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                        ;THIS SUB-PROGRAM ASSEMBLED WITH SYSTEM PARAMETER FILE - S.MAC(V414)
                                XLIST
                                LIST
                        IFNDEF T30,<T30=0>;ASSUME TYPE 30 DISPLAY IF T30 IS UNDEFINED
                        IFN T30,<
                        TITLE DIST30 - TYPE 30 DISPLAY SERVICE ROUTINES
                        ENTRY DIST30
                        DIST30:
                        >
                        IFE T30,<
                        TITLE DIS340 - TYPE 340 DISPLAY SERVICE ROUTINES
                        ENTRY DIS340
000000                  DIS340:
                        >
                        SUBTTL  R. GRUEN/RCC TS 03 JUN 69 V004
                        XP      VDISSR,004*

                                        ;PUT VERSION NUMBER IN GLOB LISTING AND LOADER STORAGE MAP
                        ;               THESE ROUTINES HANDLE INTERRUPTS FROM THE DISPLAY DATA
                        ;       CHANNEL.  THEY SEARCH THE COMMAND POINTER LIST SUPPLIED
                        ;       BY THE USER AND OUTPUT SECTIONS OF DATA AS SPECIFIED THEREIN.
                        ;       ALL OUTPUT IS DONE USING THE BLKO COMMAND.

                        ;               THE FORMAT OF THE COMMAND POINTER LIST IS AS FOLLOWS:

                        ;       RH=0            END OF COMMAND POINTER LIST
                        ;
                        ;       RH=ADR  LH=0    ADR IS ADDRESS OF THE NEXT SECTION OF THE
                        ;                       COMMAND POINTER LIST
                        ;       RH=L-1  LH=-N   OUTPUT TO THE DISPLAY THE N WORDS OF COMMANDS
                        ;                       BEGINNING AT LOCATION L.

                        ;       NOTE THAT THE CHECK FOR END OF LIST IS MADE FIRST.

                        ;       ALL ADDRESSES ARE CHECKED FOR VALIDITY (I.E., THEY MUST
                        ;       BE WITHIN USER AREA) BEFORE ANY MEM REF IS MADE.

                        ;IF THE T30 SWITCH = 1 THIS IS THE ROUTINE FOR A DEC
                        ;TYPE 30 DISPLAY WITH A TYPE 348 INTERFACE.
                        ;OTHERWISE IT IS THE ROUTINE FOR A DEC TYPE 340.
```

```
                                INTERNAL FTCHECK,FTMONP
                                IFN FTCHECK+FTMONP,<
                                EXTERNAL DISDDB,DISIOS,PENLOC,DISPNT,DISBKO,DISHI,DISONE,DISAV,OFFDIS
                                EXTERNAL DISAV1,DISREL,DISCON,DISNXT
                                INTERNAL DISNX1
                                >
                                IFE FTCHECK+FTMONP,<
                                ;DIS DEVICE DATA BLOCK
                                        INTERN  DISDDB
000000  445163  000000  DISDDB: SIXBIT  /DIS/
000001  000074  000000          XWD     +D60*HUNGST,0
000002  000000  000000  DISIOS: 0
000003  000000  000024'        EXP     DISDSP
000004  003003  020000          XWD     DVDIS+DVOUT+DVIN+DVLNG,20000
000005  000000  000000          0
000006  000000  000000          0
000007  000007  000000          XWD     PROG,0
000010  000000  000000          0
000011  000020  000000  PENLOC: 0
000012  000000  000000  DISPNT: 0
000013  000000  000000  DISBKO: 0
000014  000000  000000  DISHI:  0
000015  000000  000000  DISONE: 0
000016  000000  000000  DISAV:  0
000017  000020  000000  DISAV1: 0
000020  000021  000020  DISREL: XWD     TAC,0
                                XP      OFFDIS,0+
                                IFE TS0,<
000021  000000  000000  DISCON: EXP ONDIS>
                                IFN TS0,<
                                DISCON: 0>

                                XP PENDDB,0             ;TO SATISFY A REQUEST IN COMMON,
                                                        ; THERE IS NOT REALLY A PEN DDB.
                                >
```

```
                        IFN T30,<
                        DIS=134         ;TYPE 30 DISPLAY DEVICE NUMBER
                        >
               000100   DISTAR=100      ;CLOCK FINISHED BEFORE PICTURE
               000200   DISWAT=200      ;PICTURE FINISHED BEFORE CLOCK
               000400   DISCKR=400      ;CLOCK REQUEST IN CLOCK QUEUE
               001000   DISUUI=1000

                        IFE T30,<
               000077   DISBSY=77
               007400   PENON=7400
                        >
                        IFN T30,<
                        DISBSY=20000
                        PENON=10000
                        >

                        EXTERN JOBPFI

                        EXTERN DISSAV,DISBLK,DISJSR,PENSAV
                                EXTERN DISCHN,PENCHN
                                EXTERN  DISCHL,PENCHL
                                EXTERN  DISSAV,DISRET
                                EXTERN  DISPON,DISPOF

                                EXTERN  ADRERR,SETIOD
                                EXTERN  PION,PIOFF,CLOCK
                                EXTERN CPOPJ1,UERROR,USRREL,STOTAC,JOB,JBTSTS,JBTADR,PJOBN
                        IFE T30,<       EXTERN ONDIS,NONDIS>

                        INTERN PENINT,DISINT,DISFIN
                        ENTRY DISDSP

                                DEFINE  ADRCHK(A)
                        <
                                        CAILE   A,JOBPFI
                                        CAMLE   A,DISHI
                                        JRST    EXIT2
                        >
```

```
  120  000022  254000  000043'          JRST DISINI             ;INITILIZATION
  121  000023  263140  000000          POPJ    PDP,            ;PRINT ERROR AND STOP JOB
  122  000024  254000  000045' DISDSP: JRST    DISSTP          ;RELEASE
  123  000025  254000  000045'          JRST    DISSTP          ;CLOSE
  124  000026  265240  000000          JSP     DAT,UERROR      ;OUTPUT
  125  000027  265240  000026'          JSP     DAT,UERROR      ;INPUT
  126  000030  254000  000000          JRST    CPOPJ1          ;ENTER
  127  000031  254000  000030'          JRST    CPOPJ1          ;LOOKUP
  128  000032  254000  000245'          JRST    DISOUT          ;DUMP OUTPUT (THAT'S US)
  129  000033  254000  000242'          JRST    DISIN           ;DUMP INPUT (AS IN PEN)
  130  000034  263140  000000          POPJ    PDP,            ;SETO
  131  000035  263140  000000          POPJ    PDP,            ;SETI
  132  000036  263140  000000          POPJ    PDP,            ;GETF
  133  000037  254000  000031'          JRST    CPOPJ1          ;RENAME
  134  000040  263140  000000          POPJ    PDP,            ;CLOSE INPUT
  135  000041  263140  000000          POPJ    PDP,            ;DIRECTORY CLEAR
  136  000042  263140  000000          POPJ    PDP,            ;MTAPE
```

```
                        ;DISINI IS CALLED FOR RELEASE, CLOSE, AND SUNDRY ILLEGAL CONDITIONS
                        ;       WHICH WANT TO TURN THE DISPLAY OFF.  IT FIRST CONVINCES
                        ;       THE INTERRUPT LEVEL ROUTINES TO GO BACK TO SLEEP AND THEN
                        ;       TELLS THE MONITOR THAT THE DEVICE IS INACTIVE.  LASTLY,
                        ;       IT TURNS OFF THE INTERRUPT ASSIGNMENTS OF THE DISPLAY
                        ;       AND THE PI CHANNEL ASSOCIATED WITH THE DIS BLKO. IT RETURNS
                        ;       WITH A POPJ , SOMETIMES TO ITS CALLING ROUTINE AND SOMETIMES
                        ;       TO THE CHANNEL'S DISMISS ROUTINE, THE ADDRESS OF WHICH
                        ;       WAS CLEVERLY PLACED ON THE PUSHDOWN LIST WHEN AC'S
                        ;       WERE SAVED.  THUS IT CAN BE CALLED WITH EITHER A
                        ;       PUSHJ PDP,DISINI   OR A  JRST DISINI.

000043                  DISINI:
                        IFE T30,<
000043  713200  000100          CONO    DIS,100         ;PARAMETER MODE>
                        IFN T30,<
                                MOVEI   TAC,PENCHN      ;SET UP CONO WORD WITH PROPER
                                ASH     TAC,3           ;  CHANNEL ASSIGNMENTS
                                ADDI    TAC,DISCHN

                                TRO     TAC,4000        ;SET DISPLAY READY BIT IN CONO WORD
                                MOVEM   TAC,DISCON>
000044  254000  000050'         JRST    DISIN1

000045  200200  000000  DISSTP: MOVE ITEM,JOB            ;CLEAR NSHF SO JOB CAN BE SHUFFLED
                                MOVSI   TAC,NSHF+NSWP           ;CLEAR NSWP SO JOB CAN BE SWAPPED(IN CASE THIS
000046  205040  011000  IS A SWAPPING SYSTEM
000047  412044  000000          ANDCAM  TAC,JBTSTS(ITEM)

000050  476000  000011' DISIN1: SETOM   PENLOC
000051  205040  001200          MOVSI   TAC,DISWAT+DISUUI       ;IGNORE FURTHER TRAPS
000052  541040  010000          HRRI    TAC,IOACT       ;INDICATE DEVICE INACTIVE
000053  412040  000002'         ANDCAM  TAC,DISIOS      ;INTO DEVICE DATA BLOCK
000054  713200  000000  DISOFF: CONO    DIS,OFFDIS      ;REMOVE THE DISPLAY'S CHANNEL ASSIGNMENTS
000055  513020  000062'          HLLZS   PENINT          ;DON'T EXPECT ANY ON LITE PEN
000056  700600  000000          CONO    PI,DISPOF       ;TURN OFF DISPLAY'S BLKO CHANNEL
000057  263140  000000          POPJ    PDP,

000060  254000  000127' DISINT: JRST DISFIN
000061  254000  000060'         JRST    DISINT          ;...
```

```
                        ;PENINT RECEIEVES CONTROL ON INTERRUPTS ON THE DISPLAY NON-DATA
                        ;       CHANNEL (SPECIAL CHANNEL), IT DECIDES IF THE INTERRUPT
                        ;       WAS VALID, AND IF SO, TRANSFERS CONTROL TO AN APPROPRIATE ROUTINE

                        IFE T30,<
000062  713340  000070  PENINT: CONSO   DIS,7           ;CHECK FOR CONI FLAGS
000063  254000  000062'         JRST    PENINT          ;TO OTHER DEVICES ON SAME CHANNEL
000064  713370  000400         CONSZ   DIS,400         ;STOP FLAG
000065  254000  000072'         JRST    STPFLG
000066  713300  002000         CONSZ   DIS,2000        ;PEN FLAG?
000067  713040  000011' PENFLG: DATAI   DIS,PENLOC      ;STORE CURRENT LITE PEN LOC
000070  713200  000000         CONO    DIS,NONDIS      ;CLEAR FLAG
000071  254520  000000         JEN     @PENCHL         ;DISMISS INTERRUPT

                        ;STPFLG SERVICES STOP FLAGS (DISPLAY PROGRAMMED) BY DOING
                        ;       A CLOSE ON THE DISPLAY

000072  264000  000000  STPFLG: JSR     PENSAV          ;STOP FLAG, SAVE AC'S AND SETUP RETURN
000073  254000  000025'         JRST    DISDSP+DCL      ;DO A CLOSE AND DISMISS INTERRUPT
                        >

                        IFN T30,<
                        PENINT: CONSO DIS,0             ;CHECK FOR CONI FLAGS
                                JRST PENINT             ;TO OTHER DEVICES ON SAME CHANNEL
                                DATAI DIS,PENLOC        ;CLEAR PEN INTERRUPT
                                MOVEM TAC,PENLOC        ;SAVE AC TAC
                                MOVE TAC,DISBKO         ;GET ABSOLUTE ADR OF NEXT DATA ELEMENT
                                SUB TAC,DISREL          ;MAKE ADDRESS RELATIVE
                                HRRZS   TAC             ;CLEAR OUT GARBAGE IN THE LEFT HALF
                                EXCH TAC,PENLOC         ;SAVE ADR IN PENLOC AND RESTORE TAC
                                JEN @PENCHL             ;DISMIS THE INTERRUPT
                        >
```

```
                        ;DISNXT IS CALLED WITH A   JSR DISNXT,   IT SETS UP THE NEXT
                        ;       POINTER FOR THE DISPLAY'S BLKO BY INTERPRETING A
                        ;       COMMAND LIST SUPPLIED BY THE USER,  THIS COMMAND LIST
                        ;       IS DESCRIBED AT THE BEGINNING OF THE PROGRAM.  IF THE
                        ;       DATA TO BE TRANSMITTED TO THE DISPLAY WOULD VIOLATE THE
                        ;       MEMORY PROTECTION, THEN THE ROUTINE RETURNS TO THE
                        ;       CALLING LOCATION +1.  OTHERWISE, IF THERE
                        ;       IS NO FURTHER DATA TO BE OUTPUT (AS INDICATED BY THE
                        ;       USER'S COMMAND LIST) THE ROUTINE RETURNS TO THE CALLING
                        ;       LOCATION +2.  OTHERWISE, THE NEXT POINTER FOR THE BLKO
                        ;       IS PLACED IN DISBKO AND THE ROUTINE RETURNS TO THE CALLING
                        ;       LOCATION +3.

                        IFE FTCHECK+FTMONP,<
000074  000000  000000  DISNXT: 0                               ;JSR AT INTERRUPT OR UUO LEVELS
                        >
000075  354040  000012' DISNX1: AOSA    TAC,DISPNT            ;GET NEXT POINTER FROM LIST
000076  552040  000012' ILUP:   HRRZM   TAC,DISPNT            ;UPDATE POINTER POINTER
                                ADRCHK  TAC+

000077  303040  000000                  CAILE   TAC,JOBPFI
000100  313040  000014'                 CAMLE   TAC,DISHI
000101  254000  000124'                 JRST    EXIT2
000102  200060  000020'         MOVE    TAC,@DISREL           ;GET NEXT WORD IN POINTER LIST
000103  202040  000013'         MOVEM   TAC,DISBKO            ;PLACE IN BLKO POINTER
000104  566040  000017'         HLROM   TAC,DISAV1            ;GET NEGATIVE WORD COUNT(MAKE LH NEG, TOO)
                        IFN T30,<
                                JUMPE   TAC,EXIT1             ;END OF COMMAND LIST?
                                TRNN    TAC,-1                ;INTENSITY?
                                JRST    INTCHK                ;YES>
                        IFE T30,<
000105  606040  777777          TRNN    TAC,-1  ;END OF COMMAND LIST?
000106  254000  000123'         JRST    EXIT1   ;YES>
000107  627040  777777          TLZN    TAC,-1                ;NO. POINTER TO NEW LIST?
000110  254000  000076'         JRST    ILUP                  ;YES.
000111  301040  000077'         CAIL    TAC,JOBPFI            ;NO. ADDRESS IN BOUNDS?
000112  311040  000014'         CAML    TAC,DISHI
000113  254000  000124'         JRST    EXIT2                 ;NO
000114  274040  000017'         SUB     TAC,DISAV1            ;YES, ADR. OF LAST WORD IN BLOCK.
                                ADRCHK  TAC+
000115  303040  000111'                 CAILE   TAC,JOBPFI
000116  313040  000014'                 CAMLE   TAC,DISHI
000117  254000  000124'                 JRST    EXIT2
000120  550040  000020'         HRRZ    TAC,DISREL            ;FORM ABSOLUTE ADDR
000121  272040  000013'         ADDM    TAC,DISBKO            ;IN THE BLKO POINTER WORD
000122  350000  000074'         AOS     DISNXT                ;RETURN 2,4
000123  350000  000074' EXIT1:  AOS     DISNXT
000124  200040  000016' EXIT2:  MOVE    TAC,DISAV
000125  713220  000021'         CONO    DIS,@DISCON           ;SET UP DISPLAY STATUS WORD
000126  254120  000074'         JRST    2,@DISNXT             ;...

                        IFN T30,<
                        INTCHK: MOVSS   TAC                   ;PLACE INTENSITY IN CONO WORD
                                DPB     TAC,INTPNT
```

```
262                             JRST    DISNX1          ;GET NEXT POINTER
263                     INTPNT: POINT 3,DISCON,29>
```

```
                                ;DISFIN RECEIVES CONTROL WHEN THE DISPLAY'S BLKO POINTER REACHES
                                ;       ZERO.  IT SAVES THE TWO AC'S WHICH DISNXT USES AND
                                ;       DOES A JSR TO DISNXT.  ON A NORMAL RETURN IT RESTORES THE
                                ;       AC'S AND DISMISSES THE INTERPUPT.  ON A "NO MORE DATA"
                                ;       RETURN IT TRANSFERS CONTROL TO OVT2 FOR FURTHER
                                ;       DECISION AS TO WHETHER OR NOT TO CONTINUE DISPLAYING.

000127  202040  000016' DISFIN: MOVEM   TAC,DISAV        ;SAVE AC'S
000130  264000  000074'         JSR     DISNXT          ;SETUP NEXT BLKO POINTER
000131  254000  000236'         JRST    ADRER
000132  254000  000134'         JRST    OVT2            ;RETURN HERE IF NO NEXT POINTER
000133  254520  000000          JEN     @DISCHL         ;LET THE SCOPE DO THE REST

                                ;OVT2   RECEIVES CONTROL AT INTERRUPT LEVEL WHEN THE COMMAND LIST
                                ;       (SUPPLIED BY THE USER) RUNS OUT.  IT SAVES THE AC'S FOR
                                ;       THIS CHANNEL AND IN THE PROCESS ENABLES RETURNS BY POPJ
                                ;       AND SIMILAR GOOD THINGS SINCE IT ALSO STORES THE PC FROM
                                ;       THE JSR IN THE GENERAL PC LOCATION FOR THIS CHANNEL
                                ;       IF THE DISPLAY IS OFF, IT DOES NOT RESTART IT,

                                ;       IT CHECKS TO SEE IF THE CLOCK HAS RUN OUT BEFORE THE PICTURE;
                                ;       IF SO, IT CALLS DISBEG TO RESTART THE DISPLAY WITH A NEW
                                ;       COMMAND LIST.  IT TURNS OFF THE IO ACTIVE BIT WHICH WAS
                                ;       TURNED ON BY THE OUTPUT ROUTINE; THIS INSURES THAT ANY
                                ;       OUTPUT COMMAND WILL DISPLAY AT LEAST ONE PICTURE.  IF
                                ;       THE JOB WAS IN AN IO-WAIT, IT IS RELEASED,

000134  264000  000000  OVT2:   JSR     DISSAV          ;ASK EXEC TO SAVE AC'S
000135  201300  000000'         MOVEI DEVDAT,DISDDB     ;SETUP ACS
000136  205040  004000          MOVST   TAC,SHF
000137  205240  001000          MOVST   DAT,NSHF
000140  135200  000000          LDB     ITEM,PJOBN
000141  260140  000054'         PUSHJ   PDP,DISOFF
000142  205000  000200          MOVSI   IOS,DISWAT      ;INDICATE PICTURES FINISHED
000143  437000  000002'         IORB    IOS,DISIOS      ;...
000144  667000  001000          TLON    IOS,DISUUI      ;RESUME DISPLAY, NEW UUO.
000145  254000  000164'         JRST    OVT6            ;YES, STAY IN IO WAIT
000146  612044  000047'         TDNE    TAC,JBTSTS(ITEM)        ;DOES SYSTEM WANT TO SHUFFLE THIS JOB?
000147  254000  000153'         JRST    OVT4            ;YES
000150  603000  000100          TLNE    IOS,DISTAR      ;HAS CLOCK TRIGGERED?
000151  260140  000167'         PUSHJ   PDP,DISBEG      ;YES, RESTART DISPLAY
000152  254000  000156'         JRST OVT3
000153  603000  000100  OVT4:   TLNE    IOS,DISTAR      ;DID CLOCK FINISH BEFORE PICTURE?
000154  260140  000204'         PUSHJ   PDP,CLKREQ      ;YES, PUT IN CLOCK REQUEST.
000155  412244  000146' OVT5:   ANDCAM  DAT,JBTSTS(ITEM)        ;TURN OFF NSHF SO JOB CAN BE SHUFFLED
000156  200000  000002' OVT3:   MOVE    IOS,DISIOS      ;BIT FIDDLING TIME
000157  620000  010000          TRZ     IOS,IOACT       ;SIGNAL DISPLAY CAN BE CLOSED
000160  623000  000001          TLZE    IOS,IOW         ;IS DISPLAY CAUSING AN IO-WAIT?
000161  260140  000000          PUSHJ   PDP,SETIOD      ;UNWAIT THE JOB
000162  202000  000002'         MOVEM   IOS,DISIOS      ;RESTORE IO CONTROL WORD
000163  254000  000000          JRST    DISRET          ;RESTORE AC'S AND DISMISS
000164  202000  000002' OVT6:   MOVEM   IOS,DISIOS
000165  260140  000167'         PUSHJ   PDP,DISBEG      ;START NEW COMMAND LIST
000166  254000  000163'         JRST    DISRET
```

```
                                ;DISBEG IS CALLED WITH A PUSHJ PDP,DISBEG.  IT DISABLES THE
                                ;       DISPLAY ITSELF (BY USING DISOFF) AND ALSO DISABLES THE
                                ;       CLOK RESTART AND RESETS THE POINTER TO THE USER'S
                                ;       COMMAND LIST TO THAT SPECIFIED ON THE LAST OUTPUT
                                ;       MINUS ONE.  IT ASKS DISNXT TO SET UP THE NEXT BLKO POINTER
                                ;       IF DISNXT IS UNSUCCESSFUL (I.E., IF THE USER COMMAND LIST
                                ;       IS NULL), THEN THE ROUTINE DOES A CLOSE.  OTHERWISE, A
                                ;       REQUEST IS ENTERED FOR A CLOCK INTERRUPT AT THE END OF
                                ;       AT MOST TWO JIFFIES.  THIS CLOCK QUEQUE REQUEST IS ENTERED
                                ;       ONLY IF THERE IS NONE ALREADY IN THE QUEUE.  THE PI
                                ;       CHANNELS FOR THE DISPLAY ARE TURNED ON AGAIN AND THE
                                ;       DISPLAY IS INITIALIZED BY A CONO.  IT SHOULD THEN REQUEST
                                ;       DATA AS SOON AS THE PI CHANNEL FOR THE BLKO IS TURNED ON.
                                ;       IT TURNS THIS CHANNEL ON AND RETURNS TO ITS CALLER.

000167  205000  000300  DISBEG: MOVSI   IOS,DISTAR+DISWAT       ;INDICATE FRESH DISPLAY
000170  412000  000002'         ANDCAM  IOS,DISIOS              ;...
000171  550100  000215'         HRRZ    TAC1,DISONE     ;GET POINTER LIST ADDR (-1)
000172  552100  000012'         HRRZM   TAC1,DISPNT     ;RESET POINTER POINTER WITH IT
000173  264000  000074'         JSR     DISNXT          ;ASK FOR FIRST WORD FOR BLKO
000174  254020  000237'         JRST    ADRER1
000175  254000  000045'         JRST    DISSTP          ;NULL LIST, CLOSE
000176  260140  000234'         PUSHJ   PDP,CLKREQ      ;ENTER CLOCK QUEUE REQUEST
000177  713220  000021'         CONO    DIS,@DISCON     ;INITIALIZE THE DISPLAY
000200  201040  007400          MOVEI   TAC,PEMON       ;ALLOW SPECIAL PI INTERRUPTS
000201  542040  000062'         HRRM    TAC,PENINT      ;...
000202  700600  000000          CONO    PI,DISPON       ;ALLOW BLKO INTERRUPTS
000203  263140  000000          POPJ    PDP,            ;RETURN

000204  205000  000400  CLKREQ: MOVSI   IOS,DISCKR       ;IF NO CLOCK INTERRUPT REQUESTED
000205  200040  000214'         MOVE    TAC,CLOKRT      ;RESET TIMER
000206  700600  000000          CONO    PI,PIOFF        ;INHIBIT INTERRUPTS
000207  676000  000072'         TDON    IOS,DISIOS      ;ENTER ONLY A SINGLE CLOCK REQUEST
000210  136040  000000          IDPB    TAC,CLOCK       ;PLACE REQUEST IN QUEUE
000211  436000  000072'         IORM    IOS,DISIOS      ;PROTECT AGAINST A DUPLICATE REQUEST
000212  700600  000000          CONO    PI,PION         ;UNINHIBIT INTERRUPTS
000213  263140  000000          POPJ    PDP,            ;RETURN

000214  000215' 000002  CLOKRT: XWD     CLOK,2          ;CONTROL FOR CLOCK QUEUE: 2 JIFFIES
                                                        ;TWO JIFFIES
```

```
                                ;CLOK   IS CALLED AT THE CLOCK LEVEL IN RESPONSE TO A REQUEST
                                ;       IN THE CLOCK QUEUE.  A BIT IS SET TO INDICATE THAT THE
                                ;       CLOCL PERIOD HAS ELAPSED.  IF THE DISPLAY IS STILL IN
                                ;       PROGRESS, CLOK RETURNS AT THIS POINT.  OTHERWISE, CLOK
                                ;       GOES TO DISBEG TO START UP THE DISPLAY.  DISBEG RETURNS
                                ;       WITH A POPJ PDP,

000215  205000  000400  CLOK:   MOVSI   IOS,DISCKR       ;INDICATE CLOCK REQUEST SERVICED
000216  413000  000002'          ANDCAB  IOS,DISIOS       ;...
000217  663000  001000          TLOE IOS,DISUUI
000220  205000  000100          MOVSI   IOS,DISTAR       ;ASK DISPLAY TO RESTART
000221  437000  000002'          IORB    IOS,DISIOS       ;...
000222  607000  000200          TLNN    IOS,DISWAT       ;HAS DISPLAY FINISHED?
000223  263140  000000          POPJ    PDP,             ;NO, WAIT FOR IT TO DO SO
000224  201300  000000'          MOVEI   DEVDAT,DISDDB
000225  205040  001000          MOVSI   TAC,NSHF
000226  135200  000140'          LDB     ITEM,PJORN
000227  612044  000155'          TDNE    TAC,JBTSTS(ITEM)         ;IS SHUFFLE LOCKED OUT?
000230  254000  000167'          JRST    DISBEG           ;YES, RESTART DISPLAY AND RETURN

000231  436044  000227'          IORM    TAC,JBTSTS(ITEM)         ;NO, LOCK IT OUT,
000232  200044  000000          MOVE    TAC,JBTADR(ITEM)         ;RESET DISHI AND DISREL AFTER $HUFFLING
000233  556040  000014'          HLRZM   TAC,DISHI
000234  542040  000020'          HRRM    TAC,DISREL
000235  254000  000167'          JRST    DISBEG           ;RESART DISPLAY AND RETURN

                                ;ADRER  SERVICES PROTECTION VIOLATIONS DISCOVERED BY DISNXT,
                                ;       IT DOES A CLOSE AND THEN CALLS THE MONITOR'S ERROR PRINTING
                                ;       ROUTINES TO INFORM THE USER.

000236  264000  000134'  ADRER:  JSR     DISSAV           ;SAVE AC'S AGAIN
000237  260140  000025'  ADRER1: PUSHJ   PDP,DISDSP+DCL   ;DO A CLOSE
000240  201300  000000'          MOVEI   DEVDAT,DISDDB    ;TELL ERROR ROUTINE WHO'S UNHAPPY
000241  254000  000000          JRST    ADRERR           ;GO GRIPE

                                ;DISIN  HANDLES LITE PEN UUO (INPUT) IN A RUDIMENTARY FASHION
                                ;       BY RETURNING (TO THE ADDR SPECIFIED BY THE ADDR FIELD
                                ;       OF THE INPUT UUO) THE LAST PEN COORDINATES SEEN.

000242  211040  000001  DISIN:  MOVNI   TAC,1
000243  250040  000011'          EXCH    TAC,PENLOC       ;GET LATEST COORDINATES,
000244  254000  000000          JRST    STOTAC           ;STORE AND RETURN
```

```
                        ;DISOUT DOES THE WORK OF THE OUTPUT UUO,  IT SETS A BIT TO
                        ;       INDICATE THAT THE DEVICE IS ACTIVE AND INHIBITS
                        ;       INTERUPTS WHICH MAY STILL BE IN PROGRESS.  SINCE THE
                        ;       MONITOR CALLS WSYNCE BEFORE COMING HERE, THE USER IS
                        ;       GUARANTEED AT LEAST ONE PICTURE/OUTPUT,  THE USERS MEMORY
                        ;       ROUNDS ARE STORED FOR QUICK USE AT INTERRUPT LEVEL W/O
                        ;       SAVING AC'S.  THE LOCATION OF THE COMMAND LIST (-1) IS
                        ;       STORED FOR USE IN SETTING UP BLKO POINTERS,  THE PI
                        ;       LOCATIONS (40 + 2J) ARE INITIALIZED WITH A BLKO IN
                        ;       THE EVEN LOCATION AND A JSR TO DISFIN IN THE ODD LOCATION,
                        ;       THE NON-DATA CHANNEL CONSO IS SETUP TO BELIEVE IN THE
                        ;       A POPJ POP, IT RETURNS ON BEHALF OF THE OUTPUT UUO.

000245  661000  000220  DISOUT: TLO     IOS,IO+DISWAT   ;INDICATE OUTPUT; REQUEST START UP
000246  660000  010000          TRO     IOS,IOACT       ;INDICATE DEVICE ACTIVE
000247  275000  000001          SUBI    UUO,1           ;ALLOW FOR INCREMENT AT INTERRUPT
000250  200040  000265'        MOVE    TAC,BLKLIT      ;FEEDS WORDS TO THE DISPLAY
000251  202040  000000          MOVEM   TAC,DISBLK      ;FROM EVEN NUMBERED INTERRUPT LOC
000252  200040  000266'        MOVE    TAC,JSRLIT      ;SERVICE THE END OF BLKO
000253  202040  000000          MOVEM   TAC,DISJSR      ;FROM ODD INTERRUPT LOC
000254  201040  007400          MOVEI   TAC,PENON       ;SETUP CONSO BITS ON SPECIAL CHANNEL
000255  542040  000062'        HRRM    TAC,PENINT      ;...
000256  437000  000002'        IORB    IOS,DISIOS      ;SET IOACT ON; INDICATE OUTPUT
000257  552600  000015'        HRRZM   UUO,DISONE      ;SET NEW COMMAND LIST ORIGIN
000260  205000  001000          MOVSI IOS,DISUUI
000261  436000  000002'        IORM    IOS,DISIOS      ;ALLOW DISPLAY
000262  713320  000021'        CONSZ   DIS,@DISCON     ;DISPLAY ALREADY IN USE
000263  412000  000002'        ANDCAM IOS,DISIOS
000264  254000  000234'        JRST    CLKREQ          ;ENTER CLOCK QUEUE REQUEST AND POPJ

000265  713100  000013' BLKLIT: BLKO    DIS,DISBKO
000266  264000  000133' JSRLIT: JSR     DISCHL
                        END
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NO ERRORS DETECTED

PROGRAM BREAK IS 000267

SYMBOL TABLE

ADRER	000236'		ADRER1	000237'		ADRERR	000241'	EXT
BLKLIT	000265'		CLKREQ	000204'		CLOCK	000210'	EXT
CLOK	000215'		CLOKRT	000214'		CPOPJ1	000037'	EXT
DAT	000005	INT	DCL	000001	INT	DEVDAT	000006	INT
DIS340	000000'	INT	DISAV	000016'		DISAV1	000017'	
DISBEG	000167'		DISBKO	000013'		DISBLK	000251'	EXT
DISBSY	000077		DISCHL	000266'	EXT	DISCHN	000000	EXT
DISCKR	000400		DISCON	000021'		DISDDB	000000'	INT
DISDSP	000024'	INT	DISFIN	000127'	INT	DISHI	000014'	
DISIN	000242'		DISIN1	000050'		DISINI	000043'	
DISINT	000060'	INT	DISIOS	000002'		DISJSR	000253'	EXT
DISNX1	000075'		DISNXT	000074'		DISOFF	000054'	
DISONE	000015'		DISOUT	000245'		DISPNT	000012'	
DISPOF	000056'	EXT	DISPON	000202'	EXT	DISREL	000020'	
DISRET	000166'	EXT	DISSAV	000236'	EXT	DISSTP	000045'	
DISTAR	000100		DISUUI	001000		DISWAT	000200	
DVDIS	002000	INT	DVIN	000002	INT	DVLNG	001000	INT
DVOUT	000001	INT	EXIT1	000123'		EXIT2	000124'	
FTCHEC	000000	INT	FTMONP	000000	INT	HUNGST	000001	INT
ILUP	000076'		IO	000020	INT	IOACT	010000	INT
IOS	000000	INT	IOW	000001	INT	ITEM	000004	INT
JBTADR	000232'	EXT	JBTSTS	000231'	EXT	JOB	000045'	EXT
JOBPFI	000115'	EXT	JSRLIT	000266'		NONDIS	000070'	EXT
NSHF	001000	INT	NSWP	010000	INT	OFFDIS	000000	INT
ONDIS	000021'	EXT	OVT2	000134'		OVT3	000156'	
OVT4	000153'		OVT5	000155'		OVT6	000164'	
PDP	000003	INT	PENCHL	000071'	EXT	PENCHN	000000	EXT
PENDDB	000000	INT	PENFLG	000067'		PENINT	000062'	INT
PENLOC	000011'		PENON	007400		PENSAV	000072'	EXT
PIOFF	000206'	EXT	PION	000212'	EXT	PJOBN	000226'	EXT
PROG	000007	INT	SETIOD	000161'	EXT	SHF	004000	INT
STOTAC	000244'	EXT	STPFLG	000072'		T30	000000	
TAC	000001	INT	TAC1	000002	INT	UERROR	000227'	EXT
USRREL	000000	EXT	UUO	000014	INT	VDISSR	000204	INT

DVDIS	6#	6	59		
DVDSK	6#	6			
DVDTA	6#	6			
DVIN	6#	6	59		
DVLNG	6#	6	59		
DVLPT	6#	6			
DVMTA	6#	6			
DVOUT	6#	6	59		
DVPTP	6#	6			
DVPTR	6#	6			
DVTTY	6#	6			
ENTRP	6#	6			
EXIT1	240	254#			
EXIT2	230	245	250	255#	
FBMERR	6#	6			
FNFERR	6#	6			
FRGSFG	6#	6			
FT2REL	6#				
FTATTA	6#				
FTCHEC	6#	46	47	52	222
FTEXAM	6#				
FTFINI	6#				
FTGETT	6#				
FTHALT	6#				
FTKCT	6#				
FTMOMP	6#	46	47	52	222
FTPRV	6#				
FTRA10	6#				
FTRCHK	6#				
FTREAS	6#				
FTSLEE	6#				
FTTALK	6#				
FTTIME	6#				
FTTRAC	6#				
FTTRPS	6#				
FTTTYS	6#				
HSAMSK	6#	6			
HSAPOS	6#	6			
HSASIZ	6#	6			
HUNGCT	6#	6			
HUNGST	6#	6	56		
I	6#	6			
IB	6#	6			
IBUFR	6#	6			
ICLOSB	6#	6			
ILM	6#				
ILUERR	6#	6			
ILUP	226#	242			
INREQ	6#	6			
INITR	6#	6			
INPR	6#	6			
IO	6#	6	410		
IOACT	6#	6	167	309	411

	341	342	347	350	372	374	376	377	378	379	394	395	413	414
	415	416	417	418										
TAC1	6#	6	334	335										
TEM	6#	6												
TRNERR	6#	6												
TTYATC	6#	6												
TTYBIU	6#	6												
TTYUSE	6#	6												
UCHN	6#	6												
UERROR	10#	12#	125											
UIOMOD	6#	6												
USRMOD	6#	6												
USRRFL	10#													
UUO	6#	6	412	420										
UWP	6#	6												
UWPOFF	6#	6												
VDISSR	20#	20												
WTMASK	6#	6												

ADRCHK	115#	227	247		
CODES	6#				
DISABL	6#				
ENABLE	6#				
NOSCHE	6#				
NOSHUF	6#				
QUEUES	6#				
SCHEDU	6#				
SHUFFL	6#				
STARTD	6#				
XP	6#	6	19	72	78