP IS 1.60 MICRO-SECONDS!!!
757.  001265L 00110111 01000111                    STB     SMR
758.  001266L 00110001 00110110                    LDPP    RIMDATO,MDR        GET DATA OUT TO THE RIM
      001267L 00110111 00101000
759.  001270L 00010111 10110010    MOUTOUT CCLR
760.  001271L 00110001 11010010                    DOPIP   URFO+URC,SB,1,URI+URC DECREMENT THE COUNT IN C
      001272L 01010100 00000001
      001273L 00110111 01100010
761.  001274L 11000100 01000011                    MWAIT   ,MEMPF1
      001275L 11010111 00010001
762.  001276L 00110111 00001100                    STB     IMAR
763.  001277L 01000101 00001111                    TSTIT   ,017               BASE 16 END?
764.  001300L 11000010 01001010                    BRA     MOUTLP,FZ          COMPLETED BASE 16 IF JUMP
765.                                               RPT     3                  ** DELAY 300 NS (FOR 1.60 TOTAL) **
766.  001301L 11001110 11111111                    NOOP                          AND KEEP CODE THE SAME SIZE
766.  001302L 11001110 11111111                    NOOP                          AND KEEP CODE THE SAME SIZE
766.  001303L 11001110 11111111                    NOOP                          AND KEEP CODE THE SAME SIZE
767.  001304L 00110001 00110110                    LDPP    RIMDATO,MDR        GET FINAL DATA OUT TO THE RIM
      001305L 00110111 00101000
```

```
768.  001306L 11011111 00001111          BRA     MIOEND
```

```
                                        *
                                        . NOTE:  FOR ALL SYSTEM CALLS, THE WAY THE PC SHOULD BE LEFT IS SPECIFIED
                                        *
001307L                                 SCROMLI:                        !! UP THE PC TO NEXT INSTRUCTION
                                        . 8.70                          !! MEMORY OR SECTOR TABLE PARITY ERROR
001307L 01101111 11110010                       LDRT    TEMPL           ROM VECTOR SAVED
001310L 01010001 11110000                       LDTI    SYSROM>8        HOPEFULLY POINTING AT THE NEXT INSTRUCTION
001311L 11001111 00101100                       BRA     SCROMX
                                        *
001312L                                 BP:                             !! PC LEFT AFTER THE INSTRUCTION
                                        .       (    052)  BP           BREAKPOINT
                                        . 8.35                          (SP-2 | SP-1) <- PC
                                        .                               SP <- SP - 2; PC <- BRKPNT

001312L 01010001 00110000                       LDTI    SVBKPNT         DEBUGGING BREAKPOINT RAM VETCOR
001313L 11001111 00110010                       BRA     SCBP
                                        *
001314L                                 SC:                             !! PC LEFT AFTER THE INSTRUCTION
                                        .       (    067)  SC           SYSTEM CALL (SUPERVISOR CALL)
                                        . 8.15                          (SP-2 | SP-1) <- PC
                                        .                               SP <- SP - 2; PC <- SYSCAL

001314L 01010001 00101010                       LDTI    SVSCAL          SUPERVISOR CALL RAM VECTOR
                                        .       BRA     SCBP
                                        *
001315L                                 SCBP                            !! UP THE PC TO NEXT INSTRUCTION
                                        . 8.05                          !! RAM VECTOR FOR INTERRUPT

001315L 01101111 11110010                       LDRT    TEMPL           RAM VECTOR SAVED
001316L 01010001 11101111                       LDRI    TEMPH,SYSIVR>8
001317L 01101111 11110001
001320L 11001111 00011000                       BRA     SCPC
                                        *
001321L                                 SCRAMI:                         !! PC LEFT AFTER THE INSTRUCTION
                                        . 8.50                          !! MEMORY ACCESS & WRITE VIOLATIONS
001321L 01101111 11110010                       LDRT    TEMPL
001322L 01010001 11101111                       LDTI    SYSIVR>8
001323L 01101111 11110001               SCROMX  LDRT    TEMPH
001324L 00110001 11001001                       DLDX    PC2MR,,IMAR
001325L 00110001 11101000
001326L 00110111 00001100
001327L 11001111 00011000                       BRA     SCPC            GO TO THE RAM VECTOR
```

```
                                    +
001330L                             UDPOP:                                      !! PC LEFT AT NEXT INSTRUCTION
                                    .         (    000)  HALT                   UNDEFINED PRIVILEDGED OP
                                    .         (    001)  HALT                   (SP-1 | SP-1) <- PC
                                    .         (    377)  HALT                   SP <- SP - 2; PC <- IVIOL
                                    . 8.50 (+0.10 IF NOT USER MODE)

001330L 00110001 11011100                      TSTIP     ,SWUSER,PSWI
001331L 01000101 00000100
001332L 11000011 00100010                      BRA       UDOP,TZ                UNDEFINED IF IN PRIV MODE
                                    *
001333L 01010001 00011110           IVIOL$:    LDTI      SVIVIOL                !! PC LEFT AT LAST INSTRUCTION
001334L 11001111 00100001                      BRA       SCLSTW                 TRIES PRIV'D INSTRUCTION WHILE USER MOD
                                    *
001335L                             UDOP:                                       !! PC LEFT AT LAST INSTRUCTION
                                    . 8.05    (    171)                         (SP-2 | SP-1) <- PC
                                    . 8.05    (    175)                         SP <- SP - 2; PC <- UAINST

001335L 01010001 00110110                      LDTI      SVUAINS                UNDEFINED OP-CODE VECTOR SYSCALL
                                    *
001336L                             SCLSTW                                      !! RAM VECTOR INTERRUPT
                                    . 7.95                                      !! 5500 I/O BUS PARITY ERROR
                                    .                                           !! BACKUP PC TO START OF
                                    .                                           !! INTERRUPTING INSTRUCTION

001336L 11000100 00100001                      MWAIT     ,$+1
001337L 11000111 00011111
001340L 01101111 11110010                      LDRT      TEMPL                  SAVE RAM VECTOR ADDRESS
001341L 01010001 11101111           SCLST:     LDRI      TEMPH,SYSIVR>8
001342L 01101111 11110001
                                    . 7.65 (+ 0.65 IF IMP # 0)
001343L 11001001 00010110                      BRA       SCDON,T@,IZ            POINTS TO START OF LAST INSTRUCTION.
                                    .                                           !! 1 MSEC INTERRUPT WHEN REPEATED
001344L 00110001 11001001                      DLDX      PC2MR,,DMAR            BACK UP TO IMP SPEC CODE
001345L 00110001 11101000
001346L 00110111 00001101
001347L 00110001 10001001           SCPC       DLDX      MR2PC                  !! SYSTEM CALL PERFORM SECTION
001350L 00110001 10101000
                                    . 7.55                                      SAVE P.C. AS SHOULD BE
                                    *
001351L                             SCDON:
                                    . 7.25                                      !! 1 MSEC INTERRUPT WHEN NOT REPEATED

001351L 01010001 11110000                      LDPI      MAROH,SYSROM>8.AND.0360 CORRECT ENTRY 017 TO BE SURE
001352L 00110111 11100000
001353L 00110111 00000101                      LDPT      STW                    IN THE SECTOR TABLE
001354L 01010001 11000000                      LDTI      0300
001355L 00110101 11001011                      DOP       SP2MRL,ND              POINT TO THE PSW SAVE BYTE
001356L 00110001 11101010                      LDX       SP2MRH,DMAR
001357L 00110111 00001101
001360L 00110001 11011100                      DOPIP     MODW,ND,-1-SWSCF,PSWI CLEAR NECESSARY SYSCALL FLAGS
001361L 01010101 11011010
                                               TSTIT     SW64K                  LDAD       S'K
                                               BRA       SCD?RN,TZ              MDW,PSWI

                                               LDPP      MDW,PSWI
                                               BRA       SCD64K
```

```
                                . SYSTEM CALLS AND OP-CODES FOR IT
                                SCDNORM  LDPI   MAROH,SYSROM>8,STW
      001362L 00110111 00000100
853.  001363L 00110001 11011100          LDPP   MDW,PSWI          SAVE ORIGINAL PSW IN ITS SAVE AREA
      001364L 00110111 00101001
854.  001365L 01010101 11011010  SCD64K  DOPI   PSWO,ND,-1-SWSCF  SET NEW SYSCALL FLAGS
      001366L 00110111 10001100
855.  001367L 01010001 00001001          LDPI   LIMP,PCL          GET SET FOR PUSH OF THE P.C.
      001370L 00110111 00000001
856.  001371L 11000100 00000110          MWAIT  ,IGNORE           WAIT ON WRITE & IF ERROR, TROUBLE
857. >001372L 01011001 11111111          BRCX   PSHSTO,F@,MP,PCMOD IF NO ERROR, GO TO IT (SAVED 1 WORD)
     >001373L 01010001 11111111                                  SCSTKP
     >001374L 11000110 11111111
858.                                .
859.                                .MEMPFSC
860.                                . WOW! SYSTEM SAVE AREA HAD SECTOR TABLE OR WRITE PROTECT FAULT
861.                                .      USE THE ROM VECTOR POINT TO MARK A DOUBLE BAD INTERRUPT
862.
863.  001375L 01010001 00000110          LDTI   SRSYSMF           DO SPECIAL INTERRUPT
864.  001376L 01011001 11111111          BRAX   FETPC             FORGET PUSH, WILL PROBABLY NOT WORK
      001377L 11001111 11011011
865.                                .
866.                                .      TABPAGE PROCL
```

SCSTKP, ~~MWAIT, TST~~
& TSTIP, SW64K, PSWI
BAN SC2PCM,J2
MWAIT ,MEMPFSC
DCTIP ,ND,#200,SPIL
DOPI MAROL,OR,SCSAVSP.AND.#177
LDPP MDW,SPIL
NOOP
SC2PCM—0 MWAIT ~~ABORT~~,MEMPFSC
~~SCPFT~~ BRAX PCMOP

```
 869.                                   *
 870.  001400L                          BETA:
 871.                                   .       (    020)  BETA          SAVE ALPHA REGS AND LOAD BETA SET
 872.                                   . 27.90 (1.35 IN BETA)
 873.                                   .                                '/FXLHEDCBA/' <- FXLHEDCBA
 874.                                   .                                FXLHEDCBA <- "FXLHEDCBA"
 875.
 876.                                   .       (111 020)  BETAL        LOAD REGS FROM BETA SAVE AREA
 877.                                   . 13.45                          FXLHEDCBA <- "FXLHEDCBA"
 878.
 879.                                   .       (062 020)  SYSSAV       SAVE SYSTEM REGS
 880.                                   . 14.00                          "'/FXLHEDCBA"/' <- FXLHEDCBA
 881.
 882.                                   . NOTE: CAN NOT IMS. INTERRUPT BETWEEN BETA & FOLLOWING INSTRUCTION.
 883.
 884.  001400L 00110001 11011100              TSTIP    ,SWUSER,PSWI     ONLY IF PRIV'D
        001401L 01000101 00000100
 885.  001402L 11000010 00100100              BRA      IVIOL$,FZ
 886.  001403L 01000101 00100000              TSTIT    ,SWRPT
 887.  001404L 11010010 11000110              BRA      BETAL,FZ         IF REPEATED DO SECOND HALF
 888.  001405L 11011011 11000110              BRA      BETAL,T@,IO      IF ODD, ONLY LOAD BETA REGS
 889.  001406L 01000101 10000000              TSTIT    ,SWALBT          TEST HERE, SYSSAV NEEDS IT
 890.  001407L 11011000 11110010              BRA      SYSSAV,F@,IZ     SYSTEM SAVE IF NON-ZERO
 891.  001410L 11000010 10010100              BRA      FTCHIAB,FZ       SIMPLE BETA, FORGET IT, ALREADY IN BETA
 892.  001411L 01010011 00100000              DOPI     PSWO,OR,SWRPT    TWO PARTS, SO REPEATED
        001412L 00110111 10001100
 893.  001413L 01010001 00111110  ALPHAS     LDTI     SESAVAF.AND.0177 POINT TO CORRECT SAVE AREA (7 BITS!)
 894.  001414L 11011111 11100100              BRA      MODSAV
 895.                                   *
 896.  001415L                          SYSSAV
 897.                                   .       (062 020)  SYSSAV        SYSTEM SAVE WHICHEVER REGISTERS & FLAGS
 898.                                   . 14.00                          "'/FXLHEDCBA/"' <- FXLHEDCBA
 899.
 900.  001415L 11010011 11110100              BRA      ALPHAS,TZ        SAVE ALL REGISTERS TO THE ALPHA SET
 901.  001416L 11011111 11100101              BRA      BETAS            NO, TO BETA SET
```

```
902.                                    +
903.  001417L                          ALPHA:
904.                                    .       (    030)  ALPHA          SAVE BETA REGS AND LOAD ALPHA SET
905.                                    . 27.50 (1.35 IF ALPHA)
906.                                    .                                 "FXLHEDCBA" <- FXLHEDCBA
907.                                    .                                 FXLHEDCBA <- 'FXLHEDCBA'
908.
909.                                    .       (111 030)  ALPHAL         LOAD REGS FROM ALPHA SAVE AREA
910.                                    . 13.15                           FXLHEDCBA <- 'FXLHEDCBA'
911.
912.                                    .       (062 030)  SYSRET         RESTORE REGS AND RETURN
913.                                    . 21.00 (+ 0.40 IF BETAL)         PC <- (SP+1 | SP); SP <- SP + 2
914.                                    .                                 FXLHEDCBA <- "'FXLHEDCBA"'
915.
916.                                    . NOTE: CAN NOT 1MS. INTERRUPT BETWEEN ALPHA & FOLLOWING INSTRUCTION.
917.
918.  001417L 00110001 11011100                 TSTIP   ,SWUSER,PSWI      ONLY IF PRIVED
      001420L 01000101 00000100
919.  001421L 11000010 00100100                 BRA     IVIOL$,FZ
920.  001422L 01000101 00100000                 TSTIT   ,SWRPT
921.  001423L 11010010 10011100                 BRA     ALPHAL,FZ         IF REPEATED JUST DO SECOND HALF
922.  001424L 11011011 10011100                 BRA     ALPHAL,T@,IO      NO SAVE, JUST DO ALPHA LOAD
923.  001425L 11011000 10111000                 BRA     SYSRET,F@,IZ      RELOAD REGS & RETURN
924.  001426L 01000101 10000000                 TSTIT   ,SWALBT           IS A SIMPLE ALPHA INSTRUCTION
925.  001427L 11000011 10010100                 BRA     FTCHIAB,TZ        FORGET IT, ALREADY IN ALPHA MODE
926.  001430L 01010011 00100000                 DOPI    PSWO,OR,SWRPT     MARK REPEATED BECAUSE 2 PARTS!
      001431L 00110111 10001100
927.  001432L 01010001 00110101    BETAS       LDTI    SESAVBF.AND.0177  (7 BITS) TO POINT TO THE SAVE AREA
928.                               .           BRA     MODSAV
```

```
                                        +
                        MODSAV                                  SAVE FLAGS AND REGS IN SAVE AREA
                        . 12.75 (FETCH); 26.20 (ALPHAL); 26.40 (BETAL)
                                                                                    FSTCP  SW64K,MSWD
                                                                                    BRA    MOD SW64K,T2
                                                                                    LDPR   STW, SSTKPE
001433L 01101111 11110010       LDRT    TEMP2           SAVE AWAY FOR THE MOMENT
001434L 00110001 11101010       LDX     SP2MRH          MSB STACK POINTER IS SAVE AREA ALSO
001435L 00110001 11011011       DOTIP   ,ND,0200,SPIL   GET 128 BYTE BOUNDARY BIT (1 MSBIT)
001436L 01010101 10000000
001437L 01110011 11110010       DOPR    MAROL,OR,TEMP2  COMBINE WITH THE FLAG ADDRESS
001440L 00110111 11000000
001441L 00110001 00110101       DOPIP   MDW,ND,0303,UCFLG SAVE THE FLAGS, ONLY 4 BITS OF INTEREST
001442L 01010101 11000011
001443L 00110111 00101001
001444L 01010001 00010000 REGSVLP LDPI  LIMP,IMP8        INIT COUNT
001445L 00110111 00000001
                        MODSVLP
001446L 11010100 11011001       MWAIT   ,MEMPF1
001447L 11010111 00010001
001450L 00110111 00001101       STB     DMAR,DIMP       SAVE THE REGISTER
001451L 00110111 00001001
001452L 00110001 11011111       LDPP    MDW,IMPI
001453L 00110111 00101001
001454L 11011000 11011001       BRA     MODSVLP,F@,IZ   LOOP TILL ALL 8 REGS. ARE SAVED
                        .
001455L 00110001 11011100       TSTIP   ,SWRPT,PSWI     WELL, ONE OR TWO PARTS?
001456L 01000101 00100000
001457L 11010011 10111010       BRA     FTCHABW,TZ      ONLY SYSSAV, NO-LOAD NEW REGS.
001460L 01010101 11111110       DOPI    MODW,ND,-1-SWINTE TEMPORARILY DISABLE INTERRUPTS FOR IT
001461L 00110111 00000100
                        .
001462L 00110001 00110000       TSTPT   FI,SRVREQ       ANY REQUESTS PENDING?
001463L 11010010 10111100       BRA     MODSRV,FZ       YES, DO THEM AND I HOPE NO TROUBLE
001464L 00110001 11011100       TSTIP   ,SWALBT,PSWI    WHAT WAS IT?
001465L 01000101 10000000
001466L 11010100 11001001       MWAIT   ,MEMPF1         NEEDED AFTER MDW AT END OF LOOP ABOVE
001467L 11010111 00010001
001470L 11010010 10011100       BRA     ALPHAL,FZ       WAS BETA, DO ALPHAL NOW
                        .       BRA     BETAL           WAS ALPHA DO BETAL NOW
```

MOD SW64K

```
                                                +
                                                BETAL
                                                .       (111 020)  BETAL            LOAD REGS FROM BETA SAVE AREA
                                                . 12.70 (HERE ON)                   FXLHEDCBA <- "FXLHEDCBA"
                                                .
001471L                                                 LDX     SP2MRH
001472L 00110001 11101010                               DOTIP   ,ND,0200,SPIL
001473L 01010101 10000000
                                                        DOPI    MAROL,OR,SESAVBF.AND.0177 POINT TO BETA FLAGS IN SAVE AREA
001474L 01010011 00110101
001475L 00110111 11000000
001476L 00110111 01000111                       BETALN64K STB   SMR
001477L 00110001 11011100                               DOTIP   ,OR,SWALBT,PSWI     SET BETA MODE
001500L 01010011 10000000
001501L 01010101 11011111                               DOTI    ,ND,-1-SWRPT        RESET REPEAT FLAG (IF SET)
001502L 11011111 10010100                               BRA     MODLOD
                                                .
>001503L 01011001 11111111                      MODSRV  BRAX    SRVDO               GO TO SERVICE AS NEEDED (MODSAV USES IT)
>001504L 11001111 11111111
                                                .
>001505L 01011001 11111111                      FTCHABW BRAX    FETCHW              DO FETCH WAIT AT THE END
>001506L 11001111 11111111
                                                *
001507L                                         SYSRET
                                                .*      NOTE: THIS INSTRUCTION IS VERY LONG IN EXECUTION
                                                .*            IF DMA SLOWS IT EVEN FARTHER WE MAY HAVE PROBLEMS
                                                .
                                                .* WARNING:   IF AS SOLUTION TO LENGTH IT IS DONE AS REPEATED INSTRUCTON
                                                .*    THEN:   IF INTERUPTED (I.E. BY RESTART-DEBUG INTERRUPT)
                                                .*            THE PC WILL REFLECT THE ADDRESS OF THE INSTRUCTION TO RETURN
                                                .*            TO, WITH REPEATED FLAG ON AND THE INCORRECT REGISTER SET IN THE
                                                .*            SUPPORT REGISTERS (THE ALPHAL OR BETAL NOT COMPLETED!)
                                                .*            THIS IS VERY BAD!  BUT POSSIBILITY IS LOW AND NO SOLUTION SEEN
                                                .
                                                .* WARNING:   IF INSIDE SYSRET (REGISTER LOAD PART) THERE IS A MEMORY FAULT,
                                                .*            THE PC WILL BE INCORRECT BECAUSE OF A SPECIAL PRE-DECREMENT.
                                                .*            IF THE IMP WAS NON-ZERO, IT WILL BE EVEN FARTHER OFF
                                                .
                                                .       (062 030)  SYSRET           SYSTEM RETURN (FROM SC, BP, ETC)
                                                . 20.15 (+ 0.40 IF BETAL) HERE ON   PC <- (SP+1 | SP); SP <- SP + 2
                                                .                                   FXLHEDCBA <- "FXLHEDCBA"
                                                .
001507L 01010001 00001001                               LDPI    LIMP,PCL            GET THE RETURN ADDRESS INTO THE P.C.
001510L 00110111 00000001
>001511L 01011001 11111111                              BRC     POPSTO,,SYSRET0     OFF PAGE WITH SPECIAL RETURN
>001512L 01010001 11111111
>001513L 11001111 11111111
                                                .
001514L                                         SYSRET1:                            ASSUME ENTERED INST LEGALLY, (PRIVD)
                                                . 15.55 + IF BETAL, HERE ON         SO, COMPLETE IT LEGALLY IN PRIV'D MODE
001514L 00110001 11001001                               DLDX    PC2MR,,DMAR         CORRECT FOR IMAR IN FETCH CODE
001515L 00110001 11101000
001516L 00110111 00001101
```

```
 997.  001517L 00110001 10001001          DLDX    MR2PC
       001520L 00110001 10101000
 998.  001521L 00110001 11101010          LDX     SP2MRH          GET THE PSW
 999.  001522L 01010001 11000000          LDTI    0300
1000.  001523L 00110101 11001011          DOP     SP2MRL,ND       TO BE LOADED
1001.  001524L 00110111 00001101          STB     DMAR
1002.  001525L 00110001 11011100          DOPIP   MODW,ND,-1-SWUSER,PSWI
       001526L 01010101 11111011
       001527L 00110111 00000100
1003.  001530L 00110111 01000111 SYSRET64K STB     SMR             FROM THE SYSTEM SAVE AREA
1004.  001531L 01010101 00011000          DORIP   TEMP1,ND,SWIRIM+SWSTDT REMEMBER OLD RIM MODE INFO
       001532L 01101111 11110001
1005.  001533L 01010001 11100111          LDTI    -1-SWIRIM-SWSTDT
1006.  001534L 11010100 10100011          MWAIT   ,MEMPF1
       001535L 11010111 00010001
1007.  001536L 00110101 00110110          DOTP    ,ND,MDR         GET ALL THE OTHER STATUS BITS
1008.  001537L 01110011 11110001          DOPR    PSWO,OR,TEMP1   GET NEW PSW & DO NOT SET IT OR BAD THINGS
       001540L 00110111 10001100
1009.                                     .                       MAY HAPPEN IF STACK IN PROTECTED MEMORY
1010.  001541L 01000101 10000000          TSTIT   ,SWALBT         WHICH WAY TO GO?  WHICH WAY TO GO?
1011.  001542L 11010010 11000110          BRA     BETAL,FZ        TO BETA!
1012.                                     .       BRA     ALPHAL  TO ALPHA
1013.                                     *
1014.  001543L                            ALPHAL
1015.                                     .       (111 030)  ALPHAL   LOAD REGISTERS FROM ALPHA SAVE AREA
1016.                                     . 12.40 (HERE ON)           FXLHEDCBA <- 'FXLHEDCBA'
1017.
1018.  001543L 00110001 11101010          LDX     SP2MRH
1019.  001544L 00110001 11011011          DOTIP   ,ND,0200,SPIL   GET IT ON 128 BYTE BOUNDARY
       001545L 01010101 10000000
1020.  001546L 01010011 00111110          DOPI    MAROL,OR,SESAVAF.AND.0177 ONLY 7 BITS OF INTEREST
       001547L 00110111 11000000
1021.  001550L 00110111 01000111          STB     SMR
1022.  001551L 00110001 11011100          DOTIP   ,ND,-1-SWRPT-SWALBT,PSWI RESET REPEAT FLAG AND SET ALPHA
       001552L 01010101 01011111
1023.                                     .       BRA     MODLOD
1024.                                     *
1025.  001553L                            MODLOD
1026.                                     . 11.35                     LOAD USERS FLAGS AND REGISTERS
1027.                                     . NOTE: IF MACRO LEVEL PLAYS WITH FLAG BYTE, IT BETTER DO IT CORRECTLY
1028.
1029.  001553L 00110111 10001100          LDPT    PSWO            LOAD STATUS WORD
1030.  001554L 00010111 10110010          CCLR
1031.  001555L 11010100 10010010          MWAIT   ,MEMPF1
       001556L 11010111 00010001
1032.  001557L 00110111 00001101          STB     DMAR
1033.  001560L 00110001 00110110          DOTPP   ,AC,MDR,MDR     SET USER FLAGS
       001561L 00110010 00110110                  Ø200
1034.  001562L 00110111 00000110          STB     LUF
1035.  001563L 11011111 01100100          BRA     MODLOP          AND DO THE REGISTER LOAD
```

. REGISTER SAVE AND RESTORE

```
1038.                                   *
1039.  001564L                          REGS:
1040.                                   . 18.00  (    055)  REGS          REGISTER SAVE
1041.                                   .                                (SP-7 | SP) <- XLHEDCBA; SP <- SP - 8
1042.
1043.                                   . 10.45  (111 055)  REGL          REGISTER LOAD
1044.                                   .                                XLHEDCBA <- (HL-7 | HL)
1045.
1046.  001564L 11011000 01100110              BRA     REGL,F@,IZ         DO REGISTER LOAD NOT SAVE!
1047.  001565L 00110001 11011100              DOPIP   MODW,ND,-1-SWUSER,PSWI  ALLOW STACK ACCESS TO PROTECTED MEM.
       001566L 01010101 11111011
       001567L 00110111 00000100
1048.  001570L 00110001 11101010              DLRX    SP2MR,,SMR         GET TOP ENTRY ON THE STACK
       001571L 00110001 11001011
       001572L 00110111 01000111
1049.  001573L 11001110 11111111              MWAIT   NOOP,MEMPF1
       001574L 11010100 10000011
       001575L 11010111 00010001
1050.  001576L 00110001 00110110              LDRP    TEMPL,MDR,CC       SAVE LSB OF POINTER
       001577L 01101111 10110010
1051.  001600L 01010100 00001000              DOPI    MDW,SB,8           UPDATE TOS (ASSUMING REGS WORKS)
       001601L 00110111 00101001
1052.  001602L 11001110 11111111              MWAIT   NOOP,MEMPF1
       001603L 11010100 01111100
       001604L 11010111 00010001
1053.  001605L 00110111 00001100              STB     IMAR               GET MSB OF TOS
1054.  001606L 11011111 01111000              DELAY   2
1055.  001607L 00110111 01000111              STB     SMR
1056.  001610L 11001110 11111111              MWAIT   NOOP,MEMPF1
       001611L 11010100 01110110
       001612L 11010111 00010001
1057.  001613L 00110001 00110110              LDRP    TEMPH,MDR          SAVE MSB OF POINTER
       001614L 01101111 11110001
1058.  001615L 01010100 00000000              DOPI    MDW,SB,0           UPDATE TOS (ASSUMING REGS WORKS)
       001616L 00110111 00101001
1059.  001617L 01110001 11110010              LDTR    TEMPL              GET ORIGINAL (SAVED) LSB
1060.  001620L 11010100 01101111              MWAIT   ,MEMPF1
       001621L 11010111 00010001
1061.  001622L 00110111 11000000              LDPT    MAROL              LOAD THE MAR WITH THE INITIAL TOS
1062.  001623L 01110001 11110001              LDPR    MAROH,TEMPH,IMAR   AND CORRECT FOR THE FIRST DMAR
       001624L 00110111 11100000
       001625L 00110111 00001100
1063.  001626L 00110001 11011100              LDPP    MODW,PSWI          RESTORE THE CORRECT MODE
       001627L 00110111 00000100
1064.  001630L 11011111 11011011              BRA     REGSVLP            AND GO SAVE ALL THE REGS
```

. REGISTER SAVE AND RESTORE

```
1065.
1066.  001631L                                  +
1067.                                          REGL
1068.                                          . 10.45  (111 055)  REGL            REGISTER LOAD
1069.                                          .                                   XLHEDCBA <- (HL-7 | HL)
1070.  001631L 00110001 11100101                       BRA     SYSSTL,FR,IO
       001632L 00110001 11000110                       DLRX    HL2MR               INIT HL TO MAR
1071.  001633L 01010001 00010000          MODLOP       LDPI    LIMP,IMP8           INIT COUNTER        (FIRST IMPO TO A-REG!)
       001634L 00110111 00000001
1072.  001635L 00110111 01000111          REGLLP       STB     SMR
1073.  001636L 00110001 00110110                       LDPP    IMPO,MDR,DIMP       GET DATA & COUNT DOWN   (WILL BE WASTED)
       001637L 00110111 10001111
       001640L 00110111 00001001
1074.  001641L 11010100 01011110                       MWAIT   ,MEMPF1
       001642L 11010111 00010001
1075.  001643L 00110111 00001101                       STB     DMAR
1076.  001644L 11011000 01100010                       BRA     REGLLP,F@,IZ        LOOP FOR THE FULL COUNT
1077.  001645L 00110001 00110110                       LDPP    IMPO,MDR            FINALLY GET THE REAL A-REG VALUE
       001646L 00110111 10001111
1078. >001647L 01011001 11111111                       BRAX    FETCHRW             RESTORE CORRECT MODE (FOR SYSRET)
      >001650L 11001111 11111111                                 W S
```

SYSPSH where best

SYSPOP where best

```
                                . SECTOR TABLE LOAD
1081.                           *
1082.  001651L                  STL:
1083.                           .       (    077)  STL              LOAD THE SECTOR TABLE
1084.                           . 5.40 + C * 2.50 (+0.55 IF C>8, OR 1.50 IF C=0)
1085.                           .                                   STL (0..C) <- (HL+C ! HL); STL (15) <- SYS
1086.
1087.                           .       (022 077)  STLOA            LOAD WITH OFFSET
1088.                           .       (111 077)  STLOB            STL (R..R+C) <- (HL+C ! HL)
1089.                           .       (062 077)  STLOC            STL(15) <- SYSROM
1090.                           .       (113 077)  STLOD
1091.                           .       (174 077)  STLOE
1092.                           . 5.70 + C * 2.5 (+0.55 IF C>8, OR 1.50 IF C=0)
1093.
1094.                           .       NOTE: DOES NOT CHANGE HL OR C-REGISTERS
1095.                           .       NOTE: IN STLO'C', LOW 4 BITS COUNTER & HIGH 4 BITS OFFSET!
1096.
1097.  001651L 00110001 11011100        TSTIP   ,SWUSER,PSWI        ONLY IF PRIVED
       001652L 01000101 00000100
1098.  001653L 11000010 00100100        BRA     IVIOL$,FZ
1099.  001654L 01010101 00100000        TSTIT   ND,SWRPT,,,TW       ASSUME WILL BE ZERO, NOT REPEATED
1100.  001655L 11010011 01001000        BRA     STLNRPT,TZ          WAS NOT REPEATED
1101.
1102.  001656L 00110001 11010010        DORIP   TEMP2,ND,07,URI+URC REPEATED, GET THE HL (MAR) BIAS AND
       001657L 01010101 00000111
       001660L 01101111 11110010
1103.                                   RPT     4
1104.  001661L 00010111 10100010        SHIFT   SL                  THE POINTER BIAS AND COUNT FOR THE
1104.  001662L 00010111 10100010        SHIFT   SL                  THE POINTER BIAS AND COUNT FOR THE
1104.  001663L 00010111 10100010        SHIFT   SL                  THE POINTER BIAS AND COUNT FOR THE
1104.  001664L 00010111 10100010        SHIFT   SL                  THE POINTER BIAS AND COUNT FOR THE
1105.  001665L 01010011 00001000        DOTI    ,OR,010             FINAL EIGHT STL LOADS
1106.  001666L 11011111 01000100        BRA     STLRPTD
1107.
1108.  001667L 01101111 11110010  STLNRPT LDRT    TEMP2               REGULAR HL (MAR) NEEDS NO BIAS
1109.  001670L 00110001 11010010        TSTIP   ,017,URI+URC,TW     GET THE COUNT OF THE STEPS TO DO
       001671L 01010101 00001111
1110.  001672L 11000011 10010100        BRA     FTCHIAB,TZ          IF ZERO, WAS NOTHING TO DO. SO, THE END
1111.
1112.  001673L 11011001 00111111  STLRPTD BRA     STLZRO,T@,IZ        DO STANDARD STL
1113.  001674L 01101111 11110001        LDRT    TEMP1               SAVE AWAY
1114.  001675L 00110001 11011111        DOTIP   ,ND,0360,IMPI       IMP STL STARTS STL WITH OFFSET
       001676L 01010101 11110000
1115.  001677L 01110010 00110001        DOTR    ,AC,TEMP1,,C0       COMBINE GIVEN OFFSET WITH BIAS
1116.
1117.  001700L 01101111 11110001  STLZRO LDRT    TEMP1               SAVE THE POINTER/COUNTER AS GENERATED
1118.  001701L 00110001 11010110        DOPRP   MAROL,AC,TEMP2,URI+URL,C0 BIAS TABLE ADDRESS (IF NEEDED)
       001702L 01110010 00110010
       001703L 00110111 11000000
1119.  001704L 00110001 11010101        LDRP    TEMP2,URI+URH       SAVE AWAY URH SO CAN BE RESTORED
       001705L 01101111 11110010
1120.  001706L 00110110 11100000        DOP     MAROH,IT
1121.  001707L 00110111 10000101        LDPT    URO+URH             IN CASE TABLE CROSSES PAGE BOUNDARY
```

```
                                . SECTOR TABLE LOAD
1122.  001710L 00110111 01000111            STB     SMR                 GET NEXT (FIRST) TABLE ENTRY
1123.
1124.  001711L 01110001 11110001    STLAGN  LDTR    TEMP1               GET THE INITIAL VIRTUAL ADDRESS
1125.
1126.  001712L 11010100 00110101    STLOOP  MWAIT   ,STLDONE           RESTORE REGS & SET VECTOR FIRST
       001713L 11010111 00011110
1127.  001714L 00110111 11100000            LDPT    MAROH               LOAD VIRTUAL ADDRESS FROM TEMP
1128.  001715L 01010001 00000010            LDPI    MODW,SWBASD         DISABLE BASING (AND 1 MS INTERRUPTS)
       001716L 00110111 00000100
1129.  001717L 00110001 00110110            DOPIP   STW,ND,0375,MDR     SET PHYSICAL SECTOR # IN VIRTUAL LOCN.
       001720L 01010101 11111101
       001721L 00110111 00000101
1130.  001722L 00110001 11100101            LDX     HL2MRH,IMAR         RESTORE MARH FROM H SAVE AREA
       001723L 00110111 00001100
1131.  001724L 00110001 11011100            LDPP    MODW,PSWI           RESTORE BASING (1 MS INT. 1 INST. DELAY
       001725L 00110111 00000100
1132.  001726L 00110111 01000111            STB     SMR                 GET NEXT TABLE ENTRY
1133.  001727L 00110001 10100101            LDX     MR2HLH              SAVE MARH IN H
1134.  001730L 01110001 10110001            DORIR   TEMP1,AC,017,TEMP1,CC INC VIRTUAL SECTOR # & DECR COUNT
       001731L 01010010 00001111
       001732L 01101111 11110001
1135.  001733L 01000101 00000111            TSTIT   ,07                 AT SPLIT POINT?
1136.  001734L 11010010 00110101            BRA     STLOOP,FZ           NO, CONTINUE
1137.                                   .                               LOOPING JUMP IS DURING MEMORY READ
1138.                                   .                               THIS MAKES EXEC FASTER.
1139.  001735L 01000101 00001111            TSTIT   ,017                REALLY FINISHED?
1140.  001736L 11010011 00011110            BRA     STLDONE,TZ          YES, CLEANUP AND END
1141.  001737L 00110001 00110000            TSTPT   FI,SRVREQ           NO, ANY SERVICE TO DO?
1142.  001740L 11010011 00110110            BRA     STLAGN,TZ           NO, THEN DO SECOND HALF NOW
1143.                                   .                               REPEATED! WILL DO SERVICE BEFORE SECOND
1144.                                   .                               PART BUT DO CLEANUP FIRST
1145.  001741L 11010100 00011110    STLDONE MWAIT   ,$+1                RESTORE BEFORE MEMPF
       001742L 11010111 00011100
1146.                                   .                               BUT NOTE: MAR MSB WILL BECOME INCORRECT
1147.  001743L 01110001 11110010            LDPR    URO+URH,TEMP2       RESTORE H-REG
       001744L 00110111 10000101
1148.  001745L 01010001 11110000            LDPI    MAROH,SYSROM>8.AND.0360 !! FORCE LAST ENTRY TO
       001746L 00110111 11100000
1149.  001747L 00110111 00000101            LDPT    STW                 ACCESS PROTECT AND WRITE PROTECT
1150. >001750L 01011001 11111111            BPGX    RIND
1151.  001751L 01110001 11110001            TSTIR   ,017,TEMP1          REALLY FINISHED?
       001752L 01000101 00001111
1152. >001753L 11000011 11111111            BRA     RIND,TZ             YES, RESET REPEAT FLAG
1153. >001754L 01011001 11111111            BRAX    SRVRPT              NO, DO IT AS REPEATED INST.
      >001755L 11001111 11111111
1154.                                   .                               (BOTH RIND & SRVRPT INDIRECT TO MEMPF)
1155.                                   . NOTE: THIS INSTRUCTION DOES AN EXTRA WASTED READ. BUT WHAT IF IT IS TO
1156.                                   .       ACCESS PROTECTED MEMORY (ACROSS SECTOR BOUNDARY)?
1157.                                   .       NO PROBLEM, INSTRUCTION IS PRIV'D SO CAN'T GET THOSE VIOLATIONS
1158.                                   .       BUT A REAL MEMPF OR STPE WILL CAUSE AN INTERRUPT.
```

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1159.                                   *
1160. >001756L 01011001 11111111       MEMPF1  BRAX    MEMPF$
      >001757L 11001111 11111111
1161.                                   .
1162.  001760L                         MIOEND                          FIT REMAINDER WHERE THERE IS ROOM
1163.  001760L 00110001 10000110                DLDX    MR2HL           RESTORE REG PAIR
       001761L 00110001 10100101
1164. >001762L 01011001 11111111                BRAX    FETCH
      >001763L 11001111 11111111
1165.
1166.  001764L 11111111 11111111                TABPAGE PROCL
       001765L 11111111 11111111
       001766L 11111111 11111111
       001767L 11111111 11111111
       001770L 11111111 11111111
       001771L 11111111 11111111
       001772L 11111111 11111111
       001773L 11111111 11111111
       001774L 11111111 11111111
       001775L 11111111 11111111
       001776L 11111111 11111111
       001777L 11111111 11111111
1167.  002000                           PROCLEN EQU     $-PROCP
1168.  000000                                   USE     PROCL
1169.  000000                                   SKIP    PROCLEN
1170.  000000                                   END     POR
```