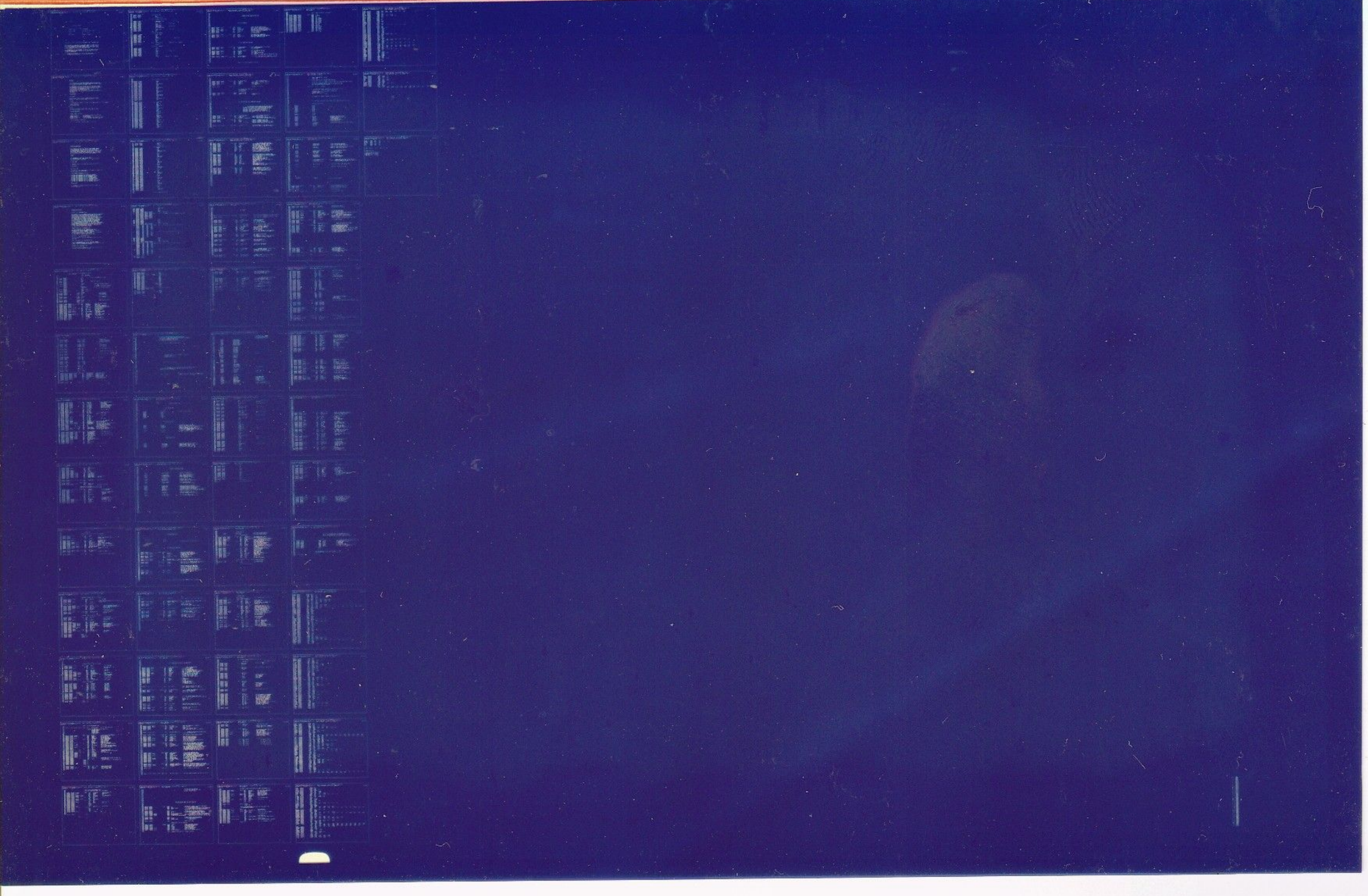
GT40,VT11

GT40 QUICK VERIFY
CDGTED0

AH-7930D-MC

FICHE 1 OF 1

JAN 1980
digital
MADE IN USA



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IDENTIFICATION

PRODUCT CODE:	AC-7928D-MC
PRODUCT NAME:	CDGTED0 GT40 QUICK VERIFY
DATE:	AUG. 1979
MAINTAINER:	DIAGNOSTIC GROUP

1. ABSTRACT

THIS VERSION OF THE PROGRAM SUPPORTS NON-SWITCH REGISTER CPU'S. FOR THESE CPU'S, THE SWITCH REGISTER CAN BE CHANGED BY CHANGING THE CONTENTS OF SWREG (170).

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 09 = 0	ROM PRESENT AS SPECIFIED BY SW 08
CONSOLE SW 09 = 1	NO ROM PRESENT
CONSOLE SW 08 = 0	TEST AS VERSION 2 OR 3 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.

8.3 XXDP/ACT/APT

THE PROGRAM IS CHAINABLE UNDER XXDP/ACT BUT CANNOT BE
SCRIPTED UNDER APT.

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.

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                        .TITLE  GT40 QUICK VERIFY MAINDEC-11-CDGTE-D
                        .ENABL  ABS,AMA
  199                                   .LIST   SEQ,BIN
  200                                   .NLIST  MD,MC,CND
  457
  458           000000                  .=0             ;0-776 IS LOADED WITH .+2, HALT
  459  000000   000000                  HALT
  460  000002   000000                  HALT
  465           000024                  .=24
  466  000024   001674                  PWRFL           ;POWER FAIL VECTOR
  467  000026   000340                  340
  468           000046                  .=46
  469  000046   002752                  LOGICAL                 ;XXDP/ACT END PASS POINTER
  470           000052                  .=52
  471  000052   000000                  0                       ;NO MANUAL INTERVENTION REQUIRED
  472           000004                  ERRVEC=4
  473           177570                  DSWR=177570             ;11/45 LIGHT DISPLAY REGISTER
  474           000170                  .=170
  475  000170   000000                  SWREG:  .WORD   0
  476           000200                  .=200
  477  000200   000137  001022          JMP     STARTB
  478           001000                  .=1000
  479  001000   172000          GTADD:  172000                          ;GT-40 ADDRESS
  480  001002   000320          GTVCT:  320                             ;GT-40 VECTOR
  481  001004   000200          GTBRL:  200                             ;GT-40 BR LEVEL
  482
  483  001006   175610          DLADD:  175610                          ;DL-11 ADDRESS
  484  001010   000300          DLVCT:  300                             ;DL-11 VECTOR
  485  001012   000240          DLBRL:  240
  486
  487  001014   166000          ROMADD: 166000                          ;ROM STARTING ADDRESS
  488  001016   001000          WORDS:  512.
  489  001020   006000          IMAGE:  6000
  490
  491  001022   012706  000500  STARTB: MOV     #500,SP         ;LOAD THE STACK POINTER
  492  001026   012777  000340  000176  MOV     #340,@PSW       ;RAISE PSW
  493  001034   004737  001316          JSR     PC,INITGT       ;INIT DEVICE ADDRESSES
  494  001040   005037  001020          CLR     IMAGE           ;PRESET FOR NO ROM SELECTED
  495  001044   032777  001000  000156  BIT     #1000,@SWR      ;TEST FOR ROM SELECTED SWITCH
  496  001052   001021                  BNE     2$              ;NO ROM SELECTED
  497  001054   032777  000400  000146  BIT     #400,@SWR       ;TEST ROM SWITCH
  498  001062   001007                  BNE     1$              ;BR IF SET
  499  001064   012737  001000  001016  MOV     #512.,WORDS     ;ASSUME VER. 2 ROM
  500  001072   012737  006000  001020  MOV     #START,IMAGE    ;LOAD IMAGE ADDRESS
  501  001100   000406                  BR      2$              ;START TEST
  502  001102   012737  000400  001016  1$:     MOV     #256.,WORDS     ;SELECT VER. 1 ROM
  503  001110   012737  016000  001020          MOV     #STARTA,IMAGE   ;LOAD IMAGE ADDRESS
  504  001116   005077  000042  2$:     CLR     @DLODBR         ;CLEAR OUTPUT
  505  001122   005077  000036          CLR     @DLODBR
  506  001126   004737  001720          JSR     PC,DOCORE       ;SET UP CORE SIZE
  507  001132   004737  001234          JSR     PC,PRIME        ;INIT THE DEVICES
  508  001136   005077  000070          CLR     @PSW
  509  001142   000137  002510          JMP     OVER            ;EXECUTE BACKGROUND TASK
```

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                                                GTPC:   172000                  ;DISPLAY PC
                                                GTSR:   172002                  ;DISPLAY STATUS REG.
                                                GTXPOS: 172004                  ;DISPLAY X REGISTER
                                                GTYPOS: 172006                  ;DISSPLAY Y REGISTER

                                                DLICSR: 175610              ;DL-11 STATUS
                                                DLIDBR: 175612                  ;DL-11 BUFFER
                                                DLOCSR: 175614                  ;DL-11 STATUS
                                                DLODBR: 175616                  ;DL-11 BUFFER

                                                GTDONE: 320                     ;DISPLAY DONE VECTOR
                                                GTDNE1: 322

                                                GTLPH:  324                     ;DISPLAY LIGHT-PEN VECTOR
                                                GTLPH1: 326

                                                GTSOTM: 330                     ;DISPLAY SHIFT-OUT/ TIME-OUT VECTOR
                                                GTSOT1: 332

                                                DLIVT:  300
                                                DLIVT1: 302
                                                DLOVT:  304
                                                DLOVT1: 306

                                                TKS:    177560
                                                TKB:    177562
                                                TPS:    177564
                                                TPB:    177566

                                                KRBVT:  60
                                                KRBVT1: 62

                                                KRBBRL: 200

                                                SWR:    177570
                                                PSW:    177776

001234  012777  002772  177704  PRIME:  MOV     #FILE00,@GTPC   ;START THE DISPLAY
001242  012777  000100  177712          MOV     #100,@DLOCSR    ;ENABLE DL OUTPUT
001250  012777  000100  177700          MOV     #100,@DLICSR    ;ENABLE DL INPUT
001256  012777  000100  177726          MOV     #100,@TKS       ;ENABLE KEYBOARD
001264  113777  005402  177672          MOVB    BUFF1,@DLODBR   ;OUTPUT A CHAR
001272  012737  000001  002310          MOV     #1,PPNT         ;PRESET PRINT POINTER
001300  005037  002312                  CLR     RPNT            ;CLEAR READ BUFFER
001304  005037  002504                  CLR     KPNT
001310  000207                          RTS     PC              ;EXIT

001312  017476                  SIZE:   17476
001314  000000                  GTDLY0: 0
```

```
563  001316  012700  001146          INITGT: MOV   #GTPC,R0              ;LOAD STARTING ADDRESS
564  001322  013701  001000                  MOV   GTADD,R1              ;SAVE VALUE
565  001326  004737  001400                  JSR   PC,LOADRO             ;LOAD GT ADDR
566  001332  013701  001006                  MOV   DLADD,R1              ;LOAD STARTING ADDRESS <DL-11>
567  001336  004737  001400                  JSR   PC,LOADRO             ;LOAD DL-11 ADDRESSES
568  001342  013701  001002                  MOV   GTVCT,R1              ;LOAD VECTOR VALUE
569  001346  004737  001400                  JSR   PC,LOADRO             ;LOAD GT-40 VECTORS
570  001352  010110                          MOV   R1,(R0)
571  001354  062720  000010                  ADD   #10,(R0)+             ;LOAD GT TIME-OUT
572  001360  010110                          MOV   R1,(R0)
573  001362  062720  000012                  ADD   #12,(R0)+
574  001366  013701  001010                  MOV   DLVCT,R1              ;LOAD VECTOR VALUE
575  001372  004737  001400                  JSR   PC,LOADRO       ;LOAD DL-11 VECTORS
576  001376  000436                          BR    INGT            ;BR
577  001400  010120          LOADRO: MOV   R1,(R0)+                ;LOAD DONE
578  001402  010110                  MOV   R1,(R0)
579  001404  062720  000002          ADD   #2,(R0)+
580  001410  010110                  MOV   R1,(R0)
581  001412  062720  000004          ADD   #4,(R0)+                ;LOAD DONE
582  001416  010110                  MOV   R1,(R0)
583  001420  062720  000006          ADD   #6,(R0)+                      ;LOAD PSW
584  001424  013746  000004          MOV   @#ERRVEC,-(SP)  ;SAVE VECTORS CONTENTS
585  001430  012737  001456  000004  MOV   #1$,@#ERRVEC    ;SET UP FOR TRAP
586  001436  012737  177570  001230  MOV   #DSWR,@#SWR      ;SET UP TO TEST FOR SWITCH REGISTER
587  001444  022777  177777  177556  CMP   #-1,@SWR         ;TEST FOR SWITCH REGISTER
588  001452  001005                  BNE   3$                ;SWITCH REGISTER IS PRESENT
589  001454  000401                  BR    2$                ;NO SWITCH REGISTER
590  001456  022626          1$:     CMP   (SP)+,(SP)+       ;POP 2 WORDS OFF STACK
591  001460  012737  000170  001230  2$:   MOV   #SWREG,@#SWR    ;SET UP FOR SOFTWARE SWITCH REGISTER
592  001466  012637  000004          3$:   MOV   (SP)+,@#ERRVEC  ;RESTORE VECOTS CONTENTS
593  001472  000207                  RTS   PC                    ;EXIT
594
595  001474  012777  002010  177464  INGT:   MOV   #GTSTOP,@GTDONE      ;LOAD DONE VECTOR
596  001502  013777  001004  177460          MOV   GTBRL,@GTDNE1
597  001510  012777  002100  177454          MOV   #GTLPEN,@GTLPH        ;LOAD LIGHT-PEN VECTOR
598  001516  013777  001004  177450          MOV   GTBRL,@GTLPH1
599  001524  012777  002116  177444          MOV   #GTSHIF,@GTSOTM       ;LOAD SHIFT-OUT VECTOR
600  001532  013777  001004  177440          MOV   GTBRL,@GTSOT1
601  001540  012737  000040  001314          MOV   #40,GTDLY0
602  001546  012737  005732  005702          MOV   #FILE0C,FILE0A
603  001554  012737  174104  003054          MOV   #STATSB!INCR+4,GRPINC
604  001562  012700  005476                  MOV   #BUFF2,R0
605  001566  005020          INTD:   CLR   (R0)+
606  001570  022700  005546          CMP   #BUFF2+50,R0
607  001574  001374                  BNE   INTD
608  001576  012700  005572          MOV   #BUFF3,R0       ;SET UP KRB BUFFER
```

```
  610  001602  005020                    INTE:   CLR     (R0)+
  611  001604  022700  005642                    CMP     #BUFF3+50,R0
  612  001610  001374                            BNE     INTE
  613  001612  105037  005657                    CLRB    OCTA
  614  001616  105037  005660                    CLRB    OCTA+1
  615  001622  105037  005661                    CLRB    OCTA+2
  616  001626  012777  002206  177346           MOV     #DLIN,@DLIVT
  617  001634  013777  001012  177342           MOV     DLBRL,@DLIVT1
  618  001642  012777  002124  177336           MOV     #DLOUT,@DLOVT
  619  001650  013777  001012  177332           MOV     DLBRL,@DLOVT1
  620  001656  012777  002320  177336           MOV     #KBIN,@KRBVT    ;LOAD KRB VECTOR
  621  001664  013777  001226  177332           MOV     KRBBRL,@KRBVT1  ;LOAD PSW
  622  001672  000207                            RTS     PC
  623
  624  001674  012737  001704  000024  PWRFL:   MOV     #PWRUP,@#24     ;LOAD VECTOR
  625  001702  000000                            HALT
  626
  627  001704  000005                    PWRUP:  RESET
  628  001706  012737  001674  000024           MOV     #PWRFL,@#24
  629  001714  000137  001022                    JMP     STARTB          ;RESTART AT BEGINING
  630
  631                                    ;SUBROUTINE TO DETERMINE THE SIZE OF CORE
  632                                    ; AND SET UP LOCATION SIZE WITH THE VALUE
  633
  634  001720  012737  001754  000004  DOCORE: MOV     #2$,@#4                 ;SET UP FOR NEM
  635  001726  012701  017776                    MOV     #17776,R1               ;SET UP ADDRESS
  636  001732  005000                            CLR     R0
  637  001734  062701  020000           1$:     ADD     #20000,R1               ;MOVE TO THE NEXT BANK
  638  001740  005200                            INC     R0                      ;INC BANK COUNTER
  639  001742  005711                            TST     (1)                     ;TIMEOUT ?
  640  001744  022701  157776                    CMP     #157776,R1              ;END ?
  641  001750  001371                            BNE     1$
  642  001752  000404                            BR      3$
  643  001754  022626                    2$:     CMP     (SP)+,(SP)+             ;POP THE STACK X2
  644  001756  005300                            DEC     R0                      ;DECREMENT BANK COUNT
  645  001760  162701  020000                    SUB     #20000,R1               ;RESTORE R1
  646  001764  012737  000006  000004  3$:      MOV     #6,@#4                  ;RESET BUSS ERROR
  647  001772  010137  001312                    MOV     R1,SIZE
  648  001776  162737  007776  001312           SUB     #7776,SIZE              ;BACK PAST LOADER
  649  002004  000137  010000                    JMP     CORTST
```

```
                                        .ENABLE AMA

                                        ;INTERRUPT SERVICE FOR THE GT STOP INTERRUPT

002010  005777  177134        GTSTOP: TST     @GTSR           ;TEST STOP
002014  100403                        BMI     1$
002016  000000                        HALT                    ;ERROR, STOP INTERRUPT BUT NO STOP FLAG
002020  000137  001022                JMP     STARTB          ;RESTART TEST

002024  005337  001314        1$:     DEC     GTDLY0          ;DECREMENT DELAY
002030  001014                        BNE     GTST1           ;BRANCH IF NOT
002032  012737  000040  001314        MOV     #40,GTDLY0      ;RESET DELAY
002040  005237  003054                INC     GRPINC          ;UPDATE GRAPH INCREMENT
002044  022737  174110  003054        CMP     #STATSB!INCR+10,GRPINC  ;TEST FOR INCREMENT
002052  001003                        BNE     GTST1           ;BRANCH IF NOT
002054  012737  174100  003054        MOV     #STATSB!INCR,GRPINC     ;RESET GRAPH INCREMENT
002062  012737  005732  005702  GTST1: MOV     #FILE0C,FILE0A
002070  012777  000001  177050        MOV     #1,@GTPC        ;RESUME THE DISPLAY
002076  000002                        RTI                     ;EXIT

002100  012737  005704  005702  GTLPEN: MOV    #FILE0B,FILE0A
002106  012777  000001  177032        MOV     #1,@GTPC        ;RESUME THE DISPLAY
002114  000002                        RTI

002116  000000                GTSHIF: HALT                    ;GT-40 SHIFT-OUT/TIME-OUT ERROR
002120  000137  001022                JMP     STARTB
```

```
                                        ;INTERRUPT SERVICE FOR THE DL PRINTER

002124  105777  177032          DLOUT:  TSTB    @DLOCSR                 ;TEST FOR DONE
002130  100403                          BMI     .+10
002132  000000                          HALT                            ;ERROR, PRINTER INTERRUPT BUT NO PRINTER FLAG
002134  000137  001022                  JMP     STARTB                  ;RESTART TEST

002140  010446                          MOV     R4,-(SP)

002142  013704  002310          DLOUTA: MOV     PPNT,R4                         ;LOAD R4 WITH BYTE POINTER
002146  116437  005402  002314          MOVB    BUFF1(R4),PUNCHR                ;LOAD A CHARACTER TO BE OUTPUTTED
002154  005237  002310                  INC     PPNT                            ;UPDATE CHARACTER POINTER
002160  022737  000050  002310          CMP     #40.,PPNT                       ;TEST FOR END
002166  001002                          BNE     DLOUTB
002170  005037  002310                  CLR     PPNT                            ;CLEAR PUNCH POINTER

002174  113777  002314  176762  DLOUTB: MOVB    PUNCHR,@DLODBR                  ;OUTPUT A CHARACTER
002202  012604                          MOV     (SP)+,R4                        ;RESTORE R4
002204  000002                          RTI                                     ;EXIT

                                        ;INTERRUPT SERVICE FOR THE DL READER

002206  105777  176744          DLIN:   TSTB    @DLICSR                         ;TEST FOR DONE
002212  100403                          BMI     .+10
002214  000000                          HALT                                    ;NOT DL INPUT FLAG
002216  000137  001022                  JMP     STARTB                          ;RESTART TEST

002222  010446                          MOV     R4,-(SP)                        ;SAVE R4
002224  013704  002312                  MOV     RPNT,R4
002230  117737  176724  002316          MOVB    @DLIDBR,REDCHR                  ;READ A CHARACTER
002236  042737  177600  002316          BIC     #177600,REDCHR                  ;MASK CHARACTER
002244  113764  002316  005476          MOVB    REDCHR,BUFF2(R4)                ;PUT CHARACTER INTO THE BUFFER
002252  005237  002312                  INC     RPNT                            ;UPDATE READ POINTER
002256  022737  000050  002312          CMP     #40.,RPNT                       ;TEST FOR END
002264  001002                          BNE     DLINB
002266  005037  002312                  CLR     RPNT
002272  013704  002312          DLINB:  MOV     RPNT,R4
002276  112764  000177  005476          MOVB    #177,BUFF2(R4)                  ;ADD CURSOR
002304  012604                          MOV     (SP)+,R4                        ;RESTORE R4
002306  000002                          RTI                                     ;EXIT

002310  000000                  PPNT:   0
002312  000000                  RPNT:   0
002314  000240                  PUNCHR: 240
002316  000240                  REDCHR: 240
```

```
                                        ;INTERRUPT SERVICE FOR THE KEYBOARD
                                        
002320  105777  176666        KBIN:   TSTB    @TKS            ;TEST FOR DONE
002324  100403                        BMI     .+10
002326  000000                        HALT                    ;NOT KRB INPUT FLAG
002330  000137  001022                JMP     STARTB          ;RESTART
                                        
002334  010346                        MOV     R3,-(SP)        ;SAVE R3
002336  010446                        MOV     R4,-(SP)        ;SAVE R4
002340  013704  002504                MOV     KPNT,R4
002344  117737  176644  002506        MOVB    @TKB,KBCHR      ;READ CHARACTER
002352  042737  177600  002506        BIC     #177600,KBCHR   ;MASK
002360  113764  002506  005572        MOVB    KBCHR,BUFF3(4)  ;SAVE THE CHAR
002366  005237  002504                INC     KPNT            ;UPDATE POINTER
002372  022737  000050  002504        CMP     #40.,KPNT       ;TEST FOR END
002400  001002                        BNE     1$
002402  005037  002504                CLR     KPNT            ;CLEAR POINTER
002406  013704  002504        1$:     MOV     KPNT,R4
002412  112764  000177  005572        MOVB    #177,BUFF3(R4)  ;ADD CURSOR
                                        
                                        ;UPDATE OCTAL READOUT
                                        
002420  013703  002506                MOV     KBCHR,R3        ;GET CHAR
002424  004737  002470                JSR     PC,10$          ;LOAD BITS
002430  110437  005661                MOVB    R4,OCTA+2       ;SAVE BITS
002434  004737  002462                JSR     PC,11$          ;MOVE BITS
002440  110437  005660                MOVB    R4,OCTA+1       ;SAVE BITS
002444  004737  002462                JSR     PC,11$          ;MOVE BITS
002450  110437  005657                MOVB    R4,OCTA         ;SAVE BITS
002454  012604                        MOV     (SP)+,R4        ;RESTORE R4
002456  012603                        MOV     (SP)+,R3        ;RESTORE R3
002460  000002                        RTI                     ;EXIT
                                        
002462  006003          11$:          ROR     R3
002464  006003                        ROR     R3
002466  006003                        ROR     R3
002470  010304          10$:          MOV     R3,R4           ;LOAD R4
002472  042704  177770                BIC     #177770,R4      ;MASK BITS
002476  062704  000060                ADD     #60,R4          ;MAKE A NUMBER
002502  000207                        RTS     PC
                                        
002504  000000          KPNT:   0
002506  000240          KBCHR:  240
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```
                                        ;PART 1 OF THE BACKGROUND TASK
                                        ;
002510  012737  001000  002770  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
                                        ;
002516  012700  000000          BACK:   MOV     #0,%0           ;SETUP INITIAL WORD NUMBER
002522  013701  001020                  MOV     IMAGE,%1        ;SET UP BUFFER
002526  001455                          BEQ     TMEM            ;NO ROM SELECTED
002530  013703  001014                  MOV     ROMADD,%3       ;SET UP ROM ADDRESS
002534  011102                  BACK1:  MOV     (%1),%2         ;READ A IMAGE WORD
002536  011304                          MOV     (%3),%4         ;READ A ROM WORD
002540  020204                          CMP     %2,%4           ;TEST FOR EQUAL
002542  001442                          BEQ     BACK2           ;BRANCH IF OK
002544  012705  010124                  MOV     #TABLE0,R5      ;LOAD PATCH POINTER
002550  020015                  1$:     CMP     R0,(R5)         ;TEST IF A PATCHED LOCATION
002552  001406                          BEQ     2$              ;BR IF YES
002554  020527  010240                  CMP     R5,#TABLEX      ;TEST IF END OF PATCH TABLE
002560  001407                          BEQ     3$              ;BR IF END * MUST BE AN ERROR
002562  062705  000004                  ADD     #4,R5           ;UPDATE PATCH POINTER
002566  000770                          BR      1$
002570  005725                  2$:     TST     (R5)+
002572  011502                          MOV     (R5),R2         ;GET PATCHED VALUE
002574  020204                          CMP     R2,R4           ;COMPARE EXPECTED TO VALUE READ
002576  001424                          BEQ     BACK2           ;BR IF OK
002600  010037  002634          3$:     MOV     R0,R0SAV        ;SAVE REGISTERS
002604  010137  002636                  MOV     R1,R1SAV
002610  010237  002640                  MOV     R2,R2SAV
002614  010337  002642                  MOV     R3,R3SAV
002620  010437  002644                  MOV     R4,R4SAV
002624  010537  002646                  MOV     R5,R5SAV
002630  000000                          HALT                    ;ERROR ROM VALUE FAILED TO EQUAL THE
002632  000740                          BR      BACK1           ; THE EXPECTED
002634  000000          R0SAV:  0                               ;CONTENTS OR REGS. AT ROM COMPARE HALT
002636  000000          R1SAV:  0
002640  000000          R2SAV:  0
002642  000000          R3SAV:  0
002644  000000          R4SAV:  0
002646  000000          R5SAV:  0
                                        ;
002650  022123          BACK2:  CMP     (%1)+,(%3)+     ;BUMP BOTH REGISTERS
002652  005200                  INC     %0              ;UPDATE WORD COUNTER
002654  023700  001016          CMP     WORDS,%0        ;TEST FOR LAST WORD
002660  001325                  BNE     BACK1           ;BRANCK IF NOT LAST
                                        ;
```

```
  823                                   ;PART 2 OF THE BACKGROUND TASK
  824                                   ; EXECUTE WORSE CASE NOISE TEST THRU MEMORY
  825
  826  002662  004737  017000          TMEM:   JSR     PC,BUFFER       ;EXECUTE NOISE TEST
  827  002666  005337  002770                  DEC     PCOUNT          ;DONE PASS ?
  828  002672  001311                          BNE     BACK            ;NO
  829  002674  012777  000001  176246          MOV     #1,@GTSR        ;YES RING THE BELL
  830  002702  012777  000207  176310          MOV     #207,@TPB       ;RING THE BELL
  831  002710  105777  176302          1$:     TSTB    @TPS
  832  002714  100375                          BPL     1$
  833  002716  012777  000207  176274          MOV     #207,@TPB
  834  002724  105777  176266          2$:     TSTB    @TPS
  835  002730  100375                          BPL     2$
  836  002732  005737  000042                  TST     @#42            ;TEST LOC. 42
  837  002736  001664                          BEQ     OVER            ;BR IF =0
  838  002740  000005                          RESET
  839  002742  000005                          RESET
  840  002744  000005                          RESET
  841  002746  013700  000042                  MOV     @#42,R0         ;READ VALUE
  842  002752  004710                  LOGICAL:        JSR     PC,(0)
  843  002754  000240                          NOP
  844  002756  000240                          NOP
  845  002760  000240                          NOP
  846  002762  000240                          NOP
  847  002764  000137  001022                  JMP     STARTB
  848
  849
  850  002770  000000                  PCOUNT: 0
```

```
                                                                B 2
 852
 853  002772  114140          FILE00: POINT!LPON
 854  002774  000000                  0
 855  002776  001377                  MAXY
 856  003000  174300                  STATSB!LPLITE
 857
 858                          ;LINE THE EDGES OF THE SCREEN
 859
 860  003002  113004                  LONGV!INT4!LINE0                ;TOP LINE
 861  003004  041777                  INTX!MAXX
 862  003006  000000                  0
 863  003010  110005                  LONGV!LINE1             ;RIGHT LINE
 864  003012  040000                  INTX
 865  003014  021377                  MINUSX!MAXY
 866  003016  110006                  LONGV!LINE2             ;BOTTOM LINE
 867  003020  061777                  INTX!MINUSX!MAXX
 868  003022  000000                  0
 869  003024  110007                  LONGV!LINE3             ;LEFT LINE
 870  003026  040000                  INTX
 871  003030  001377                  MAXY
 872
 873                          ;SETUP THE X SINEWAVE
 874
 875  003032  114004                  POINT!LINE0
 876  003034  000400                  400
 877  003036  000200                  200
 878  003040  110000                  LONGV
 879  003042  041200                  INTX+1200                       ;DRAW X AXIS
 880  003044  000000                  0
 881  003046  114000                  POINT
 882  003050  000440                  440
 883  003052  000200                  200
 884  003054  174104          GRPINC: STATSB!INCR+4           ;GRAPHPLOT THE X SINEWAVE
 885
 886  003056  124000                  GRAPHY
 888
 889                          ;SETUP THE Y SINEWAVE
 890
 891  003536  114000                  POINT
 892  003540  000200                  200
 893  003542  000040                  40
 894  003544  110000                  LONGV                           ;DRAW Y AXIS
 895  003546  040000                  INTX
 896  003550  001200                  1200
 897  003552  114000                  POINT
 898  003554  000200                  200
 899  003556  000100                  100
 900  003560  120000                  GRAPHX          ;GRAPHPLOT THE Y SINEWAVE
 901
 903
```

```
                                                C 2
905
906                             ;SETUP TO DISPLAY THE OCTAGONS
907
908  004240  114000                     POINT
909  004242  001434                     1434
910  004244  000724                     724
911  004246  130030                     RELATV!BLKON
913  004270  114000                     POINT
914  004272  001430                     1430
915  004274  000710                     710
916  004276  130020                     RELATV!BLKOFF
918  004320  114000                     POINT
919  004322  001420                     1420
920  004324  000660                     660
921  004326  104030                     SHORTV!BLKON
923  004350  114000                     POINT
924  004352  001400                     1400
925  004354  000600                     600
926  004356  104020                     SHORTV!BLKOFF
928  004400  114030                     POINT!BLKON
929  004402  001360                     1360
930  004404  000520                     520
932  004450  114120                     POINT!BLKOFF!LPOFF
933  004452  001340                     1340
934  004454  000440                     440
936
937  004520  114140                     POINT!LPON
938  004522  000100                     100
939  004524  001277                     MAXY-100
940  004526  164000                     DNOP
941  004530  170040                     STATSA!ITAL0
942  004532  100000                     CHAR
944  004630  164000                     DNOP
945  004632  170060                     STATSA!ITAL1
946  004634  114000                     POINT
947  004636  000100                     100
948  004640  001247                     MAXY-130
949  004642  100000                     CHAR
951  004740  170040                     STATSA!ITAL0
952  004742  114000                     POINT
953  004744  000220                     220
954  004746  001177                     MAXY-200
955  004750  100000                     CHAR
957  005012  170060                     STATSA!ITAL1
958  005014  114000                     POINT
959  005016  000220                     220
960  005020  001147                     MAXY-230
961  005022  100000                     CHAR
963  005064  170040                     STATSA!ITAL0
964  005066  114000                     POINT
965  005070  000220                     220
966  005072  001077                     MAXY-300
967  005074  100000                     CHAR
969  005140  170060                     STATSA!ITAL1
970  005142  114000                     POINT
971  005144  000220                     220
```

```
                                                    D 2
  972  005146  001047                    MAXY-330
  973  005150  100000                    CHAR
  975  005214  170040                    STATSA!ITAL0
  976
  977                                ;SETUP INTENSITY LEVEL TEST
  978  005216  114000                    POINT
  979  005220  000340                    340
  980  005222  001000                    1000
  981  005224  113604                    LONGV!INT7!LINE0
  982  005226  040400                    INTX+400
  983  005230  000000                    0
  984  005232  114000                    POINT
  985  005234  000340                    340
  986  005236  000740                    740
  987  005240  113400                    LONGV!INT6
  988  005242  040400                    INTX+400
  989  005244  000000                    0
  990  005246  114000                    POINT
  991  005250  000340                    340
  992  005252  000700                    700
  993  005254  113200                    LONGV!INT5
  994  005256  040400                    INTX+400
  995  005260  000000                    0
  996  005262  114000                    POINT
  997  005264  000340                    340
  998  005266  000640                    640
  999  005270  113000                    LONGV!INT4
 1000  005272  040400                    INTX+400
 1001  005274  000000                    0
 1002  005276  114000                    POINT
 1003  005300  000340                    340
 1004  005302  000600                    600
 1005  005304  112600                    LONGV!INT3
 1006  005306  040400                    INTX+400
 1007  005310  000000                    0
 1008  005312  114000                    POINT
 1009  005314  000340                    340
 1010  005316  000540                    540
 1011  005320  112400                    LONGV!INT2
 1012  005322  040400                    INTX+400
 1013  005324  000000                    0
 1014  005326  114000                    POINT
 1015  005330  000340                    340
 1016  005332  000500                    500
 1017  005334  112200                    LONGV!INT1
 1018  005336  040400                    INTX+400
 1019  005340  000000                    0
 1020  005342  114000                    POINT
 1021  005344  000340                    340
 1022  005346  000440                    440
 1023  005350  112000                    LONGV!INT0
 1024  005352  040400                    INTX+400
 1025  005354  000000                    0
 1026
 1027                               ;SETUP THE MESSAGA BUFFERS
 1028
```

```
1029  005356  117000                        POINT!INT4
1030  005360  000400                        400
1031  005362  000020                        20
1032  005364  100000                        CHAR
1033  005366  047503  020115  052517        .ASCII  /COM OUTPUT  /
      005374  050124  052125  020040
1034  005402  042504  043503  040522  BUFF1:  .ASCII  /DECGRAPHIC-11 DISPLAY TERMINAL GT40 VR14/
      005410  044120  041511  030455
      005416  020061  044504  050123
      005424  040514  020131  042524
      005432  046522  047111  046101
      005440  043440  032124  020060
      005446  051126  032061
1035  005452  114000                        POINT
1036  005454  000400                        400
1037  005456  000320                        320
1038  005460  100000                        CHAR
1039  005462  047503  027115  044440        .ASCII  /COM. INPUT  /
      005470  050116  052125  020040
1040  005476     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
      005501     000     000     000
      005504     000     000     000
      005507     000     000     000
      005512     000     000     000
      005515     000     000     000
      005520     000     000
1041  005522     000     000     000        .BYTE   0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
      005525     000     000     000
      005530     000     000     000
      005533     000     000     000
      005536     000     000     000
      005541     000     000     000
      005544     000     000
1042  005546  114000                        POINT
1043  005550  000400                        400
1044  005552  000350                        350
1045  005554  100000                        CHAR
1046  005556  051113  027102  044440        .ASCII  /KRB. INPUT  /
      005564  050116  052125  020040
1047  005572     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
      005575     000     000     000
      005600     000     000     000
      005603     000     000     000
      005606     000     000     000
      005611     000     000     000
      005614     000     000
1048  005616     000     000     000        .BYTE   0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
      005621     000     000     000
      005624     000     000     000
      005627     000     000     000
      005632     000     000     000
      005635     000     000     000
      005640     000     000
1049
1050  005642  114000                        POINT
1051  005644  000400                        400
```

```
1052  005646  000400                          400
1053  005650  100000                          CHAR
1054  005652  041517  020124      000         .ASCIZ  /OCT /
1055  005657     000     000      000  OCTA:  .BYTE   0,0,0
1056  005662  164000                          DNOP
1057  005664  164000                          DNOP
1058  005666  164000                          DNOP
1059  005670  164000                          DNOP
1060  005672  164000                          DNOP
1061  005674  164000                          DNOP
1062  005676  164000                          DNOP
1063  005700  160000                          DJMP
1064  005702  005732                  FILE0A: FILE0C
1065  005704  114000                  FILE0B: POINT
1066  005706  001000                          1000
1067  005710  000440                          440
1068  005712  100000                          CHAR
1069  005714  044514  044107  026524          .ASCIZ  /LIGHT-PEN HIT/
      005722  042520  020116  044510
      005730  000124
1070                                          .EVEN
1071  005732  173400                  FILE0C: DSTOP
1072  005734  160000                          DJMP
1073  005736  002772                          FILE00
1074
```

```
1076                            ;*********************************************************
1077                            ;       EXCEPT FOR THE NEW ORGIN ADDRESS AND SEVERAL ''!160000''
1078                            ;       FOR ADDRESS FUDGING THIS IS AN EXACT COPY OF THE CONTENTS
1079                            ;       OF THE GT-40 BOOTSTRAP VERSION #2
1080                            ;*********************************************************
1081
1082
1083                                    .TITLE  SCROLLING ROM BOOTSTRAP FOR THE GT40
1084
1085
1086
1087
1088
1089
1090
1091                            ;                       BOOTGT.T16      OCT 10, 1973
1092
1093
1094
1095
1096                            ;               COPYRIGHT 1973, DIGITAL EQUIPMENT CORPORATION
1097                            ;               146 MAIN STREET
1098                            ;               MAYNARD, MASSACHUSETTS
1099                            ;                                       01754
1100
1101
1102
1103
1104                            ;               WRITTEN BY JACK BURNESS.
1105
1106
1107
1108
1109
1110                            ;               THIS PROGRAM IS THE SECOND VERSION THE THE ROM BOOTSTRAP FOR
1111                            ;       THE GT40 DISPLAY TERMINAL. IT INCLUDES SCROLLING AND AN END OF
1112                            ;       MEMORY SEARCH FOR THE LOADER.
1113
1114
1115
1116
1117                                    .ENABL  ABS,AMA                 ;ASSEMBLER DIRECTIVES FOR ABSOLUTE BINARY OUTPUT
1118                                                                    ;  NOTE: USE 'MACDLX'' TO ASSEMBLE THIS PROGRAM.
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128                                    .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
```

```
1237
1238
1239
1240                                    ;               GT40 BOOTSTRAP CODE
1241                                    ;               ---- --------- ----
1242
1243
1244
1245
1246            006000                          .=6000
1247
1248                                    ;       .=ORIGIN                        ;DEFINE ORIGIN OF THE BOOTSTRAP.
1249
1250
1251
1252
1253
1254
1255                                    ;               COLD INITIALIZATION CODE
1256                                    ;               ---- -------------- ----
1257
1258
1259
1260  006000  000005                    START:  RESET                           ;RESET ALL HARDWARE NOW.
1261  006002  012737  000007  175610            MOV     #7,DL11IS               ;INITIALIZE DL-11 INPUT NOW.
1262  006010  012706  007776                    MOV     #TMPEND,SP              ;ESTABLISH A GOOD TEMPORARY STACK
1263                                                                            ;POINTER FOR CORE SEARCH.
1264  006014  005237  175614                    INC     DL11OS                  ;SET BREAK BIT
1265  006020  004337  166652                    JSR     SCAN,OUTLIT!160000      ;FOR 2 CHARACTER TIMES
1266  006024  000000                            .WORD 0                         ;SEND TWO ZERO'S
1267
1268  006026  012703  000004                    MOV     #CORSTR,SCAN            ;GET ADDRESS OF BAD CORE TRAP VECTOR.
1269  006032  012723  166042                    MOV     #NOTHERE!160000,(SCAN)+ ;AND INSERT A POINTER TO US THERE.
1270
1271  006036  005023                    ENDCOR: CLR     (SCAN)+                 ;NOW CLEAR ALL OF MEMORY BEYOND THE POINTER,
1272  006040  000776                            BR      ENDCOR                  ;UNTIL WE RUN OUT OF MEMORY AND TRAP.
1273
1274
1275  006042  005743                    NOTHER: TST     -(SCAN)                 ;WHEN WE TRAP OUT, WE COME HERE.
1276                                                                            ;WE BACK UP POINTER TO GOOD CORE.
1277                                                                            ;NOTE THAT IF WE TRAP OUT AGAIN, IT
1278                                                                            ;IS STILL OK, BECAUSE WE WILL LOOP
1279                                                                            ;UNTIL WE GET A GOOD CORE ADDRESS.
1280  006044  010306                            MOV     SCAN,SP                 ;WHEN WE GET ONE, THAT IS LAST LOCATION
1281                                                                            ;IN THE MACHINE, AND HENCE OUR SP.
1282  006046  105737  175614            1$:     TSTB    DL11OS                  ;SEE IF BREAK IS DONE
1283  006052  100375                            BPL     1$                      ;NO GO BACK
1284  006054  005037  175614                    CLR     DL11OS                  ;CLEAR BREAK BIT
1285
1286
1287
1288
1289
1290
1291                                    ;               RESTART INITIALIZATION CODE WHEN COMMUNICATIONS IS WORKING.
1292                                    ;               ------- -------------- ---- ---- -------------- -- --------
```

```
1293
1294
1295
1296  006060  052706  007776          RESTRT: BIS     #TMPEND,SP              ;FORCE THE SP TO LIMIT OF EXISTING CORE.
1297
1298
1299  006064  012703  006700                  MOV     #BLIMIT-NUMLIN-NUMLIN,SCAN      ;NOW WE WILL FILL THE KEY AREAS OF THE
1300  006070  012702  000040                  MOV     #NUMLIN,TABCNT          ;DISPLAY BUFFER WITH INITIAL CR-LF'S.
1301
1302  006074  012723  005015          SETLP1: MOV     #CRLF,(SCAN)+           ;INSERT A CRLF NOW.
1303  006100  005302                          DEC     TABCNT                  ;AND LOOP UNTIL DONE.
1304  006102  003374                          BGT     SETLP1                  ;THUS DISPLAY CORE IS ALMOST CORRECT.
1305
1306
1307  006104  012703  166432                  MOV     #SETUP!160000,SCAN              ;NOW WE WILL INITALIZE CORE FOR THE
1308                                                                          ;DISPLAY. PICK UP POINTER TO LIST.
1309
1310  006110  012302          SETLP2: MOV     (SCAN)+,TABCNT          ;GET NUMBER OF ITEMS TO INSERT.
1311  006112  001405                  BEQ     SETDUN                  ;IF ZERO, WE ARE DONE.
1312  006114  012301                  MOV     (SCAN)+,POINTR          ;PICK UP FIRST CORE ADDRESS POINTER.
1313
1314  006116  012321          SETLP3: MOV     (SCAN)+,(POINTR)+       ;MOVE OVER A DATA ITEM NOW.
1315  006120  005302                  DEC     TABCNT                  ;ALL DONE?
1316  006122  003375                  BGT     SETLP3                  ;NOPE. MOVE OVER THE NEXT.
1317  006124  000771                  BR      SETLP2                  ;YES. GET NEXT MAJOR LIST TO INSERT.
1318
1319
1320  006126  012701  006776  SETDUN: MOV     #BLIMIT-2,POINTR        ;ESTABLISH THE BUFFER POINTER NOW.
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332                                  .SBTTL  VT05 SIMULATOR
```

```
1334
1335
1336
1337                                    ;           VT05 (SCROLLING) PORTION OF THE BOOTSTRAP
1338                                    ;           ---- ---------  ------- -- --- ---------
1339
1340
1341
1342  006132  004737  166564  NXTCHR: JSR     PC,GETCHR!160000        ;GET A CHARACTER NOW.
1343  006136  020027  000177          CMP     CHAR,#177               ;IS IT OUT OF RANGE?
1344  006142  002373                  BGE     NXTCHR                  ;YEP. GET ANOTHER ONE.
1345  006144  020027  000040          CMP     CHAR,#40                ;IS IT A PRINTING CHARACTER?
1346  006150  002020                  BGE     NORMAL                  ;YES. IT'S A NORMAL PRINTING CHARACTER.
1347  006152  010003                  MOV     CHAR,SCAN               ;MOVE IT OVER SO WE CAN PLAY WITH IT.
1348  006154  162703  000007          SUB     #7,SCAN                 ;BIAS SO THAT BELL [7] IS ZERO.
1349  006160  020327  000007          CMP     SCAN,#7                 ;IF CHARACTER IS LESS THEN BELL OR
1350  006164  103362                  BHIS    NXTCHR                  ;GREATER THEN CR, THEN IGNORE.
1351  006166  006303                  ASL     SCAN                    ;IF GOOD, MAKE IT WORD INDEX.
1352  006170  060307                  ADD     SCAN,PC                 ;AND GO TO THE CORRECT ROUTINE.
1353
1354  006172  000426                  BR      BELL                    ;7=BELL
1355  006174  000406                  BR      NORMAL                  ;10=BACKSPACE
1356  006176  000411                  BR      TAB                     ;11=TAB
1357  006200  000437                  BR      LF                      ;12=LINE FEED [LF]
1358  006202  000420                  BR      VT                      ;13=VERTICAL TAB [VT]
1359  006204  000424                  BR      FF                      ;14=FORM FEED [FF]
1360                                                                  ;15=CARRIAGE RETURN [CR]
1361
1362
1363  006206  012702  177777  CR:     MOV     #-1,TABCNT              ;RESET TAB POSITION ON A CR, AND
1364                                                                  ;FALL THROUGH TO INSERT THE CHARACTER.
1365
1366
1367  006212  004737  166350  NORMAL: JSR     PC,INSERT!160000        ;INSERT THE CHARACTER IN THE BUFFER.
1368  006216  005202                  INC     TABCNT                  ;UPDATE TAB POSITION NOW.
1369  006220  000744                  BR      NXTCHR                  ;AND GET NEXT CHARACTER.
1370
1371
1372
1373
1374  006222  012700  000040  TAB:    MOV     #40,CHAR                ;ON A TAB, INSERT BLANKS UNTIL THE
1375  006226  004737  166350          JSR     PC,INSERT!160000        ;NEXT CHARACTER POSITION IS A MULTIPLE
1376  006232  005202                  INC     TABCNT                  ;OF 8.
1377  006234  032702  000007          BIT     #7,TABCNT               ;ARE WE DONE YET?
1378  006240  001370                  BNE     TAB                     ;NOPE.
1379  006242  000733                  BR      NXTCHR                  ;YES.
1380
1381
1382  006244  111705          VT:     MOVB    (PC),COUNTR             ;THIS PUTS THE LOW BYTE OF THE
1383                                                                  ;BRANCH CODE IN COUNTR-SAVE A WORD
1384  006246  000405                  BR      FFLOOP
1385                                                                  ;
1386  006250  005037  172002  BELL:   CLR     GT40SR                  ;RING BELL -WRITE IN GT40SR
1387  006254  000726                  BR      NXTCHR                  ;AND LOOP BACK
1388
1389  006256  012705  000040  FF:     MOV     #NUMLIN,COUNTR          ;FORM FEED IS DONE BY INSERTING LF'S.
```

```
1390
1391  006262  012700  000012          FFLOOP: MOV     #12,CHAR                ;MAKE THE CHARACTER A LINEFEED.
1392  006266  004737  166304                  JSR     PC,LFSUB!160000         ;DO A LINEFEED.
1393  006272  005305                         DEC     COUNTR                  ;DONE?
1394  006274  003372                         BGT     FFLOOP                  ;NOPE. KEEP SENDING THEM.
1395  006276  000715                         BR      NXTCHR                  ;YES. NOW RETURN. DO NOT FALL THROUGH.
1396
1397
1398  006300  012746  166132          LF:     MOV     #NXTCHR!160000,-(SP)            ;RETURN TO NXTCHR AFTER PROCESSING
1399                                                                          ;THE LF BY FAKING A JSR.
1400
1401  006304  013703  007012          LFSUB:  MOV     JMPADD,SCAN             ;GET POINTER TO FIRST CHAR ON SCREEN
1402
1403  006310  122300                  LFLOOP: CMPB    (SCAN)+,CHAR            ;AND LOOK FOR A LINEFEED.
1404  006312  001406                          BEQ     LFOUND                  ;GOT IT. SEARCH HAS ENDED.
1405  006314  020327  007000                  CMP     SCAN,#BLIMIT            ;ARE WE AT END OF BUFFER?
1406  006320  103773                          BLO     LFLOOP                  ;NOPE. KEEP ON LOOKING.
1407  006322  012703  001000                  MOV     #BSTART,SCAN            ;IF AT TOP, RESET TO BOTTOM OF BUFFER
1408  006326  000770                          BR      LFLOOP                  ;AND KEEP ON LOOKING.
1409
1410  006330  005203                  LFOUND: INC     SCAN                    ;WE'VE GOT THE LINE FEED. STOP SHOWING
1411  006332  042703  000001                  BIC     #1,SCAN                 ;FIRST LINE BY CHANGING THE 'DISJMP'
1412  006336  010337  007012                  MOV     SCAN,JMPADD             ;INSTRUCTION TO FIRST CHAR BEYOND LF.
1413  006342  004737  166350                  JSR     PC,INSERT!160000                ;INSERT THE LF IN THE BUFFER.
1414  006346  005000                          CLR     CHAR                    ;AND THEN INSERT ONE NULL CHARACTER BECAUSE
1415                                                                          ;THE 'DISJMP' ADDRESS MUST BE EVEN, AND
1416                                                                          ;THIS GUARANTEES WE WILL NOT LOSE A
1417                                                                          ;A GOOD DATA CHARACTER. WE FALL THROUGH
1418                                                                          ;TO INSERT THE NULL IN THE BUFFER.
1419
1420
1421  006350  110021                  INSERT: MOVB    CHAR,(POINTR)+          ;STICK IN THE CHARACTER NOW.
1422  006352  032701  000001                  BIT     #1,POINTR               ;IS NEXT POSITION EVEN OR ODD?
1423  006356  001021                          BNE     INSRTX                  ;ODD. NO PROBLEMS. SPACE IS ALLOCATED.
1424  006360  020127  007000                  CMP     POINTR,#BLIMIT          ;EVEN. ARE WE AT THE END OF THE BUFFER?
1425  006364  103410                          BLO     INSRTL                  ;NO. JUST MAKE ROOM FOR ANOTHER WORD.
1426  006366  010103                          MOV     POINTR,SCAN             ;AT THE END. MOVE THE STUFF TO THE
1427  006370  012701  001000                  MOV     #BSTART,POINTR          ;BEGINNING OF THE BUFFER.
1428  006374  004737  166406                  JSR     PC,INSRTL!160000                ;CALL THE ROUTINE TO SAVE SPACE.
1429  006400  005023                          CLR     (SCAN)+                 ;AND CLEAR UP THE INSTRUCTIONS AT THE
1430  006402  005013                          CLR     (SCAN)                  ;END OF THE BUFFER.
1431  006404  000207                          RTS     PC                      ;AND THEN RETURN.
1432
1433  006406  022121                  INSRTL: CMP     (POINTR)+,(POINTR)+     ;BYPASS THE 'DISJMP' BY ADDING 4 TO POINTR.
1434  006410  012711  166474                  MOV     #HEADER!160000,(POINTR) ;NOW INSERT THE DISJMP INSTRUCTION TO OUR HEADER
1435  006414  012741  160000                  MOV     #DISJMP,-(POINTR)       ;AND IT'S ADDRESS (PUT THEM IN BACKWARDS).
1436  006420  005041                          CLR     -(POINTR)               ;MAKE AVAILABLE A NEW CHARACTER SPOT.
1437
1438  006422  000207                  INSRTX: RTS     PC                      ;FINALLY RETURN TO THE CALLER.
1439
1440
1441
1442
1443
1444  006424  012737  001000  172000  GTBUSE: MOV     #BSTART,GT40PC          ;ON A BUS ERROR, WE MERELY RESTART THE GT40 AT
1445
```

```
                                                        ;THE RTI FOR THIS ROUTINE
                                                        ;IS THE FIRST WORD OF THE TABLE
                                                        ;BELOW-IT SAVES A WORD!
                                ;
                                ;                       INITIALIZATION TABLE FOR THE SCROLLER
                                ;                       -------------- ----- --- --- --------

006432  000002          SETUP:  .WORD   2               ;INITIALIZE 2 WORDS.--ALSO RTI FROM ABOVE
006434  000330                  .WORD   330             ;STARTING AT LOCATION 330
006436  166424                  .WORD   GTBUSE!160000           ;FIRST WORD IS POINTER TO BUS ERROR ROUT
006440  000200                  .WORD   200             ;SECOND WORD IS NEW STATUS WORD ON INTERUPT.

006442  000007                  .WORD   7               ;INITIALIZE THE END OF THE BUFFER TO
006444  006776                  .WORD   BLIMIT-2        ;A CLEAR SPACE TO INSERT THE CHARACTER.
006446  000000                  .WORD   0               ;THIS IS THE "RUNNING" START. THIS IS
006450  160000  166474          .WORD   DISJMP,HEADER!160000            ;FOLLOWED BY A DISJMP TO OUR HEADER BLOC
006454  160000  001000          .WORD   DISJMP,BSTART           ;AND THEN A DISJMP TO THE START OF THE BUFFER
006460  160000  006700          .WORD   DISJMP,BLIMIT-NUMLIN-NUMLIN     ;AND A DISJMP TO THE FIRST CHAR ON SCREE

006464  000001                  .WORD   1               ;FINALLY START THE GT40 GOING AT
006466  172000                  .WORD   GT40PC          ;THE POSITION INSTRUCTION IN THE
006470  166474                  .WORD   HEADER!160000           ;HEADER BLOCK.

006472  000000                  .WORD   0               ;END OF INIT CODE
                                ;
                                ;               HEADER BLOCK FOR THE SCROLLER

006474  103334          HEADER: .WORD   103334          ;ENABL CHAR MODE,BLINKING
006476  000177                  .WORD   177             ;A BLINKING BOX-RUB OUT!
006500  116124                  .WORD   116124          ;GO TO POINT MODE
006502  171340                  .WORD   171340          ;LOAD STATUS REGISTER
006504  000000  001352          .WORD   0,1352          ;POINT TO UPPER LEFT
006510  103324                  .WORD   103324          ;BACK TO CHAR MODE
006512  160000  007010          .WORD   DISJMP,JMPADD-2         ;AND TO THE CHANGING JMP INST.

                                .SBTTL  COMMUNICATIONS AND MISC. SUPPORT ROUTINES
```

```
1495
1496
1497
1498                                    ;                   COMMUNICATIONS HANDLING ROUTINES
1499                                    ;                   -------------- -------- --------
1500
1501
1502
1503
1504
1505
1506                                    ;                   THE DL-11 HANDLER
1507                                    ;                   --- ----- -------
1508
1509
1510
1511  006516  105737  175610            GETDL:  TSTB    DL11IS              ;CHECK THE HOST INPUT STATUS.
1512  006522  100011                    BPL     GETDL1              ;HOST DID NOT SEND ANYTHING, YET.
1513  006524  113700  175612            MOVB    DL11IB,CHAR         ;HOST SENT US A CHARACTER. PROCESS IT.
1514  006530  012737  000007  175610    MOV     #7,DL11IS           ;REENABLE THE HOST TELECOMMUNICATIONS.
1515  006536  042700  177600            BIC     #-200,CHAR          ;MAKE CHARACTER JUST SEVEN BITS.
1516  006542  001765                    BEQ     GETDL               ;IF NULL, IGNORE IT.
1517  006544  000207                    RTS     PC                  ;ELSE RETURN NOW.
1518
1519  006546  105737  177560            GETDL1: TSTB    KBDIS               ;DID USER TYPE A CHARACTER?
1520  006552  100361                    BPL     GETDL               ;NO. GO BACK AND CHECK HOST MACHINE.
1521  006554  113737  177562  175616    MOVB    KBDIB,DL110B        ;MOVE THE CHARACTER TO THE HOST.
1522  006562  000755                    BR      GETDL               ;AND CHECK AGAIN FOR INPUT.
1523
1524
1525
1526
1527
1528                                    ;                   THE ''GET CHARACTER'' ROUTINE
1529                                    ;                   --- --- ---------  -------
1530
1531
1532
1533  006564  004737  166516            GETCHR: JSR     PC,GETDL!160000     ;GET A CHARACTER FROM THE HOST NOW.
1534  006570  020027  000175            CMP     CHAR,#ALTMOD        ;IS IT AN ''ALTMODE''
1535  006574  001025                    BNE     GETEXT              ;NO. EXIT NOW.
1536
1537  006576  004737  166516            JSR     PC,GETDL!160000     ;YES. GET ANOTHER ONE NOW.
1538  006602  020027  000114            CMP     CHAR,#'L            ;IS IT AN 'L''
1539  006606  001501                    BEQ     LOADER              ;YES. START LOADING NOW.
1540  006610  020027  000122            CMP     CHAR,#'R            ;IS IT AN 'R''
1541  006614  001015                    BNE     GETEXT              ;NO. IGNORE THE ALTMODE AND JUST RETURN THE CHAR
1542
1543  006616  012737  173000  007010    MOV     #DISTOP,JMPADD-2    ;YES. RESET. STOP DISPLAY BY INSERTING A 'DISTOP
1544  006624  000137  166060            PRESTR: JMP     RESTRT!160000               ;INSTRUCTION IN THE BUFFER, AND RESTART.
1545
1546
1547
1548
1549
1550                                    ;                   THE ''GET A SIX BIT CHARACTER'' ROUTINE
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1551                                    ;               --- --- - --- --- ---------  -------
1552
1553
1554
1555  006630  004737  166564          GETSIX: JSR     PC,GETCHR!160000                ;GET A CHARACTER NOW.
1556  006634  020027  000040                  CMP     CHAR,#40                ;IS IT A LEGAL PRINTING CHARACTER?
1557  006640  002517                          BLT     L.BAD                   ;NOPE. ABORT
1558  006642  020027  000137                  CMP     CHAR,#137               ;IT'S BIG ENOUGH. IS IT TOO BIG?
1559  006646  003114                          BGT     L.BAD                   ;YEP. ABORT.
1560
1561  006650  000207          GETEXT: RTS     PC                              ;RETURN TO THE CALLER.
1562
1563
1564                                    ;               THIS OUTPUTS TWO CHARACTERS VIA A
1565                                    ;               JSR SCAN,OUTLIT
1566                                    ;               'TWO CHARACTERS'
1567
1568  006652  112337  175616          OUTLIT: MOVB    (SCAN)+,DL110B
1569  006656  112337  175616                  MOVB    (SCAN)+,DL110B          ;DOUBLE BUFFERED
1570  006662  000203                          RTS     SCAN                    ;RETURN
1571
1572
1573
1574
1575
1576
1577
1578                                    ;               THE ''GET AN EIGHT BIT CHARACTER'' ROUTINE
1579                                    ;               --- --- -- ----- --- ---------  -------
1580
1581
1582
1583                                    ;                       THIS ROUTINE DIFFERS FROM THE PREVIOUS ROUTINES
1584                                    ;               IN THAT IT WILL TAKE SIX BIT CHARACTERS AND ASSEMBLE
1585                                    ;               THEM FOR THE LOADER TO USE. NOTE THAT FROM THIS POINT
1586                                    ;               ON WE WILL SWITCH TO THE LOADER DEFINITIONS OF THE
1587                                    ;               REGISTERS. THUS THE CHARACTER IS RETURNED IN
1588                                    ;               REGISTER ''L.BYT'' RATHER THAN CHAR (THOUGH THEY ARE
1589                                    ;               PHYSICALLY THE SAME).
1590
1591
1592
1593  006664  004737  166630          GET8:   JSR     PC,GETSIX!160000                ;GET A SIXBIT CHARACTER.
1594  006670  010046                          MOV     L.BYT,-(SP)             ;SAVE IT ON THE STACK.
1595  006672  005723                          TST     (INDEX)+                ;UPDATE INDEX TO NEXT ITEM (ALL ARE *2)
1596  006674  000163  166676                  JMP     GET8TB-2!160000(INDEX)          ;AND DISPATCH ACCORDING TO THE INDEX.
1597
1598  006700  000404          GET8TB: BR      GET81                   ;INDEX=2: ASSEMBLE FIRST CHAR
1599  006702  000416                  BR      GET82                   ;INDEX=4: ASSEMBLE SECOND CHAR
1600  006704  000432                  BR      GET83                   ;INDEX=6: ASSEMBLE THIRD AND LAST CHAR
1601                                                                  ;INDEX=8: RESET INDEX TO 0 [2] AND RETRY.
1602
1603
1604  006706  012703  000002          GET84:  MOV     #2,INDEX                ;THE FOURTH INDEX IS THE SAME AS THE FIRST
1605                                                                  ;INDEX. JUST RESET IT AND FALL THROUGH.
1606
```

```
1607
1608  006712  004737  166630    GET81:  JSR     PC,GETSIX!160000        ;GET ANOTHER CHARACTER NOW.
1609  006716  010004                    MOV     L.BYT,HOLD              ;AND PRESERVE IT FOR NEXT TIME THROUGH.
1610  006720  006300                    ASL     L.BYT                   ;NOW THROW AWAY LEFT MOST BITS OF
1611  006722  006300                    ASL     L.BYT                   ;THE 8 BIT CHARACTER. NOW MERGE IN
1612  006724  106300                    ASLB    L.BYT                   ;THE LEFT TWO BITS OF THE
1613  006726  106116                    ROLB    (SP)                    ;NEW SIX BIT CHARACTER WITH THE SIX
1614  006730  106300                    ASLB    L.BYT                   ;BITS FROM THE CHARACTER ON THE
1615  006732  106116                    ROLB    (SP)                    ;STACK. 1ST CHARACTER IS NOW ASSEMBLED,
1616  006734  012600                    MOV     (SP)+,L.BYT             ;SO WE'LL RETURN IT TO THE USER.
1617  006736  000207                    RTS     PC                      ;AND THEN WE SHALL RETURN TO HIM.
1618
1619
1620  006740  006300            GET82:  ASL     L.BYT                   ;THE SECOND CHARACTER IS CREATED FROM
1621  006742  006300                    ASL     L.BYT                   ;THE 4 RIGHT BITS OF THE PREVIOUS CHARACTER
1622  006744  106300                    ASLB    L.BYT                   ;AND THE FOUR MIDDLE BITS OF THE PRESENT
1623  006746  106104                    ROLB    HOLD                    ;8 BIT CHARACTER.
1624  006750  106300                    ASLB    L.BYT                   ;WE WILL CREATE THE NEW 8 BIT
1625  006752  106104                    ROLB    HOLD                    ;IN THIS REGISTER, SINCE IT
1626  006754  106300                    ASLB    L.BYT                   ;MORE CONVIENT. WE WILL MOVE OVER THE
1627  006756  106104                    ROLB    HOLD                    ;ANSWER AT THE END.
1628  006760  106300                    ASLB    L.BYT                   ;ONE MORE TO GO
1629  006762  106104                    ROLB    HOLD                    ;DONE.
1630  006764  010400                    MOV     HOLD,L.BYT              ;BRING OVER THE VALUE.
1631  006766  012604                    MOV     (SP)+,HOLD              ;AND REMEMBER THE LAST CHARACTER WE RECEIVED.
1632  006770  000207                    RTS     PC                      ;AND RETURN TO THE CALLER.
1633
1634
1635  006772  006100            GET83:  ROL     L.BYT                   ;FINAL CHARACTER IS EASY. JUST A
1636  006774  106100                    ROLB    L.BYT                   ;SIMPLE MERGER OF LEFT TWO BITS OF
1637  006776  006004                    ROR     HOLD                    ;PREVIOUS VALUE WITH RIGHT SIX BITS
1638  007000  106000                    RORB    L.BYT                   ;OF LAST (4TH) CHARACTER RECEIVED.
1639  007002  006004                    ROR     HOLD
1640  007004  106000                    RORB    L.BYT                   ;AND WE ARE DONE.
1641  007006  005726                    TST     (SP)+                   ;FINALLY THROW AWAY STACK.
1642  007010  000207                    RTS     PC                      ;AND RETURN TO THE CALLER.
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655                                .SBTTL  THE LOADER
```

```
                                                                E 3
                                        ;               THE LOADER
                                        ;               --- ------
                                        ;
                                        ;
                                        ;
                                        ;
007012  012737  173000  007010  LOADER: MOV     #DISTOP,JMPADD-2        ;STOP THE GT40 BY INSERTING A 'DISTOP'' IN THE LI
                                        ;
007020  005003                  L.LD2:  CLR     INDEX                   ;RESET THE 8 BIT ASSEMBLER TO THE FIRST CHAR
                                        ;
007022  005005                          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.
```

```
1713  007140  000300                  SWAB    L.BYT                   ;AND THEN REASSEMBLE THE MESS.
1714  007142  052600                  BIS     (SP)+,L.BYT             ;WITH THE FEARSOME POWER OF THE 11.
1715  007144  000207                  RTS     PC                      ;AND RETURN TO THE CALLER.
1716
1717
1718
1719
1720  007146  004737  167126  L.JMP:  JSR     PC,L.GWRD!160000                ;ALL DONE WITH THE LOAD. ASSEMBLE
1721  007152  010046                  MOV     L.BYT,-(SP)             ;THE STARTING ADDRESS NOW.
1722  007154  004737  167114          JSR     PC,L.PTR!160000         ;AND DON'T FORGET TO CHECKSUM IT.
1723  007160  105705                  TSTB    L.CKSM
1724  007162  001346                  BNE     L.BAD                   ;A BAD CHECKSUM. ALL IS EVIL.
1725
1726  007164  004337  166652          JSR     SCAN,OUTLIT!160000              ;GOOD CHKSUM,INFORM HOST
1727  007170     175     107          .BYTE   ALTMOD,'G               ;WITH ALTMOD G
1728
1729  007172  032716  000001          BIT     #1,(SP)                 ;DO WE WANT TO START EXECUTION?
1730  007176  001401                  BEQ     L.JMP1                  ;YES. AWAY WE GO.
1731
1732  007200  000000  L.HALT: HALT                                    ;IF NOT, HALT.
1733
1734  007202  000136  L.JMP1: JMP     @(SP)+                          ;IF GO, THEN GO ALREADY. WHEEEE!
1735
1736
1737
1738                          .SBTTL  THE SELF TEST
1739
1740
1741
1742
1743
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1746
1747
1748
1749
1750
```

```
1752                                                    ;THIS IS GT40 QUICK TEST
1753                                                            ;GIVES QUICK VISUAL TEST
1754                                                            ;OF CONDITION OF MACHINE
1755                                                            ;WITHOUT READING IN DIAG.
1756            100000          CHAR=100000
1757            104000          SHORTV=104000
1758            110000          LONGV=110000
1759            114000          POINT=114000
1760            120000          GRAPHX=120000
1761            124000          GRAPHY=124000
1762            130000          RELATV=130000
1763
1764            002000          INT0=2000
1765            002200          INT1=2200
1766            002400          INT2=2400
1767            002600          INT3=2600
1768            003000          INT4=3000
1769            003200          INT5=3200
1770            003400          INT6=3400
1771            003600          INT7=3600                       ;BRIGHTEST
1772
1773            000100          LPOFF=100
1774            000140          LPON=140
1775            000020          BLKOFF=20
1776            000030          BLKON=30
1777
1778            000004          LINE0=4
1779            000005          LINE1=5
1780            000006          LINE2=6
1781            000007          LINE3=7
1782
1783            160000          DJMP=160000
1784            164000          DNOP=164000
1785            170000          STATSA=170000
1786            173400          DSTOP=173400                    ;STOP INTERRUPT
1787
1788            000300          LPLITE=300
1789            000200          LPDARK=200
1790            000040          ITAL0=40                        ;ITALICS OFF
1791            000060          ITAL1=60                        ;"       ON
1792            000004          SYNON=4                         ;SYNC ON
1793
1794
1795            174000          STATSB=174000
1796
1797            000100          INCR=100                        ;LOAD GRAPH INCR
1798            040000          INTX=40000                      ;INTENSIFY BIT
1799            001777          MAXX=1777                       ;BIGGEST X VECTOR
1800            001377          MAXY=1377                       ;BIGGEST Y VECTOR
1801            020000          MINUSX=20000                    ;THE MINUS BIT
1802            020000          MINUSY=MINUSX
1803            017600          MAXSX=17600                     ;BIGGEST X IN SHORTVEC
1804            000077          MAXSY=77                        ;   "    Y IN  "
1805            000100          MINSUY=100                      ;MINUS BIT FOR Y IN SHORTVEC
1806
1807
```

```
1808  007204  012737  167214  172000          MOV     #FILE0!160000,GT40PC            ;START THE GT40
1809  007212  000001                          WAIT                                    ;AND WAIT
1810
1811  007214  114020                  FILE0:  POINT!BLKOFF                            ;POINT--INVISIBLE
1812  007216  000000                          0
1813  007220  001377                          MAXY
1814
1815  007222  112004                          LONGV!INT0!LINE0                        ;DRAW TOP LINE
1816  007224  041777                          INTX!MAXX
1817  007226  000000                          0
1818
1819  007230  112405                          LONGV!INT2!LINE1
1820  007232  040000                          INTX                                    ;DRAW LINE TO RIGHT
1821  007234  021377                          MINUSX!MAXY
1822
1823  007236  113006                          LONGV!INT4!LINE2
1824  007240  061777                          INTX!MINUSX!MAXX                        ;DRAW BOTTOM LINE
1825  007242  000000                          0
1826
1827  007244  113407                          LONGV!INT6!LINE3
1828  007246  040000                          INTX
1829  007250  001377                          MAXY                                    ;DRAW LINE TO LEFT
1830
1831  007252  114000                          POINT
1832  007254  000400                          400
1833  007256  000500                          500
1834  007260  106200                          SHORTV!INT1
1835  007262  057677                          57677                                   ;+X+Y
1836  007264  106600                          SHORTV!INT3
1837  007266  077677                          77677                                   ;+X-Y
1838  007270  107200                          SHORTV!INT5
1839  007272  077777                          77777                                   ;-X-Y
1840  007274  107600                          SHORTV!INT7
1841  007276  057777                          57777                                   ;-X+Y
1842
1843  007300  114000                          POINT
1844  007302  001400                          1400
1845  007304  000500                          500
1846  007306  133030                          RELATV!INT4!BLKON
1847  007310  057677                          57677                                   ;+X+Y
1848  007312  077677                          77677                                   ;+X-Y
1849  007314  077777                          77777                                   ;-X-Y
1850  007316  057777                          57777                                   ;-X+Y
1851
1852  007320  114000                          POINT
1853  007322  000400                          400
1854  007324  000100                          100
1855  007326  174120                          STATSB!INCR+20                          ;TRY GRAPH MODES
1856  007330  114000                          POINT
1857  007332  001000                          1000
1858  007334  000200                          200
1859
1860  007336  120000                          GRAPHX
1861  007340  001010                          1010
1862  007342  001020                          1020
1863  007344  001030                          1030
```

```
 1864  007346  001040                    1040
 1865  007350  001050                    1050
 1866
 1867  007352  114000                    POINT
 1868  007354  001000                    1000
 1869  007356  001200                    1200
 1870
 1871  007360  124000                    GRAPHY
 1872  007362  001020                    1020
 1873  007364  001030                    1030
 1874  007366  001040                    1040
 1875  007370  001050                    1050
 1876  007372  001060                    1060
 1877
 1878  007374  160000                    DJMP
 1879  007376  167214                    FILE0!160000
 1880
 1881                                    .SBTTL  PAPER TAPE BOOT
```

```
1883
1884                                    ;
1885                                    ; PAPER TAPE BOOT
1886                                    ;
1887            177550                  HSR=177550                      ;HIGH SPEED READER ADDRESS
1888            177560                  LSR=177560                      ;LOW SPEED READER ADDRESS
1889                                    ;       .=ORIGIN+1400
1890                                    ;
1891  007400   012701  160000           PTBOOT: MOV     #160000,R1      ;SET MEMORY CHECK LIMITS
1892  007404   012702  000004                   MOV     #4,R2           ;TRAP ADDRESS IS LOC. 4
1893  007410   012703  167500                   MOV     #DEV+4!160000,R3        ;POINTER TO DEVICE ADDRESSES
1894  007414   010712                           MOV     PC,@R2          ;PRESET TRAP ADDRESS IN LOC. 4
1895  007416   012706  000024                   MOV     #24,SP          ;STACK SET UP AT SPECIAL ADDRESS
1896  007422   014304                   DEV1:   MOV     -(R3),R4        ;GET DEVICE ADDRESS
1897  007424   005714                           TST     @R4             ;CHECK AVAILABILITY OF DEVICE
1898  007426   100775                           BMI     DEV1            ;CHECK DEVICE FOR ERRORS
1899  007430   010712                           MOV     PC,@R2          ;RESET TRAP ADDRESS AT LOC. 4
1900  007432   012706  000024                   MOV     #24,SP          ;SPECIAL ADDRESS USED AS MASK LATER
1901  007436   010441                           MOV     R4,-(R1)        ;DO MEM CHK:READER STATUS ADDRESS
1902                                                                    ;IS MOVED
1903  007440   040601                           BIC     SP,R1           ;SET R1=X7752,MASK IN SP=24
1904  007442   010111                           MOV     R1,@R1          ;STORE OWN ADDRESS IN POINTER
1905  007444   011102                   LOOP:   MOV     @R1,R2          ;GET BYTE POINTER
1906  007446   005214                           INC     @R4             ;ENABLE READER
1907  007450   105714                           TSTB    @R4             ;TEST DONE BIT
1908  007452   100376                           BPL     .-2             ;WAIT UNTIL READY
1909  007454   116412  000002                   MOVB    2(R4),@R2       ;THEN PICK IT UP AND STORE IT
1910  007460   005211                           INC     @R1             ;BUMP POINTER
1911  007462   120227  000375                   CMPB    R2,#375         ;STORED JUMP OFFSET?
1912  007466   001366                           BNE     LOOP            ;NOT YET
1913  007470   105222                           INCB    (R2)+           ;YES,ALL DONE
1914  007472   000142                           JMP     -(R2)           ;GO EXECUTE AS BRANCH
1915                                    ;
1916                                    ; DEVICE ADDRESSES FOLLOW - DO NOT CHANGE THE ORDER
1917                                    ;
1918  007474   177560                   DEV:    LSR                     ;LOW SPEED READER
1919  007476   177550                           HSR                     ;HIGH SPEED READER
1920
                                                .SBTTL  CASSETTE BOOT
```

```
1923                                    ;
1924                                    ; CASSETTE BOOT
1925                                    ;
1926            177500                  TACS=177500                     ;TA-11 CONTROL AND STATUS REGISTER
1927                                    ;       .=ORIGIN+1500
1928  007500    012700  177500          TABOOT: MOV     #TACS,R0
1929  007504    005010                          CLR     (R0)            ;SELECT UNIT #0
1930  007506    010701                  RES:    MOV     PC,R1           ;USE FOR PIC
1931  007510    062701  000052                  ADD     #TABLE-.,R1     ;R1 HOLDS ADDR. OF COMMAND TABLE
1932  007514    012702  000375                  MOV     #375,R2         ;MEMORY PTR. AND DATA FLAG
1933  007520    112103                          MOVB    (R1)+,R3        ;TEST BITS
1934                                    ;
1935  007522    112110                  LOOP1:  MOVB    (R1)+,(R0)      ;COMMAND FROM TABLE TO TACS
1936  007524    100413                          BMI     DONE            ;WHEN COMMAND CODE NEG., QUIT
1937  007526    130310                  LOOP2:  BITB    R3,(R0)         ;TEST READY AND T-REQ BITS IN TACS
1938  007530    001776                          BEQ     LOOP2           ;LOOP 'TIL SOMETHING COMES UP
1939  007532    105202                          INCB    R2              ;ADVANCE MEMORY POINTER
1940  007534    100772                          BMI     LOOP1           ;IF MINUS, TRY NEXT COMMAND
1941  007536    116012  000002                  MOVB    2(R0),(R2)      ;READ DATA INTO MEMORY
1942  007542    120337  000000                  CMPB    R3,@#0          ;FIRST BYTE READ SHOULD BE '240'
1943  007546    001767                          BEQ     LOOP2           ;IF O.K., GO READ ANOTHER BYTE
1944  007550    000000                  STOP:   HALT                    ;HALT ON ERROR
1945  007552    000755                          BR      RES             ;RESTART ON CONTINUE
1946                                    ;
1947  007554    005710                  DONE:   TST     (R0)            ;CHECK FOR ERROR
1948  007556    100774                          BMI     STOP            ;HALT ON ERROR
1949  007560    005007                          CLR     PC              ;= 'JMP @#0'
1950                                    ;
1951  007562    017640                  TABLE:  .WORD   17640           ;.BYTE 240: READY+T-REQ.
1952                                                                    ;.BYTE 37:  ILBS+READY+GO
1953  007564    002415                          .WORD   2415            ;.BYTE  15: SFB+GO
1954                                                                    ;.BYTE   5: READ+GO
1955  007566    112024                          .WORD   112024          ;.BYTE  24: READ+ILBS
1956                                                                    ;.BYTE 224: READ+ILBS+E.O.TABLE
1957  007570    000000  000000                .WORD   0,0             ;THESE ARE FILLER WORDS
1958  007574    167500                          .WORD   TABOOT!160000           ;POWER UP VECTOR AND PRIORITY
1959  007576    000340                          .WORD   340             ;
1960
1961
1962                                            .SBTTL  MR11-DB BOOT
```

```
                                ;MR11-DB BULK STORAGE PROGRAM LOADER LISTING

                                ;       .=ORIGIN+1600                           ;KEEP TRACK OF ORIGIN

007600  010702          RF11:   MOV PC,R2               ;FIXED HEAD DISK (256 KW)
007602  000451                  BR OTHER
007604  177462                  177462
007606  000005                  5

007610  010702          RK11:   MOV PC,R2               ;MOVING HEAD DISK (CARTRIDGE)
007612  000445                  BR OTHER
007614  177406                  177406
007616  000005                  5

007620  010702          TC11:   MOV PC,R2
007622  000417                  BR TAPES
007624  177344                  177344                  ;ADDRESS OF WORD COUNT
007626  000005                  5                       ;LAST COMMAND
007630  004003                  4003                    ;FIRST COMMAND
007632  100000                  100000                  ;DONE MASK
007634  024000                  24000                   ;ERROR MASK

007636  010702          TM11:   MOV PC,R2
007640  000410                  BR TAPES
007642  172524                  172524                  ;ADDRESS OF BYTE COUNT
007644  060003                  60003                   ;LAST COMMAND
007646  060011                  60011                   ;FIRST COMMAND
007650  000200                  200                     ;DONE MASK
007652  100000                  100000                  ;ERROR MASK

007654  010702          RP11:   MOV PC,R2               ;MOVING HEAD DISK (PACK)
007656  000423                  BR OTHER
007660  176716                  176716

007662  000005          TAPES:  RESET
007664  010200                  MOV R2,R0               ;GET THE ADDRESS OF THE BRANCH
007666  005720                  TST (0)+                ;R0 TO POINT AT LAST COMMAND
007670  012001                  MOV (0)+,R1             ;GET THE WORD COUNT ADDRESS
007672  005311                  DEC (1)                 ;SET UP FOR ADVANCE 1 RECORD
007674  005720                  TST (0)+                ;MOVE R0 TO FIRST COMMAND
007676  012041                  MOV (0)+,-(1)           ;COMMAND WORD TO COMMAND REG.
007700  031011                  BIT (0),(1)             ;LOOK FOR DONE INDICATORS
007702  001776                  BEQ .-2                 ;NONE SET, TRY AGAIN
007704  005720                  TST (0)+                ;DONE FIRST COMMAND, CHECK FOR ERROR
007706  031041                  BIT (0),-(1)            ;LOOK FOR SET ERROR BITS
007710  001406                  BEQ OTHER               ;NO ERRORS - TRY THE READ
007712  000112          AGAIN:  JMP (2)                 ;RERUN FOR ERRORS

007714  167600          RFVEC:  RF11!160000                     ;RF11 POWER UP VECTOR
007716  000340                  340
```

```
2020  007720  010702                  RC11:   MOV PC,R2               ;FIXED HEAD DISK (64KW)
2021  007722  000401                          BR OTHER
2022  007724  177450                          177450                  ;ADRS OF WORD COUNT (COMMAND+2)
2023                                                                  ;COMMAND WORD (5) IS THE RESET
2024
2025  007726  000005                  OTHER:  RESET
2026  007730  010200                          MOV R2,R0               ;R0 TO POINT AT WORD COUNT ADRS
2027  007732  005720                          TST (0)+                ;POINT TO ADDRESS
2028  007734  012001                          MOV (0)+,R1             ;WORD COUNT ADDRESS TO R1
2029  007736  012711  177000                 MOV #-1000,(1)          ;LOAD WORD COUNT
2030  007742  011041                          MOV (0),-(1)            ;COMMAND TO COMMAND REGISTER
2031  007744  032711  100200                 BIT #100200,(1)         ;CHECK FOR ERROR OR DONE
2032  007750  001775                          BEQ .-4                 ;IF NEITHER, KEEP LOOKING
2033  007752  100757                          BMI AGAIN               ;ERROR, TRY AGAIN
2034  007754  005007                          CLR PC
2035
2036  007756  000000                          0                       ;FILLER
2037  007760  167610                  RKVEC:  RK11!160000                     ;RK POWER UP VECTOR
2038  007762  000340                          340
2039  007764  167720                  RCVEC:  RC11!160000                     ;RC POWER UP VECTOR
2040  007766  000340                          340
2041  007770  167654                  RPVEC:  RP11!160000                     ;RP POWER UP VECTOR
2042  007772  000340                          340
2043  007774  167620                  TCVEC:  TC11!160000                     ;TC11 POWER UP VECTOR
2044  007776  000340                          340
```

```
                                        ;ROUTINE TO LOAD EXCESS CORE WITH WORSE CASE MEMORY TEST

010000  013700  001312          CORTST: MOV     SIZE,R0         ;GET LAST FREE CORE ADDRESS
010004  012701  017000                  MOV     #BUFFER,R1      ;GET END OF PROGRAM
010010  020001                          CMP     R0,R1           ;TEST FOR EQUAL
010012  103410                          BLO     XMRTS           ;BRANCH IF NO ROOM
010014  012702  010050          XMLOP1: MOV     #MEMTST,R2      ;MOVE CODE BETWEEN
010020  012221                  XMLOP2: MOV     (R2)+,(R1)+     ;MEMTST AND MEMEND TILL
010022  022702  010120                  CMP     #MEMEND,R2      ;CORE IS FULL
010026  001374                          BNE     XMLOP2
010030  020100                          CMP     R1,R0           ;TEST FOR MORE ROOM
010032  101770                          BLOS    XMLOP1
010034  012721  000207          XMRTS:  MOV     #207,(R1)+      ;SETUP RTS PC
010040  005021                          CLR     (R1)+
010042  005021                          CLR     (R1)+
010044  000207                          RTS     PC

010046  151456                  ROTVAL: 151456
                                        .DSABL  AMA

                                        ;THIS IS THE BACKGROUND TASK WHICH WILL BE LOADED THRU
                                        ; THE REMAINDER OF MEMORY

010050  000277                  MEMTST: SCC                     ;SET CARRY BIT
010052  012727  123456                  MOV     #123456,(PC)+   ;MEMDAT CONTAINS
010056  123456                  MEMDAT: 123456
010060  106067  177773                  RORB    MEMDAT+1        ;ROTATE LEFT BYTE OF MEMDAT
010064  103401                          BCS     .+4
010066  000000                          HALT                    ;C BIT WAS NOT SET
010070  102001                          BVC     .+4
010072  000000                          HALT                    ;V BIT WAS SET
010074  022767  151456  177754        CMP     #151456,MEMDAT  ;CHECK HERE FOR CORRECT ROTATE
010102  001401                          BEQ     .+4
010104  000000                          HALT                    ;ROTATE FAILED
010106  026737  177744  010046        CMP     MEMDAT,@#ROTVAL ;CHECK AGAIN REFERENCE LOW MEMORY
010114  001401                          BEQ     .+4
010116  000000                          HALT                    ;REF. TO LOW MEMORY FAILED
010120  000000                  MEMEND: 0
010122  000000                          0
```

```
2086
2087                                        .SBTTL  TABLE OF PATCHES TO VERSION 2
2088
2089  010124  000001  000137    TABLE0: .WORD   1,137
2090  010130  000002  167636            .WORD   2,167636
2091  010134  000003  000000            .WORD   3,0
2092  010140  000327  000137            .WORD   215.,137
2093  010144  000330  167620            .WORD   216.,167620
2094  010150  000710  105737            .WORD   456.,105737
2095  010154  000711  175614            .WORD   457.,175614
2096  010160  000712  100375            .WORD   458.,100375
2097  010164  000713  112337            .WORD   459.,112337
2098  010170  000714  175616            .WORD   460.,175616
2099  010174  000715  000203            .WORD   461.,203
2100  010200  000716  000000            .WORD   462.,0
2101  010204  000717  005037            .WORD   463.,5037
2102  010210  000720  177776            .WORD   464.,177776
2103  010214  000721  012737            .WORD   465.,12737
2104  010220  000722  010007            .WORD   466.,10007
2105  010224  000723  175610            .WORD   467.,175610
2106  010230  000724  000137            .WORD   468.,137
2107  010234  000725  166010            .WORD   469.,166010
2108  010240  000000            TABLEX: 0
```

```
                                .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.S09  5/2/72      <SPECIAL>


                        ;       VT-40 BOOTSTRAP LOADER, VERSION S09, 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
```

```
                                        COREND=36000            ;FIRST LOCATION OF NON-CORE.
                                        ROMORG=166000           ;WHERE THE ROM PROGRAM SHOULD GO.

                                        STARTX=0                ;WHERE TO START DISPLAYING THE X POSITIONS.
                                        STARTY=1360             ;WHERE TO START DISPLAYING THE Y.


                                        VT40PC=172000-150000            ;VT40 PROGRAM COUNTER.
                                        KBDIS=27560             ;TTY INPUT STATUS.
                                        P10OS=25614             ;PDP-10 OUTPUT STATUS.
                                        P10IS=25610             ;PDP-10 INPUT STATUS.

                                        KBDIB=KBDIS+2           ;TTY INPUT BUFFER.
                                        P10IB=P10IS+2           ;PDP-10 INPUT CHARACTER.
                                        P10OB=P10OS+2           ;PDP-10 OUTPUT BUFFER.


                                        P10OC=COREND-2+10000            ;CHARACTER TO BE SENT TO THE PDP-10
                                        P10IC=P10OC-4           ;INPUT CHARACTER FROM 10 PLUS ONE SAVE CHARACTER
                                        STKSRT=P10IC-2-30000            ;FIRST LOCATION OF STACK.


                                        JMPDIS=160000           ;THE VT-40 DISPLAY JUMP INSTRUCTION.


                                        PWRFAL=24               ;POWER FAIL RESTART LOCATION.


                                ;       .=16000
                                ;       .=ROMORG                ;SET THE ORIGIN NOW!!!!


016000 012705 000026    STARTA: MOV     #PWRFAL+2,SCR1          ;PICK UP POINTER TO P.F. STATUS.
016004 005015                   CLR     @SCR1                   ;CLEAR IT OUT TO BE SURE.
016006 010745                   MOV     PC,-(SCR1)              ;SET UP THE RESTART LOCATION.

016010 000005                   RESET                           ;RESET THE BUS.

016012 012767 000007 007570     MOV     #7,P10IS                ;INITIALIZE PDP-10 INPUT
```

```
2222  016020  012767  000001  011532          MOV     #1,KBDIS                ;INITIALIZE TTY INPUT.
2223  016026  012767  000201  007560          MOV     #201,P10OS              ;INITIALIZE PDP-10 OUTPUT.
2224
2225
2226
2227  016034  012706  015770          RSTRT:  MOV     #STKSRT,SP              ;SET UP THE STACK NOW!
2228  016040  005001                  CLR     LADR                    ;CLEAR ADDRESS POINTER.
2229  016042  012702  160000          MOV     #JMPDIS,INP2            ;PLACE A DISPLAY JUMP INSTRUCTION IN A REGISTER.
2230  016046  010221                  MOV     INP2,(LADR)+            ;MOVE IT TO LOCATION 0.
2231  016050  012711  166756          MOV     #DISPRG+150000,(LADR)           ;MOVE ADDRESS POINTER INTO 2.
2232  016054  012701  000030          MOV     #PWRFAL+4,LADR          ;SET UP WHERE WE WILL STORE CHARACTERS.
2233  016060  005000                  CLR     RET1                    ;PREPARE TO INSERT A ZERO CHARACTER.
2234  016062  004767  000022          JSR     PC,DOCHAR               ;INSERT IT NOW.
2235  016066  005067  003706          CLR     VT40PC                  ;CLEAR THE DISPLAY PROGRAM COUNTER AND START.
2236
2237  016072  004767  000210  MAJOR:  JSR     PC,GTCHR                ;GT A CHARACTER NOW.
2238  016076  000240                  NOP
2239  016100  000240                  NOP
2240  016102  000240                  NOP
2241  016104  012746  166072          MOV     #MAJOR+150000,-(SP)             ;INSERT IN DISPLAY BUFFER NOW.
2242
2243  016110  010105  DOCHAR: MOV     LADR,SCR1               ;GT CURRENT BUUFER POSITION NOW.
2244  016112  022525                  CMP     (SCR1)+,(SCR1)+         ;BYPASS CURRENT DISPLAY JUMP.
2245  016114  005025                  CLR     (SCR1)+                 ;CLEAR FUTURE ADDRESS FOR JUMP.
2246  016116  010225                  MOV     INP2,(SCR1)+            ;STICK IN TEMPORARY JUMP WHILE WE REPLACE CURREN
2247  016120  005015                  CLR     (SCR1)                  ;A DISPLAY JUMP TO ZERO.
2248  016122  005011                  CLR     (LADR)                  ;NOW REPLACE CURRENT DISPLAY JUMP BY THE CHARACT
2249  016124  050021                  BIS     RET1,(LADR)+            ;IT'S DONE THIS WAY TO WASTE 2 CYCLES.
2250  016126  010211                  MOV     INP2,(LADR)             ;TO AVOID TIMING PROBLEMS WITH THE VT40.
2251  016130  000207                  RTS     PC                      ;AND FINALLY RETURN.
2252
2253
2254
2255
2256
2257
2258
2259
2260
2261
2262
2263
2264
2265
2266
2267
2268  016132  004767  000124  GT8:    JSR     PC,GTSIX                ;GT SIX BITS NOW.
2269  016136  010046                  MOV     RET1,-(SP)              ;SAVE THE CHARACTER NOW.
2270  016140  000401                  BR      GTP84                   ;BYPASS THE 8'ER
2271  016142  005002          GT84:   CLR     INP2                    ;RESET THE MAGIC REGISTER NOW.
2272  016144  005722          GTP84:  TST     (INP2)+                 ;INCREMENT WHERE TO GO.
2273  016146  066207  166250          ADD     GT8TB+150000(INP2),PC           ;UPDATE PC NOW.
2274
2275          016152          GT8P=.
2276
2277  016152  004767  000104  GT81:   JSR     PC,GTSIX                ;GT A CHARACTER NOW.
```

```
                                                    F 4
 2278  016156  010004                GT81:   MOV     RET1,WORK2              ;SAVE FOR A SECOND.
 2279  016160  006300                        ASL     RET1
 2280  016162  006300                        ASL     RET1                    ;SHIFT TO LEFT OF BYTE
 2281  016164  106300                        ASLB    RET1
 2282  016166  106116                        ROLB    @SP                     ;PACK THEM IN.
 2283  016170  106300                        ASLB    RET1
 2284  016172  106116                        ROLB    @SP                     ;A GOOD 8 BIT THING.
 2285  016174  012600                        MOV     (SP)+,RET1              ;POP AND RETURN NOW.
 2286  016176  000207                        RTS     PC
 2287
 2288  016200  006300                GT82:   ASL     RET1                    ;WORST CASE. SHIFT 4
 2289  016202  006300                        ASL     RET1
 2290  016204  106300                        ASLB    RET1
 2291  016206  106104                        ROLB    WORK2
 2292  016210  106300                        ASLB    RET1
 2293  016212  106104                        ROLB    WORK2
 2294  016214  106300                        ASLB    RET1
 2295  016216  106104                        ROLB    WORK2
 2296  016220  106300                        ASLB    RET1
 2297  016222  106104                        ROLB    WORK2
 2298  016224  010400                        MOV     WORK2,RET1
 2299  016226  012604                        MOV     (SP)+,WORK2
 2300  016230  000207                        RTS     PC
 2301
 2302  016232  006100                GT83:   ROL     RET1
 2303  016234  006100                        ROL     RET1
 2304  016236  006004                        ROR     WORK2
 2305  016240  106000                        RORB    RET1
 2306  016242  006004                        ROR     WORK2
 2307  016244  106000                        RORB    RET1                    ;FINAL CHARACTER ASSEMBLED.
 2308  016246  005726                        TST     (SP)+                   ;FUDGE STACK.
 2309  016250  000207                        RTS     PC                      ;AND RETURN NOW.
 2310
 2311          016250                GT8TB   =       .-2                     ;PUSH ZERO CONDITION BACK INTO NEVER-NEVER LAND.
 2312
 2313  016252  000000                        .WORD   GT81-GT8P
 2314  016254  000026                        .WORD   GT82-GT8P
 2315  016256  000060                        .WORD   GT83-GT8P
 2316  016260  177770                        .WORD   GT84-GT8P
 2317
 2318
 2319  016262  004767  000020        GTSIX:  JSR     PC,GTCHR
 2320  016266  020027  000040                CMP     RET1,#40
 2321  016272  002546                        BLT     LBAD
 2322  016274  020027  000137                CMP     RET1,#137
 2323  016300  003143                        BGT     LBAD
 2324  016302  000207                        RTS     PC
 2325
 2326
 2327
 2328  016304  005726                GTCHP:  TST     (SP)+                   ;UPDATE THE STACK.
 2329
 2330  016306  012700  015772        GTCHR:  MOV     #P10IC-30000,RET1               ;SET UP POINTER TO THE INPUT CHARACTER.
 2331  016312  004767  000064        GTCHL:  JSR     PC,CHECK
 2332  016316  005710                        TST     @RET1                   ;ANY CHARACTERS THERE?
 2333  016320  001774                        BEQ     GTCHL
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                                                                G 4
2334  016322  011046                    MOV     @RET1,-(SP)             ;PUSH THE CHAR ON THE STACK.
2335  016324  005020                    CLR     (RET1)+                 ;CLEAR THE CHAR GOT FLAG NOW.
2336  016326  042716  177600            BIC     #-200,(SP)              ;CLEAR AWAY PARITY NOW.
2337  016332  001764                    BEQ     GTCHP                   ;IF ZERO, GT ANOTHER
2338  016334  022716  000177            CMP     #177,(SP)
2339  016340  001761                    BEQ     GTCHP                   ;ALSO IGNORE RUBOUTS.
2340  016342  022710  000175            CMP     #175,@RET1              ;WAS IT A ''175''
2341  016346  001007                    BNE     GTNP                    ;NOPE.
2342  016350  011610                    MOV     (SP),@RET1              ;YEP. RESET IN CASE OF ABORT.
2343  016352  021027  000122            CMP     @RET1,#122              ;IS IT AN R
2344  016356  001626                    BEQ     RSTRT                   ;YEP. RESTART
2345  016360  021027  000114            CMP     @RET1,#114              ;IS IT AN L
2346  016364  001455                    BEQ     LOAD                    ;YEP. LOAD.
2347
2348  016366  011610            GTNP:   MOV     (SP),@RET1              ;NOW DO THE FDUGING.
2349  016370  012600                    MOV     (SP)+,RET1
2350  016372  020027  000175            CMP     RET1,#175
2351  016376  001743                    BEQ     GTCHR                   ;IF ALTMODE, LOOP
2352  016400  000207                    RTS     PC
2353
2354
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2360
2361  016402  005767  027370    CHECK:  TST     P100C                   ;DO WE WANT TO OUTPUT?
2362  016406  001410                    BEQ     CHECK1                  ;NO.
2363  016410  105767  007200            TSTB    P100S                   ;WE DO. IS THE 10 READY?
2364  016414  100005                    BPL     CHECK1                  ;NOT QUITE.
2365  016416  016767  027354  007172    MOV     P100C,P100B             ;IT'S READY. SEND THE CHARACTER.
2366  016424  005067  027346            CLR     P100C                   ;AND THE SAVED CHARACTER.
2367
2368  016430  105767  011124    CHECK1: TSTB    KBDIS                   ;HEY, IS THE KEYBOARD READY?
2369  016434  100014                    BPL     CHECK3                  ;NOPE. NO LUCK.
2370  016436  116746  011120            MOVB    KBDIB,-(SP)             ;YEP. SAVE THE CHARACTER NOW.
2371  016442  012767  000001  011110    MOV     #1,KBDIS                ;AND REENABLE THE COMMUNICATIONS DEVICE.
2372
2373  016450  004767  177726    CHECK2: JSR     PC,CHECK                ;IS THE OUTPUT READY?
2374  016454  005767  027316            TST     P100C
2375  016460  001373                    BNE     CHECK2                  ;IF NOT, WAIT TILL DONE.
2376  016462  012667  007130            MOV     (SP)+,P100B             ;AND THEN SEND OUT THE CHARACTER.
2377
2378
2379  016466  105767  007116    CHECK3: TSTB    P10IS                   ;IS THE 10 TALKING TO ME.
2380  016472  100011                    BPL     CHECK4                  ;NOPE. EXIT.
2381  016474  116767  007112  027270    MOVB    P10IB,P10IC             ;GT THE CHARACTER NOW.
2382  016502  052767  177400  027262    BIS     #-400,P10IC             ;MAKE SURE IT'S NONE ZERO.
2383  016510  012767  000007  007072    MOV     #7,P10IS                ;REINITIALIZE COMMUNICATION LINE.
2384
2385  016516  000207            CHECK4: RTS     PC                      ;AND RETURN.
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2402                                    ;       THE    L O A D E R
2403
2404  016520  005002                    LOAD:   CLR     INP2                    ;RESET TO FIRST 8 BIT CHARACTER.
2405  016522  012712  172000                    MOV     #172000,(INP2)          ;AND ALSO CLEVERLY STOP THE VT40.
2406  016526  012706  015770                    MOV     #STKSRT,SP              ;RESET STACK POINTER NOW.
2407
2408  016532  005003                    LLD2:   CLR     LCKSM                   ;CLEAR THE CHECKSUM
2409  016534  004767  000070                    JSR     PC,LPTR         ;GT A BYTE NOW.
2410  016540  105300                            DECB    LBYT                    ;IS IT ONE?
2411  016542  001373                            BNE     LLD2                    ;NOPE. WAIT AWHILE
2412  016544  004767  000060                    JSR     PC,LPTR         ;YEP. GT NEXT CHARACTER.
2413
2414  016550  004767  000072                    JSR     PC,LGWRD                ;GT A WORD.
2415  016554  010005                            MOV     LBYT,LBC                ;GT THE COUNTER NOW.
2416  016556  162705  000004                    SUB     #4,LBC                  ;CHOP OFF EXTRA STUFF.
2417  016562  022705  000002                    CMP     #2,LBC                  ;NULL?
2418  016566  001437                            BEQ     LJMP                    ;YEP. MUST BE END.
2419  016570  004767  000052                    JSR     PC,LGWRD                ;NOPE. GT THE ADDRESS.
2420  016574  010001                            MOV     LBYT,LADR               ;AND REMEMBER FOR OLD TIMES SAKE.
2421
2422  016576  004767  000026            LLD3:   JSR     PC,LPTR         ;GT A BYTE (DATA)
2423  016602  002010                            BGE     LLD4                    ;ALL DONE WITH THE COUNTER?
2424  016604  105703                            TSTB    LCKSM                   ;YEP. GOOD CHECK SUM?
2425  016606  001751                            BEQ     LLD2                    ;NOPE. LOAD ERROR.
2426
2427  016610  012700                    LBAD:   MOV     (PC)+,RET1              ;SEND OUT SOME CHARACTERS NOW.
2428                                    ;       .BYTE   175,102                 ;"CTRL BAD"
2429  016612     102     175                    .BYTE   102,175                 ;'BAD CTRL"
2430  016614  004767  000110                    JSR     PC,SENDIT
2431  016620  000167  177210                    JMP     RSTRT
2432
2433  016624  110021                    LLD4:   MOVB    LBYT,(LADR)+            ;PLACE THE BYTE IN CORE.
2434  016626  000763                            BR      LLD3                    ;GT ANOTHER ONE.
2435
2436  016630  004767  177276            LPTR:   JSR     PC,GT8                  ;GT 8 BITS NOW.
2437  016634  060003                            ADD     LBYT,LCKSM              ;UPDATE CHECKSUM
2438  016636  042700  177400                    BIC     #177400,LBYT            ;CLEAN UP THE BYTE NOW.
2439  016642  005305                            DEC     LBC                     ;UPDATE THE COUNTER.
2440  016644  000207                            RTS     PC                      ;RETURN NOW.
2441
2442  016646  004767  177756            LGWRD:  JSR     PC,LPTR         ;GT A CHARACTER.
2443  016652  010046                            MOV     LBYT,-(SP)              ;SAVE FOR A SECOND.
2444  016654  004767  177750                    JSR     PC,LPTR         ;GT ANOTHER CHARACTER.
2445  016660  000300                            SWAB    LBYT                    ;NOW ASSEMBLE THE WORD.
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2446  016662  052600                  BIS     (SP)+,LBYT              ;AND RETURN WITH A 16 BITER.
2447  016664  000207                  RTS     PC
2448
2449  016666  004767  177754  LJMP:   JSR     PC,LGWRD                ;GT A WORD
2450  016672  010046                  MOV     LBYT,-(SP)              ;SAVE ON THE STACK.
2451  016674  004767  177730          JSR     PC,LPTR         ;GT A CHARCTER.
2452  016700  105703                  TSTB    LCKSM                   ;IS IT ZERO?
2453  016702  001342                  BNE     LBAD                    ;YEP. WHAT CRAP.
2454  016704  032716  000001          BIT     #1,(SP)                 ;IS IT ODD?
2455  016710  001406                  BEQ     LJMP1                   ;YEP. START PROGRAM GOING NOW.
2456  016712  012700                  MOV     (PC)+,RET1              ;TELL PDP-10 WE'VE LOADED OK.
2457                          ;       .BYTE   175,107                 ;"CTRL GOOD"
2458  016714     107     175          .BYTE   107,175                 ;"GOOD CTRL"
2459  016716  004767  000006          JSR     PC,SENDIT
2460  016722  000000                  HALT
2461  016724  000776                  BR      .-2
2462
2463  016726  000136  LJMP1:  JMP     @(SP)+                  ;AND AWAY WE GO.
2464
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2481  016730  004767  177446  SENDIT: JSR     PC,CHECK                ;POLL THE OUTPUT DEVICE NOW.
2482  016734  005767  027036          TST     P100C                   ;OUTPUT CLEAR?
2483  016740  001373                  BNE     SENDIT                  ;NOPE. LOOP AWHILE LONGER.
2484  016742  010067  006650          MOV     RET1,P100B              ;SEND OUT THE CHARACTER.
2485  016746  105000                  CLRB    RET1                    ;CLEAR THE BYTE.
2486  016750  000300                  SWAB    RET1                    ;AND SWAP THEM NOW.
2487  016752  001366                  BNE     SENDIT                  ;IF NOT EQUAL, REPEAT.
2488  016754  000207                  RTS     PC
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2502
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2507                                    ;               THIS IS THE INITIALIZING VT40 PROGRAM WHICH WILL
2508                                    ;               JUMP TO THE PROGRAM AFTER THE POWER FAIL LOCATIONS
2509                                    ;               WHICH WILL JUMP TO ZERO WHICH WILL JUMP BACK TO HERE.
2510
2511
2512
2513
2514  016756  170256                   DISPRG: .WORD   170256          ;LOAD STATUS REGISTER FOR NORMAL OPERATION.
2515  016760  115124                           .WORD   115124          ;SET POINT MODE, 'NORMAL".
2516  016762  000000                           .WORD   STARTX          ;X COORDINATE
2517  016764  001360                           .WORD   STARTY          ;Y COORDINATE
2518  016766  100000                           .WORD   100000          ;SET CHARACTER MODE.
2519  016770  160000                           .WORD   JMPDIS          ;THEN JUMP TO THE POWERFAIL LOCATION.
2520  016772  000030                           .WORD   PWRFAL+4        ;TO DISPLAY USERS CHARACTERS.
2521  016774  000000                           .WORD   0
2522  016776  000000                           .WORD   0
2523
2524
2525
2526                                    ;STARTING FROM HERE TO THE TOP OF MEMORY
2527                                    ; A BACKGROUND WORSE CASE NOISE TASK WILL BE EXECUTED
2528
2529  017000  000000                   BUFFER: 0
2530
2531          000001                           .END
```

```
AGAIN   007712          2014#   2033
ALTMOD= 000175          1213#   1534    1694    1727
BACK    002516           783#    828
BACK1   002534           787#    809     820
BACK2   002650           790     801     817#
BELL    006250          1354    1386#
BLIMIT= 007000          1206#   1209    1299    1320    1405    1424    1471    1475
BLKOFF= 000020           219#    916     926     932    1775#   1811
BLKON = 000030           220#    911     921     928    1776#   1846
BSTART= 001000          1205#   1407    1427    1444    1474
BUFFER  017000           826    2049    2529#
BUFF1   005402           554     689    1034#
BUFF2   005476           604     606     710*    716*   1040#
BUFF3   005572           608     611     740*    746*   1047#
CHAR  = 100000           202#    942     949     955     961     967     973    1032    1038    1045    1053    1068    1156#
CHECK   016402          2331    2361#   2373    2481
CHECK1  016430          2362    2364    2368#
CHECK2  016450          2373#   2375
CHECK3  016466          2369    2379#
CHECK4  016516          2380    2385#
COREND= 036000          2169#   2186
CORSTR= 000004          1208#   1268
CORTST  010000           649    2048#
CR      006206          1363#
CRLF  = 005015          1212#   1302
DEV     007474          1892    1917#
DEV1    007422          1895#   1897
DISJMP= 160000          1215#   1435    1473    1474    1475    1491
DISPRG  016756          2231    2514#
DISTOP= 173000          1216#   1543    1666
DJMP  = 160000           225#   1063    1072    1783#   1878
DLADD   001006           483#    566
DLBRL   001012           485#    617     619
DLICSR  001156           518#    552*    701
DLIDBR  001160           519#    708
DLIN    002206           616     701#
DLINB   002272           713     715#
DLIVT   001202           532#    616*
DLIVT1  001204           533#    617*
DLOCSR  001162           520#    551*    681
DLODBR  001164           504*    505*    521#    554*    695*
DLOUT   002124           618     681#
DLOUTA  002142           688#
DLOUTB  002174           692     695#
DLOVT   001206           534#    618*
DLOVT1  001210           535#    619*
DLVCT   001010           484#    574
DL11IB= 175612          1194#   1195    1513
DL11IS= 175610          1193#   1194    1261*   1511    1514*
DL11OB= 175616          1196#   1521*   1568*   1569*
DL11OS= 175614          1195#   1196    1264*   1282    1284*
DNOP  = 164000           226#    940     944    1056    1057    1058    1059    1060    1061    1062    1784#
DOCHAR  016110          2234    2243#
DOCORE  001720           506     634#
DONE    007554          1936    1947#
DSTOP = 173400           228#   1071    1786#
```

```
DSWR   = 177570            473#    586
ENDCOR   006036           1271#   1272
ERRVEC=  000004            472#    584     585*    592*
FF       006256           1359    1389#
FFLOOP   006262           1384    1391#   1394
FILEO    007214           1808    1811#   1879
FILEOA   005702            602*    667*    671*   1064#
FILEOB   005704            671    1065#
FILEOC   005732            602     667    1064    1071#
FILEOO   002772            550     853#   1073
GETCHR   006564           1342    1533#   1555
GETDL    006516           1511#   1516    1520    1522    1533    1537
GETDL1   006546           1512    1519#
GETEXT   006650           1535    1541    1561#
GETSIX   006630           1555#   1593    1608
GET8     006664           1593#   1703
GET8TB   006700           1596    1598#
GET81    006712           1598    1608#
GET82    006740           1599    1620#
GET83    006772           1600    1635#
GET84    006706           1604#
GRAPHX=  120000            206#    900    1760#   1860
GRAPHY=  124000            207#    886    1761#   1871
GRPINC   003054            603*    663*    664     666*    884#
GTADD    001000            479#    564
GTBRL    001004            481#    596     598     600
GTBUSE   006424           1444#   1467
GTCHL    016312           2331#   2333
GTCHP    016304           2328#   2337    2339
GTCHR    016306           2237    2319    2330#   2351
GTDLYO   001314            561#    601*    660*    662*
GTDNE1   001170            524#    596*
GTDONE   001166            523#    595*
GTLPEN   002100            597     671#
GTLPH    001172            526#    597*
GTLPH1   001174            527#    598*
GTNP     016366           2341    2348#
GTPC     001146            513#    550*    563     668*    672*
GTP84    016144           2270    2272#
GTSHIF   002116            599     675#
GTSIX    016262           2268    2277    2319#
GTSOTM   001176            529#    599*
GTSOT1   001200            530#    600*
GTSR     001150            514#    655     829*
GTSTOP   002010            595     655#
GTST1    002062            661     665     667#
GTVCT    001002            480#    568
GTXPOS   001152            515#
GTYPOS   001154            516#
GT40PC=  172000           1201#   1202    1444*   1478    1808*
GT40SR=  172002           1202#   1386*
GT8      016132           2268#   2436
GT8P   = 016152           2275#   2313    2314    2315    2316
GT8TB  = 016250           2273    2311#
GT81     016152           2277#   2313
GT82     016200           2288#   2314
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GT83    016232          2302#   2315
GT84    016142          2271#   2316
HEADER  006474          1434    1473    1479    1485#
HSR   = 177550          1886#   1918
IMAGE   001020           489#    494*    500*    503*    784
INCR  = 000100           236#    603     664     666     884    1797#   1855
INGT    001474           576     595#
INITGT  001316           493     563#
INSERT  006350          1367    1375    1413    1421#
INSRTL  006406          1425    1428    1433#
INSRTX  006422          1423    1438#
INTD    001566           605#    607
INTE    001602           610#    612
INTX  = 040000           239#    861     864     867     870     879     895     912     917     922     927     931     935
                         982     988     994    1000    1006    1012    1018    1024   1798#   1816    1820    1824    1828
INT0  = 002000           209#   1023   1764#   1815
INT1  = 002200           210#   1017   1765#   1834
INT2  = 002400           211#   1011   1766#   1819
INT3  = 002600           212#   1005   1767#   1836
INT4  = 003000           213#    860     999    1029   1768#   1823    1846
INT5  = 003200           214#    993   1769#   1838
INT6  = 003400           215#    987   1770#   1827
INT7  = 003600           216#    981   1771#   1840
ITAL0 = 000040           231#    941     951     963     975    1790#
ITAL1 = 000060           232#    945     957     969    1791#
JMPADD= 007012          1209#   1401   1412*   1491    1543*   1666*
JMPDIS= 160000          2191#   2229   2519
KBCHR   002506           738*    739*    740     750     770#
KBDIB = 027562          1199#   1521   2181#   2370
KBDIS = 027560          1198#   1199   1519    2177#   2181    2222*   2368    2371*
KBIN    002320           620     730#
KPNT    002504           557*    737     741*    742     744*    745     769#
KRBBRL  001226           545#    621
KRBVT   001222           542#    620*
KRBVT1  001224           543#    621*
LBAD    016610          2321    2323   2427#   2453
LF      006300          1357    1398#
LFLOOP  006310          1403#   1406   1408
LFOUND  006330          1404    1410#
LFSUB   006304          1392    1401#
LGWRD   016646          2414    2419   2442#   2449
LINE0 = 000004           221#    860     875     981    1778#   1815
LINE1 = 000005           222#    863   1779#   1819
LINE2 = 000006           223#    866   1780#   1823
LINE3 = 000007           224#    869   1781#   1827
LJMP    016666          2418   2449#
LJMP1   016726          2455   2463#
LLD2    016532          2408#   2411   2425
LLD3    016576          2422#   2434
LLD4    016624          2423   2433#
LOAD    016520          2346   2404#
LOADER  007012          1539   1666#
LOADRO  001400           565     567     569     575     577#
LOGICA  002752           469     842#
LONGV = 110000           204#    860     863     866     869     878     894     931     935     981     987     993     999
                        1005    1011    1017    1023   1758#   1815    1819    1823    1827
```

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                                                    N 4
LOOP    007444          1904#   1911
LOOP1   007522          1935#   1940
LOOP2   007526          1937#   1938    1943
LPDARK= 000200           230#   1789#
LPLITE= 000300           229#    856    1788#
LPOFF = 000100           217#    932    1773#
LPON  = 000140           218#    853     937    1774#
LPTR    016630          2409    2412    2422    2436#   2442    2444    2451
LSR   = 177560          1887#   1917
L.BAD   007100          1557    1559    1693#   1724
L.GWRD  007126          1678    1683    1710#   1720
L.HALT  007200          1732#
L.JMP   007146          1682    1720#
L.JMP1  007202          1730    1734#
L.LD2   007022          1671#   1674    1690
L.LD3   007066          1687#   1699
L.LD4   007110          1688    1698#
L.PTR   007114          1672    1676    1687    1703#   1710    1712    1722
MAJOR   016072          2237#   2241
MAXSX = 017600           244#   1803#
MAXSY = 000077           245#   1804#
MAXX  = 001777           240#    861     867    1799#   1816    1824
MAXY  = 001377           241#    855     865     871     939     948     954     960     966     972    1800#   1813    1821
                        1829
MEMDAT  010056          2071#   2072*   2077    2080
MEMEND  010120          2054    2083#
MEMTST  010050          2052    2069#
MINSUY= 000100           246#    912     917     922     927    1805#
MINUSX= 020000           242#    865     867     912     917     922     927     931     935    1801#   1802    1821    1824
MINUSY= 020000           243#   1802#
NORMAL  006212          1346    1355    1367#
NOTHER  006042          1269    1275#
NUMLIN= 000040          1210#   1299    1300    1389    1475
NXTCHR  006132          1342#   1344    1350    1369    1379    1387    1395    1398
OCTA    005657           613*    614*    615*    752*    754*    756*   1055#
ORIGIN= 166000          1191#
OTHER   007726          1969    1974    1998    2013    2021   2025#
OUTLIT  006652          1265    1568#   1693    1726
OVER    002510           509     774#    837
PCOUNT  002770           774*    827*    850#
POINT = 114000           205#    853     875     881     891     897     908     913     918     923     928     932     937
                         946     952     958     964     970     978     984     990     996    1002    1008    1014    1020
                        1029    1035    1042    1050    1065   1759#   1811    1831    1843    1852    1856    1867
PPNT    002310           555*    688     690*    691     693*    720#
PRESTR  006624          1544#   1695
PRIME   001234           507     550#
PSW     001232           492*    508*    548#
PTBOOT  007400          1890#
PUNCHR  002314           689*    695     722#
PWRFAL= 000024          2194#   2215    2232    2520
PWRFL   001674           466     624#    628
PWRUP   001704           624     627#
P10IB = 025612          2182#   2381
P10IC = 045772          2187#   2188    2330    2381*   2382*
P10IS = 025610          2179#   2182    2221*   2379    2383*
P100B = 025616          2183#   2365*   2376*   2484*
```

```
P100C = 045776            2186#   2187    2361    2365    2366*   2374    2482
P100S = 025614            2178#   2183    2223*   2363
RCVEC   007764            2039#
RC11    007720            2020#   2039
REDCHR  002316             708*    709*    710     723#
RELATV= 130000             208#    911     916    1762#   1846
RES     007506            1930#   1945
RESTRT  006060            1296#   1544
RFVEC   007714            2017#
RF11    007600            1968#   2017
RKVEC   007760            2037#
RK11    007610            1973#   2037
ROMADD  001014             487#    786
ROMORG= 166000            2170#
ROTVAL  010046            2063#   2080
RPNT    002312             556*    707     711*    712     714*    715     721#
RPVEC   007770            2041#
RP11    007654            1997#   2041
RSTRT   016034            2227#   2344    2431
R0SAV   002634             802*    810#
R1SAV   002636             803*    811#
R2SAV   002640             804*    812#
R3SAV   002642             805*    813#
R4SAV   002644             806*    814#
R5SAV   002646             807*    815#
SENDIT  016730            2430    2459    2481#   2483    2487
SETDUN  006126            1311    1320#
SETLP1  006074            1302#   1304
SETLP2  006110            1310#   1317
SETLP3  006116            1314#   1316
SETUP   006432            1307    1465#
SHORTV= 104000             203#    921     926    1757#   1834    1836    1838    1840
SIZE    001312             560#    647*    648*    2048
START   006000             500    1260#
STARTA  016000             503    2215#
STARTB  001022             477     491#    629     658     676     684     704     733     847
STARTX= 000000            2172#   2516
STARTY= 001360            2173#   2517
STATSA= 170000             227#    941     945     951     957     963     969     975    1785#
STATSB= 174000             235#    603     664     666     856     884    1795#   1855
STKSRT= 015770            2188#   2227    2406
STOP    007550            1944#   1948
SWR     001230             495     497     547#    586*    587     591*
SWREG   000170             475#    591
SYNOFF= 000010             233#
SYNON = 000004             234#   1792#
TAB     006222            1356    1374#   1378
TABLE   007562            1931    1951#
TABLEX  010240             794    2108#
TABLE0  010124             791    2089#
TABOOT  007500            1928#   1958
TACS  = 177500            1926#   1928
TAPES   007662            1980    1989    2002#
TCVEC   007774            2043#
TC11    007620            1979#   2043
TKB     001214             538#    738
```

```
TKS      001212            537#    553*    730
TMEM     002662            785     826#
TMPEND=  007776           1207#   1262    1296
TM11     007636           1988#
TPB      001220            540#    830*    833*
TPS      001216            539#    831     834
VT       006244           1358    1382#
VT40PC=  022000           2176#   2235*
WORDS    001016            488#    499*    502*    819
XMLOP1   010014           2052#   2057
XMLOP2   010020           2053#   2055
XMRTS    010034           2051    2058#
.      = 017002            458#    464     465#    468#    470#    474#    476#    478#    682     702     731     1246#   1907
                          1931    2010    2032    2073    2075    2078    2081    2206#   2275    2311    2461
```

```
GRAPH     294#    887     902
OCTGN     248#    912     917     922     927
OCTGON    258#    931     935
PAT1      277#    943     950
PAT2      282#    968     974
PAT3      287#    956     962


. ABS.  017002     000     CON   RW    ABS   LCL   I

 ERRORS DETECTED:  0

 CDGTED,CDGTED/CRF=CDGTED
 RUN-TIME: 2 5 .8 SECONDS
 RUN-TIME RATIO: 22/9=2.4
 CORE USED:  7K  (13 PAGES)
```