PDP11/05

QUICK VERIFY

MD-11-DDGTE-B

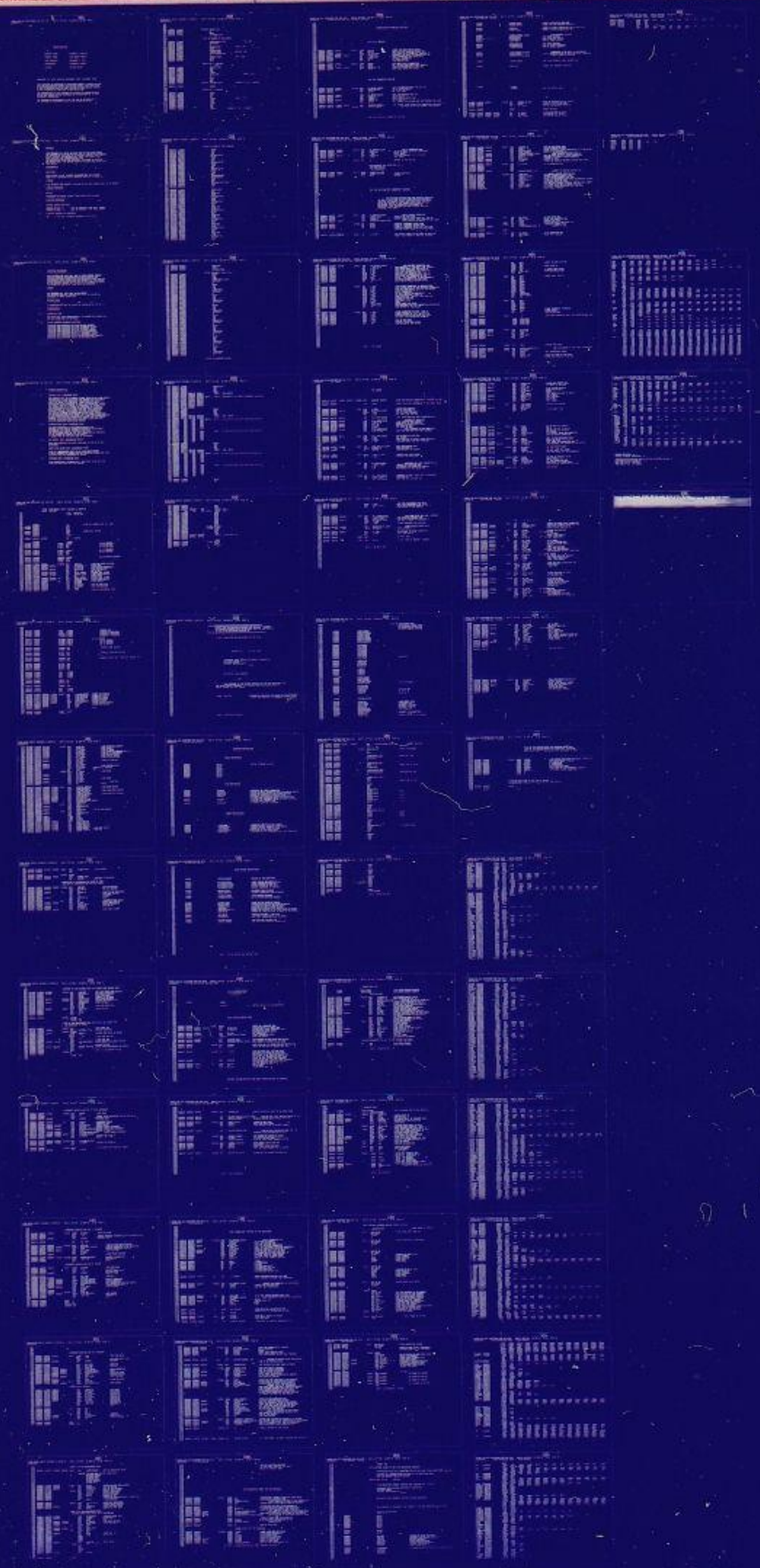
EP DDGTE B DL A

OCT 1976

FICHE 1 OF 1

digital

Made in U.S.A.



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                .REM    *
```

IDENTIFICATION

PRODUCT CODE:	MAINDEC-11-DDGTE-B
PRODUCT NAME:	GT40 QUICK VERIFY
DATE CREATED:	NOVEMBER 1, 1973
MAINTAINER:	DIAGNOSTIC GROUP
AUTHOR:	RAYMOND SHOOP

1. ABSTRACT

THIS PROGRAM IS A QUICK GO-NOGO TEST OF THE GT40 SYSTEM.
THE PURPOSE OF THIS TEST IS TO QUICKLY IDENTIFY ANY PROBLEM
IN THE SYSTEM. THE PROGRAM WILL START THE DISPLAY AND
THEN INITIATE THE COMMUNICATION LINE.
TWO BACKGROUND TASKS ARE EXECUTED. THE FIRST IS A GT-40
ROM VERIFY TEST. THE SECOND TASK IS A WORSE CASE NOISE TEST
THRU MEMORY.

2. REQUIREMENTS

2.1 EQUIPTMENT

GT40 SYSTEM (11/05, DISPLAY PROCESSOR AND VR14 SCOPE)
MODEM TEST CONNECTOR WHICH CONNECTS DATA OUT TO DATA IN.

2.2 STORAGE

THIS PROGRAM USED MEMORY LOCATIONS 0-7776 AND 16000-16776 (2K OF MEMORY).

3. LOADING PROCEDURE

3.1 METHOD

PROCEDURE FOR NORMAL BINARY TAPES SHOULD BE FOLLOWED.

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

CONSOLE SW 08 = 0 TEST AS VERSION 2 ROM (512. WORDS)
CONSOLE SW 08 = 1 TEST AS VERSION 1 ROM (256. WORDS)

4.2 STARTING ADDRESS OR ADDRESSES

200 IS THE ONLY STARTING ADDRESS OF THIS TEST

5. OPERATING PROCEDURE

ONCE STARTED THE TEST WILL RUN IN THEIR NORMAL MANNER
WITHOUT OPERATOR INTERVENTION OR SWITCH SELECTION.
THE OPERATOR MUST VERIFY THE DATA RETURNING FROM THE COM-
MUNICATION LINE BY COMPARING 'COM OUTPUT' TO 'COM INPUT'
ON THE DISPLAY SCREEN. BY TYPING ON THE CONSOLE KEYBOARD,
THE CHARACTER AND OCTAL VALUE WILL BE DISPLAYED.

6. ERRORS

THE PROGRAM WILL ONLY HALT ON AN ERROR.
THE PROGRAM DOES NOT CONTAIN FACILITES FOR REPORTING
MESSAGES OR ERROR CONDITIONS.

7. RESTRICTIONS

A COMMUNICATION TEST PLUG MUST BE INSTALLED ON THE DL-11.

8. MISCELANEOUS

8.1 EXECUTION TIME

THE TEST WILL TAKE APPROXIMATELY 10 SECONDS FOR COMPLETION
AND WILL RING THE 'GT-40' BELL.

8.2 DEVICE ADDRESS PROGRAM LOCATIONS

LOCATION 1000 CONTAINS THE GT40 DEVICE ADDRESS
LOCATION 1002 CONTAINS THE GT40 INTERRUPT VECTOR.
LOCATION 1004 CONTAINS THE GT40 INTERRUPT LEVEL.
LOCATION 1006 CONTAINS THE DL-11 DEVICE ADDRESS.
LOCATION 1010 CONTAINS THE DL-11 INTERRUPT VECTOR.
LOCATION 1012 CONTAINS THE DL-11 INTERRUPT LEVEL.
LOCATION 1014 CONTAINS THE GT-40 ROM BOOTSTRAP ADDRESS.
LOCATION 1016 CONTAINS THE GT-40 ROM WORD LENGTH,

9. PROGRAM DESCRIPTION

9.1 DISPLAY FILE (FORGROUND TASK)

THE DISPLAY FILE IS A COMPACT VISUAL TEST OF ALL GT40 DISPLAY INSTRUCTIONS. A BOX OUTLINING THE SCREEN WITH DIFFERENT LINE TYPE VALUE IS DISPLAYED. THREE PAIRS OF ASCII STRINGS ARE ALSO DISPLAYED TO TEST THE CHARACTER LOGIC. THE FIRST LINE OF A STRING IS DISPLAYED IN 'NORMAL' FONT THE SECOND LINE OF A STRING IS DISPLAYED IN 'ITALICS'. ALSO INCLUDED IN THIS VISUAL TEST ARE THE 8 DIFFERENT INTENSITY LEVELS. THE DISPLAY PATTERN IS ENHANSED BY THE USE OF BLINKING OCTAGONS AND MOVING SINE WAVES. THE DISPLAY PATTERN ALSO SERVES AS FOR VISUAL INSPECTION OF THE COMMUNICATION LINE DATA. ALL LINES AND CHARACTERS ARE ENABLED FOR LIGHT-PEN INTERACTION EXCEPT FOR THE LARGEST OCTAGON. UPON LIGHT-PEN HIT, THE TEXT 'LIGHT-PEN HIT' WILL BE DISPLAYED NEAR CENTER SCREEN.

9.2 COMMUNICATION DATA (FORGROUND TASK)

THE DATA PRESENTED TO THE COMMUNICATION LINE APPEARS ON THE DISPLAY SCREEN AS FOUND AT 'COM OUTPUT'. (DECGRAPHIC-11 DISPLAY TERMINAL GT40 VR14) THE DATA ECHOED BACK BY THE TEST CONNECTOR IS DISPLAYED ON THE SCREEN AS FOUND AT 'COM INPUT'. A VISUAL TEST OF THE DATA MUST BE PERFORMED.

9.3 ROM VERIFY TEST (BACKGROUND TASK)

THIS TEST VERIFIES THE DATA CONTAINED IN THE GT-40 ROM BOOTSTRAP.

9.4 WORSE CASE NOISE TEST (BACKGROUND TASK)

THIS IS A BACKGROUND TEST OF ALL AVAILABLE MEMORY. A SMALL PROGRAM IS LOADED INTO ALL EXISTING MEMORY AND THEN EXECUTED THRU THE REMAINDER OF MEMORY.

9.5 KEYBOARD DATA (FORGROUND TASK)

UPON DEPRESSING A KEYBOARD KEY, THE OCTAL VALUE WILL BE DISPLAYED AND ECHO ONTO THE SCREEN.

←

```
                        .TITLE  GT40 QUICK VERIFY MAINDEC-11-DDGTE-B
                        .ENABL  ABS,AMA
  180                                   .LIST   SEQ,BIN
  181                                   .NLIST  MD,MC,CND
  182
  183
  184
  185
  186
  187           000000                  .=0             ;0-776 IS LOADED WITH .+2, HALT
  188  000000   000000                  HALT
  189  000002   000000                  HALT
  190           000024                  .=24
  191  000024   001612                  PWRFL           ;POWER FAIL VECTOR
  192  000026   000340                  340
  193           000200                  .=200
  194
  195  000200   000137  001022          JMP     STARTB
  196
  197           001000                  .=1000
  198  001000   172000          GTADD:  172000                          ;GT-40 ADDRESS
  199  001002   000320          GTVCT:  320                             ;GT-40 VECTOR
  200  001004   000200          GTBRL:  200                             ;GT-40 BR LEVEL
  201
  202  001006   175610          DLADD:  175610                          ;DL-11 ADDRESS
  203  001010   000300          DLVCT:  300                             ;DL-11 VECTOR
  204  001012   000240          DLBRL:  240
  205
  206  001014   166000          ROMADD: 166000                          ;ROM STARTING ADDRESS
  207  001016   001000          WORDS:  512.
  208  001020   006000          IMAGE:  6000
  209
  210  001022   012706  000500  STARTB: MOV     #500,SP         ;LOAD THE STACK POINTER
  211  001026   012777  000340  000162  MOV     #340,@PSW       ;RAISE PSW
  212  001034   004737  001302          JSR     PC,INITGT       ;INIT DEVICE ADDRESSES
  213  001040   032777  000400  000146  BIT     #400,@SWR       ;TEST ROM SWITCH
  214  001046   001007                  BNE     1$              ;BR IF SET
  215  001050   012737  001000  001016  MOV     #512.,WORDS     ;ASSUME VER. 2 ROM
  216  001056   012737  006000  001020  MOV     #START,IMAGE    ;LOAD IMAGE ADDRESS
  217  001064   000406                  BR      2$              ;START TEST
  218  001066   012737  000400  001016  1$:     MOV     #256.,WORDS     ;SELECT VER. 1 ROM
  219  001074   012737  016000  001020          MOV     #STARTA,IMAGE   ;LOAD IMAGE ADDRESS
  220  001102   005077  000042  2$:     CLR     @LOOBR          ;CLEAR OUTPUT
  221  001106   005077  000036          CLR     @LOOBR
  222  001112   004737  001636          JSR     PC,DOCORE       ;SET UP CORE SIZE
  223  001116   004737  001220          JSR     PC,PRIME        ;INIT THE DEVICES
  224  001122   005077  000070          CLR     @PSW
  225  001126   000137  002544          JMP     OVER            ;EXECUTE BACKGROUND TASK
```

```
001132  172000                          GTPC:    172000                          ;DISPLAY PC
001134  172002                          G1SR:    172002                          ;DISPLAY STATUS REG.
001136  172004                          GTXPOS:  172004                          ;DISPLAY X REGISTER
001140  172006                          GTYPOS:  172006                          ;DISSPLAY Y REGISTER

001142  175610                          DLICSR:  175610                 ;DL-11 STATUS
001144  175612                          DLIDBR:  175612                          ;DL-11 BUFFER
001146  175614                          DLOCSR:  175614                          ;DL-11 STATUS
001150  175616                          DLODBR:  175616                          ;DL-11 BUFFER

001152  000320                          GTDONE:  320                             ;DISPLAY DONE VECTOR
001154  000322                          GTDNE1:  322

001156  000324                          GTLPH:   324                             ;DISPLAY LIGHT-PEN VECTOR
001160  000326                          GTLPH1:  326

001162  000330                          GTSOTM:  330                             ;DISPLAY SHIFT-OUT/ TIME-OUT VECTOR
001164  000332                          GTSOT1:  332

001166  000300                          DLIVT:   300
001170  000302                          DLIVT1:  302
001172  000304                          DLOVT:   304
001174  000306                          DLOVT1:  306

001176  177560                          TKS:     177560
001200  177562                          TKB:     177562
001202  177564                          TPS:     177564
001204  177566                          TPB:     177566

001206  000060                          KRBVT:   60
001210  000062                          KRBVT1:  62

001212  000200                          KRBBRL:  200

001214  177570                          SWR:     177570
001216  177776                          PSW:     177776

001220  012777  002724  177704  PRIME:  MOV      #FILE00,@GTPC   ;START THE DIGPLAY
001226  012777  000100  177712          MOV      #100,@DLOCSR    ;ENABLE DL OUTPUT
001234  012777  000100  177700          MOV      #100,@DLICSR    ;ENABLE DL INPUT
001242  012777  000100  177726          MOV      #100,@TKS       ;ENABLE KEYBOARD
001250  113777  005334  177672          MOVB     BUFF1,@DLODBR   ;OUTPUT A CHAR
001256  012737  000001  002344          MOV      #1,PPNT         ;PRESET PRINT POINTER
001264  005037  002346                  CLR      RPNT            ;CLEAR READ BUFFER
001270  005037  002540                  CLR      KPNT
001274  000207                          RTS      PC              ;EXIT

001276  017476                          SIZE:    17476
001300  000000                          GTDLY0:  0
```

```
  277  001302  012700  001132          INITGT: MOV     #GTPC,R0                ;LOAD STARTING ADDRESS
  278  001306  013701  001000                  MOV     GTADD,R1                ;SAVE VALUE
  279  001312  004737  001364                  JSR     PC,LOADR0               ;LOAD GT ADDR
  280  001316  013701  001006                  MOV     DLADD,R1                ;LOAD STARTING ADDRESS (DL-11)
  281  001322  004737  001364                  JSR     PC,LOADR0               ;LOAD DL-11 ADDRESSES
  282  001326  013701  001002                  MOV     GTVCT,R1                ;LOAD VECTOR VALUE
  283  001332  004737  001364                  JSR     PC,LOADR0               ;LOAD GT-40 VECTORS
  284  001336  010110                          MOV     R1,(R0)
  285  001340  062720  000010                  ADD     #10,(R0)+               ;LOAD GT TIME-OUT
  286  001344  010110                          MOV     R1,(R0)
  287  001346  062720  000012                  ADD     #12,(R0)+
  288  001352  013701  001010                  MOV     DLVCT,R1                ;LOAD VECTOR VALUE
  289  001356  004737  001364                  JSR     PC,LOADR0       ;LOAD DL-11 VECTORS
  290  001362  000413                          BR      INGT            ;BR
  291  001364  010120          LOADR0: MOV     R1,(R0)+                ;LOAD DONE
  292  001366  010110                  MOV     R1,(R0)
  293  001370  062720  000002                  ADD     #2,(R0)+
  294  001374  010110                          MOV     R1,(R0)
  295  001376  062720  000004                  ADD     #4,(R0)+                ;LOAD DONE
  296  001402  010110                          MOV     R1,(R0)
  297  001404  062720  000006                  ADD     #6,(R0)+                        ;LOAD PSW
  298  001410  000207                          RTS     PC                      ;EXIT
  299
  300  001412  012777  002044  177532  INGT:   MOV     #GTSTOP,@GTDONE         ;LOAD DONE VECTOR
  301  001420  013777  001004  177526          MOV     GTBRL,@GTDNE1
  302  001426  012777  002134  177522          MOV     #GTLPEN,@GTLPH          ;LOAD LIGHT-PEN VECTOR
  303  001434  013777  001004  177516          MOV     GTBRL,@GTLPH1
  304  001442  012777  002152  177512          MOV     #GTSHIF,@GTSOTM         ;LOAD SHIFT-OUT VECTOR
  305  001450  013777  001004  177506          MOV     GTBRL,@GTSOT1
  306  001456  012737  000040  001300          MOV     #40,GTDLYD
  307  001464  012737  005664  005634          MOV     #FILEOC,FILEOA
  308  001472  012737  174104  003006          MOV     #STATSB!INCR+4,GRPINC
  309  001500  012700  005430                  MOV     #BUFF2,R0
  310  001504  005020                  INTD:   CLR     (R0)+
  311  001506  022700  005500                  CMP     #BUFF2+50,R0
  312  001512  001374                          BNE     INTD
  313  001514  012700  005524                  MOV     #BUFF3,R0               ;SET UP KRB BUFFER
  314  001520  005020                  INTE:   CLR     (R0)+
  315  001522  022700  005574                  CMP     #BUFF3+50,R0
  316  001526  001374                          BNE     INTE
  317  001530  105037  005611                  CLRB    OCTA
  318  001534  105037  005612                  CLRB    OCTA+1
  319  001540  105037  005613                  CLRB    OCTA+2
  320  001544  012777  002242  177414          MOV     #DLIN,@DLIVT
  321  001552  013777  001012  177410          MOV     DLBRL,@DLIVT1
  322  001560  012777  002160  177404          MOV     #DLOUT,@DLOVT
  323  001566  013777  001012  177400          MOV     DLBRL,@DLOVT1
  324  001574  012777  002354  177404          MOV     #KBIN,@KRBVT            ;LOAD KRB VECTOR
  325  001602  013777  001212  177400          MOV     KRBBRL,@KRBVT1          ;LOAD PSW
  326  001610  000207                          RTS     PC
```

```
  327
  328  001612  012737  001622  000024  PWRFL:  MOV     #PWRUP,@#24     ;LOAD VECTOR
  329  001620  000000                  HALT
  330
  331  001622  000005                  PWRUP:  RESET
  332  001624  012737  001612  000024          MOV     #PWRFL,@#24
  333  001632  000137  001022                  JMP     START8          ;RESTART AT BEGINING
  334
  335                                  ;SUBROUTINE TO DETERMINE THE SIZE OF CORE
  336                                  ; AND SET UP LOCATION SIZE WITH THE VALUE
  337
  338  001636  012737  001670  000004  DOCORE: MOV     #2$,@#4                 ;SET UP FOR NEM
  339  001644  012701  017776                  MOV     #17776,R1               ;SET UP ADDRESS
  340  001650  005000                          CLR     R0
  341  001652  062701  020000          1$:     ADD     #20000,R1               ;MOVE TO THE NEXT BANK
  342  001656  005200                          INC     R0                      ;INC BANK COUNTER
  343  001660  005711                          TST     (1)                     ;TIMEOUT ?
  344  001662  022701  177776                  CMP     #177776,R1              ;END ?
  345  001666  001371                          BNE     1$
  346  001670  005300                  2$:     DEC     R0                      ;DECREMENT BANK COUNT
  347  001672  012737  000006  000004          MOV     #6,@#4                  ;RESET BUSS ERROR
  348  001700  022626                          CMP     (SP)+,(SP)+             ;POP THE STACK X2
  349  001702  162701  020000                  SUB     #20000,R1               ;RESTORE R1
  350  001706  010137  001276                  MOV     R1,SIZE
  351  001712  162737  007776  001276          SUB     #7776,SIZE              ;BACK PAST LOADER
```

```
                                        ;ROUTINE TO LOAD EXCESS CORE WITH WORSE CASE MEMORY TEST
                                        ;
001720  013700  001276        CORTST: MOV     SIZE,R0         ;GET LAST FREE CORE ADDRESS
001724  012701  017000                MOV     #BUFFER,R1      ;GET END OF PROGRAM
001730  020001                        CMP     R0,R1           ;TEST FOR EQUAL
001732  103410                        BLO     XMRTS           ;BRANCH IF NO ROOM
001734  012702  001770        XMLOP1: MOV     #MEMTST,R2      ;MOVE CODE BETWEEN
001740  012221                XMLOP2: MOV     (R2)+,(R1)+     ;MEMTST AND MEMEND TILL
001742  022702  002040                CMP     #MEMEND,R2      ;CORE IS FULL
001746  001374                        BNE     XMLOP2
001750  020100                        CMP     R1,R0           ;TEST FOR MORE ROOM
001752  101770                        BLOS    XMLOP1
001754  012721  000207        XMRTS:  MOV     #207,(R1)+      ;SETUP RTS PC
001760  005021                        CLR     (R1)+
001762  005021                        CLR     (R1)+
001764  000207                        RTS     PC
                                        ;
001766  151456                ROTVAL: 151456
                                        .DSABL  AMA
                                        ;
                                        ;THIS IS THE BACKGROUND TASK WHICH WILL BE LOADED THRU
                                        ; THE REMAINDER OF MEMORY
                                        ;
001770  000277                MEMTST: SCC                             ;SET CARRY BIT
001772  012727  123456                MOV     #123456,(PC)+   ;MEMDAT CONTAINS
001776  123456                MEMDAT: 123456
002000  106067  177773                RORB    MEMDAT+1        ;ROTATE LEFT BYTE OF MEMDAT
002004  103401                        BCS     .+4
002006  000000                        HALT                    ;C BIT WAS NOT SET
002010  102001                        BVC     .+4
002012  000000                        HALT                    ;V BIT WAS SET
002014  022767  151456  177754        CMP     #151456,MEMDAT  ;CHECK HERE FOR CORRECT ROTATE
002022  001401                        BEQ     .+4
002024  000000                        HALT                    ;ROTATE FAILED
002026  026737  177744  001766        CMP     MEMDAT,@#ROTVAL ;CHECK AGAIN REFERENCE LOW MEMORY
002034  001401                        BEQ     .+4
002036  000000                        HALT                    ;REF. TO LOW MEMORY FAILED
002040  000000                MEMEND: 0
002042  000000                        0
                                        .ENABL  AMA
```

```
                                        ;INTERRUPT SERVICE FOR THE GT STOP INTERRUPT

002044  005777  177064        GTSTOP: TST     @GTSR           ;TEST STOP
002050  100403                        BMI     1$
002052  000000                        HALT                    ;ERROR, STOP INTERRUPT BUT NO STOP FLAG
002054  000137  001022                JMP     STARTB          ;RESTART TEST

002060  005337  001300        1$:     DEC     GTDLYO          ;DECREMENT DELAY
002064  001014                        BNE     GTST1           ;BRANCH IF NOT
002066  012737  000040  001300        MOV     #40,GTDLYO      ;RESET DELAY
002074  005237  003006                INC     GRPINC          ;UPDATE GRAPH INCREMENT
002100  022737  174110  003006        CMP     #STATSB!INCR+10,GRPINC  ;TEST FOR INCREMENT
002106  001003                        BNE     GTST1           ;BRANCH IF NOT
002110  012737  174100  003006        MOV     #STATSB!INCR,GRPINC     ;RESET GRAPH INCREMENT
002116  012737  005664  005634GTST1:  MOV     #FILEOC,FILEOA
002124  012777  000001  177000        MOV     #1,@GTPC        ;RESUME THE DISPLAY
002132  000002                        RTI                     ;EXIT

002134  012737  005636  005634GTLPEN: MOV     #FILEOB,FILEOA
002142  012777  000001  176762        MOV     #1,@GTPC        ;RESUME THE DISPLAY
002150  000002                        RTI

002152  000000                GTSHIF: HALT                    ;GT-40 SHIFT-OUT/TIME-OUT ERROR
002154  000137  001022                JMP     STARTB
```

```
                                        ;INTERRUPT SERVICE FOR THE DL PRINTER
                                        
002160  105777  176762          DLOUT:  TSTB    @DLOCSR         ;TEST FOR DONE
002164  100403                          BMI     .+10
002166  000000                          HALT                    ;ERROR, PRINTER INTERRUPT BUT NO PRINTER FLAG
002170  000137  001022                  JMP     STARTB          ;RESTART TEST
                                        
002174  010446                          MOV     R4,-(SP)
                                        
002176  013704  002344          DLOUTA: MOV     PPNT,R4                 ;LOAD R4 WITH BYTE POINTER
002202  116437  005334  002350          MOVB    BUFF1(R4),PUNCHR        ;LOAD A CHARACTER TO BE OUTPUTTED
002210  005237  002344                  INC     PPNT                    ;UPDATE CHARACTER POINTER
002214  022737  000050  002344          CMP     #40.,PPNT               ;TEST FOR END
002222  001002                          BNE     DLOUTB
002224  005037  002344                  CLR     PPNT                    ;CLEAR PUNCH POINTER
                                        
002230  113777  002350  176712  DLOUTB: MOVB    PUNCHR,@DLODBR          ;OUTPUT A CHARACTER
002236  012604                          MOV     (SP)+,R4                ;RESTORE R4
002240  000002                          RTI                             ;EXIT
                                        
                                        ;INTERRUPT SERVICE FOR THE DL READER
                                        
002242  105777  176674          DLIN:   TSTB    @DLICSR                 ;TEST FOR DONE
002246  100403                          BMI     .+10
002250  000000                          HALT                            ;NOT DL INPUT FLAG
002252  000137  001022                  JMP     STARTB                  ;RESTART TEST
                                        
002256  010446                          MOV     R4,-(SP)                ;SAVE R4
002260  013704  002346                  MOV     RPNT,R4
002264  117737  176654  002352          MOVB    @DLIDBR,REDCHR          ;READ A CHARACTER
002272  042737  177600  002352          BIC     #177600,REDCHR          ;MASK CHARACTER
002300  113764  002352  005430          MOVB    REDCHR,BUFF2(R4)        ;PUT CHARACTER INTO THE BUFFER
002306  005237  002346                  INC     RPNT                    ;UPDATE READ POINTER
002312  022737  000050  002346          CMP     #40.,RPNT               ;TEST FOR END
002320  001002                          BNE     DLINB
002322  005037  002346                  CLR     RPNT
002326  013704  002346          DLINB:  MOV     RPNT,R4
002332  112764  000177  005430          MOVB    #177,BUFF2(R4)          ;ADD CURSOR
002340  012604                          MOV     (SP)+,R4                ;RESTORE R4
002342  000002                          RTI                             ;EXIT
                                        
002344  000000          PPNT:   0
002346  000000          RPNT:   0
002350  000240          PUNCHR: 240
002352  000240          REDCHR: 240
```

```
                                        ;INTERRUPT SERVICE FOR THE KEYBOARD
002354  105777  176616          KBIN:   TSTB    @TKS            ;TEST FOR DONE
002360  100403                          BMI     .+10
002362  000000                          HALT                    ;NOT KRB INPUT FLAG
002364  000137  001022                  JMP     STARTB          ;RESTART

002370  010346                          MOV     R3,-(SP)        ;SAVE R3
002372  010446                          MOV     R4,-(SP)        ;SAVE R4
002374  013704  002540                  MOV     KPNT,R4
002400  117737  176574  002542          MOVB    @TKB,KBCHR      ;READ CHARACTER
002406  042737  177600  002542          BIC     #177600,KBCHR   ;MASK
002414  113764  002542  005524          MOVB    KBCHR,BUFF3(4)  ;SAVE THE CHAR
002422  005237  002540                  INC     KPNT            ;UPDATE POINTER
002426  022737  000050  002540          CMP     #40.,KPNT       ;TEST FOR END
002434  001002                          BNE     1$
002436  005037  002540                  CLR     KPNT            ;CLEAR POINTER
002442  013704  002540          1$:     MOV     KPNT,R4
002446  112764  000177  005524          MOVB    #177,BUFF3(R4)  ;ADD CURSOR

                                        ;UPDATE OCTAL READOUT

002454  013703  002542                  MOV     KBCHR,R3        ;GET CHAR
002460  004737  002524                  JSR     PC,10$          ;LOAD BITS
002464  110437  005613                  MOVB    R4,OCTA+2       ;SAVE BITS
002470  004737  002516                  JSR     PC,11$          ;MOVE BITS
002474  110437  005612                  MOVB    R4,OCTA+1       ;SAVE BITS
002500  004737  002516                  JSR     PC,11$          ;MOVE BITS
002504  110437  005611                  MOVB    R4,OCTA         ;SAVE BITS
002510  012604                          MOV     (SP)+,R4        ;RESTORE R4
002512  012603                          MOV     (SP)+,R3        ;RESTORE R3
002514  000002                          RTI                     ;EXIT

002516  006003                  11$:    ROR     R3
002520  006003                          ROR     R3
002522  006003                          ROR     R3
002524  010304                  10$:    MOV     R3,R4           ;LOAD R4
002526  042704  177770                  BIC     #177770,R4      ;MASK BITS
002532  062704  000060                  ADD     #60,R4          ;MAKE A NUMBER
002536  000207                          RTS     PC

002540  000000                  KPNT:   0
002542  000240                  KBCHR:  240
```

```
                                        ;PART 1 OF THE BACKGROUND TASK
                                        ;
002544  012737  001000  002722 OVER:    MOV     #1000,PCOUNT    ;SET UP EXECUTION COUNT
                                        ;
                                        ;       COMPARE THE ROM DATA TO THE IMAGE DATA
                                        ;               R0=WORD NUMBER
                                        ;               R1=GOOD DATA
                                        ;               R2=GOOD DATA
                                        ;               R3=BAD ADDRESS
                                        ;               R4=BAD DATA
                                        ;
002552  012700  000000          BACK:   MOV     #0,%0           ;SETUP INITIAL WORD NUMBER
002556  013701  001020                  MOV     IMAGE,%1        ;SET UP BUFFER
002562  013703  001014                  MOV     ROMADD,%3       ;SET UP ROM ADDRESS
002566  011102                  BACK1:  MOV     (%1),%2         ;READ A IMAGE WORD
002570  011304                          MOV     (%3),%4         ;READ A ROM WORD
002572  020204                          CMP     %2,%4           ;TEST FOR EQUAL
002574  001402                          BEQ     BACK2           ;BRANCH IF OK
002576  000000                          HALT                    ;ERROR ROM VALUE FAILED TO EQUAL THE
002600  000772                          BR      BACK1           ; THE EXPECTED
                                        ;
002602  022123                  BACK2:  CMP     (%1)+,(%3)+     ;BUMP BOTH REGISTERS
002604  005200                          INC     %0              ;UPDATE WORD COUNTER
002606  023700  001016                  CMP     WORDS,%0        ;TEST FOR LAST WORD
002612  001365                          BNE     BACK1           ;BRANCK IF NOT LAST
                                        ;
                                        ;PART 2 OF THE BACKGROUND TASK
                                        ; EXECUTE WORSE CASE NOISE TEST THRU MEMORY
                                        ;
002614  004737  017000                  JSR     PC,BUFFER       ;EXECUTE NOISE TEST
002620  005337  002722                  DEC     PCOUNT          ;DONE PASS ?
002624  001352                          BNE     BACK            ;NO
002626  012777  000001  176300          MOV     #1,@GTSR        ;YES RING THE BELL
002634  012777  000207  176342          MOV     #207,@TPB       ;RING THE BELL
002642  105777  176334          1$:     TSTB    @TPS
002646  100375                          BPL     1$
002650  012777  000207  176326          MOV     #207,@TPB
002656  105777  176320          2$:     TSTB    @TPS
002662  100375                          BPL     2$
002664  005737  000042                  TST     @#42            ;TEST LOC. 42
002670  001725                          BEQ     OVER            ;BR IF =0
002672  000005                          RESET
002674  000005                          RESET
002676  000005                          RESET
002700  013700  000042                  MOV     @#42,R0         ;READ VALUE
002704  004710                  LOGICAL:        JSR     PC,(0)
002706  000240                          NOP
002710  000240                          NOP
002712  000240                          NOP
002714  000240                          NOP
002716  000137  001022                  JMP     STARTB


002722  000000          PCOUNT: 0
```

```
                                565
                                566
                                567
002724  114140          FILEDO: POINT!LPON
002726  000000                  0
002730  001377                  MAXY
002732  174300                  STATSB!LPLITE
                                572
                                573          ;LINE THE EDGES OF THE SCREEN
                                574
002734  113004                  LONGV!INT4!LINE0                ;TOP LINE
002736  041777                  INTX!MAXX
002740  000000                  0
002742  110005                  LONGV!LINE1             ;RIGHT LINE
002744  040000                  INTX
002746  021377                  MINUSX!MAXY
002750  110006                  LONGV!LINE2             ;BOTTOM LINE
002752  061777                  INTX!MINUSX!MAXX
002754  000000                  0
002756  110007                  LONGV!LINE3             ;LEFT LINE
002760  040000                  INTX
002762  001377                  MAXY
                                587
                                588          ;SETUP THE X SINEWAVE
                                589
002764  114004                  POINT!LINE0
002766  000400                  400
002770  000200                  200
002772  110000                  LONGV
002774  041200                  INTX+1200                       ;DRAW X AXIS
002776  000000                  0
003000  114000                  POINT
003002  000440                  440
003004  000200                  200
003006  174104          GRPINC: STATSB!INCR+4           ;GRAPHPLOT THE X SINEWAVE
                                600
003010  124000                  GRAPHY
                                602
                                603          ;SETUP THE Y SINEWAVE
                                604
003470  114000                  POINT
003472  000200                  200
003474  000040                  40
003476  110000                  LONGV                   ;DRAW Y AXIS
003500  040000                  INTX
003502  001200                  1200
003504  114000                  POINT
003506  000200                  200
003510  000100                  100
003512  120000                  GRAPHX          ;GRAPHPLOT THE Y SINEWAVE
                                615
                                616
```

```
                                        ;SETUP TO DISPLAY THE OCTAGONS

004172  114030                                POINT
004174  001434                                1434
004176  000724                                724
004200  130030                                RELATV!BLKON
004222  114000                                POINT
004224  001430                                1430
004226  000710                                710
004230  130020                                RELATV!BLKOFF
004252  114020                                POINT
004254  001420                                1420
004256  000660                                660
004260  104030                                SHORTV!BLKON
004302  114000                                POINT
004304  001400                                1400
004306  000600                                600
004310  104020                                SHORTV!BLKOFF
004332  114030                                POINT!BLKON
004334  001360                                1360
004336  000520                                520
004402  114120                                POINT!BLKOFF!LPOFF
004404  001340                                1340
004406  000440                                440

004452  114140                                POINT!LPON
004454  000100                                100
004456  001277                                MAXY-100
004460  164000                                DNOP
004462  170040                                STATSA!ITALO
004464  100000                                CHAR
004562  164000                                DNOP
00[illegible]4  170060                        STATSA!ITAL1
00[illegible]66  114000                       POINT
004570  000100                                100
004572  001247                                MAXY-130
004574  100000                                CHAR
004672  170040                                STATSA!ITALO
004674  114000                                POINT
004676  000220                                220
004700  001177                                MAXY-200
004702  100000                                CHAR
004744  170060                                STATSA!ITAL1
004746  114000                                POINT
004750  000220                                220
004752  001147                                MAXY-230
004754  100000                                CHAR
005016  170040                                STATSA!ITALO
005020  114000                                POINT
005022  000220                                220
005024  001077                                MAXY-300
005026  100000                                CHAR
005072  170060                                STATSA!ITAL1
005074  114000                                POINT
005076  000220                                220
```

```
  673  005100  001047                    MAXY-330
  674  005102  100000                    CHAR
  675  005146  170040                    STATSA!ITALO
  676
  677                                ;SETUP INTENSITY LEVEL TEST
  678  005150  114000                    POINT
  679  005152  000340                    340
  680  005154  001000                    1000
  681  005156  113604                    LONGV!INT7!LINEO
  682  005160  040400                    INTX+400
  683  005162  000000                    0
  684  005164  114000                    POINT
  685  005166  000340                    340
  686  005170  000740                    740
  687  005172  113400                    LONGV!INT6
  688  005174  040400                    INTX+400
  689  005176  000000                    0
  690  005200  114000                    POINT
  691  005202  000340                    340
  692  005204  000700                    700
  693  005206  113200                    LONGV!INT5
  694  005210  040400                    INTX+400
  695  005212  000000                    0
  696  005214  114000                    POINT
  697  005216  000340                    340
  698  005220  000640                    640
  699  005222  113000                    LONGV!INT4
  700  005224  040400                    INTX+400
  701  005226  000000                    0
  702  005230  114000                    POINT
  703  005232  000340                    340
  704  005234  000600                    600
  705  005236  112600                    LONGV!INT3
  706  005240  040400                    INTX+400
  707  005242  000000                    0
  708  005244  114000                    POINT
  709  005246  000340                    340
  710  005250  000540                    540
  711  005252  112400                    LONGV!INT2
  712  005254  040400                    INTX+400
  713  005256  000000                    0
  714  005260  114000                    POINT
  715  005262  000340                    340
  716  005264  000500                    500
  717  005266  112200                    LONGV!INT1
  718  005270  040400                    INTX+400
  719  005272  000000                    0
  720  005274  114000                    POINT
  721  005276  000340                    340
  722  005300  000440                    440
  723  005302  112000                    LONGV!INTO
  724  005304  040400                    INTX+400
  725  005306  000000                    0
  726
  727                                ;SETUP THE MESSAGA BUFFERS
  728
```

```
  729  005310  117000                          POINT!INT4
  730  005312  000400                          400
  731  005314  000020                          20
  732  005316  100000                          CHAR
  733  005320  047503  020115  052517          .ASCII  /COM OUTPUT  /
  734  005326  050124  052125  020040
  735  005334  042504  043503  040522  BUFF1:  .ASCII  /DECGRAPHIC-11 DISPLAY TERMINAL GT40 VR14/
  736  005342  044120  041511  030455
  737  005350  020061  044504  050123
  738  005356  040514  020131  042524
  739  005364  046522  047111  046101
  740  005372  043440  032124  020060
  741  005400  051126  032061
  742  005404  114000                          POINT
  743  005406  000400                          400
  744  005410  000320                          320
  745  005412  100000                          CHAR
  746  005414  047503  027115  044440          .ASCII  /COM. INPUT  /
  747  005422  050116  052125  020040
  748  005430     000     000     000  BUFF2:  .BYTE   0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
  749  005433     000     000     000
  750  005436     000     000     000
  751  005441     000     000     000
  752  005444     000     000     000
  753  005447     000     000     000
  754  005452     000     000
  755  005454     000     000     000          .BYTE   0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
  756  005457     000     000     000
  757  005462     000     000     000
  758  005465     000     000     000
  759  005470     000     000     000
  760  005473     000     000     000
  761  005476     000     000
  762  005500  114000                          POINT
  763  005502  000400                          400
  764  005504  000350                          350
  765  005506  100000                          CHAR
  766  005510  051113  027102  044440          .ASCII  /KRB. INPUT  /
  767  005516  050116  052125  020040
  768  005524     000     000     000  BUFF3:  .BYTE   0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
  769  005527     000     000     000
  770  005532     000     000     000
  771  005535     000     000     000
  772  005540     000     000     000
  773  005543     000     000     000
  774  005546     000     000
  775  005550     000     000     000          .BYTE   0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
  776  005553     000     000     000
  777  005556     000     000     000
  778  005561     000     000     000
  779  005564     000     000     000
  780  005567     000     000     000
  781  005572     000     000
  782
  783  005574  114000                          POINT
  784  005576  000400                          400
```

```
  785  005600  000400                          400
  786  005602  100000                          CHAR
  787  005604  041517  020124      000         .ASCIZ  /OCT /
  788  005611     000     000      000  OCTA:   .BYTE   0,0,0
  789  005614  164000                          DNOP
  790  005616  164000                          DNOP
  791  005620  164000                          DNOP
  792  005622  164000                          DNOP
  793  005624  164000                          DNOP
  794  005626  164000                          DNOP
  795  005630  164000                          DNOP
  796  005632  160000                          DJMP
  797  005634  005664                  FILEOA: FILEOC
  798  005636  114000                  FILEOB: POINT
  799  005640  001000                          1000
  800  005642  000440                          440
  801  005644  100000                          CHAR
  802  005646  044514  044107  026524          .ASCIZ  /LIGHT-PEN HIT/
  803  005654  042520  020116  044510
  804  005662  000124
  805                                          .EVEN
  806  005664  173400                  FILEOC: DSTOP
  807  005666  160000                          DJMP
  808  005670  002724                          FILEOO
  809
```

```
                        ;*********************************************************
                        ;       EXCEPT FOR THE NEW ORGIN ADDRESS AND SEVERAL "!160000"
                        ;       FOR ADDRESS FUDGING THIS IS AN EXACT COPY OF THE CONTENTS
                        ;       OF THE GT-40 BOOTSTRAP VERSION #2
                        ;*********************************************************


                                .TITLE  SCROLLING ROM BOOTSTRAP FOR THE GT40



                        ;                       BOOTGT.T16      OCT 10, 1973



                        ;               COPYRIGHT 1973, DIGITAL EQUIPMENT CORPORATION
                        ;               146 MAIN STREET
                        ;               MAYNARD, MASSACHUSETTS
                        ;                                       01754


                        ;               WRITTEN BY JACK BURNESS.



                        ;               THIS PROGRAM IS THE SECOND VERSION THE THE ROM BOOTSTRAP FOR
                        ;       THE GT40 DISPLAY TERMINAL. IT INCLUDES SCROLLING AND AN END OF
                        ;       MEMORY SEARCH FOR THE LOADER.


                                .ENABL  ABS,AMA                 ;ASSEMBLER DIRECTIVES FOR ABSOLUTE BINARY OUTPUT
                                                                ;  NOTE: USE "MACDLX" TO ASSEMBLE THIS PROGRAM.



                                .SBTTL  DEFINITION SECTION
```

```
                        ;                       REGISTER DEFINITIONS
                        ;                       -------- -----------

                        ;               BASIC DEFINTIONS
                        ;               ----- ----------

000000                          R0=%0                           ;DEFINE STANDARD VALUES.
000001                          R1=%1
000002                          R2=%2
000003                          R3=%3
000004                          R4=%4
000005                          R5=%5
000006                          SP=%6
000007                          PC=%7


                        ;               GT40 DEFINTIONS
                        ;               ---- ----------

000000                          CHAR=R0                         ;CONTAINS THE INPUT CHARACTER.
000001                          POINTR=R1                       ;POINTS TO NEXT INSERTION BYTE IN DISPLAY BUFFER
000002                          TABCNT=R2                       ;CHARACTER COUNTER FOR THE "TAB" FEATURE.
000003                          SCAN=R3                         ;GENERALLY CONTAINS A POINTER WHICH
                                                                ;IS USED WHEN SCANNING MEMORY FOR SOMETHING.
000004                          HOLD=R4                         ;TYPICALLY A TEMPORARY WHICH IS USED TO RETAIN
                                                                ;A VALUE FOR A SHORT TIME.
000005                          COUNTR=R5                       ;TYPICALLY USED AS A COUNTER.


                        ;               LOADER DEFINITIONS
                        ;               ------ -----------


000000                          L.BYT=CHAR                      ;CHARACTER INPUT FOR THE LOADER.
000001                          L.ADR=POINTR                    ;CURRENT MEMORY ADDRESS TO BE LOADED.
000002                          L.BC=TABCNT                     ;NUMBER OF DATA ITEMS TO LOAD.
000005                          L.CKSM=COUNTR                   ;CHECKSUM ON THE INPUT DATA.
000003                          INDEX=SCAN                      ;INDICATES HOW TO ASSEMBLE THE 8 BIT CHARACTER.
```

```
                                ;
                                ;               MAJOR SYSTEM DEFINITIONS
                                ;               ----- ------ -----------


        166000                  ORIGIN=166000                   ;ORIGIN OF THE BOOTSTRAP.

        175610                  DL11IS=175610                   ;INPUT STATUS REGISTER OF DL11
        175612                  DL11IB=DL11IS+2                 ;INPUT CHARACTER FROM DL11
        175614                  DL11OS=DL11IB+2                 ;OUTPUT STATUS OF THE DL11
        175616                  DL11OB=DL11OS+2                 ;OUTPUT CHARACTER TO THE DL11

        177560                  KBDIS=177560                    ;KEYBOARD INPUT STATUS
        177562                  KBDIB=KBDIS+2                   ;CURRENT CHARACTER FROM KEYBOARD.

        172000                  GT40PC=172000                   ;GT40 PROGRAM COUNTER.
        172002                  GT40SR=GT40PC+2                 ;GT40 STATUS REGISTER ADDRESS.


        001000                  BSTART=1000                     ;START OF THE DISPLAY BUFFER
        007000                  BLIMIT=7000                     ;APPROXIMATE END OF THE DISPLAY BUFFER.
        007776                  TMPEND=7776                     ;LOCATION OF INITIALIZATION STACK.
        000004                  CORSTR=4                        ;LOCATION OF PDP-11 TRAP VECTOR.
        007012                  JMPADD=BLIMIT+10.               ;WHERE THE POINTER IS TO FIRST CHAR ON SCREEN
        000040                  NUMLIN=32.                      ;NUMBER OF LINES ON TEXT TO SHOW ON THE SCREEN

        005015                  CRLF=5015                       ;CARRIAGE RETURN - LINE FEED
        000175                  ALTMOD=175                      ;THE "KEY" CHARACTER [I.E. ALTMODE].

        160000                  DISJMP=160000                   ;THE GT40 JMP INSTRUCTION
        173000                  DISTOP=173000                   ;THE GT40 STOP DISPLAY INSTRUCTION.



















                                .SBTTL  INITIALIZATION AND RESTART CODE
```

```
                                ;               GT40 BOOTSTRAP CODE
                                ;               ---- --------- ----

006000                                  .=6000
                                ;       .=ORIGIN                        ;DEFINE ORIGIN OF THE BOOTSTRAP.

                                ;               COLD INITIALIZATION CODE
                                ;               ---- ------------ ----

006000  000005                  START:  RESET                           ;RESET ALL HARDWARE NOW.
006002  012737  000007  175610          MOV     #7,DL11IS               ;INITIALIZE DL-11 INPUT NOW.
006010  012706  007776                  MOV     #TMPEND,SP              ;ESTABLISH A GOOD TEMPORARY STACK
                                                                        ;POINTER FOR CORE SEARCH.
006014  005237  175614                  INC     DL11OS                  ;SET BREAK BIT
006020  004337  166652                  JSR     SCAN,OUTLIT!160000      ;FOR 2 CHARACTER TIMES
006024  000000                          .WORD 0                         ;SEND TWO ZERO'S

006026  012703  000004                  MOV     #CORSTR,SCAN            ;GET ADDRESS OF BAD CORE TRAP VECTOR.
006032  012723  166042                  MOV     #NOTHERE!160000,(SCAN)+ ;AND INSERT A POINTER TO US THERE.

006036  005023                  ENDCOR: CLR     (SCAN)+                 ;NOW CLEAR ALL OF MEMORY BEYOND THE POINTER,
006040  000776                          BR      ENDCOR                  ;UNTIL WE RUN OUT OF MEMORY AND TRAP.

006042  005743                  NOTHER: TST     -(SCAN)                 ;WHEN WE TRAP OUT, WE COME HERE.
                                                                        ;WE BACK UP POINTER TO GOOD CORE.
                                                                        ;NOTE THAT IF WE TRAP OUT AGAIN, IT
                                                                        ;IS STILL OK, BECAUSE WE WILL LOOP
                                                                        ;UNTIL WE GET A GOOD CORE ADDRESS.
006044  010306                          MOV     SCAN,SP                 ;WHEN WE GET ONE, THAT IS LAST LOCATION
                                                                        ;IN THE MACHINE, AND HENCE OUR SP.
006046  105737  175614          1$:     TSTB    DL11OS                  ;SEE IF BREAK IS DONE
006052  100375                          BPL     1$                      ;NO GO BACK
006054  005037  175614                  CLR     DL11OS                  ;CLEAR BREAK BIT

                                ;               RESTART INITIALIZATION CODE WHEN COMMUNICATIONS IS WORKING.
                                ;               ------- ------------ ---- ---- ------------- -- --------
```

```
1024
1025
1026
1027  006060  052706  007776          RESTRT: BIS     #TMPEND,SP              ;FORCE THE SP TO LIMIT OF EXISTING CORE.
1028
1029
1030  006064  012703  006700                  MOV     #BLIMIT-NUMLIN-NUMLIN,SCAN      ;NOW WE WILL FILL THE KEY AREAS OF THE
1031  006070  012702  000040                  MOV     #NUMLIN,TABCNT          ;DISPLAY BUFFER WITH INITIAL CR-LF'S.
1032
1033  006074  012723  005015          SETLP1: MOV     #CRLF,(SCAN)+           ;INSERT A CRLF NOW.
1034  006100  005302                          DEC     TABCNT                  ;AND LOOP UNTIL DONE.
1035  006102  003374                          BGT     SETLP1                  ;THUS DISPLAY CORE IS ALMOST CORRECT.
1036
1037
1038  006104  012703  166432                  MOV     #SETUP!160000,SCAN                      ;NOW WE WILL INITALIZE CORE FOR THE
1039                                                                          ;DISPLAY. PICK UP POINTER TO LIST.
1040
1041  006110  012302          SETLP2: MOV     (SCAN)+,TABCNT          ;GET NUMBER OF ITEMS TO INSERT.
1042  006112  001405                  BEQ     SETDUN                  ;IF ZERO, WE ARE DONE.
1043  006114  012301                  MOV     (SCAN)+,POINTR          ;PICK UP FIRST CORE ADDRESS POINTER.
1044
1045  006116  012321          SETLP3: MOV     (SCAN)+,(POINTR)+       ;MOVE OVER A DATA ITEM NOW.
1046  006120  005302                  DEC     TABCNT                  ;ALL DONE?
1047  006122  003375                  BGT     SETLP3                  ;NOPE. MOVE OVER THE NEXT.
1048  006124  000771                  BR      SETLP2                  ;YES. GET NEXT MAJOR LIST TO INSERT.
1049
1050
1051  006126  012701  006776  SETDUN: MOV     #BLIMIT-2,POINTR        ;ESTABLISH THE BUFFER POINTER NOW.
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063                                  .SBTTL  VTOS SIMULATOR
```

```
1064
1065
1066
1067                                    ;               VTOS (SCROLLING) PORTION OF THE BOOTSTRAP
1068                                    ;               ---- --------- ------- -- --- ---------
1069
1070
1071
1072  006132  004737  166564  NXTCHR: JSR     PC,GETCHR!160000                ;GET A CHARACTER NOW.
1073  006136  020027  000177          CMP     CHAR,#177               ;IS IT OUT OF RANGE?
1074  006142  002373                  BGE     NXTCHR                  ;YEP. GET ANOTHER ONE.
1075  006144  020027  000040          CMP     CHAR,#40                ;IS IT A PRINTING CHARACTER?
1076  006150  002020                  BGE     NORMAL                  ;YES. IT'S A NORMAL PRINTING CHARACTER.
1077  006152  010003                  MOV     CHAR,SCAN               ;MOVE IT OVER SO WE CAN PLAY WITH IT.
1078  006154  162703  000007          SUB     #7,SCAN                 ;BIAS SO THAT BELL (7) IS ZERO.
1079  006160  020327  000007          CMP     SCAN,#7                 ;IF CHARACTER IS LESS THEN BELL OR
1080  006164  103362                  BHIS    NXTCHR                  ;GREATER THEN CR, THEN IGNORE.
1081  006166  006303                  ASL     SCAN                    ;IF GOOD, MAKE IT WORD INDEX.
1082  006170  060307                  ADD     SCAN,PC                 ;AND GO TO THE CORRECT ROUTINE.
1083
1084  006172  000426                  BR      BELL                    ;7=BELL
1085  006174  000406                  BR      NORMAL                  ;10=BACKSPACE
1086  006176  000411                  BR      TAB                     ;11=TAB
1087  006200  000437                  BR      LF                      ;12=LINE FEED (LF)
1088  006202  000420                  BR      VT                      ;13=VERTICAL TAB (VT)
1089  006204  000424                  BR      FF                      ;14=FORM FEED (FF)
1090                                                                   ;15=CARRIAGE RETURN (CR)
1091
1092
1093  006206  012702  177777  CR:     MOV     #-1,TABCNT              ;RESET TAB POSITION ON A CR, AND
1094                                                                   ;FALL THROUGH TO INSERT THE CHARACTER.
1095
1096
1097  006212  004737  166350  NORMAL: JSR     PC,INSERT!160000                ;INSERT THE CHARACTER IN THE BUFFER.
1098  006216  005202                  INC     TABCNT                  ;UPDATE TAB POSITION NOW.
1099  006220  000744                  BR      NXTCHR                  ;AND GET NEXT CHARACTER.
1100
1101
1102
1103
1104  006222  012700  000040  TAB:    MOV     #40,CHAR                ;ON A TAB, INSERT BLANKS UNTIL THE
1105  006226  004737  166350          JSR     PC,INSERT!160000                ;NEXT CHARACTER POSITION IS A MULTIPLE
1106  006232  005202                  INC     TABCNT                  ;OF 8.
1107  006234  032702  000007          BIT     #7,TABCNT               ;ARE WE DONE YET?
1108  006240  001370                  BNE     TAB                     ;NOPE.
1109  006242  000733                  BR      NXTCHR                  ;YES.
1110
1111
1112  006244  111705          VT:     MOVB    (PC),COUNTR             ;THIS PUTS THE LOW BYTE OF THE
1113                                                                   ;BRANCH CODE IN COUNTR-SAVE A WORD
1114  006246  000405                  BR      FFLOOP
1115                                                                   ;
1116  006250  005037  172002  BELL:   CLR     GT40SR                  ;RING BELL -WRITE IN GT40SR
1117  006254  000726                  BR      NXTCHR                  ;AND LOOP BACK
1118
1119  006256  012705  000040  FF:     MOV     #NUMLIN,COUNTR          ;FORM FEED IS DONE BY INSERTING LF'S.
```

```
1120
1121  006262  012700  000012          FFLOOP: MOV     #12,CHAR                ;MAKE THE CHARACTER A LINEFEED.
1122  006266  004737  166304                  JSR     PC,LFSUB!160000         ;DO A LINEFEED.
1123  006272  005305                         DEC     COUNTR                  ;DONE?
1124  006274  003372                         BGT     FFLOOP                  ;NOPE. KEEP SENDING THEM.
1125  006276  000715                         BR      NXTCHR                  ;YES. NOW RETURN. DO NOT FALL THROUGH.
1126
1127
1128  006300  012746  166132          LF:     MOV     #NXTCHR!160000,-(SP)            ;RETURN TO NXTCHR AFTER PROCESSING
1129                                                                          ;THE LF BY FAKING A JSR.
1130
1131  006304  013703  007012          LFSUB:  MOV     JMPADD,SCAN             ;GET POINTER TO FIRST CHAR ON SCREEN
1132
1133  006310  122300                  LFLOOP: CMPB    (SCAN)+,CHAR            ;AND LOOK FOR A LINEFEED.
1134  006312  001406                          BEQ     LFOUND                  ;GOT IT. SEARCH HAS ENDED.
1135  006314  020327  007000                  CMP     SCAN,#BLIMIT            ;PRE WE AT END OF BUFFER?
1136  006320  103773                          BLO     LFLOOP                  ;NOPE. KEEP ON LOOKING.
1137  006322  012703  001000                  MOV     #BSTART,SCAN            ;IF AT TOP, RESET TO BOTTOM OF BUFFER
1138  006326  000770                          BR      LFLOOP                  ;AND KEEP ON LOOKING.
1139
1140  006330  005203                  LFOUND: INC     SCAN                    ;WE'VE GOT THE LINE FEED. STOP SHOWING
1141  006332  042703  000001                  BIC     #1,SCAN                 ;FIRST LINE BY CHANGING THE "DISJMP"
1142  006336  010337  007012                  MOV     SCAN,JMPADD             ;INSTRUCTION TO FIRST CHAR BEYOND LF.
1143  006342  004737  166350                  JSR     PC,INSERT!160000                ;INSERT THE LF IN THE BUFFER.
1144  006346  005000                          CLR     CHAR                    ;AND THEN INSERT ONE NULL CHARACTER BECAUSE
1145                                                                          ;THE "DISJMP" ADDRESS MUST BE EVEN, AND
1146                                                                          ;THIS GUARANTEES WE WILL NOT LOSE A
1147                                                                          ;A GOOD DATA CHARACTER. WE FALL THROUGH
1148                                                                          ;TO INSERT THE NULL IN THE BUFFER.
1149
1150
1151  006350  110021                  INSERT: MOVB    CHAR,(POINTR)+          ;STICK IN THE CHARACTER NOW.
1152  006352  032701  000001                  BIT     #1,POINTR               ;IS NEXT POSITION EVEN OR ODD?
1153  006356  001021                          BNE     INSRTX                  ;ODD. NO PROBLEMS. SPACE IS ALLOCATED.
1154  006360  020127  007000                  CMP     POINTR,#BLIMIT          ;EVEN. ARE WE AT THE END OF THE BUFFER?
1155  006364  103410                          BLO     INSRTL                  ;NO. JUST MAKE ROOM FOR ANOTHER WORD.
1156  006366  010103                          MOV     POINTR,SCAN             ;AT THE END. MOVE THE STUFF TO THE
1157  006370  012701  001000                  MOV     #BSTART,POINTR          ;BEGINNING OF THE BUFFER.
1158  006374  004737  166406                  JSR     PC,INSRTL!160000                ;CALL THE ROUTINE TO SAVE SPACE.
1159  006400  005023                          CLR     (SCAN)+                 ;AND CLEAR UP THE INSTRUCTIONS AT THE
1160  006402  005013                          CLR     (SCAN)                  ;END OF THE BUFFER.
1161  006404  000207                          RTS     PC                      ;AND THEN RETURN.
1162
1163  006406  022121                  INSRTL: CMP     (POINTR)+,(POINTR)+     ;BYPASS THE "DISJMP" BY ADDING 4 TO POINTR.
1164  006410  012711  166474                  MOV     #HEADER!160000,(POINTR) ;NOW INSERT THE DISJMP INSTRUCTION TO OUR HEADER
1165  006414  012741  160000                  MOV     #DISJMP,-(POINTR)       ;AND IT'S ADDRESS (PUT THEM IN BACKWARDS).
1166  006420  005041                          CLR     -(POINTR)               ;MAKE AVAILABLE A NEW CHARACTER SPOT.
1167
1168  006422  000207                  INSRTX: RTS     PC                      ;FINALLY RETURN T' THE CALLER.
1169
1170
1171
1172
1173
1174  006424  012737  001000  172000  GTBUSE: MOV     #BSTART,GT40PC          ;ON A BUS ERROR, WE MERELY RESTART THE GT40 AT
1175
```

```
1176                                                    ;THE RTI FOR THIS ROUTINE
1177                                                    ;IS THE FIRST WORD OF THE TABLE
1178                                                    ;BELOW-IT SAVES A WORD!
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190                            ;               INITIALIZATION TABLE FOR THE SCROLLER
1191                            ;               ---------- ----- --- --- --------
1192
1193
1194
1195  006432  000002            SETUP:  .WORD   2                       ;INITIALIZE 2 WORDS.--ALSO RTI FROM ABOVE
1196  006434  000330                    .WORD   330                     ;STARTING AT LOCATION 330
1197  006436  166424                    .WORD   GTBUSE!160000                   ;FIRST WORD IS POINTER TO BUS ERROR ROUT
1198  006440  000200                    .WORD   200                     ;SECOND WORD IS NEW STATUS WORD ON INTERUPT.
1199
1200  006442  000007                    .WORD   7                       ;INITIALIZE THE END OF THE BUFFER TO
1201  006444  006776                    .WORD   BLIMIT-2                ;A CLEAR SPACE TO INSERT THE CHARACTER.
1202  006446  000000                    .WORD   0                       ;THIS IS THE "RUNNING" START, THIS IS
1203  006450  160000  166474            .WORD   DISJMP,HEADER!160000            ;FOLLOWED BY A DISJMP TO OUR HEADER BLOC
1204  006454  160000  001000            .WORD   DISJMP,BSTART           ;AND THEN A DISJMP TO THE START OF THE BUFFER
1205  006460  160000  006700            .WORD   DISJMP,BLIMIT-NUMLIN-NUMLIN     ;AND A DISJMP TO THE FIRST CHAR ON SCREE
1206
1207  006464  000001                    .WORD   1                       ;FINALLY START THE GT40 GOING AT
1208  006466  172000                    .WORD   GT40PC                  ;THE POSITION INSTRUCTION IN THE
1209  006470  166474                    .WORD   HEADER!160000                   ;HEADER BLOCK.
1210
1211  006472  000000                    .WORD   0                       ;END OF INIT CODE
1212
1213                            ;               HEADER BLOCK FOR THE SCROLLER
1214
1215  006474  103334            HEADER: .WORD   103334                  ;ENAB. CHAR MODE,BLINKING
1216  006476  000177                    .WORD   177                     ;A BLINKING BOX-RUB OUT!
1217  006500  116124                    .WORD   116124                  ;SET TO POINT MODE
1218  006502  171340                    .WORD   171340                  ;LOAD STATUS REGISTER
1219  006504  000000  001352            .WORD   0,1352                  ;POINT TO UPPER LEFT
1220  006510  103324                    .WORD   103324                  ;BACK TO CHAR MODE
1221  006512  160000  007010            .WORD   DISJMP,JMPADD-2         ;AND TO THE CHANGING JMP INST.
1222
1223                                    .SBTTL  COMMUNICATIONS AND MISC. SUPPORT ROUTINES
```

```
1224
1225
1226
1227                                    ;                   COMMUNICATIONS HANDLING ROUTINES
1228                                    ;                   ------------- -------- --------
1229
1230
1231
1232
1233
1234
1235                                    ;                   THE DL-11 HANDLER
1236                                    ;                   --- ----- -------
1237
1238
1239
1240  006516  105737  175610          GETDL:  TSTB    DL11IS          ;CHECK THE HOST INPUT STATUS.
1241  006522  100011                          BPL     GETDL1          ;HOST DID NOT SEND ANYTHING, YET.
1242  006524  113700  175612                  MOVB    DL11IB,CHAR     ;HOST SENT US A CHARACTER. PROCESS IT.
1243  006530  012737  000007  175610          MOV     #7,DL11IS       ;REENABLE THE HOST TELECOMMUNICATIONS.
1244  006536  042700  177600                  BIC     #-200,CHAR      ;MAKE CHARACTER JUST SEVEN BITS.
1245  006542  001765                          BEQ     GETDL           ;IF NULL, IGNORE IT.
1246  006544  000207                          RTS     PC              ;ELSE RETURN NOW.
1247
1248  006546  105737  177560          GETDL1: TSTB    KBDIS           ;DID USER TYPE A CHARACTER?
1249  006552  100361                          BPL     GETDL           ;NO. GO BACK AND CHECK HOST MACHINE.
1250  006554  113737  177562  175616          MOVB    KBDIB,DL11OB    ;MOVE THE CHARACTER TO THE HOST.
1251  006562  000755                          BR      GETDL           ;AND CHECK AGAIN FOR INPUT.
1252
1253
1254
1255
1256
1257                                    ;                   THE "GET CHARACTER" ROUTINE
1258                                    ;                   --- --- --------- -------
1259
1260
1261
1262  006564  004737  166516          GETCHR: JSR     PC,GETDL!160C00 ;GET A CHARACTER FROM THE HOST NOW.
1263  006570  020027  000175                  CMP     CHAR,#ALTMOD    ;IS IT AN "ALTMODE"
1264  006574  001025                          BNE     GETEXT          ;NO. EXIT NOW.
1265
1266  006576  004737  166516                  JSR     PC,GETDL!160000 ;YES. GET ANOTHER ONE NOW.
1267  006602  020027  000114                  CMP     CHAR,#'L        ;IS IT AN "L"
1268  006606  001501                          BEQ     LOADER          ;YES. START LOADING NOW.
1269  006610  020027  000122                  CMP     CHAR,#'R        ;IS IT AN "R"
1270  006614  001015                          BNE     GETEXT          ;NO. IGNORE THE ALTMODE AND JUST RETURN THE CHAR
1271
1272  006616  012737  173000  007010          MOV     #DISTOP,JMPADD-2 ;YES. RESET. STOP DISPLAY BY INSERTING A "DISTOP
1273  006624  000137  166060          PRESTR: JMP     RESTRT!160000           ;INSTRUCTION IN THE BUFFER, AND RESTART.
1274
1275
1276
1277
1278
1279                                    ;                   THE "GET A SIX BIT CHARACTER" ROUTINE
```

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1280                                    ;               --- --- - --- --- ---------  -------
1281
1282
1283
1284  006630  004737  166564    GETSIX: JSR     PC,GETCHR!160000                ;GET A CHARACTER NOW.
1285  006634  020027  000040            CMP     CHAR,#40                ;IS IT A LEGAL PRINTING CHARACTER?
1286  006640  002517                    BLT     L.BAD                   ;NOPE. ABORT
1287  006642  020027  000137            CMP     CHAR,#137               ;IT'S BIG ENOUGH. IS IT TOO BIG?
1288  006646  003114                    BGT     L.BAD                   ;YEP. ABORT.
1289
1290  006650  000207            GETEXT: RTS     PC                      ;RETURN TO THE CALLER.
1291
1292
1293                                    ;               THIS OUTPUTS TWO CHARACTERS VIA A
1294                                    ;               JSR SCAN,OUTLIT
1295                                    ;               'TWO CHARACTERS'
1296
1297  006652  112337  175616    OUTLIT: MOVB    (SCAN)+,DL1108
1298  006656  112337  175616            MOVB    (SCAN)+,DL1108          ;DOUBLE BUFFERED
1299  006662  000203                    RTS     SCAN                    ;RETURN
1300
1301
1302
1303
1304
1305
1306
1307                                    ;               THE "GET AN EIGHT BIT CHARACTER" ROUTINE
1308                                    ;               --- --- -- ----- --- ---------  -------
1309
1310
1311
1312                                    ;                       THIS ROUTINE DIFFERS FROM THE PREVIOUS ROUTINES
1313                                    ;               IN THAT IT WILL TAKE SIX BIT CHARACTERS AND ASSEMBLE
1314                                    ;               THEM FOR THE LOADER TO USE. NOTE THAT FROM THIS POINT
1315                                    ;               ON WE WILL SWITCH TO THE LOADER DEFINITIONS OF THE
1316                                    ;               REGISTERS. THUS THE CHARACTER IS RETURNED IN
1317                                    ;               REGISTER "L.BYT" RATHER THAN CHAR (THOUGH THEY ARE
1318                                    ;               PHYSICALLY THE SAME).
1319
1320
1321
1322  006664  004737  166630    GETB:   JSR     PC,GETSIX!160000                ;GET A SIXBIT CHARACTER.
1323  006670  010046                    MOV     L.BYT,-(SP)             ;SAVE IT ON THE STACK.
1324  006672  005723                    TST     (INDEX)+                ;UPDATE INDEX TO NEXT ITEM (ALL ARE #2)
1325  006674  000163  166676            JMP     GETBTB-2!160000(INDEX)          ;AND DISPATCH ACCORDING TO THE INDEX.
1326
1327  006700  000404            GETBTB: BR      GETB1                   ;INDEX=2: ASSEMBLE FIRST CHAR
1328  006702  000416                    BR      GETB2                   ;INDEX=4: ASSEMBLE SECOND CHAR
1329  006704  000432                    BR      GETB3                   ;INDEX=6: ASSEMBLE THIRD AND LAST CHAR
1330                                                                    ;INDEX=8: RESET INDEX TO 0 [2] AND RETRY.
1331
1332
1333  006706  012703  000002    GETB4:  MOV     #2,INDEX                ;THE FOURTH INDEX IS THE SAME AS THE FIRST
1334                                                                    ;INDEX. JUST RESET IT AND FALL THROUGH.
1335
```

```
1336
1337  006712  004737  166630        GET81:  JSR     PC,GETSIX!160000        ;GET ANO ER CHARACTER NOW.
1338  006716  010004                        MOV     L.BYT,HOLD              ;AND PRESERVE IT FOR NEXT TIME THROUGH.
1339  006720  006300                        ASL     L.BYT                   ;NOW THROW AWAY LEFT MOST BITS OF
1340  006722  006300                        ASL     L.BYT                   ;THE 8 BIT CHARACTER. NOW MERGE IN
1341  006724  106300                        ASLB    L.BYT                   ;THE LEFT TWO BITS OF THE
1342  006726  106116                        ROLB    (SP)                    ;NEW SIX BIT CHARACTER WITH THE SIX
1343  006730  106300                        ASLB    L.BYT                   ;BITS FROM THE CHARACTER ON THE
1344  006732  106116                        ROLB    (SP)                    ;STACK, 1ST CHARACTER IS NOW ASSEMBLED,
1345  006734  012600                        MOV     (SP)+,L.BYT             ;SO WE'LL RETURN IT TO THE USER.
1346  006736  000207                        RTS     PC                      ;AND THEN WE SHALL RETURN TO HIM.
1347
1348
1349  006740  006300        GET82:  ASL     L.BYT                   ;THE SECOND CHARACTER IS CREATED FROM
1350  006742  006300                        ASL     L.BYT                   ;THE 4 RIGHT BITS OF THE PREVIOUS CHARACTER
1351  006744  106300                        ASLB    L.BYT                   ;AND THE FOUR MIDDLE BITS OF THE PRESENT
1352  006746  106104                        ROLB    HOLD                    ;8 BIT CHARACTER.
1353  006750  106300                        ASLB    L.BYT                   ;WE WILL CREATE THE NEW 8 BIT
1354  006752  106104                        ROLB    HOLD                    ;IN THIS REGISTER, SINCE IT
1355  006754  106300                        ASLB    L.BYT                   ;MORE CONVIENT. WE WILL MOVE OVER THE
1356  006756  106104                        ROLB    HOLD                    ;ANSWER AT THE END.
1357  006760  106300                        ASLB    L.BYT                   ;ONE MORE TO GO
1358  006762  106104                        ROLB    HOLD                    ;DONE.
1359  006764  010400                        MOV     HOLD,L.BYT              ;BRING OVER THE VALUE.
1360  006766  012604                        MOV     (SP)+,HOLD              ;AND REMEMBER THE LAST CHARACTER WE RECEIVED.
1361  006770  000207                        RTS     PC                      ;AND RETURN TO THE CALLER.
1362
1363
1364  [illegible]  006100        GET83:  ROL     L.BYT                   ;FINAL CHARACTER IS EASY. JUST A
1365  [illegible]  106100                ROLB    L.BYT                   ;SIMPLE MERGER OF LEFT TWO BITS OF
1366  [illegible]  006004                ROR     HOLD                    ;PREVIOUS VALUE WITH RIGHT SIX BITS
1367  007000       106000                RORB    L.BYT                   ;OF LAST (4TH) CHARACTER RECEIVED.
1368  007002       006004                ROR     HOLD
1369  007004       106000                RORB    L.BYT                   ;AND WE ARE DONE.
1370  007006       005726                TST     (SP)+                   ;FINALLY THROW AWAY STACK.
1371  007010       000207                RTS     PC                      ;AND RETURN TO THE CALLER.
1372
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1381
1382
1383
1384                               .SBTTL  THE LOADER
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                                        ;               THE LOADER
                                        ;               --- ------
007012  012737  173000  007010  LOADER: MOV     #DISTOP,JMPADD-2        ;STOP THE GT40 BY INSERTING A "DISTOP" IN THE LI
007020  005003                          CLR     INDEX                   ;RESET THE 8 BIT ASSEMBLER TO THE FIRST CHAR
007022  005005                  L.LD2:  CLR     L.CKSM                  ;CLEAR THE CHECKSUM
007024  004737  167114                  JSR     PC,L.PTR!160000         ;GET A BYTE NOW.
007030  105300                          DECB    L.BYT                   ;IS IT A ONE (HEADER)?
007032  001373                          BNE     L.LD2                   ;NO. WAIT FOR THE ONE.
007034  004737  167114                  JSR     PC,L.PTR!160000         ;YES. SKIP OVER THE NEXT CHARACTER NOW.
007040  004737  167126                  JSR     PC,L.GWRD!160000                ;ASSEMBLE A WORD NOW.
007044  010002                          MOV     L.BYT,L.BC              ;MOVE OVER TO THE COUNTER.
007046  162702  000004                  SUB     #4,L.BC                 ;REDUCE TO ACTUAL DATA COUNT.
007052  022702  000002                  CMP     #2,L.BC                 ;ANY DATA AT ALL?
007056  001433                          BEQ     L.JMP                   ;NO. MUST BE END
007060  004737  167126                  JSR     PC,L.GWRD!160000                ;YES. ASSEMBLE A DATA WORD NOW.
007064  010001                          MOV     L.BYT,L.ADR             ;AND THIS MUST BE THE FIRST ADDRESS.

007066  004737  167114          L.LD3:  JSR     PC,L.PTR!160000         ;GET A BYTE OF DATA NOW.
007072  002006                          BGE     L.LD4                   ;ALL DONE?
007074  105705                          TSTB    L.CKSM                  ;YEP. COUNTER IS MINUS. CHECK CHECKSUM.
007076  001751                          BEQ     L.LD2                   ;CHECKSUM GOOD. GET NEXT COMMAND.

007100  004337  166652          L.BAD:  JSR     SCAN,OUTLIT!160000      ;BAD LOAD INFORM HOST
007104     175     102                  .BYTE   ALTMOD,'B               ;SEND ALTMODE B
007106  000646                          BR      PRESTRT                 ;AND RESTART THE DISPLAY.

007110  110021          L.LD4:  MOVB    L.BYT,(L.ADR)+          ;INSERT BYTE INTO MEMORY.
007112  000765                  BR      L.LD3                   ;AND GET THE NEXT BYTE.

007114  004737  166664  L.PTR:  JSR     PC,GET8!160000                  ;ASSEMBLE AN 8 BIT CHARACTER NOW.
007120  060005                  ADD     L.BYT,L.CKSM            ;UPDATE THE CHECKSUM NOW.
007122  005302                  DEC     L.BC                    ;DECREMENT THE CHARACTER COUNTER.
007124  000207                  RTS     PC                      ;AND RETURN TO THE CALLER NOW.

007126  004737  167114  L.GWRD: JSR     PC,L.PTR!160000         ;ASSEMBLE A WORD. FIRST GET A CHARACTER
007132  010046                  MOV     L.BYT,-(SP)             ;AND SAVE IT.
007134  004737  167114          JSR     PC,L.PTR!160000         ;AND THEN GET ANOTHER ONE.
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1441  007140  000300                        SWAB    L.BYT                   ;AND THEN REASSEMBLE THE MESS.
1442  007142  052600                        BIS     (SP)+,L.BYT             ;WITH THE FEARSOME POWER OF THE 11.
1443  007144  000207                        RTS     PC                      ;AND RETURN TO THE CALLER.
1444
1445
1446
1447
1448  007146  004737  167126      L.JMP:  JSR     PC,L.GWRD!160000                ;ALL DONE WITH THE LOAD. ASSEMBLE
1449  007152  010046                        MOV     L.BYT,-(SP)             ;THE STARTING ADDRESS NOW.
1450  007154  004737  167114                JSR     PC,L.PTR!160000         ;AND DON'T FORGET TO CHECKSUM IT.
1451  007160  105705                        TSTB    L.CKSM
1452  007162  001346                        BNE     L.BAD                   ;A BAD CHECKSUM. ALL IS EVIL.
1453
1454  007164  004337  166652                JSR     SCAN,OUTLIT!160000              ;GOOD CHKSUM,INFORM HOST
1455  007170     175     107                .BYTE   ALTMOD,'G               ;WITH ALTMOD G
1456
1457  007172  032716  000001                BIT     #1,(SP)                 ;DO WE WANT TO START EXECUTION?
1458  007176  001401                        BEQ     L.JMP1                  ;YES. AWAY WE GO.
1459
1460  007200  000000      L.HALT: HALT                                    ;IF NOT, HALT.
1461
1462  007202  000136      L.JMP1: JMP     @(SP)+                          ;IF GO, THEN GO ALREADY. WHEEEE!
1463
1464
1465
1466                              .SBTTL  THE SELF TEST
1467
1468
1469
1470
1471
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1479                                                    ;THIS IS GT40 QUICK TEST
1480                                                            ;GIVES QUICK VISUAL TEST
1481                                                            ;OF CONDITION OF MACHINE
1482                                                            ;WITHOUT READING IN DIAG.
1483            100000          CHAR=100000
1484            104000          SHORTV=104000
1485            110000          LONGV=110000
1486            114000          POINT=114000
1487            120000          GRAPHX=120000
1488            124000          GRAPHY=124000
1489            130000          RELATV=130000
1490
1491            002000          INT0=2000
1492            002200          INT1=2200
1493            002400          INT2=2400
1494            002600          INT3=2600
1495            003000          INT4=3000
1496            003200          INT5=3200
1497            003400          INT6=3400
1498            003600          INT7=3600                       ;BRIGHTEST
1499
1500            000100          LPOFF=100
1501            000140          LPON=140
1502            000020          BLKOFF=20
1503            000030          BLKON=30
1504
1505            000004          LINE0=4
1506            000005          LINE1=5
1507            000006          LINE2=6
1508            000007          LINE3=7
1509
1510            160000          DJMP=160000
1511            164000          DNOP=164000
1512            170000          STATSA=170000
1513            173400          DSTOP=173400                    ;STOP INTERRUPT
1514
1515            000300          LPLITE=300
1516            000200          LPDARK=200
1517            000040          ITAL0=40                        ;ITALICS OFF
1518            000060          ITAL1=60                        ;"       ON
1519            000004          SYNON=4                         ;SYNC ON
1520
1521
1522            174000          STATSB=174000
1523
1524            000100          INCR=100                        ;LOAD GRAPH INCR
1525            040000          INTX=40000                      ;INTENSIFY BIT
1526            001777          MAXX=1777                       ;BIGGEST X VECTOR
1527            001377          MAXY=1377                       ;BIGGEST Y VECTOR
1528            020000          MINUSX=20000                    ;THE MINUS BIT
1529            020000          MINUSY=MINUSX
1530            017600          MAXSX=17600                     ;BIGGEST X IN SHORTVEC
1531            000077          MAXSY=77                        ;"       Y IN  "
1532            000100          MINSUY=100                      ;MINUS BIT FOR Y IN SHORTVEC
1533
1534
```

```
1535  007204  012737  167214  172000          MOV     #FILE0!160000,GT40PC            ;START THE GT40
1536  007212  000001                          WAIT                                    ;AND WAIT
1537
1538  007214  114020                  FILE0:  POINT!BLKOFF                            ;POINT--INVISIBLE
1539  007216  000000                          0
1540  007220  001377                          MAXY
1541
1542  007222  112004                          LONGV!INT0!LINE0                        ;DRAW TOP LINE
1543  007224  041777                          INTX!MAXX
1544  007226  000000                          0
1545
1546  007230  112405                          LONGV!INT2!LINE1
1547  007232  040000                          INTX                                    ;DRAW LINE TO RIGHT
1548  007234  021377                          MINUSX!MAXY
1549
1550  007236  113006                          LONGV!INT4!LINE2
1551  007240  061777                          INTX!MINUSX!MAXX                        ;DRAW BOTTOM LINE
1552  007242  000000                          0
1553
1554  007244  113407                          LONGV!INT6!LINE3
1555  007246  040000                          INTX
1556  007250  001377                          MAXY                                    ;DRAW LINE TO LEFT
1557
1558  007252  114000                          POINT
1559  007254  000400                          400
1560  007256  000500                          500
1561  007260  106200                          SHORTV!INT1
1562  007262  057677                          57677                                   ;+X+Y
1563  007264  106600                          SHORTV!INT3
1564  007266  077677                          77677                                   ;+X-Y
1565  007270  107200                          SHORTV!INT5
1566  007272  077777                          77777                                   ;-X-Y
1567  007274  107600                          SHORTV!INT7
1568  007276  057777                          57777                                   ;-X+Y
1569
1570  007300  114000                          POINT
1571  007302  001400                          1400
1572  007304  000500                          500
1573  007306  133030                          RELATV!INT4!BLKON
1574  007310  057677                          57677                                   ;+X+Y
1575  007312  077677                          77677                                   ;+X-Y
1576  007314  077777                          77777                                   ;-X-Y
1577  007316  057777                          57777                                   ;-X+Y
1578
1579  007320  114000                          POINT
1580  007322  000400                          400
1581  007324  000100                          100
1582  007326  174120                          STATSB!INCR+20                          ;TRY GRAPH MODES
1583  007330  114000                          POINT
1584  007332  001000                          1000
1585  007334  000200                          200
1586
1587  007336  120000                          GRAPHX
1588  007340  001010                          1010
1589  007342  001020                          1020
1590  007344  001030                          1030
```

```
1591  007346  001040                          1040
1592  007350  001050                          1050
1593
1594  007352  114000                          POINT
1595  007354  001000                          1000
1596  007356  001200                          1200
1597
1598  007360  124000                          GRAPHY
1599  007362  001020                          1020
1600  007364  001030                          1030
1601  007366  001040                          1040
1602  007370  001050                          1050
1603  007372  001060                          1060
1604
1605  007374  160000                          DJMP
1606  007376  167214                          FILEO!160000
1607
1608                                          .SBTTL  PAPER TAPE BOOT
```

```
1609                                    ;
1610                                    ; PAPER TAPE BOOT
1611                                    ;
1612            177550                  HSR=177550                      ;HIGH SPEED READER ADDRESS
1613            177560                  LSR=177560                      ;LOW SPEED READER ADDRESS
1614                                    ;       .=ORIGIN+1400
1615                                    ;
1616  007400  012701  160000            PTBOOT: MOV     #160000,R1      ;SET MEMORY CHECK LIMITS
1617  007404  012702  000004                    MOV     #4,R2           ;TRAP ADDRESS IS LOC. 4
1618  007410  012703  167500                    MOV     #DEV+4!160000,R3        ;POINTER TO DEVICE ADDRESSES
1619  007414  010712                            MOV     PC,@R2          ;PRESET TRAP ADDRESS IN LOC. 4
1620  007416  012706  000024                    MOV     #24,SP          ;STACK SET UP AT SPECIAL ADDRESS
1621  007422  014304                    DEV1:   MOV     -(R3),R4        ;GET DEVICE ADDRESS
1622  007424  005714                            TST     @R4             ;CHECK AVAILABILITY OF DEVICE
1623  007426  100775                            BMI     DEV1            ;CHECK DEVICE FOR ERRORS
1624  007430  010712                            MOV     PC,@R2          ;RESET TRAP ADDRESS AT LOC. 4
1625  007432  012706  000024                    MOV     #24,SP          ;SPECIAL ADDRESS USED AS MASK LATER
1626  007436  010441                            MOV     R4,-(R1)        ;DO MEM CHK:READER STATUS ADDRESS
1627                                                                    ;IS MOVED
1628  007440  040601                            BIC     SP,R1           ;SET R1=X7752,MASK IN SP=24
1629  007442  010111                            MOV     R1,@R1          ;STORE OWN ADDRESS IN POINTER
1630  007444  011102                    LOOP:   MOV     @R1,R2          ;GET BYTE POINTER
1631  007446  005214                            INC     @R4             ;ENABLE READER
1632  007450  105714                            TSTB    @R4             ;TEST DONE BIT
1633  007452  100376                            BPL     .-2             ;WAIT UNTIL READY
1634  007454  116412  000002                    MOVB    2(R4),@R2       ;THEN PICK IT UP AND STORE IT
1635  007460  005211                            INC     @R1             ;BUMP POINTER
1636  007462  120227  000375                    CMPB    R2,#375         ;STORED JUMP OFFSET?
1637  007466  001366                            BNE     LOOP            ;NOT YET
1638  007470  105222                            INCB    (R2)+           ;YES,ALL DONE
1639  007472  000142                            JMP     -(R2)           ;GO EXECUTE AS BRANCH
1640                                  ;
1641                                  ; DEVICE ADDRESSES FOLLOW - DO NOT CHANGE THE ORDER
1642                                  ;
1643  007474  177560                  DEV:    LSR                     ;LOW SPEED READER
1644  007476  177550                          HSR                     ;HIGH SPEED READER
1645
1646                                          .SBTTL  CASSETTE BOOT
```

```
1647
1648                                    ;
1649                                    ; CASSETTE BOOT
1650                                    ;
1651            177500                  TACS=177500                     ;TA-11 CONTROL AND STATUS REGISTER
1652                                    ;       .=ORIGIN+1500
1653  007500   012700  177500           TABOOT: MOV     #TACS,R0
1654  007504   005010                           CLR     (R0)            ;SELECT UNIT #0
1655  007506   010701                   RES:    MOV     PC,R1           ;USE FOR PIC
1656  007510   062701  000052                   ADD     #TABLE-.,R1     ;R1 HOLDS ADDR. OF COMMAND TABLE
1657  007514   012702  000375                   MOV     #375,R2         ;MEMORY PTR. AND DATA FLAG
1658  007520   112103                           MOVB    (R1)+,R3        ;TEST BITS
1659                                    ;
1660  007522   112110                   LOOP1:  MOVB    (R1)+,(R0)      ;COMMAND FROM TABLE TO TACS
1661  007524   100413                           BMI     DONE            ;WHEN COMMAND CODE NEG., QUIT
1662  007526   130310                   LOOP2:  BITB    R3,(R0)         ;TEST READY AND T-REQ BITS IN TACS
1663  007530   001776                           BEQ     LOOP2           ;LOOP 'TIL SOMETHING COMES UP
1664  007532   105202                           INCB    R2              ;ADVANCE MEMORY POINTER
1665  007534   100772                           BMI     LOOP1           ;IF MINUS, TRY NEXT COMMAND
1666  007536   116012  000002                   MOVB    2(R0),(R2)      ;READ DATA INTO MEMORY
1667  007542   120337  000000                   CMPB    R3,@#0          ;FIRST BYTE READ SHOULD BE '240'
1668  007546   001767                           BEQ     LOOP2           ;IF O.K., GO READ ANOTHER BYTE
1669  007550   000000                   STOP:   HALT                    ;HALT ON ERROR
1670  007552   000755                           BR      RES             ;RESTART ON CONTINUE
1671                                    ;
1672  007554   005710                   DONE:   TST     (R0)            ;CHECK FOR ERROR
1673  007556   100774                           BMI     STOP            ;HALT ON ERROR
1674  007560   005007                           CLR     PC              ;= 'JMP @#0'
1675                                    ;
1676  007562   017640                   TABLE:  .WORD   17640           ;.BYTE 240: READY+T-REQ.
1677                                            .WORD   2415            ;.BYTE 37:  ILBS+READY+GO
1678  007564   002415                           .WORD   112024          ;.BYTE  15: SFB+GO
1679                                            .WORD   0,0             ;.BYTE   5: READ+GO
1680  007566   112024                           .WORD   TABOOT!160000   ;.BYTE  24: READ+ILBS
1681  007570   000000  000000                   .WORD   340             ;.BYTE 224: READ+ILBS+E.O.TABLE
1682  007574   167500                   ;THESE ARE FILLER WORDS
1683  007576   000340                           ;POWER UP VECTOR AND PRIORITY
1684                                    ;
1685
1686                                            .SBTTL  MR11-DB BOOT
```

```
1687                                    ;MR11-DB BULK STORAGE PROGRAM LOADER LISTING
1688
1689                                    ;       .=ORIGIN+1600                   ;KEEP TRACK OF ORIGIN
1690
1691  007600  010702                    RF11:   MOV PC,R2               ;FIXED HEAD DISK (256 KW)
1692  007602  000451                            BR OTHER
1693  007604  177462                            177462
1694  007606  000005                            5
1695
1696  007610  010702                    RK11:   MOV PC,R2               ;MOVING HEAD DISK (CARTRIDGE)
1697  007612  000445                            BR OTHER
1698  007614  177406                            177406
1699  007616  000005                            5
1700
1701
1702  007620  010702                    TC11:   MOV PC,R2
1703  007622  000417                            BR TAPES
1704  007624  177344                            177344                  ;ADDRESS OF WORD COUNT
1705  007626  000005                            5                       ;LAST COMMAND
1706  007630  004003                            4003                    ;FIRST COMMAND
1707  007632  100000                            100000                  ;DONE MASK
1708  007634  024000                            24000                   ;ERROR MASK
1709
1710
1711  007636  010702                    TM11:   MOV PC,R2
1712  007640  000410                            BR TAPES
1713  007642  172524                            172524                  ;ADDRESS OF BYTE COUNT
1714  007644  060003                            60003                   ;LAST COMMAND
1715  007646  060011                            60011                   ;FIRST COMMAND
1716  007650  000200                            200                     ;DONE MASK
1717  007652  100000                            100000                  ;ERROR MASK
1718
1719
1720  007654  010702                    RP11:   MOV PC,R2               ;MOVING HEAD DISK (PACK)
1721  007656  000423                            BR OTHER
1722  007660  176716                            176716
1723
1724
1725  007662  000005                    TAPES:  RESET
1726  007664  010200                            MOV R2,R0               ;GET THE ADDRESS OF THE BRANCH
1727  007666  005720                            TST (0)+                ;R0 TO POINT AT LAST COMMAND
1728  007670  012001                            MOV (0)+,R1             ;GET THE WORD COUNT ADDRESS
1729  007672  005311                            DEC (1)                 ;SET UP FOR ADVANCE 1 RECORD
1730  007674  005720                            TST (0)+                ;MOVE R0 TO FIRST COMMAND
1731  007676  012041                            MOV (0)+,-(1)           ;COMMAND WORD TO COMMAND REG.
1732  007700  031011                            BIT (0),(1)             ;LOOK FOR DONE INDICATORS
1733  007702  001776                            BEQ .-2                 ;NONE SET, TRY AGAIN
1734  007704  005720                            TST (0)+                ;DONE FIRST COMMAND, CHECK FOR ERROR
1735  007706  031041                            BIT (0),-(1)            ;LOOK FOR SET ERROR BITS
1736  007710  001406                            BEQ OTHER               ;NO ERRORS - TRY THE READ
1737  007712  000112                    AGAIN:  JMP (2)                 ;RERUN FOR ERRORS
1738
1739
1740  007714  167600                    RFVEC:  RF11!160000                     ;RF11 POWER UP VECTOR
1741  007716  000340                            340
1742
```

```
1743  007720  010702                  RC11:   MOV PC,R2               ;FIXED HEAD DISK (64KW)
1744  007722  000401                          BR OTHER
1745  007724  177450                          177450                  ;ADRS OF WORD COUNT (COMMAND+2)
1746                                                                  ;COMMAND WORD (5) IS THE RESET
1747
1748  007726  000005                  OTHER:  RESET
1749  007730  010200                          MOV R2,R0               ;R0 TO POINT AT WORD COUNT ADRS
1750  007732  005720                          TST (0)+                ;POINT TO ADDRESS
1751  007734  012001                          MOV (0)+,R1             ;WORD COUNT ADDRESS TO R1
1752  007736  012711  177000                 MOV #-1000,(1)          ;LOAD WORD COUNT
1753  007742  011041                          MOV (0),-(1)            ;COMMAND TO COMMAND REGISTER
1754  007744  032711  100200                 BIT #100200,(1)         ;CHECK FOR ERROR OR DONE
1755  007750  001775                          BEQ .-4                 ;IF NEITHER, KEEP LOOKING
1756  007752  100757                          BMI AGAIN               ;ERROR, TRY AGAIN
1757  007754  005007                          CLR PC
1758
1759  007756  000000                          0                       ;FILLER
1760  007760  167610                  RKVEC:  RK11!160000                     ;RK POWER UP VECTOR
1761  007762  000340                          340
1762  007764  167720                  RCVEC:  RC11!160000                     ;RC POWER UP VECTOR
1763  007766  000340                          340
1764  007770  167654                  RPVEC:  RP11!160000                     ;RP POWER UP VECTOR
1765  007772  000340                          340
1766  007774  167620                  TCVEC:  TC11!160000                     ;TC11 POWER UP VECTOR
1767  007776  000340                          340
1768
1769                                          .SBTTL  ROM VERSION 1 VALUES
```

```
                                        .DSABL  AMA

                                ;DATA PATTERN STORED IN THE GT40 BOOTSTRAP VERSION 1

                                ;       ************ THIS IS A IMAGE LISTING OF THE GT40 (VT40) BOOTSTRAP ********
                                ;
                                ;       THE DATA IS A MIRROR IMAGE OF THAT IN THE BOOTSTRAP ROMS
                                ;       ONLY THE ADDRESS FIELD IS CHANGED

                                ;BOOTVT.SO9  5/2/72     (SPECIAL)


                                ;       VT-40 BOOTSTRAP LOADER, VERSION SO9, RELEASE R01, 5/2/72

                                ;       COPYRIGHT 1972, DIGITAL EQUIPMENT CORPORATION.
                                ;       146 MAIN STREET
                                ;       MAYNARD, MASSACHUSSETTS
                                ;                               01754


                                ;       WRITTEN BY JACK BURNESS, SENIOR SYSTEMS ARCHITECT!



                                ;       THIS ROUTINE IS INTENDED TO BE LOADED IN THE ROM PORTION OF THE VT-40.


                                ;       REGISTER DEFINITIONS:

000000                                  R0=%0
000001                                  R1=%1
000002                                  R2=%2
000003                                  R3=%3
000004                                  R4=%4
000005                                  R5=%5
000006                                  R6=%6
000007                                  R7=%7

000006                                  SP=R6
000007                                  PC=R7

000000                                  RET1=R0                 ;RETURN OF VALUE REGISTER.
000001                                  INP1=R1                 ;ARGUMENT FOR CALLED FUNCTION
000002                                  INP2=R2                 ;SECOND ARGUMENT.
000003                                  WORK1=R3                ;FIRST WORK REGISTER.
000004                                  WORK2=R4                ;SECOND WORKING REGISTER.
000005                                  SCR1=R5                 ;SCRATCH REGISTER.

000003                                  LCKSM=WORK1             ;OVERLAPPING DEFINITIONS FOR LOADER PORTION.
000000                                  LBYT=RET1
000005                                  LBC=SCR1
000001                                  LADR=INP1
```

```
1826
1827            036000                  COREND=36000            ;FIRST LOCATION OF NON-CORE.
1828            166000                  ROMORG=166000           ;WHERE THE ROM PROGRAM SHOULD GO.
1829
1830            000000                  STARTX=0                ;WHERE TO START DISPLAYING THE X POSITIONS.
1831            001360                  STARTY=1360             ;WHERE TO START DISPLAYING THE Y.
1832
1833
1834            022000                  VT40PC=172000-150000            ;VT40 PROGRAM COUNTER.
1835            027560                  KBDIS=27560             ;TTY INPUT STATUS.
1836            025614                  P10OS=25614             ;PDP-10 OUTPUT STATUS.
1837            025610                  P10IS=25610             ;PDP-10 INPUT STATUS.
1838
1839            027562                  KBDIB=KBDIS+2           ;TTY INPUT BUFFER.
1840            025612                  P10IB=P10IS+2           ;PDP-10 INPUT CHARACTER.
1841            025616                  P10OB=P10OS+2           ;PDP-10 OUTPUT BUFFER.
1842
1843
1844            045776                  P10OC=COREND-2+10000            ;CHARACTER TO BE SENT TO THE PDP-10
1845            045772                  P10IC=P10OC-4           ;INPUT CHARACTER FROM 10 PLUS ONE SAVE CHARACTER
1846            015770                  STKSRT=P10IC-2-30000            ;FIRST LOCATION OF STACK.
1847
1848
1849            160000                  JMPDIS=160000           ;THE VT-40 DISPLAY JUMP INSTRUCTION.
1850
1851
1852            000024                  PWRFAL=24               ;POWER FAIL RESTART LOCATION.
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864            016000                  .=16000
1865                            ;       .=ROMORG                ;SET THE ORIGIN NOW!!!!
1866
1867
1868
1869
1870
1871
1872
1873  016000    012705  000026  STARTA: MOV     #PWRFAL+2,SCR1          ;PICK UP POINTER TO P.F. STATUS.
1874  016004    005015                  CLR     @SCR1                   ;CLEAR IT OUT TO BE SURE.
1875  016006    010745                  MOV     PC,-(SCR1)              ;SET UP THE RESTART LOCATION.
1876
1877  016010    000005                  RESET                           ;RESET THE BUS.
1878
1879  016012    012767  000007  007570  MOV     #7,P10IS                ;INITIALIZE PDP-10 INPUT
1880  016020    012767  000001  011532  MOV     #1,KBDIS                ;INITIALIZE TTY INPUT.
1881  016026    012767  000201  007560  MOV     #201,P10OS              ;INITIALIZE PDP-10 OUTPUT.
```

```
1892
1893
1894
1895  016034  012706  015770  RSTRT:  MOV   #STKSRT,SP          ;SET UP THE STACK NOW!
1896  016040  005001          CLR   LADR                 ;CLEAR ADDRESS POINTER.
1897  016042  012702  160000  MOV   #JMPDIS,INP2         ;PLACE A DISPLAY JUMP INSTRUCTION IN A REGISTER.
1898  016046  010221          MOV   INP2,(LADR)+         ;MOVE IT TO LOCATION 0.
1899  016050  012711  166756  MOV   #DISPRG+150000,(LADR)          ;MOVE ADDRESS POINTER INTO 2.
1890  016054  012701  000030  MOV   #PWRFAL+4,LADR       ;SET UP WHERE WE WILL STORE CHARACTERS.
1891  016060  005000          CLR   RET1                 ;PREPARE TO INSERT A ZERO CHARACTER.
1892  016062  004767  000022  JSR   PC,DOCHAR            ;INSERT IT NOW.
1893  016066  005067  003706  CLR   VT40PC               ;CLEAR THE DISPLAY PROGRAM COUNTER AND START.
1894
1895  016072  004767  000210  MAJOR:  JSR   PC,GTCHR             ;GT A CHARACTER NOW.
1896  016076  000240          NOP
1897  016100  000240          NOP
1898  016102  000240          NOP
1899  016104  012746  166072  MOV   #MAJOR+150000,-(SP)          ;INSERT IN DISPLAY BUFFER NOW.
1900
1901  016110  010105  DOCHAR:  MOV   LADR,SCR1           ;GT CURRENT BUUFER POSITION NOW.
1902  016112  022525          CMP   (SCR1)+,(SCR1)+      ;BYPASS CURRENT DISPLAY JUMP.
1903  016114  005025          CLR   (SCR1)+              ;CLEAR FUTURE ADDRESS FOR JUMP.
1904  016116  010225          MOV   INP2,(SCR1)+         ;STICK IN TEMPORARY JUMP WHILE WE REPLACE CURREN
1905  016120  005015          CLR   (SCR1)               ;A DISPLAY JUMP TO ZERO.
1906  016122  005011          CLR   (LADR)               ;NOW REPLACE CURRENT DISPLAY JUMP BY THE CHARACT
1907  016124  050021          BIS   RET1,(LADR)+         ;IT'S DONE THIS WAY TO WASTE 2 CYCLES.
1908  016126  010211          MOV   INP2,(LADR)          ;TO AVOID TIMING PROBLEMS WITH THE VT40.
1909  016130  000207          RTS   PC                   ;AND FINALLY RETURN.
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926  016132  004767  000124  GT8:    JSR   PC,GTSIX             ;GT SIX BITS NOW.
1927  016136  010046          MOV   RET1,-(SP)           ;SAVE THE CHARACTER NOW.
1928  016140  000401          BR    GTP84                ;BYPASS THE 8'ER
1929  016142  005002  GT84:   CLR   INP2                 ;RESET THE MAGIC REGISTER NOW.
1930  016144  005722  GTP84:  TST   (INP2)+              ;INCREMENT WHERE TO GO.
1931  016146  066207  166250  ADD   GT8TB+150000(INP2),PC          ;UPDATE PC NOW.
1932
1933          016152  GT8P=.
1934
1935  016152  004767  000104  GT81:   JSR   PC,GTSIX             ;GT A CHARACTER NOW.
1936  016156  010004          MOV   RET1,WORK2           ;SAVE FOR A SECOND.
1937  016160  006300          ASL   RET1
```

```
1938  016162  006300                  ASL     RET1                    ;SHIFT TO LEFT OF BYTE
1939  016164  106300                  ASLB    RET1
1940  016166  106116                  ROLB    @SP                     ;PACK THEM IN.
1941  016170  106300                  ASLB    RET1
1942  016172  106116                  ROLB    @SP                     ;A GOOD 8 BIT THING.
1943  016174  012600                  MOV     (SP)+,RET1              ;POP AND RETURN NOW.
1944  016176  000207                  RTS     PC
1945
1946  016200  006300          GT82:   ASL     RET1                    ;WORST CASE. SHIFT 4
1947  016202  006300                  ASL     RET1
1948  016204  106300                  ASLB    RET1
1949  016206  106104                  ROLB    WORK2
1950  016210  106300                  ASLB    RET1
1951  016212  106104                  ROLB    WORK2
1952  016214  106300                  ASLB    RET1
1953  016216  106104                  ROLB    WORK2
1954  016220  106300                  ASLB    RET1
1955  016222  106104                  ROLB    WORK2
1956  016224  010400                  MOV     WORK2,RET1
1957  016226  012604                  MOV     (SP)+,WORK2
1958  016230  000207                  RTS     PC
1959
1960  016232  006100          GT83:   ROL     RET1
1961  016234  006100                  ROL     RET1
1962  016236  006004                  ROR     WORK2
1963  016240  106000                  RORB    RET1
1964  016242  006004                  ROR     WORK2
1965  016244  106000                  RORB    RET1                    ;FINAL CHARACTER ASSEMBLED.
1966  016246  005726                  TST     (SP)+                   ;FUDGE STACK.
1967  016250  000207                  RTS     PC                      ;AND RETURN NOW.
1968
1969          016250          GT8TB   =       .-2                     ;PUSH ZERO CONDITION BACK INTO NEVER-NEVER LAND.
1970
1971  016252  000000                  .WORD   GT81-GT8P
1972  016254  000026                  .WORD   GT82-GT8P
1973  016256  000060                  .WORD   GT83-GT8P
1974  016260  177770                  .WORD   GT84-GT8P
1975
1976
1977  016262  004767  000020  GTSIX:  JSR     PC,GTCHR
1978  016266  020027  000040          CMP     RET1,#40
1979  016272  002546                  BLT     LBAD
1980  016274  020027  000137          CMP     RET1,#137
1981  016300  003143                  BGT     LBAD
1982  016302  000207                  RTS     PC
1983
1984
1985
1986  016304  005726          GTCHP:  TST     (SP)+                   ;UPDATE THE STACK.
1987
1988  016306  012700  015772  GTCHR:  MOV     #P10IC-30000,RET1               ;SET UP POINTER TO THE INPUT CHARACTER.
1989  016312  004767  000064  GTCHL:  JSR     PC,CHECK
1990  016316  005710                  TST     @RET1                   ;ANY CHARACTERS THERE?
1991  016320  001774                  BEQ     GTCHL
1992  016322  011046                  MOV     @RET1,-(SP)             ;PUSH THE CHAR ON THE STACK.
1993  016324  005020                  CLR     (RET1)+                 ;CLEAR THE CHAR GOT FLAG NOW.
```

```
1994  016326  042716  177600          BIC     #-200,(SP)          ;CLEAR AWAY PARITY NOW.
1995  016332  001764                  BEQ     GTCHP               ;IF ZERO, GT ANOTHER
1996  016334  022716  000177          CMP     #177,(SP)
1997  016340  001761                  BEQ     GTCHP               ;ALSO IGNORE RUBOUTS.
1998  016342  022710  000175          CMP     #175,@RET1          ;WAS IT A "175"
1999  016346  001007                  BNE     GTNP                ;NOPE.
2000  016350  011610                  MOV     (SP),@RET1          ;YEP. RESET IN CASE OF ABORT.
2001  016352  021027  000122          CMP     @RET1,#122          ;IS IT AN R
2002  016356  001626                  BEQ     RSTRT               ;YEP. RESTART
2003  016360  021027  000114          CMP     @RET1,#114          ;IS IT AN L
2004  016364  001455                  BEQ     LOAD                ;YEP. LOAD.
2005
2006  016366  011610          GTNP:   MOV     (SP),@RET1          ;NOW DO THE FDUGING.
2007  016370  012600                  MOV     (SP)+,RET1
2008  016372  020027  000175          CMP     RET1,#175
2009  016376  001743                  BEQ     GTCHR               ;IF ALTMODE, LOOP
2010  016400  000207                  RTS     PC
2011
2012
2013
2014
2015
2016
2017
2018
2019  016402  005767  027370  CHECK:  TST     P100C               ;DO WE WANT TO OUTPUT?
2020  016406  001410                  BEQ     CHECK1              ;NO.
2021  016410  105767  007200          TSTB    P100S               ;WE DO. IS THE IO READY?
2022  016414  100005                  BPL     CHECK1              ;NOT QUITE.
2023  016416  016767  027354  007172  MOV     P100C,P100B         ;IT'S READY. SEND THE CHARACTER.
2024  016424  005067  027346          CLR     P100C               ;AND THE SAVED CHARACTER.
2025
2026  016430  105767  011124  CHECK1: TSTB    KBDIS               ;HEY, IS THE KEYBOARD READY?
2027  016434  100014                  BPL     CHECK3              ;NOPE. NO LUCK.
2028  016436  116746  011120          MOVB    KBDIB,-(SP)         ;YEP. SAVE THE CHARACTER NOW.
2029  016442  012767  000001  011110  MOV     #1,KBDIS            ;AND REENABLE THE COMMUNICATIONS DEVICE.
2030
2031  016450  004767  177726  CHECK2: JSR     PC,CHECK            ;IS THE OUTPUT READY?
2032  016454  005767  027316          TST     P100C
2033  016460  001373                  BNE     CHECK2              ;IF NOT, WAIT TILL DONE.
2034  016462  012667  007130          MOV     (SP)+,P100B         ;AND THEN SEND OUT THE CHARACTER.
2035
2036
2037  016466  105767  007116  CHECK3: TSTB    P10IS               ;IS THE IO TALKING TO ME.
2038  016472  100011                  BPL     CHECK4              ;NOPE. EXIT.
2039  016474  116767  007112  027270  MOVB    P10IB,P10IC         ;GT THE CHARACTER NOW.
2040  016502  052767  177400  027262  BIS     #-400,P10IC         ;MAKE SURE IT'S NONE ZERO.
2041  016510  012767  000007  007072  MOV     #7,P10IS            ;REINITIALIZE COMMUNICATION LINE.
2042
2043  016516  000207          CHECK4: RTS     PC                  ;AND RETURN.
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2060                            ;       THE    L  O  A  D  E  R
2061
2062  016520  005002            LOAD:   CLR     INP2                    ;RESET IO FIRST 8 BIT CHARACTER.
2063  016522  012712  172000            MOV     #172000,(INP2)          ;AND ALSO CLEVERLY STOP THE VT40.
2064  016526  012706  015770            MOV     #STKSRT,SP              ;RESET STACK POINTER NOW.
2065
2066  016532  005003            LLD2:   CLR     LCKSM                   ;CLEAR THE CHECKSUM
2067  016534  004767  000070            JSR     PC,LPTR         ;GT A BYTE NOW.
2068  016540  105300                    DECB    LBYT                    ;IS IT ONE?
2069  016542  001373                    BNE     LLD2                    ;NOPE. WAIT AWHILE
2070  016544  004767  000060            JSR     PC,LPTR         ;YEP. GT NEXT CHARACTER.
2071
2072  016550  004767  000072            JSR     PC,LGWRD                ;GT A WORD.
2073  016554  010005                    MOV     LBYT,LBC                ;GT THE COUNTER NOW.
2074  016556  162705  000004            SUB     #4,LBC                  ;CHOP OFF EXTRA STUFF.
2075  016562  022705  000002            CMP     #2,LBC                  ;NULL?
2076  016566  001437                    BEQ     LJMP                    ;YEP. MUST BE END.
2077  016570  004767  000052            JSR     PC,LGWRD                ;NOPE. GT THE ADDRESS.
2078  016574  010001                    MOV     LBYT,LADR               ;AND REMEMBER FOR OLD TIMES SAKE.
2079
2080  016576  004767  000026    LLD3:   JSR     PC,LPTR         ;GT A BYTE (DATA)
2081  016602  002010                    BGE     LLD4                    ;ALL DONE WITH THE COUNTER?
2082  016604  105703                    TSTB    LCKSM                   ;YEP. GOOD CHECK SUM?
2083  016606  001751                    BEQ     LLD2                    ;NOPE. LOAD ERROR.
2084
2085  016610  012700            LBAD:   MOV     (PC)+,RET1              ;SEND OUT SOME CHARACTERS NOW.
2086                            ;       .BYTE   175,102                 ;"CTRL BAD"
2087  016612     102     175            .BYTE   102,175                 ;"BAD CTRL"
2088  016614  004767  000110            JSR     PC,SENDIT
2089  016620  000167  177210            JMP     RSTRT
2090
2091  016624  110021            LLD4:   MOVB    LBYT,(LADR)+            ;PLACE THE BYTE IN CORE.
2092  016626  000763                    BR      LLD3                    ;GT ANOTHER ONE.
2093
2094  016630  004767  177276    LPTR:   JSR     PC,GTB                  ;GT 8 BITS NOW.
2095  016634  060003                    ADD     LBYT,LCKSM              ;UPDATE CHECKSUM
2096  016636  042700  177400            BIC     #177400,LBYT            ;CLEAN UP THE BYTE NOW.
2097  016642  005305                    DEC     LBC                     ;UPDATE THE COUNTER.
2098  016644  000207                    RTS     PC                      ;RETURN NOW.
2099
2100  016646  004767  177756    LGWRD:  JSR     PC,LPTR         ;GT A CHARACTER.
2101  016652  010046                    MOV     LBYT,-(SP)              ;SAVE FOR A SECOND.
2102  016654  004767  177750            JSR     PC,LPTR         ;GT ANOTHER CHARACTER.
2103  016660  000300                    SWAB    LBYT                    ;NOW ASSEMBLE THE WORD.
2104  016662  052600                    BIS     (SP)+,LBYT              ;AND RETURN WITH A 16 BITER.
2105  016664  000207                    RTS     PC
```

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2106
2107  016666  004767  177754          LJMP:   JSR     PC,LGWRD                ;GT A WORD
2108  016672  010046                          MOV     LBYT,-(SP)              ;SAVE ON THE STACK.
2109  016674  004767  177730                  JSR     PC,LPTR         ;GT A CHARCTER.
2110  016700  105703                          TSTB    LCKSM                   ;IS IT ZERO?
2111  016702  001342                          BNE     LBAD                    ;YEP. WHAT CRAP.
2112  016704  032716  000001                  BIT     #1,(SP)                 ;IS IT 000?
2113  016710  001406                          BEQ     LJMP1                   ;YEP. START PROGRAM GOING NOW.
2114  016712  012700                          MOV     (PC)+,RET1              ;TELL PDP-10 WE'VE LOADED OK.
2115                                  ;       .BYTE   175,107                 ;"CTRL GOOD"
2116  016714     107     175                  .BYTE   107,175                 ;"GOOD CTRL"
2117  016716  004767  000006                  JSR     PC,SENDIT
2118  016722  000000                          HALT
2119  016724  000776                          BR      .-2
2120
2121  016726  000136          LJMP1:  JMP     @(SP)+                  ;AND AWAY WE GO.
2122
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2139  016730  004767  177446          SENDIT: JSR     PC,CHECK                ;POLL THE OUTPUT DEVICE NOW.
2140  016734  005767  027036                  TST     P100C                   ;OUTPUT CLEAR?
2141  016740  001373                          BNE     SENDIT                  ;NOPE. LOOP AWHILE LONGER.
2142  016742  010067  006650                  MOV     RET1,P100B              ;SEND OUT THE CHARACTER.
2143  016746  105000                          CLRB    RET1                    ;CLEAR THE BYTE.
2144  016750  000300                          SWAB    RET1                    ;AND SWAP THEM NOW.
2145  016752  001366                          BNE     SENDIT                  ;IF NOT EQUAL, REPEAT.
2146  016754  000207                          RTS     PC
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2161
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2164
2165                                    ;               THIS IS THE INITIALIZING VT40 PROGRAM WHICH WILL
2166                                    ;               JUMP TO THE PROGRAM AFTER THE POWER FAIL LOCATIONS
2167                                    ;               WHICH WILL JUMP TO ZERO WHICH WILL JUMP BACK TO HERE.
2168
2169
2170
2171
2172  016756  170256   DISPRG: .WORD   170256          ;LOAD STATUS REGISTER FOR NORMAL OPERATION.
2173  016760  115124           .WORD   115124          ;SET POINT MODE, "NORMAL".
2174  016762  000000           .WORD   STARTX          ;X COORDINATE
2175  016764  001360           .WORD   STARTY          ;Y COORDINATE
2176  016766  100000           .WORD   100000          ;SET CHARACTER MODE.
2177  016770  160000           .WORD   JMPDIS          ;THEN JUMP TO THE POWERFAIL LOCATION.
2178  016772  000030           .WORD   PWRFAL+4        ;TO DISPLAY USERS CHARACTERS.
2179  016774  C 3000           .WORD   0
2180  016776  000000           .WORD   0
2181
2182
2183
2184                                    ;STARTING FROM HERE TO THE TOP OF MEMORY
2185                                    ; A BACKGROUND WORSE CASE NOISE TASK WILL BE EXECUTED
2186
2187  017000  000000   BUFFER: 0
2188
2189          000001           .END
```

```
AGAIN   007712          1737#   1756
ALTMOD= 000175           945#   1263    1422    1455
BACK    002552           522#    542
BACK1   002566           525#    530     535
BACK2   002602           528     532#
BELL    006250          1084    1116#
BLIMIT= 007000           938#    941    1030    1051    1135    1154    1201    1205
BLKOFF= 000020           182#    627     635     639    1502#   1538
BLKON = 000030           182#    623     631     636    1503#   1573
BSTART= 001000           937#   1137    1157    1174    1204
BUFFER  017000           355     540    2187#
BUFF1   005334           269     430     735#
BUFF2   005430           309     311     451*    457*    748#
BUFF3   005524           313     315     480*    486*    768#
CHAR  = 100000           182#    648     654     659     664     669     674     732     745     765     786     801     889#
                         909    1073    1075    1077    1104*   1121*   1133    1144*   1151    1242*   1244*   1263    1267
                        1269    1285    1287    1483#
CHECK   016402          1989    2019#   2031    2139
CHECK1  016430          2020    2022    2026#
CHECK2  016450          2031#   2033
CHECK3  016466          2027    2037#
CHECK4  016516          2038    2043#
COMEND= 017000          1827#   1844
COPSTR= 000004           940#    999
CORTST  001720           354#
COUNTR= 001005           896#    912    1112*   1119*   1123*
CR      000206          1093#
CRLF  = 005015           944#   1033
DEV     007474          1618    1643#
DEV1    007422          1621#   1623
DISJMP= 160000           947#   1165    1203    1204    1205    1221
DISPRG  016756          1889    2172#
DISTOP= 173000           948#   1272    1394
DJMP  = 160000           182#    796     807    1510#   1605
DLADD   001006           202#    280
DLBRL   001012           204#    321     323
DLICSR  001142           233#    267*    442
DLIDBR  001144           234#    449
DLIN    002242           320     442#
DLINB   002326           454     456#
DLIVT   001166           247#    320*
DLIVT1  001170           248#    321*
DLOCSR  001146           235#    266*    422
DLODBR  001150           220*    221*    236#    269*    436*
DLOUT   002160           322     422#
DLOUTA  002176           429#
DLOUTB  002230           433     436#
DLOVT   001172           249#    322*
DLOVT1  001174           250#    323*
DLVCT   001010           203#    288
DL11IB= 175612           926#    927    1242
DL11IS= 175610           925#    926     992*   1240    1243*
DL11OB= 175616           928#   1250*   1297*   1298*
DL11OS= 175614           927#    928     995*   1013    1015*
DNOP  = 164000           182#    646     649     789     790     791     792     793     794     795    1511#
DOCHAR  016110          1892    1901#
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DOCORE  001636            222     338#
DONE    007554           1660    1671#
DSTOP = 173403            182#    806    1513#
ENDCOR  006036           1002#   1003
FF      006256           1089    1119#
FFLOOP  006262           1114    1121#   1124
FILEO   007214           1535    1538#   1606
FILEOA  005634            307*    409*    413*    797#
FILEOB  005636            413     798#
FILEOC  005664            307     409     797     806#
FILEOD  002724            265     568#    808
GETCHR  006564           1072    1262#   1284
GETDL   006516           1240#   1245    1249    1251    1262    1266
GETDL1  006546           1241    1248#
GETEXT  006650           1264    1270    1290#
GETSIX  006630           1284#   1322    1337
GETB    006664           1322#   1431
GETBTB  006700           1325    1327#
GETB1   006712           1327    1337#
GETB2   006740           1328    1349#
GETB3   006772           1329    1364#
GETB4   006706           1333#
GRAPHX= 120000            182#    614    1487#   1587
GRAPHY= 124000            182#    601    1488#   1598
GRPINC  003006            308*    405*    406     408*    599#
GTADD   001000            198#    278
GTBRL   001004            200#    301     303     305
GTBUSE  006424           1174#   1197
GTCHL   016312           1989#   1991
GTCHP   016304           1986#   1995    1997
GTCHR   016306           1995    1977    1988#   2009
GTDLYD  001300            276#    306*    402*    404*
GTDNE1  001154            239#    301*
GTDONE  001152            238#    300*
GTLPEN  002134            302     413#
GTLPH   001156            247     302*
GTLPH1  001160            247     303*
GTNP    016366           1979    2006#
GTPC    001132            228#    265*    277     410*    414*
GTPSH   016144           1928    1930#
GTSHIF  002152            304     417#
GTSIX   016262           1926    1935    1977#
GTSOTM  001162            244#    304*
GTSOT1  001164            245#    305*
GTSR    001134            229#    397     543*
GTSTOP  002044            300     397#
GTST1   002116            403     407     409#
GTVCT   001002            199#    282
GTXPOS  001136            230#
GTYPOS  001140            231#
GT40PC= 172000            933#    934    1174*   1208    1535*
GT40SR= 172002            934#   1116*
GTB     016132           1926#   2094
GTBP  = 016152           1933#   1971    1972    1973    1974
GTBTB = 016250           1931    1969#
GTB1    016152           1935#   1971
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GT82    016200          1946#   1972
GT83    016232          1960#   1973
GT84    016142          1929#   1974
HEADER  006474          1164    1203    1209    1215#
HOLD   =x000004          894#    1338*   1352*   1354*   1356*   1358*   1359    1360*   1366*   1368*
HSR    = 177550         1612#   1644
IMAGE   001020           208#    216*    219*    523
INCR   = 000100          182#    308     406     408     599     1524#   1582
INDEX  =x000003          913#    1324    1325    1333*   1396*
INGT    001412           290     300#
INITGT  001302           212     277#
INP1   =x000001          1813#   1822
INP2   =x000002          1814#   1887*   1888    1904    1908    1929*   1930    1931    2062*   2063*
INSERT  006350           1097    1105    1143    1151#
INSRTL  006406           1155    1158    1163#
INSRTX  006422           1153    1168#
INTD    001504           310#    312
INTE    001520           314#    316
INTX   = 040000          182#    576     579     582     585     594     609     624     628     632     636     639     642
                         682     688     694     700     706     712     718     724     1525#   1543    1547    1551    1555
INT0   = 002000          182#    723     1491#   1542
INT1   = 002200          182#    717     1492#   1561
INT2   = 002400          182#    711     1493#   1546
INT3   = 002600          182#    705     1494#   1563
INT4   = 003000          182#    575     699     729     1495#   1550    1573
INT5   = 003200          182#    693     1496#   1565
INT6   = 003400          182#    687     1497#   1554
INT7   = 003600          182#    681     1498#   1567
ITALO  = 000040          182#    647     655     665     675     1517#
ITAL1  = 000060          182#    650     660     670     1518#
JMPADD= 007012           941#    1131    1142*   1221    1272*   1394*
JMPDIS= 160000           1849#   1887    2177
KBCHR   002542           478*    479*    480     490     510#
KBDIB  = 027562          931#    1250    1839#   2028
KBDIS  = 027560          930#    931     1248    1835#   1839    1880*   2026    2029*
KBIN    002354           324     470#
KPNT    002540           272*    477     481*    482     484*    485     509#
KRBBRL  001212           260#    325
KRBVT   001206           257#    324*
KRBVT1  001210           258#    325*
LAOR   =%000001          1822#   1886*   1888*   1889*   1890*   1901    1906*   1907*   1908*   2078*   2091*
LBAD    016610           1979    1981    2085#   2111
LBC    =%000005          1821#   2073*   2074*   2075    2097*
LBYT   =%000000          1820#   2068*   2073    2078    2091    2095    2096*   2101    2103*   2104*   2108
LCKSM  =%000003          1819#   2066*   2082    2095*   2110
LF      006300           1087    1128#
LFLOOP  006310           1133#   1136    1138
LFOUND  006330           1134    1140#
LFSUB   006304           1122    1131#
LGHRD   016646           2072    2077    2100#   2107
LINE0  = 000004          182#    575     590     681     1505#   1542
LINE1  = 000005          182#    578     1506#   1546
LINE2  = 000006          182#    581     1507#   1550
LINE3  = 000007          182#    584     1508#   1554
LJMP    016666           2076    2107#
LJMP1   016726           2113    2121#
```

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LLD2    016532           2066#   2069    2083
LLD3    016576           2080#   2092
LLD4    016624           2081    2091#
LOAD    016520           2004    2062#
LOADER  007012           1268    1394#
LOADR0  001364            279     281     283     289     291#
LOGICA  002704            556#
LONGV = 110000            182#    575     578     581     584     593     608     639     642     681     687     693     699
                          705     711     717     723    1485#   1542    1546    1550    1554
LOOP    007444           1630#   1637
LOOP1   007522           1659#   1664
LOOP2   007526           1661#   1662    1667
LPDARK= 000200            182#   1516#
LPLITE= 000300            182#    571    1515#
LPOFF = 000100            182#    639    1500#
LPON  = 000140            182#    568     643    1501#
LPTR    016630           2067    2070    2080    2094#   2100    2102    2109
LSR   = 177560           1613#   1643
L.ADR =%000001            910#   1412*   1426*
L.BAD   007100           1286    1288    1421#   1452
L.BC  =%000002            911#   1407*   1408*   1409    1433*
L.BYT =%000000            909#   1323    1338    1339*   1340*   1341*   1343*   1345*   1349*   1350*   1351*   1353*   1355*
                         1357*   1359*   1364*   1365*   1367*   1369*   1401*   1407    1412    1426    1432    1439    1441*
                         1442*   1449
L.CKSM=%000005            912#   1399*   1417    1432*   1451
L.GWRD  007126           1406    1411    1438#   1448
L.HALT  007200           1460#
L.JMP   007146           1410    1448#
L.JMP1  007202           1458    1462#
L.LD2   007022           1399#   1402    1418
L.LD3   007066           1415#   1427
L.LD4   007110           1416    1426#
L.PTR   007114           1400    1404    1415    1431#   1438    1440    1450
MAJOR   016072           1895#   1899
MAXSX = 017600            182#   1530#
MAXSY = 000077            182#   1531#
MAXX  = 001777            182#    576     582    1526#   1543    1551
MAXY  = 001377            182#    570     580     586     645     653     658     663     668     673    1527#   1540    1548
                         1556
MEMDAT  001776            377#    378*    383     386
MEMEND  002040            360     384#
MEMTST  001770            358     375#
MINSUY= 000100            182#    624     628     632     636    1532#
MINUSX= 020000            182#    580     582     624     628     632     636     639     642    1528#   1529    1548    1551
MINUSY= 020000            182#   1529#
NORMAL  006212           1076    1085    1097#
NOTHER  006042           1000    1006#
NUMLIN= 000040            942#   1030    1031    1119    1205
NXTCHR  006132           1072#   1074    1080    1099    1109    1117    1125    1128
OCTA    005611            317*    318*    319*    492*    494*    496*    788#
ORIGIN= 166000            923#
OTHER   007726           1692    1697    1721    1736    1744    1748#
OUTLIT  006652            996    1297#   1421    1454
OVER    002544            225     513#    551
PC    =%000007            186#    212*    222*    223*    273*    279*    281*    283*    289*    298*    326*    367*    376*
                          491*    493*    495*    507*    540*    556*    881#   1072*   1082*   1097*   1105*   1112    1122*
```

```
                        1143*  1158*  1161*  1168*  1246*  1262*  1266*  1284*  1290*  1322*  1337*  1346*  1361*
                        1371*  1400*  1404*  1406*  1411*  1415*  1431*  1434*  1438*  1440*  1443*  1448*  1450*
                        1619   1624   1654   1673*  1691   1696   1702   1711   1720   1743   1757*  1810*  1875
                        1892*  1895*  1909*  1926*  1931*  1935*  1944*  1958*  1967*  1977*  1982*  1989*  2010*
                        2031*  2043*  2067*  2070*  2072*  2077*  2080*  2085   2088*  2094*  2098*  2100*  2102*
                        2105*  2107*  2109*  2114   2117*  2139*  2146*
PCOUNT  002722           513*   541*   564*
POINT = 114000           182*   568    590    596    605    611    620    624    628    632    636    639    643
                         651    656    661    666    671    678    684    690    696    702    708    714    720
                         729    742    762    783    798   1486*  1538   1558   1570   1579   1583   1594
POINTR=%000001           890*   910   1043*  1045*  1051*  1151*  1152   1154   1156   1157*  1163   1164*  1165*
                        1166*
PPNT    002344           270*   429    431*   432    434*   461*
PRESTR  006624          1273*  1423
PRIME   001220           223    265*
PSW     001216           211*   224*   263*
PTBOOT  007400          1616*
PUNCHR  002350           430*   436    463*
PWRFAL= 000024          1852*  1873   1890   2178
PWRFL   001612           191    328*   332
PWRUP   001622           328    331*
P10IB = 025612          1840*  2039
P10IC = 045772          1845*  1846   1988   2039*  2040*
P10IS = 025610          1837*  1840   1879*  2037   2041*
P10OB = 025616          1841*  2023*  2034*  2142*
P10OC = 045776          1844*  1845   2019   2023   2024*  2032   2140
P10OS = 025614          1836*  1841   1881*  2021
RCVEC   007764          1762*
RC11    007720          1743*  1762
REDCHR  002352           449*   450*   451    464*
RELATV= 130000           182*   623    627   1489*  1573
RES     007506          1654*  1669
RESTRT  006060          1027*  1273
RET1  =%000000          1812*  1820   1891*  1907   1927   1936   1937*  1938*  1939*  1941*  1943*  1946*  1947*
                        1948*  1950*  1952*  1954*  1956*  1960*  1961*  1963*  1965*  1978   1980   1988*  1990
                        1992   1993*  1998   2000*  2001   2003   2006*  2007*  2008   2085*  2114*  2142   2143*
                        2144*
RFVEC   007714          1740*
RF11    007600          1691*  1740
RKVEC   007760          1760*
RK11    007610          1696*  1760
ROMADD  001014           206*   524
ROMORG= 166000          1828*
ROTVAL  001766           369*   386
RPNT    002346           271*   448    452*   453    455*   456    462*
RPVEC   007770          1764*
RP11    007654          1720*  1764
RSTRT   016034          1885*  2002   2089
R0    =%000000           186*   277*   284*   285*   286*   287*   291*   292*   293*   294*   295*   296*   297*
                         309*   310*   311    313*   314*   315    340*   342*   346*   354*   356    362    555*
                         874*   889   1652*  1653*  1659*  1661   1665   1671   1726*  1749*  1800*  1812
R1    =%000001           186*   278*   280*   282*   284    286    288*   291    292    294    296    339*   341*
                         344    349*   350    355*   356    359*   362    364*   365*   366*   875*   890   1616*
                        1626*  1628*  1629*  1630   1635*  1654*  1655*  1657   1659   1728*  1751*  1801*  1813
R2    =%000002           186*   358*   359    360    876*   891   1617*  1619*  1624*  1630*  1634*  1636   1638*
                        1639   1656*  1663*  1665*  1691*  1696*  1702*  1711*  1720*  1726   1743*  1749   1802*
```

```
                    1814
R3      =%000003     186#   475    490*   498*   501*   502*   503*   504    877#   892    1618*  1621   1657*
                    1661   1666   1803#  1815
R4      =%000004     186#   427    429*   430    437*   447    448*   451*   456*   457*   458*   476    477*
                     485*   486*   492    494    496    497*   504*   505*   506*   878#   894    1621*  1622
                    1626   1631*  1632   1634   1804#  1816
R5      =%000005     186#   879#   896    1805#  1817
R6      =%000006    1806#  1809
R7      =%000007    1807#  1810
SCAN    =%000003     892#   913    996*   999*   1000*  1002*  1006   1011   1030*  1033*  1038*  1041   1043
                    1045   1077*  1078*  1079   1081*  1082   1131*  1133   1135   1137*  1140*  1141*  1142
                    1156*  1159*  1160*  1297   1298   1299*  1421*  1454*
SCR1    =%000005    1817#  1821   1873*  1874*  1875*  1901*  1902   1903*  1904*  1905*
SENDIT   016730     2088#  2117   2139#  2141   2145
SETDUN   006126     1042#  1051#
SETLP1   006074     1033#  1035
SETLP2   006110     1041#  1048
SETLP3   006116     1045#  1047
SETUP    006432     1038   1195#
SHORTV=  104000      182#   631    635    1484#  1561   1563   1565   1567
SIZE     001276      275#   350*   351*   354
SP      =%000006     186#   210*   348    427*   437    447*   458    475*   476*   497    498    880#   993*
                    1011*  1027*  1128*  1323*  1342*  1344*  1345   1360   1370   1439*  1442   1449*  1457
                    1462   1620*  1625*  1628   1809#  1885*  1899*  1927*  1940*  1942*  1943   1957   1966
                    1986   1992*  1994*  1996   2000   2006   2007   2028*  2034   2064*  2101*  2104   2108*
                    2112   2121
START    006000      216    991#
STARTA   016000      219   1873#
STARTB   001022      195    210#   333    400    418    425    445    473    561
STARTX=  000000     1830#  2174
STARTY=  001360     1831#  2175
STATSA=  170000      182#   647    650    655    660    665    670    675   1512#
STATSB=  174000      182#   308    406    408    571    599   1522#  1582
STKSRT=  015770     1846#  1885   2064
STOP     007550     1668#  1672
SWR      001214      213    262#
SYNOFF=  000010      182#
SYNON =  000004      182#  1519#
TAB      006222     1086   1104#  1108
TABCNT=%000002      891#   911    1031*  1034*  1041*  1046*  1093*  1098*  1106*  1107
TABLE    007562     1655   1675#
TABOOT   007500     1652#  1682
TACS  =  177500     1650#  1652
TAPES    007662     1703   1712   1725#
TCVEC    007774     1766#
TC11     007620     1702#  1766
TKB      001200      253#   478
TKS      001176      252#   268*   470
TMPEND=  007776      939#   993   1027
TM11     007636     1711#
TPB      001204      255#   544*   547*
TPS      001202      254#   545    548
VT       006244     1088   1112#
VT40PC=  022000     1834#  1893*
WORDS    001016      207#   215*   218*   534
WORK1   =%000003    1815#  1819
```

```
WORK2 =X000004          1816#  1936#  1949#  1951#  1953#  1955#  1956   1957#  1962#  1964#
XMLOP1  001734           358#   363
XMLOP2  001740           359#   361
XMRTS   001754           357    364#
.      = 017002          187#   190#   193#   197#   379    381    384    387    423    443    471    977#  1633
                        1655   1733   1755   1864#  1933   1969   2119
```

GRAPH	186#	602	616		
OCTGN	183#	624	628	632	636
OCTGON	184#	639	642		
PAT1	184#	649	655		
PAT2	185#	670	675		
PAT3	186#	660	665		

```
        2073    2078    2085    2101    2108    2114    2142
MOVB     269     430     436     449     451     457     478     480     486     492     494     496    1112    1151    1242
        1250    1297    1298    1426    1634    1657    1659    1665    2028    2039    2091
NOP      557     559     559     560    1896    1897    1898
RESET    331     553     553     554     991    1725    1748    1877
ROL     1364    1960    1961
ROLB    1342    1344    1352    1354    1356    1358    1365    1940    1942    1949    1951    1953    1955
ROR      501     502     503    1356    1368    1962    1964
RORB     378    1367    1369    1963    1965
RTI      411     415     438     459     499
RTS      273     298     326     367     507    1161    1168    1246    1290    1299    1346    1361    1371    1434    1443
        1909    1944    1958    1967    1982    2010    2043    2098    2105    2146
SCC      375
SUB      349     351    1078    1408    2074
SWAB    1441    2103    2144
TST      343     397     550    1006    1324    1370    1622    1671    1727    1730    1734    1750    1930    1966    1986
        1990    2019    2032    2140
TSTB     422     442     470     545     548    1013    1240    1248    1417    1451    1632    2021    2026    2037    2082
        2110
WAIT    1536
.ASCII   649     655     733     735     746     766
.ASCIZ   649     655     787     802
.BYTE    660     665     670     675     748     755     768     775     788    1422    1455    2087    2116
.DSABL   370    1770
.ENABL   179     391     851
.END    2189
.EVEN    649     655     660     665     670     675     805
.LIST      1     180     182     186
.MACRO   183     184     185     186
.NLIST     1     181     182     186
.PAGE    863     916     968    1064    1224    1385    1479    1770
.REM       1
.REPT    190
.SBTTL   862     967    1063    1223    1384    1466    1608    1646    1686    1769
.TITLE   178     817
.WORD    997    1195    1196    1197    1198    1200    1201    1202    1203    1204    1205    1207    1208    1209    1211
        1215    1216    1217    1218    1219    1220    1221    1675    1677    1679    1681    1682    1683    1971    1972
        1973    1974    2172    2173    2174    2175    2176    2177    2178    2179    2180
```

```
ERRORS DETECTED:  0
DEFAULT GLOBALS GENERATED:  0

*DOGTEB,DOGTEB.SEQ/SOL/CRF/DS:ERFZ/EN:ABS=DSKM:DOGTEB.P11
RUN-TIME:  6 13  3 SECONDS
RUN-TIME RATIO:  104/24=4.3
CORE USED:  9K  (17 PAGES)
```

FOS