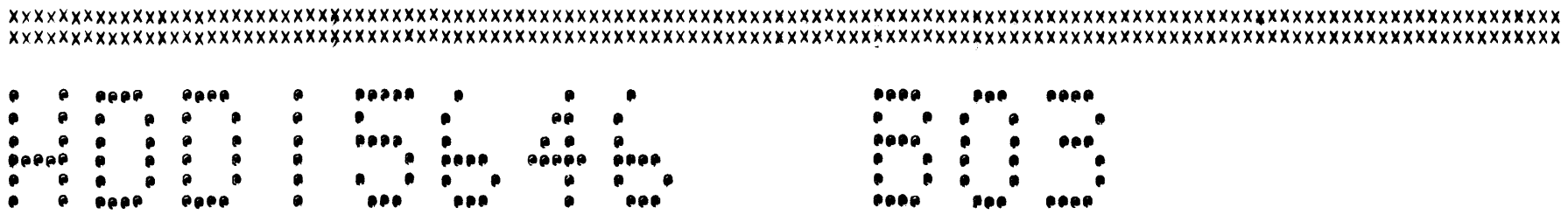

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**********************************
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**                              **

**  PDP-9 MINI TIME-SHARING SYSTEM  **
**   MEMORY PROTECTION OVERLAY #1   **
**            DTSS:MP1              **
**             DK0:B03              **
**             TPN:B03              **
**                              **
**********************************
**********************************
```

```
100             .NAME   MP1--B03
110             .INSRT  MP0
100             .TITLE  ROUTINES TO SERVICE MEMORY PROTECT VIOLATIONS
110             .HEAD   M
120             .INSRT  DEFINS
100             .IFUND  DEFINS
```

```
5720            ,LIST   ON
5730            ,END
130             ,HEAD   M
```

```
                M                       MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

                                140     .STITL  MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS
                                150
                                160
                                170     TABLE   .DEFIN                  IOT TABLE ENTRY
                                180             .PMC    SAVE,OFF
                                190             #1/16.+740000
                                200             .PMC    RESTORE
                                210             .ENDM
    001000                      220             .LOC    OVSTRT
    000702                      230     INSTR   .EQU    $OC0
    000702                      240     TEMP2   .EQU    $OC0
    000703                      250     OPCOD   .EQU    $OC1
    000703                      260     TEMP3   .EQU    $OC1
    000704                      270     TEMP4   .EQU    $OC2
    000705                      280     TEMP5   .EQU    $OC3
001000  601027                  290     MPSTRT  JMP     MPST            OVERLAY ENTRANCE VECTOR
001001  601006                  300             JMP     PINT-1          ENTRANCE FOR PROGRAM INTERRUPT SIMULATION
001002  601214                  310             JMP     IOT0
001003  001265                  320             RDBLK                   POINTER TO THE ROADBLOCK ROUTINE
001004  601631                  330             JMP     .OPR,           POINTER TO OPERATE HANDLING
001005  000000                  340     PINST   .DSA                    PERMANENT INSTRUCTION SAVE IN CASE IT IS A GRAPHICS II INSTRUCTION
                                350     *
                                360     *       AN IOT INTERRUPT HAS OCCURRED -- GENERATE A USER PI INTERRUPT IF THE PI SYSTEM IS ON
                                370     *       TREAT AS IF LOCATION 1 CONTAINED AN XCT OF THE USER'S LOCATION 1 -- ONE XCT IS STILL LEGAL
                                380     *
001006  101162                  390             JMS     REGSAVE
001007  100525                  400     PINT    JMS     $IO,OT          SAVE USER TEMPS
001010  201760                  410             LAC     $IORS           LOAD THE USER'S IORS WORD
001011  740110                  420             SMA!RAL
001012  600270                  430             RET     SPIDON          EXIT IF PI SYSTEM IS NOT ENABLED
001013  744020                  440             CLL!RAR
001014  041760                  450             DAC     $IORS           ELSE TURN OFF THE PI SYSTEM
001015  200000                  460             LAC     0
001016  501633                  470             AND     (677777)        REMOVE THE MEMORY PROTECT BIT
001017  041713                  480             DAC     $,0             SET THE USER PC IN HIS LOCATION 0
001020  500634                  490             AND     $BIT0           SAVE THE LINK STATUS
001021  341634                  500             TAD     (100001)
001022  040000                  510             DAC     0               FAKE THE NEXT INSTRUCTION CAME FROM LOCATION 1 WITH MEMORY PROTECT ON
001023  201714                  520             LAC     $,0+1           LOAD THE USER'S LOCATION 1 INSTRUCTION
001024  140704                  530             DZM     TEMP4           INITIALIZE THE COUNT OF MEMORY OVERLAY EXCHANGES
001025  140705                  540             DZM     TEMP5           INITIALIZE THE XCT COUNT
001026  601042                  550             JMP     MP111+1         AND CHECK THE INSTRUCTION
                                560
                                570
                                580
    001027                      590     MPST    ...
001027  101162                  600             JMS     REGSAVE         SAVE THE MQ AND SC
001030  140704                  610             DZM     TEMP4           INITIALIZE THE COUNT OF MEMORY OVERLAY EXCHANGES
001031  140705                  620             DZM     TEMP5           INITIALIZE THE XCT COUNT (CHECK FOR XCT LOOPS)
                                630     *
                                640     *       CHECK TO SEE IF THE VIOLATION WAS CAUSED BY AN ATTEMPT TO TRANSFER TO PROTECTED MEMORY
                                650     *
```

```
                M                       MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

 001032  200000  660            LAC     0               LOAD THE USER PC
 001033  500651  670            AND     SADRSS          GET RID OF NON-ADDRESS BITS
 001034  341635  680            TAD     (-BOUNDARY)
 001035  755101  690            SPA!CLA!CMA!CLL         SKIP UNLESS A TRANSFER TO PROTECTED MEMORY WAS REQUESTED
 001036  601240  700            JMP     ERR1            YES -- VIOLATION WAS A TRANSFER TO PROTECTED MEMORY -- ILLEGAL
                 710    *
                 720    *       THE VIOLATION WAS NOT CAUSED BY AN ATTEMPT TO TRANSFER TO PROTECTED MEMORY
                 730    *       NOW GET THE VIOLATING INSTRUCTION AND SEPARATE OUT ITS OP CODE
                 740    *
 001037  340000  750            TAD     0               YIELDS LOCATION OF THE OFFENDING INSTRUCTION AND SETS THE LINK
 001040  040702  760            DAC     INSTR
 001041  220702  770    MP111   LAC     INSTR,X
 001042  040702  780            DAC     INSTR           INSTR CONTAINS THE BAD INSTRUCTION
 001043  041005  790            DAC     PINST           SAVE THE INSTRUCTION IN CASE IT IS A GRAPHICS II INSTRUCTION
 001044  501636  800            AND     (NOP)
 001045  741200  810            SNA
 001046  601236  820            JMP     ERR3            CAL IS AN ILLEGAL INSTRUCTION
 001047  040703  830            DAC     OPCOD           SAVE THE OP CODE OF THE VIOLATING INSTRUCTION
                 840    *
                 850    *       NOW CHECK FOR A MICRO-CODED INSTRUCTION; OPERATE OR IOT
                 860    *
 001050  541637  870            SAD     (EAE)
 001051  601115  880            JMP     O,K.            EAE INSTRUCTIONS ARE INNOCENT
 001052  541636  890            SAD     (OPR)
 001053  601631  900    OPRST   JMP     .OPR.           OPERATE INSTRUCTION VIOLATION
 001054  541640  910            SAD     (IOT)
 001055  601202  920            JMP     .IOT.           SERVICE IOT VIOLATION
```

M MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

```
                    930             .EJECT
                    940     *
                    950     *       NOT A MICROCODED INSTUCTION, SO ESTABLISH THE EFFECTIVE INSTRUCTION
                    960     *
001056  200702      970             LAC     INSTR
001057  501641      980             AND     (020000)
001060  741200      990             SNA                     SKIP IF THE VIOLATING INSTRUCTION HAD THE INDIRECT BIT ON
001061  601073     1000             JMP     MPBA1           ELSE CARRY ON NORMALLY
001062  200702     1010             LAC     INSTR           LOAD THE ORIGINAL INSTRUCTION
001063  501642     1020             AND     (17770)         RETAIN THE ADDRESS ONLY -- DELETING THE LOW ORDER THREE BITS
001064  541643     1030             SAD     (10)            SKIP IF ADDRESSED LOCATION WAS NOT AUTO-INDEX REGISTER
001065  460702     1040             INX     INSTR,X         ELSE INCREMENT THE LOCATION
001066  740000     1050             NOP                     IT JUST MIGHT SKIP
001067  220702     1060             LAC     INSTR,X
001070  500651     1070             AND     SADRSS          RECOVER THE EFFECTIVE ADDRESS
001071  240703     1080             XOR     OPCOD           AND ADD THE OP CODE BACK IN
001072  040702     1090             DAC     INSTR           SAVE THE (CONSTRUCTED) EFFECTIVE INSTRUCTION
                    1100    *
                    1110    *       VIOLATION WAS A MEMORY REFERENCE INSTRUCTION (OTHER THAN CAL, JMP, JMS, OR XCT)
                    1120    *       WHICH ATTEMPTED TO REFERENCE A LOCATION BELOW THE BOUNDARY.
                    1130    *       OR THE VIOLATION WAS AN XCT OR PI INTERRUPT AND THE REFERENCE MAY NOT BE TO PROTECTED MEMORY
                    1140    *       REFERENCES TO 0-7 & 21-27 MUST BE FAKED; REFERENCES TO 10-20 & 30-37 ARE CARRIED OUT LITERALLY
                    1150    *
001073  200702     1160     MPBA1   LAC     INSTR           LOAD THE OFFENDING INSTRUCTION
001074  500651     1170             AND     SADRSS          RETAIN JUST THE ADDRESS BITS
001075  341644     1180             TAD     (-10)
001076  741100     1190             SPA
001077  601112     1200             JMP     FAKIT           REFERENCE TO 0-7
001100  341644     1210             TAD     (-10)
001101  741100     1220             SPA
001102  601115     1230             JMP     O.K.            REFERENCE TO 10-17
001103  341645     1240             TAD     (-20)
001104  741100     1250             SPA
001105  601112     1260             JMP     FAKIT           REFERENCE TO 21-37
001106  341646     1270             TAD     (-BOUNDARY+40)
001107  751100     1280             SPA!CLA
001110  601241     1290             JMP     ERR2            THE REFERENCE IS TO 40-BOUNDARY
001111  601115     1300             JMP     O.K.            THE REFERENCE IS ABOVE THE BOUNDARY
                    1310    *
                    1320    *       CONVERT THE LEGAL PROTECTED MEMORY REFERENCE TO A REFERENCE TO THE USER TABLE
                    1330    *
001112  201647     1340     FAKIT   LAC     ($.0)
001113  340702     1350             TAD     INSTR           CONVERT REFERENCE TO POINT TO USER TABLE IMAGE
001114  040702     1360             DAC     INSTR
                    1370    *
                    1380    *       NOW DO THE USER INSTRUCTION
                    1390    *
001115              1400     O.K.    ...                     NOTE THE USER MQ, SC, 10, & 11 ARE STILL O.K. AT THIS POINT
                    1410                                     UNLESS ARRIVED AS A PI INTERRUPT, IN THAT CASE 10 & 11
                    1420                                     MAY BE OFF, BUT THE USER'S LOCATION 1 CAN'T LEGALLY BE A
                    1430                                     MEMORY REFERENCE INSTRUCTION, ANYWAY.
                    1440    *
```

M MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

```
                    1450    *       SPECIAL CASE OP CODES
                    1460    *
001115  200703      1470    MP12    LAC     OPCOD           RELOAD THE OP CODE
001116  540634      1480            SAD     $BIT0
001117  601155      1490            JMP     .XCT.           VIOLATION WAS AN XCT INSTRUCTION
001120  541650      1500            SAD     (JMS)
001121  601142      1510            JMP     .JMS.           VIOLATION WAS CAUSED BY A JMS INSTRUCTION
001122  541651      1520            SAD     (JMP)
001123  601146      1530            JMP     .JMP.
001124  200000      1540            LAC     0
001125  740010      1550            RAL                     RESTORE THE USER'S LINK FOR THIS OPERATION
001126  200005      1560            LAC     $3AC            AND ALSO HIS AC
001127  400702      1570            XCT     INSTR           EXECUTE THE USER'S INSTRUCTION
001130  741000      1580            SKP                     AVOID INCREMENTING THE RETURN IF THE USER'S INSTRUCTION DID NOT SKIP
001131  440000      1590            INX     0               BUT BUMP THE RETURN IF THE USER'S INSTRUCTION DID SKIP
001132  040005      1600            DAC     $3AC            AND SAVE THE USER'S AC
001133  200000      1610            LAC     0               INITIATE SAVING THE CURRENT USER LINK
001134  500644      1620            AND     $CB0            CLEAR THE OLD LINK
001135  741400      1630            SZL                     IS THE LINK ON?
001136  240634      1640            XOR     $BIT0           YES, SO SAVE IT
001137  040000      1650    MP15    DAC     0               RESAVE THE CURRENT USER RETURN, WITH LINK
001140  101170      1660            JMS     REGRES          RESTORE HIS REGISTERS THAT WON'T GET OTHERWISE RESTORED
001141  600274      1670            RET     $PIDN2
                    1680    *
                    1690    *       SPECIAL MEMORY REFERENCE INSTRUCTIONS
                    1700    *
001142  200000      1710    .JMS,   LAC     0               LOAD THE USER'S PC
001143  501633      1720            AND     (677777)        TURN OFF THE MEMORY PROTECT BIT
001144  060702      1730            DAC     INSTR,X         SET THE USER PC AT THE START OF THE SUBROUTINE
001145  440702      1740            INX     INSTR           AND INCREMENT THE TRANSFER
                    1750
001146  200000      1760    .JMP,   LAC     0               LOAD THE USER'S PC
001147  501640      1770            AND     (700000)        KEEP THE HIGH ORDER BITS OF THE PC
001150  040000      1780            DAC     0
001151  200702      1790            LAC     INSTR
001152  500651      1800            AND     $ADRSS          GET THE NEW USER PC
001153  240000      1810            XOR     0               COMBINE IT WITH THE OLD HIGH-ORDER BITS
001154  601137      1820            JMP     MP15            EXIT
                    1830
001155  200705      1840    .XCT,   LAC     TEMP5           LOAD THE XCT COUNT
001156  750200      1850            SZA!CLA
001157  601235      1860            JMP     ERR4            CHAINED XCT'S NOT YET LEGAL
001160  440705      1870    XCT1    INX     TEMP5           NOW COUNT THE XCT
001161  601041      1880            JMP     MP111           AND ITERATE
                    1890
    001162          1900    REGSAVE ENTER                   SAVE THE REGISTERS THAT HAVEN'T ALREADY BEEN SAVED
                                    .PMC    SAVE,ON
001162  740040                    XX
001163  641002      1910            LACQ                    THE FOLLOWING LOCATIONS MAY ALTER IF THE VIOLATION WAS AN IOT INSTRUCTION
001164  041754      1920            DAC     SMQ
001165  641001      1930            LACS
001166  041755      1940            DAC     SSC
```

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                M                                MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

001167  621162  1950            RET     REGSAVE,(
                1960
    001170      1970    REGRES  ENTER                   RESTORE THE REGISTERS THAT REGSAVE SAVED
                        ,PMC    SAVE,ON
001170  740040                    XX
001171  201755  1980            LAC     $SC             RELOAD THE OLD STEP COUNT
001172  241652  1990            XOR     (77)            COMPLEMENT THE STEP COUNT
001173  341653  2000            TAD     (640402)        DEVELOP A PSEUDO-NORMALIZE INSTRUCTION
001174  501654  2010            AND     (640477)        DELETE POSSIBLE STEP COUNT OVERFLOW
001175  041176  2020            DAC     .+1             PLACE THE NORMALIZE INSTRUCTION IN SEQUENCE
001176  740040  2030            XX                      STEP COUNT TO THE SC
001177  201754  2040            LAC     $MQ             RELOAD THE OLD MQ
001200  652000  2050            LMQ                     AND SET IT
001201  621170  2060            RET     REGRES,X
```

M MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

```
                    2070            ,EJECT
                    2080    *
                    2090    *       VIOLATION WAS AN IOT INSTRUCTION -- SEPARATE THE MICROCODING FROM THE REST
                    2100    *
001202  200702      2110    .IOT,   LAC     INSTR           LOAD THE VIOLATING IOT INSTRUCTION
001203  501655      2120            AND     ($SPMSK)        RECOVER THE "SPECIAL" BITS
001204  541656      2130            SAD     ($SPECIAL)      AND CHECK THEM
001205  601246      2140            JMP     SWAP2           YES -- GET THE SPECIALS HANDLER
001206  200702      2150            LAC     INSTR           ELSE RELOAD THE VIOLATING IOT INSTRUCTION
001207  640504      2160            LRS     4               PUT THE MICROCODED BITS IN THE MQ
001210  040702      2170            DAC     INSTR           SAVE FILL + ALL BUT THE MICROCODED BITS
001211  641601      2180            EAECLA!LLS 1            RECOVER THE CLEAR AC BIT
001212  740200      2190            SZA
001213  140005      2200            DZM     $3AC            ZERO THE USER AC IF THAT BIT WAS SET
                    2210    *
                    2220    *       LOOK UP THE IOT AND BRANCH TO THE PROPER HANDLING ROUTINE
                    2230    *
    001214          2240    IOT0    ...
001214  140266      2250            DZM     $DKLOK          CLEAR THE DISK-USE FLAG
001215  761333      2260            LAW     IOTTT-1
001216  040010      2270            DAC     10              SET UP THE TABLE READ
001217  220010      2280    IOT1    LAC     10,X            READ THE NEXT TABLE ENTRY
001220  540702      2290            SAD     INSTR           CHECK AGAINST THE INSTRUCTION IN QUESTION
001221  601225      2300            JMP     IOT2            MATCHES--BRANCH TO THE HANDLING ROUTINE
001222  541346      2310            SAD     IOTT9           CHECK FOR THE END OF THE TABLE
001223  601366      2320            JMP     IOTSW           DONE, AND NO MATCH FOUND
001224  601217      2330            JMP     IOT1
                    2340
001225  220010      2350    IOT2    LAC     10,X
001226  040702      2360            DAC     TEMP2           SET THE TRANSFER
001227  641002      2370            LACQ
001230  040703      2380            DAC     TEMP3           SET THE MICROCODE
001231  742010      2390            RTL
001232  751100      2400            $PAICLA                 SKIP IF THERE IS NO IOPS EVENT TIME 1 EVENT
001233  440702      2410            INX     TEMP2           ELSE BUMP THE ENTRANCE
001234  601374      2420            JMP     IOT3
                    2430    *
                    2440    *       COMMON ERROR MESSAGES
                    2450    *
001235  340641      2460    ERR4    TAD     $BIT17          CHAINED XCT'S
001236  340641      2470    ERR3    TAD     $BIT17          ILLEGAL INSTRUCTION
001237  741000      2480            SKP
001240  440000      2490    ERR1    INX     0               ILLEGAL TRANSFER PC NEEDS TO BE FUDGED TO BE ONE TOO GREAT (LIKE ALL ELSE)
001241  341657      2500    ERR2    TAD     (2)             BAD ADDRESS
001242  041706      2510    ERR     DAC     $UTEM2          SET THE ERROR MESSAGE NUMBER
001243  101170      2520            JMS     REGRES          FIX UP THE USER REGISTERS BEFORE TRANSFERRING OUT OF THIS ROUTINE
001244  761004      2530    SWAP1   LAW     $SWERR
001245  600335      2540            JMP     $SWAP           GET THE SWAPPER -- ERROR MESSAGE ENTRY POINT
001246  101170      2550    SWAP2   JMS     REGRES          FIX UP THE USER REGISTERS BEFORE TRANSFERRRING OUT OF THIS ROUTINE
001247  761005      2560            LAW     $SWSPL
001250  600335      2570            JMP     $SWAP           GO READ IN THE MONITOR/MESSAGE PHANTOM PROGRAM
                    2580
```

```
M                                MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

                    2590
                    2600
    001251          2610    OAC     ENTER                   INCLUSIVE OR AC WITH USER AC FOR IOT'S
                                    .PMC    SAVE,ON
001251  740040                      XX
001252  040002  2620              DAC     $3TM21
001253  740001  2630              CMA
001254  500005  2640              AND     $3AC
001255  240002  2650              XOR     $3TM21
001256  040005  2660              DAC     $3AC
001257  621251  2670              RET     OAC,X
                    2680
                    2690
    001260          2700    TIM3    ENTER                   DETERMINE WHETHER OR NOT THERE IS AN IOPS EVENT TIME 3 EVENT REQUESTED
                                    .PMC    SAVE,ON
001260  740040                      XX
001261  200703  2710              LAC     TEMP3
001262  751100  2720              SPAICLA
001263  621260  2730              RET     TIM3,X          YES -- GO DO IT
001264  601614  2740              JMP     MEMD1           EXIT
                    2750
                    2760    *
                    2770    *       RDBLK LOOKS FIRST AT THE USER DUE TO RUN NEXT, IF HE IS I/O ROADBLOCKED, THE
                    2780    *       FOLLOWING USER IS EXAMINED, THIS PROCESS IS REPEATED UNTIL SOME USER IS FOUND
                    2790    *       WHO IS FREE TO RUN, NOTE THAT THE ROUTINE, ONCE ENTERED, WILL LOOP INDEFINITELY
                    2800    *       UNTIL A FREE USER IS FOUND.
                    2810    *
                    2820    *       WHEN A FREE USER IS FOUND, THE RETURN IS IMMEDIATE WITH HIS RE-ENTRANT
                    2830    *       TEMPORARY STORAGE SET UP.
                    2840    *
                    2850    *       RDBLK ENABLES THE INTERRUPT SYSTEM TO PERMIT TELETYPE I/O TO
                    2860    *       GO ON WHILE CHECKING FOR ROADBLOCKS, OTHERWISE A TELETYPE
                    2870    *       I/O ROADBLOCK COULD NEVER BE RELIEVED, THIS MEANS THAT BEFORE
                    2880    *       ENABLING INTERRUPTS, THE CALLER'S SAVED AC; 10, & 11 MUST BE
                    2890    *       COPIED, AND RECOPIED BEFORE EXIT,
                    2900    *
                    2910    *       THIS ROUTINE RUNS WITH THE CLOCK OFF TO PREVENT RE-ENTRANCE
                    2920    *       AT A TIME WHEN IT WOULD CRASH THE SYSTEM, ALSO NO ONE IS RUNNING
                    2930    *       AS LONG AS WE ARE HUNG IN THIS LOOP, SO NOTHING IS LOST,
                    2940    *
    001265          2950    RDBLK   ENTER
                                    .PMC    SAVE,ON
001265  740040                      XX
001266  700004  2960              CLOF
001267  200000  2970              LAC     0
001270  040702  2980              DAC     TEMP2           SAVE THE RETURN
001271  200005  2990              LAC     $3AC
001272  040703  3000              DAC     TEMP3           THE SAVED AC
001273  200026  3010              LAC     $,310
001274  040010  3020              DAC     10              THE SAVED AUTO-INDEX REGISTER 10
001275  200027  3030              LAC     $,311
001276  040011  3040              DAC     11              THE SAVED AUTO-INDEX REGISTER 11
```

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                M                       MEMORY PROTECT ROUTINES COMMON TO BOTH OVERLAYS

001277  700042  3050            ION
001300  201771  3060            LAC     SNUMBR          SEE WHO IS RUNNING, IF ANYONE
001301  540104  3070            SAD     SCTNAM
001302  601310  3080            JMP     RDBK2           #1 IS NOW RUNNING -- SO GIVE #2 A CHANCE
001303  540133  3090            SAD     SL1NAM
001304  601313  3100            JMP     RDBK3           #2 IS NOW RUNNING -- SO GIVE #3 A CHANCE
                3110
001305  200102  3120    RDBK1   LAC     SCTFLG          LOAD USER #0 I/O FLAGS
001306  101317  3130            JMS     RDBK5           SEE IF USER #0 IS I/O ROADBLOCKED
001307  760076  3140            LAW     SCTBIN-2        LOAD A POINTER TO USER #0 PARAMETERS
001310  200131  3150    RDBK2   LAC     SL1FLG
001311  101317  3160            JMS     RDBK5           SEE IF USER #1 IS I/O ROADBLOCKED
001312  760125  3170            LAW     SL1BIN-2
001313  200160  3180    RDBK3   LAC     SL2FLG
001314  101317  3190            JMS     RDBK5           SEE IF USER #2 IS I/O ROADBLOCKED
001315  760154  3200            LAW     SL2BIN-2
001316  601305  3210            JMP     RDBK1           LOOP
                3220
                3230    *       SEE IF THE SPECIFIED USER IS I/O ROADBLOCKED, IF SO, RETURN TO THE
                3240    *       ROADBLOCK ROUTINE FOR ANOTHER TRY, IF NOT, EXIT WITH HIS TEMPS SET UP.
                3250
    001317      3260    RDBK5   ENTER
                        .PMC    SAVE,ON
001317  740040                    XX
001320  742010  3270            RTL                     TELEPRINTER FLAG TO LINK; KEYBOARD FLAG TO AC(0)
001321  741500  3280            SZLISPA                 SKIP IF THERE IS NO I/O ROADBLOCK
001322  621317  3290            RET     RDBK5,X         ELSE TRY THE NEXT ONE
                3300    *
                3310    *       A NON-ROADBLOCKED USER HAS BEEN FOUND, TURN OFF THE INTERRUPT
                3320    *       SYSTEM, SET UP HIS RE-ENTRANT PARAMETERS AND EXIT.
                3330    *       NOTE THAT AUTO-INDEX REGISTERS 10 & 11 ARE ALREADY CORRECT
                3340    *       SO ONLY THE AC AND THE RESTART ADDRESS NEED TO BE RESTORED.
                3350    *
001323  700002  3360            IOF                     TURN OFF THE INTERRUPT SYSTEM
001324  200702  3370            LAC     TEMP2
001325  040000  3380            DAC     0               RESTORE THE SAVED RETURN
001326  200703  3390            LAC     TEMP3
001327  040005  3400            DAC     S3AC            AND THE SAVED AC
001330  421317  3410            XCT     RDBK5,X         LOAD THE POINTER TO HIS PARAMETERS
001331  100513  3420            JMS     SIO,IN          AND GO SET THEM UP
                3430    *
                3440    *       NOW WE ARE EVIDENTLY READY TO RUN SOMEONE AGAIN, SO TURN IT
                3450    *       BACK ON.
                3460    *
001332  700044  3470            CLON
001333  621265  3480            RET     RDBLK,X         DONE
                3490            .END
```

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M                                TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

                  120            .STITL  TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)
                  130     *
                  140     *      IOT INSTRUCTION TRANSFER TABLE
                  150     *
    001334        160     IOTTT  ...                      IOT INSTRUCTION TRANSFER TABLE
001334  774020    170            774020                   700400
001335  601463    180            JMP     CTLP             TSF;TCF;TLS
001336  774014    190            774014                   700300
001337  601523    200            JMP     CKBD             KSF;KRB;;IORS
001340  774002    210            774002                   700040
001341  601576    220            JMP     .ON              ION;CLON
001342  774154    230            774154                   703300
001343  601553    240            JMP     BRK1             TTS;DBK;CAF
001344  774000    250            774000                   IOT NOP
001345  601614    260            JMP     MEMD1
001346  001000    270     IOTT9  1000                     FLAG THE END OF THE TABLE
                  280
                  290
                  300     *
                  310     *      SUBROUTINE TO CHECK FOR AN I/O ROADBLOCKED CONDITION.  THIS OCCURS IF AN IOT SKIP
                  320     *      INSTRUCTION FAILS TO SKIP AND THE FOLLOWING INSTRUCTION IS A <JMP .-1>.  THE ROUTINE
                  330     *      RETURNS +1 IF ALL IS NORMAL OR +2 IF AN I/O ROADBLOCK WAS DISCOVERED
                  340     *
    001347        350     IOBLK  ENTER
                                 .PMC    SAVE,ON
001347  740040                   XX
001350  751101    360            SPA!CLA!CMA              SKIP IF IOT FLAG IS NOT SET
001351  601360    370            JMP     IOBL8            ELSE EXIT, INCREMENTING THE USER'S PC
                  380     *
                  390     *      NOW CHECK FOR A TIGHT LOOP -- <IOT SKIP ON FLAG>, <JMP .-1>.
                  400     *
001352  340000    410            TAD     0                NOTE THIS ALSO COMPLEMENTS THE LINK
001353  500651    420            AND     SADRSS           ESTABLISH THE VALUE OF <.-1>
001354  240652    430            XOR     SJMP             FORM <JMP .-1> INSTRUCTION
001355  560000    440            SAD     0,X              SKIP IF NOT A TIGHT LOOP
001356  441347    450            INX     IOBLK            ELSE BUMP THE RETURN
001357  741002    460            SKP!CML                  CORRECT THE LINK
001360  440000    470     IOBL8  INX     0
001361  621347    480            RET     IOBLK,X
                  490
    001362        500     MFLG   ENTER
                                 .PMC    SAVE,ON
001362  740040                   XX
001363  241760    510            XOR     SIORS
001364  041760    520            DAC     SIORS
001365  621362    530            RET     MFLG,X
                  540     *
                  550     *
                  560     *      ROUTINE TO CALL MEMORY PROTECTION OVERLAY #2 IF IT HAS NOT ALREADY
                  570     *      HAD ITS CHANCE AT THE VIOLATION
                  580     *
    001366        590     IOTSW  ...
```

M TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

```
001366  200704  600          LAC     TEMP4           LOAD THE OVERLAY COUNT
001367  750200  610          SZA!CLA                 SKIP UNLESS ALL OVERLAYS HAVE ALREADY HAD A CHANCE
001370  601236  620          JMP     ERR3            ELSE THIS WAS THE LAST CHANCE -- IT MUST HAVE BEEN AN ILLEGAL INSTRUCTION
001371  440704  630          INX     TEMP4           COUNT THIS OVERLAY
001372  761010  640          LAW     SSWMP2          LOAD A POINTER TO THE SWAPPER ENTRANCE TO GET THE NEXT OVERLAY
001373  600335  650          JMP     SSWAP           AND GET IT
```

M TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

```
                    660             .EJECT
    001374          670     IOT3    ...
001374  201771      680             LAC     $NUMBR          LOAD TTY NUMBER (= POINTER TO RESIDENT PARAMETERS)
001375  100513      690             JMS     $IO.IN          SET UP THE RESIDENT PARAMETERS
                    700     *
                    710     *       SET UP THE USER'S IORS WORD -- MOST ROUTINES IN THIS OVERLAY NEED IT
                    720     *
001376  201760      730             LAC     $IORS
001377  500634      740             AND     $BIT0
001400  700304      750             IORS-10                 INCLUSIVE OR THE STATUS -- SOME FLAGS KEPT IN HARDWARE
001401  501660      760             AND     (401400)        KEEP ONLY THE NO-TAPE FLAGS
001402  041760      770             DAC     $IORS
                    780     *
                    790     *       SET UP THE READER AND PUNCH FLAGS IF THIS READER HAS THE APPROPRIATE DEVICE
                    800     *
001403  200235      810     MTAPE   LAC     $RPTR
001404  540035      820             SAD     $RCORE
001405  601412      830             JMP     MPT1            THIS USER HAS THE READER, SO SET HIS FLAG
001406  201760      840             LAC     $IORS
001407  501661      850             AND     (776777)        ELSE REMOVE THE READER-OUT-OF-TAPE FLAG
001410  041760      860             DAC     $IORS
001411  601416      870             JMP     MPT2            AND CHECK ON THE PUNCH
001412  200234      880     MPT1    LAC     $RFLAG
001413  750200      890             SZA!CLA
001414  201662      900             LAC     (200000)
001415  101362      910             JMS     MFLG            SET THE READER FLAG IN THE IORS WORD
001416  200230      920     MPT2    LAC     $RPTP
001417  540035      930             SAD     $RCORE
001420  601425      940             JMP     MP3             THIS USER HAS THE PUNCH, SO SET HIS FLAG
001421  201760      950             LAC     $IORS
001422  501663      960             AND     (777377)        ELSE REMOVE THE PUNCH-OUT-OF-TAPE FLAG
001423  041760      970             DAC     $IORS
001424  601431      980             JMP     MKBD            AND CHECK ON THE TELETYPE KEYBOARD
001425  200227      990     MP3     LAC     $PFLAG
001426  750200      1000            SZA!CLA
001427  201650      1010            LAC     (100000)
001430  101362      1020            JMS     MFLG            SET THE PUNCH FLAG IN THE IORS WORD
                    1030    *
                    1040    *       THE KEYBOARD FLAG GETS SET IF EITHER:
                    1050    *            BOTH THE OUTPUT-IN-PROGRESS AND SOFTWARE KEYBOARD FLAGS ARE SET OR
                    1060    *            THE OUTPUT-IN-PROGRESS FLAG IS NOT SET AND THE ROTARY BUFFER IS NON-EMPTY.
                    1070    *
001431  200053      1080    MKBD    LAC     $3TEM2          LOAD THE SOFTWARE KEYBOARD FLAGS
001432  741100      1090            SPA                     SKIP IF OUTPUT IS NOT IN PROGRESS
001433  601440      1100            JMP     MK1             ELSE CHECK THE SOFTWARE KEYBOARD FLAG
001434  200052      1110            LAC     $3TEM1
001435  540051      1120            SAD     $3TEM0          SKIP IF THE ROTARY BUFFER IS NON-EMPTY
001436  601442      1130            JMP     MTLP            EMPTY BUFFER -- EXIT WITHOUT SETTING THE FLAG
001437  750001      1140            CLC                     NON-EMPTY BUFFER -- LOAD KEYBOARD FLAG (WITH OTHER GARBAGE)
001440  501664      1150    MK1     AND     (040000)        KEEP JUST THE KEYBOARD FLAG
001441  101362      1160            JMS     MFLG            SET THE KEYBOARD FLAG
                    1170    *
```

M TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

```
                    1180    *       THE TELEPRINTER FLAG GETS SET IF EITHER:
                    1190    *            THE OUTPUT-IN-PROGRESS FLAG IS SET AND THE ROTARY BUFFER IS NON-FULL OR
                    1200    *            THE OUTPUT-IN-PROGRESS FLAG IS NOT SET
                    1210    *
001442  200053      1220    MTLP    LAC     S3TEM2          LOAD THE TELETYPE SOFTWARE FLAGS
001443  740100      1230            SMA                     SKIP IF OUTPUT IS IN PROGRESS
001444  601454      1240            JMP     MT1             ELSE OUTPUT IS O.K.
001445  201641      1250            AND     (020000)        RECOVER THE TELEPRINTER FLAG
001446  741200      1260            SNA                     SKIP IF IT IS SET
001447  601462      1270            JMP     MT2             ELSE DON'T SET IT IN THE IORS WORD
001450  200051      1280            LAC     S3TEM0          LOAD THE INPUT POINTER
001451  100623      1290            JMS     SNXPTR          AND FIND OUT THE NEXT LOCATION
001452  540052      1300            SAD     S3TEM1          SKIP UNLESS THE BUFFER WOULD OVERFLOW
001453  601462      1310            JMP     MT2             IN WHICH CASE DO NOT SET THE FLAG IN THE IORS WORD
001454  201641      1320    MT1     LAC     (020000)        ALL SET -- LOAD THE TELEPRINTER FLAG
001455  101362      1330            JMS     MFLG            AND SET IT IN THE IORS WORD
                    1340    *
                    1350    *       CHECK THE DISK CONDITION
                    1360    *
001456  201761      1370    MDISK   LAC     SDFLAG          LOAD THE USER'S SOFTWARE DISK FLAG
001457  740200      1380            SZA
001460  201665      1390            LAC     (000020)
001461  101362      1400            JMS     MFLG            SET THE DISK FLAG IN THE IORS WORD
                    1410
                    1420
001462  620702      1430    MT2     JMP     TEMP2,X         GO TO THE CORRECT SERVICE ROUTINE
```

```
                    1440            .EJECT
001463  601474      1450    CTLP    JMP     CTLP1           NO IOPS EVENT TIME 1
001464  201760      1460    .TSF    LAC     $IORS           LOAD THE IORS WORD
001465  640704      1470            ALS     4               GET THE FLAG
001466  101347      1480            JMS     IOBLK           CHECK THE FLAG AND FOR I/O ROADBLOCK
001467  601474      1490            JMP     CTLP1           NO ROADBLOCK -- CARRY ON NORMALLY
001470  200645      1500            LAC     $CB1
001471  500053      1510            AND     $3TEM2          CLEAR THE I/O ROADBLOCK FLAG
001472  241662      1520            XOR     (200000)        SET THE I/O ROADBLOCK FLAG
001473  040053      1530            DAC     $3TEM2          REPLACE THE SOFTWARE FLAGS
001474  740400      1540    CTLP1   SNL                     SKIP IF THERE IS AN EVENT TIME TWO ACTIVITY
001475  601501      1550            JMP     .T2             ELSE TRY FOR EVENT TIME THREE
001476  200053      1560    .TCF    LAC     $3TEM2          LOAD THE TELETYPE SOFTWARE FLAGS
001477  501666      1570            AND     (757777)        CLEAR THE TELEPRINTER FLAG
001500  040053      1580            DAC     $3TEM2          AND RESTORE THE UPDATED FLAGS
001501  101260      1590    .T2     JMS     TIM3            RETURN IF THERE IS AN IOPS TIME 3 EVENT
001502  200053      1600    .TLS    LAC     $3TEM2          LOAD THE TELETYPE SOFTWARE FLAGS
001503  741100      1610            SPA                     SKIP IF OUTPUT IS NOT INPROGRESS
001504  601511      1620            JMP     .TLS1           ELSE JUST PACK THE OUTPUT
001505  100540      1630            JMS     $NEWBR          CLEAR THE INPUT BUFFER
001506  200005      1640            LAC     $3AC            ELSE LOAD WHAT THE USER WANTS PRINTED
001507  400056      1650            XCT     $3TEM5          AND PRINT IT
001510  601516      1660            JMP     .TLS2
001511  200005      1670    .TLS1   LAC     $3AC
001512  500643      1680            AND     $BL8            THE BUFFER EXPECTS EIGHT-BIT ASCII
001513  040002      1690            DAC     $3TM21
001514  100546      1700            JMS     $PUTIN          PLACE THE CHARACTER IN THE BUFFER
001515  740000      1710            NOP                     DISCARD ANY OVERFLOW
001516  200053      1720    .TLS2   LAC     $3TEM2          LOAD THE TELETYPE SOFTWARE FLAGS
001517  501667      1730            AND     (355777)        CLEAR THE O-I-P, TELEPRINTER, AND BUFFER TYPE FLAGS
001520  241670      1740            XOR     (422000)        SET THE OUTPUT-IN-PROGRESS, TELEPRINTER, AND OUTPUT-BUFFER FLAGS
001521  040053      1750            DAC     $3TEM2          RESTORE THE UPDATED FLAGS
001522  601614      1760            JMP     MEMD1
                    1770
                    1780
                    1790
001523  601534      1800    CKBD    JMP     CKBD1           NO IOPS EVENT TIME 1
001524  201760      1810    .KSF    LAC     $IORS           LOAD THE USER'S STATUS WORD
001525  640703      1820            ALS     3               GET THE KEYBOARD FLAG
001526  101347      1830            JMS     IOBLK           CHECK THE FLAG AND FOR I/O ROADBLOCK
001527  601534      1840            JMP     CKBD1           NO ROADBLOCK -- CARRY ON NORMALLY
001530  201633      1850            LAC     (677777)
001531  500053      1860            AND     $3TEM2          CLEAR THE I/O ROAD BLOCK FLAG
001532  241650      1870            XOR     (100000)        SET THE I/O ROADBLOCK FLAG
001533  040053      1880            DAC     $3TEM2          REPLACE THE SOFTWARE FLAGS
001534  740400      1890    CKBD1   SNL
001535  601547      1900            JMP     CKBD2           NO IOPS EVENT TIME 2
                    1910    *
                    1920    *       TRY TO READ THE CHARACTER FROM THE ROTARY BUFFER IF THERE IS NO OUTPUT
                    1930    *       IN PROGRESS, READ THE CHARACTER FROM THE SOFTWARE KEYBOARD BUFFER IF THE
                    1940    *       ROTARY BUFFER TURNS OUT TO BE EMPTY, OR IF OUTPUT IS IN PROGRESS.
                    1950    *
```

M TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

```
                    1960    *       CLEAR THE SOFTWARE KEYBOARD FLAG IN ANY CASE.
                    1970    *
001536  200053      1980    .KRB    LAC     $3TEM2          LOAD THE TELETYPE SOFTWARE FLAGS
001537  501671      1990            AND     (737777)        CLEAR THE SOFTWARE KEYBOARD FLAG ON ANY KRB
001540  040053      2000            DAC     $3TEM2          SAVE THE UPDATED SOFTWARE FLAGS
001541  500640      2010            AND     $BIT7           RECOVER THE BUFFER TYPE
001542  741200      2020            SNA                     SKIP IF IT IS AN OUTPUT BUFFER
001543  100602      2030            JMS     $FGET           ELSE GET THE OLDEST CHARACTER IN THE BUFFER
001544  200053      2040            LAC     $3TEM2          LOAD THE SOFTWARE KEYBOARD BUFFER IF NO INPUT IN BUFFER
001545  500643      2050            AND     $BL8            RETAIN ONLY 8-BIT INPUT
001546  101251      2060    KRB2    JMS     OAC             AND PUT IT IN THE USERS AC
001547  101260      2070    CKBD2   JMS     TIM3            RETURN IF THERE IS AN IOPS TIME 3 EVENT
001550  201760      2080    .IORS.  LAC     $IORS           LOAD THE USER IORS WORD
001551  101251      2090            JMS     OAC
001552  601614      2100            JMP     MEMD1
                    2110
                    2120
                    2130
001553  741000      2140    BRK1    SKP
001554  440000      2150            INX     0               'TTS' -- SKIP IF NOT TYPE 28
001555  740400      2160    .CAF    SNL
001556  600270      2170            RET     $PIDON          NO IOPS EVENT TIME 2
001557  200230      2180            LAC     $RPTP
001560  541771      2190            SAD     $NUMBR          SKIP IF THE PUNCH IS NOT ASSIGNED TO THIS USER
001561  140227      2200            DZM     $PFLAG          PUNCH FLAG
001562  200235      2210            LAC     $RPTR
001563  541771      2220            SAD     $NUMBR          SKIP IF THE READER IS NOT ASSIGNED TO THIS USER
001564  140234      2230            DZM     $RFLAG          READER FLAG
001565  200053      2240            LAC     $3TEM2          LOAD THE SOFTWARE FLAGS
001566  501672      2250            AND     (420000)        KILL ALL EXCEPT THE OUTPUT-IN-PROGRESS FLAG AND EXEC'S TLP FLAG
001567  040053      2260            DAC     $3TEM2          RESTORE THE UPDATED FLAGS
001570  141760      2270            DZM     $IORS           CAF ALWAYS CLEARS ALL THINGS ON THE IORS WORD
001571  141762      2280            DZM     $DAP0
001572  141763      2290            DZM     $DAP1
001573  141764      2300            DZM     $DFN
001574  141761      2310            DZM     $DFLAG          DISK FLAG
001575  601614      2320    .DBK    JMP     MEMD1           DBK REQUIRES NO ACTION, EVEN IF PRESENT
                    2330
                    2340
                    2350
                    2360
001576  740400      2370    .ON     SNL                     SKIP ONLY IF THERE IS AN EVENT TIME 2 EVENT (ION)
001577  601236      2380            JMP     ERR3
001600  200703      2390    .ION    LAC     TEMP3
001601  751100      2400            SPA!CLA
001602  601236      2410            JMP     ERR3            THERE WAS AN ILLEGAL EVENT TIME 3 EVENT (CLON)
001603  201760      2420            LAC     $IORS           LOAD THE USER'S IORS WORD
001604  500644      2430            AND     $CB0
001605  240634      2440            XOR     $BIT0
001606  041760      2450            DAC     $IORS           RESTORE THE IORS WORD WITH THE PI ON
001607  501673      2460            AND     (375220)
001610  740200      2470            SZA                     SKIP IF THERE WERE NO FLAGS ON TO CAUSE INTERRUPTS
```

M TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

```
001611  601007  2480          JMP     PINT            GENERATE A USER PROGRAM INTERRUPT
001612  101170  2490          JMS     REGRES          RESTORE THE REGISTERS
001613  600270  2500          RET     $PIDON          EXIT
                2510
    001614      2520  MEMD1   ...                     EXIT MEMORY PROTECT SERVICE
001614  740000  2530          NOP                     ALLOW FOR IOT NOP
001615  101170  2540          JMS     REGRES
001616  100525  2550          JMS     $IO.OT
001617  200053  2560          LAC     $3TEM2
001620  501674  2570          AND     ($IOBLK)        GET JUST THE USER'S I/O ROADBLOCK FLAGS
001621  741200  2580          SNA                     SKIP IF A ROADBLOCK CONDITION EXISTS
001622  600270  2590          RET     $PIDON          ELSE RETURN
001623  101265  2600          JMS     RDBLK           SEE WHO IS NEXT USER NOT I/O ROADBLOCKED
001624  200055  2610          LAC     $3TEM4          LOAD HIS USER NUMBER
001625  540035  2620          SAD     $RCORE          SEE IF IT IS THE CURRENT USER
001626  600270  2630          RET     $PIDON          IF SO, EXIT (CONTINUE)
001627  761003  2640          LAW     $SWCLK
001630  600335  2650          JMP     $SWAP
                2660
    001631      2670  .OPR,   ...
001631  761011  2680          LAW     $SWOPR
001632  600335  2690          JMP     $SWAP           SWITCH OVERLAYS AND RESTART AT OPERATE INSTRUCTION HANDLING
001633  677777  2700          .END    OVSTRT
001634  100001
001635  776000
001636  740000
001637  640000
001640  700000
001641  020000
001642  017770
001643  000010
001644  777770
001645  777760
001646  776040
001647  001713
001650  100000
001651  600000
001652  000077
001653  640402
001654  640477
001655  777400
001656  705000
001657  000002
001660  401400
001661  776777
001662  200000
001663  777377
001664  040000
001665  000020
001666  757777
001667  355777
001670  422000
```

M TELETYPE, DISK, AND DECTAPE ROUTINES (MAINLY)

```
001671  737777
001672  420000
001673  375220
001674  300000

TRANSFER ADDRESS  601000
```

M CROSS REFERENCE TABLE

1713	.0	4510	4520	480	520	1340							
26	.310	3400	3010										
27	.311	3410	3030										
4464	.DT	570											
1550	.IORS;	2080											
6460	.TP	550											
2023	10SAVE	1870	1880										
2024	11SAVE	1880	1920										
5	3AC	3370	1560	1600	2200	2640	2660	2990	3400	1640	1670		
305	3REST	3870	3880										
51	3TEM0	3530	3540	1120	1280								
52	3TEM1	3540	3550	1110	1300								
53	3TEM2	3550	3560	1080	1220	1510	1530	1560	1580	1600	1720	1750	1860	1880
			1980	2000	2040	2240	2260	2560					
54	3TEM3	3560	3570										
55	3TEM4	3570	3580	2610									
56	3TEM5	3580	3590	1650									
57	3TEM6	3590	3600										
50	3TM80	3520	3530										
2	3TM81	3350	2620	2650	1690								
3	3TM82	3360											
14000	7K	1030											
16000	8K	1020	910	1010	2640	2650							
1753	AC	4520	4530										
1756	ACS	4550	4560										
2015	ACSAVE	1810	1820										
2022	ACSW	1860	1870										
651	ADRSS	4100	4110	670	1070	1170	1880	420					
300	AT	2950											
300	ATSGN	2900											
422030	BAS	420											
2151	BCNTRL	2330	2340										
634	BIT0	3970	3980	490	1480	1640	740	2440					
641	BIT17	4020	4030	2460	2470								
635	BIT36	3980	3990										
636	BIT5	3990	4000										
637	BIT6	4000	4010										
640	BIT7	4010	4020	2010									
642	BL7	4030	4040										
643	BL8	4040	4050	1680	2050								
2000	BOUNDA	970	960	980	990	1000	1630	5040	5080	680	1270		
387	BRK	5550											
2170	BUFFER	2490	2550										
1000	BUFLEN	2500	2550										
644	CB0	4050	4060	1620	2430								
645	CB1	4060	4070	1500									
646	CB5	4070	4080										
647	CB7	4080	4090										
650	CBL8	4090	4100										
6	CHRMAX	3180	3200										
2	CHRPAK	3130	3200										
50	CLKMAX	2840	3180										

M CROSS REFERENCE TABLE

60	CLK$PD	3160	3170			
1757	CLOCK	4560	4570			
45	CMP1	3490	3500			
46	CMP2	3500	3510			
6	CNTRL	3380	3390			
2053	COMFLG	2200	2210			
2150	COM$TO	2270	2280			
16000	CORMAX	910	980			
47	CSPL	3510	3520			
44	CSWP	3480	3490			
60	CTBFR	3600	3630	3640		
100	CTBIN	3640	3650	3670	4250	3140
2000	CTEMP0	1630				
2001	CTEMP1	1640				
2002	CTEMP2	1650				
2003	CTEMP3	1660				
2004	CTEMP4	1670				
2005	CTEMP5	1680				
2006	CTEMP6	1690				
2007	CTEMP7	1700				
2010	CTEMP8	1710				
2011	CTEMP9	1720				
102	CTFLG	3650	3660	3120		
104	CTNAM	3660	3070			
2043	D PC	2120	2130			
2154	D BCA	2370	2380			
2153	D BDA	2360	2370			
2163	D FDA	2440	2450			
2042	D LOC	2110	2120			
2022	D ACSW	1860				
2156	D BALT	2390	2400			
2155	D BLEN	2380	2390			
2161	D BMAX	2420	2430			
2157	D BMIN	2400	2410			
2162	D BPTR	2430	2440			
2167	D FMAX	2480	2490			
2165	D FMIN	2460	2470			
2046	D MASK	2150	2160			
2164	D MFDA	2450	2460			
2036	DADRSW	2070	2080			
1762	DAP0	4590	4600	2280		
1763	DAP1	4600	4610	2290		
653	DBK	4120	4130			
24	DBKNUM	2220	2270			
2054	DBKTAB	2210	2270			
2035	DBSTOR	2050	2060			
422027	DDT	410				
12000	DDT$T	5000				
2037	DDUMSW	2080	2090			
1761	DFLAG	4580	4590	1370	2310	
1764	DFN	4610	4620	2300		
2151	DFTYPE	2340	2350			

M CROSS REFERENCE TABLE

2045	DHICOR	2140	2150		
2050	DINDIR	2170	2180		
100	DK0	4270			
127	DK1	4310			
156	DK2	4350			
37	DKCA	2750			
675	DKDON	4170	4180		
16080	DKLEN	2650	2660		
34	DKLENB	2660			
266	DKLOK	3830	3840	2250	
672	DKOVR	4160	4170		
2	DKRD	2760			
36	DKWC	2740			
4	DKWRT	2770			
2041	DLIMIT	2100	2110		
2044	DLOCOR	2130	2140		
2160	DMBMIN	2410	2420		
2166	DMFMIN	2470	2480		
654	DO	4130	4140		
662	DO2	4140	4150		
663	DO3	4150	4160		
2152	DOFTYP	2350	2360		
2032	DPACSW	1980			
2040	DPATSW	2090	2100		
2051	DPCMSK	2180	2190		
2052	DREGBR	2190	2200		
2035	DREGSW	2060	2070		
2047	DRELOC	2160	2170		
1765	DSTAT	4620	4630		
446400	DT.	560			
2000	DTEMP0	1630			
2001	DTEMP1	1640			
2002	DTEMP2	1650			
2003	DTEMP3	1660			
2004	DTEMP4	1670			
2005	DTEMP5	1680			
2006	DTEMP6	1690			
2007	DTEMP7	1700			
2010	DTEMP8	1710			
2011	DTEMP9	1720			
275	EQUAL	2910			
602	FGET	3950	3960	2030	
1701	FRCA	4410	4420		
1700	FRDA	4400	4410		
1702	FRLEN	4420	4430		
1703	FRSTA	4430	4440		
2	FUDGE	3190	3200		
276	GREAT	2930			
1700	IMPLEN	990			
3170	IMPSTR	2550			
422020	INT	320			
513	IO.IN	3910	3920	3420	690

M

CROSS REFERENCE TABLE

```
   525  IO.OT      3920    3930     400    2550
300000  IOBLK      2830    2570
  1760  IORS       4570    4580     410     450     510     520     730     770     840     860     950     970    1460
                           1810    2080    2270    2420    2450
  1002  IOTO       4900    4910
   652  JMP        4110    4120     430
   100  JTLEN       960
  1700  JTSTRT      950     940     960    1000    4400
    16  KBLEN      3610    3630    3640    3680    3690    3730    3740
    10  KBNUM      3620    3670    3720
    76  LOLOK      3630
   107  L1BFR      3670    3680    3690
   127  L1BIN      3690    3700    3720    4290    3170
   131  L1FLG      3700    3710    3150
   125  L1LOK      3680
   133  L1NAM      3710    3090
   136  L2BFR      3720    3730    3740
   156  L2BIN      3740    3750    4330    3200
   160  L2FLG      3750    3760    3180
   154  L2LOK      3730
   162  L2NAM      3760    3770
422026  LDR         390
  2000  LDRST      5040
   274  LESS       2920
  1576  M  ,ON     2370     220
  1501  M  ,T2     1590    1550
  1242  M  ERR     2510
  1440  M  MK1     1150    1100
  1425  M  MP3      990     940
  1454  M  MT1     1320    1240
  1462  M  MT2     1430    1270    1310
  1251  M  OAC     2610    2670    2060    2090
  1555  M .CAF     2160
  1575  M .DBK     2320
  1600  M .ION     2390
  1536  M .KRB     1980
  1524  M .KSF     1810
  1476  M .TCF     1560
  1592  M .TLS     1600
  1464  M .TSF     1460
  2022  M ACSW     1860
  1553  M BRK1     2140     240
  1523  M CKBD     1800     200
  1463  M CTLP     1450     180
  1240  M ERR1     2490     700
  1241  M ERR2     2500    1290
  1236  M ERR3     2470     820     620    2380    2410
  1235  M ERR4     2460    1860
  1214  M IOTO     2240     310
  1217  M IOT1     2280    2330
  1225  M IOT2     2350    2300
  1374  M IOT3      670    2420
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M CROSS REFERENCE TABLE

1546	M KRB2	2060												
1362	M MFLG	500	530	910	1020	1160	1330	1400						
1431	M MKBD	1080	980											
1115	M MP12	1470												
1137	M MP15	1650	1820											
1027	M MPST	590	290											
1412	M MPT1	880	830											
1416	M MPT2	920	870											
1442	M MTLP	1220	1130											
1115	M O,K,	1400	880	1230	1300									
1007	M PINT	400	300	2480										
1260	M TIM3	2700	2730	1590	2070									
1160	M XCT1	1870												
1202	M,IOT,	2110	920											
1146	M,JMP,	1760	1530											
1142	M,JMS,	1710	1510											
1631	M,OPR,	2670	330	900										
1511	M,TLS1	1670	1620											
1516	M,TLS2	1720	1660											
1155	M,XCT,	1840	1490											
1534	MCKBD1	1890	1800	1840										
1547	MCKBD2	2070	1900											
1474	MCTLP1	1540	1450	1490										
1112	MFAKIT	1340	1200	1260										
10	MINBUF	3200	3610											
702	MINSTR	230	760	770	780	970	1010	1040	1060	1090	1160	1350	1360	1570
			1730	1740	1790	2110	2150	2170	2290					
1360	MIOBL8	470	370											
1347	MIOBLK	350	450	480	1480	1830								
1366	MIOTSW	590	2320											
1346	MIOTT9	270	2310											
1334	MIOTTT	160	2260											
1456	MMDISK	1370												
1614	MMEMD1	2520	2740	260	1760	2100	2320							
1041	MMP111	770	550	1880										
1073	MMPBA1	1160	1000											
1403	MMTAPE	810												
703	MOPCOD	250	830	1080	1470									
1053	MOPRST	900												
422023	MP1	350												
422024	MP2	360												
2032	MPACSW	1980												
1005	MPINST	340	790											
1004	MPOPR	4920												
1000	MPST	4880	4890											
1000	MPSTRT	290												
1754	MQ	4530	4540	1920	2040									
2016	MQSAVE	1820	1830											
1305	MRDBK1	3120	3210											
1310	MRDBK2	3150	3080											
1313	MRDBK3	3180	3100											
1317	MRDBK5	3260	3130	3160	3190	3290	3410							

M

CROSS REFERENCE TABLE

1265	MRDBLK	2950	320	3480	2600				
1244	MSWAP1	2530							
1246	MSWAP2	2550	2140						
2000	MTEMP0	1630							
2001	MTEMP1	1640							
702	MTEMP2	240	2360	2410	2980	3370	1430		
703	MTEMP3	260	2380	2710	3000	3390	2390		
704	MTEMP4	270	530	610	600	630			
705	MTEMP5	280	540	620	1840	1870			
2006	MTEMP6	1690							
2007	MTEMP7	1700							
2010	MTEMP8	1710							
2011	MTEMP9	1720							
422025	MTR	370							
2000	MTRST	5080							
1772	NAME	4670	4680						
540	NEWBR	3930	3940	1630					
1771	NUMBR	4660	4670	3060	680	2190	2220		
623	NXPTR	3960	3970	1290					
702	OC0	4180	4190	230	240				
703	OC1	4190	4200	250	260				
704	OC2	4200	4210	270					
705	OC3	4210	280						
574646	OFF	2730							
575600	ON	2720							
1773	OVER	4680	4690						
790	OVLEN	940							
1000	OVSTRT	930	920	940	4750	4880	4960	220	2700
2033	P10SAV	1990	2000						
2034	P11SAV	2000	2050						
2025	PACSAV	1930	1940						
2032	PACSW	1980	1990						
241	PBFLAG	3810	3820						
2017	PCSAVE	1830	1840						
227	PFLAG	3770	3780	990	2200				
77	PH0	4260	4270						
126	PH1	4300	4310						
155	PH2	4340	4350						
1	PHANTO	2780							
2150	PHFLAG	2280	2330						
1700	PHLEN	2640							
2025	PHSTOR	1920	1930						
274	PIDN2	3850	3860	1670					
270	PIDON	3840	3850	430	2170	2500	2590	2630	
1001	PINT	4890	4900						
303	PIOUT	3860	3870						
602026	PLDR	400							
2026	PMQSAV	1940	1950						
602025	PMTR	380							
2027	PPCSAV	1950	1960						
606064	PPT	520							
2031	PSCSAV	1970	1980						

M CROSS REFERENCE TABLE

2030	PSTSAV	1960	1970					
606460	PTP	510						
606462	PTR	500						
12100	PURLEN	1010						
1775	PURNM	4700	4710					
3700	PURSTR	2560	990	1010	2560			
546	PUTIN	3940	3950	1700				
34	RACS	3440						
6	RCNT	3390						
35	RCORE	3450	820	930	2620			
1003	RDBLK	4910	4920					
32	RDT0	3420						
33	RDT1	3430						
1170	REGRES	1970	1660	2060	2520	2550	2490	2540
1162	REGSAV	1900	390	600	1950			
422021	RES	330						
40	RESCAT	3470	3480					
1000	RESLEN	920						
234	RFLAG	3790	3800	880	2230			
230	RPTP	3780	3790	920	2180			
235	RPTR	3800	3810	810	2210			
242	RSCO	3820	3830					
1776	RSTRT	4710						
1755	SC	4540	4550	1940	1980			
640000	SCRSTR	2670						
2021	SCSAVE	1850	1860					
243	SHARP	2890						
377	SPCOD	5410						
422122	SPL	430						
1000	SPLST	4960						
777400	SPMSK	5390	2120					
2020	STSAVE	1840	1850					
335	SWAP	3880	3890	2540	2570	650	2650	2690
336	SWAP1	3890	3900					
340	SWAP3	3900	3910					
1000	SWCAT	4750	4760					
1003	SWCLK	4780	4790	2640				
1004	SWERR	4790	4800	2530				
1007	SWMP1	4820	4830					
1010	SWMP2	4830	4840	640				
1002	SWMTR	4770	4780					
1011	SWOPR	4840	2680					
422022	SWP	340						
1001	SWPPR	4760	4770					
40	SWPS	3460	3470					
1005	SWSPL	4800	4810	2560				
1006	SXSPL	4810	4820					
1300	SYSBAS	2800	2810					
41300	SYSDA	2810						
1777	SYSMAX	2820						
100	TABLEN	2630	2640					
2000	TEMP0	1630	1640					

M CROSS REFERENCE TABLE

2001	TEMP1	1640	1650	
2012	TEMP10	1730	1740	
2013	TEMP11	1740	1750	
2014	TEMP12	1750	1800	
2002	TEMP2	1650	1660	
2003	TEMP3	1660	1670	
2004	TEMP4	1670	1680	
2005	TEMP5	1680	1690	
2006	TEMP6	1690	1700	
2007	TEMP7	1700	1710	
2010	TEMP8	1710	1720	
2011	TEMP9	1720	1730	
646000	TP.	540		
376	TRCOFF	5540		
375	TRCON	5530		
2000	TTEMP0	1630		
2001	TTEMP1	1640		
2002	TTEMP2	1650		
2003	TTEMP3	1660		
2004	TTEMP4	1670		
2005	TTEMP5	1680		
2006	TTEMP6	1690		
2007	TTEMP7	1700		
2010	TTEMP8	1710		
2011	TTEMP9	1720		
6	TTYCLK	3170	3180	
3	TTYNUM	3140		
10	TTYSPD	3150	3170	
1774	TYPE	4690	4700	
1766	UCORE	4630	4640	
1767	UDISK	4640	4650	
336	UPARR	2940		
76	US0	4250	4260	4280
125	US1	4290	4300	4320
154	US2	4330	4340	4360
0	USER	2790		
3	USERS	2850	3200	
14000	USLEN	980	2640	
2015	USTORE	1800	1810	
75	UT0	4280		
124	UT1	4320		
153	UT2	4360		
1704	UTEM0	4440	4450	
1705	UTEM1	4450	4460	
1706	UTEM2	4460	4470	2510
1707	UTEM3	4470	4480	
1710	UTEM4	4480	4490	
1711	UTEM5	4490	4500	
1712	UTEM6	4500	4510	
1770	VALID	4650	4660	

M UNDEFINED SYMBOLS

#1	5630												
#2	5640												
#3	5650												
#4	5660												
#5	5680												
DEFINS	100	100	120	120	580	580	2680	2680	3210	3210	5330	5330	
M #1	190												
PURCOD	5140	5270											

M MACRO CROSS REFERENCE TABLE

ENTER	5280	1900	1970	2610	2700	2950	3260	350	500
MPOFF	5430								
SWAP	5610								
TABLE	170								