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TITLE	MINMON - TD8E DECTAPE MINIMONITOR
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MINMON - TD8E DECTAPE MINIMONITOR

DECUS Program Library Write-up DECUS NO. 8-644

SECTION A

Setting up the System

0. Introduction

Use of the TD8E Minimonitor is described in the companion 'Users Manual'. These notes describe how to bootstrap the system onto DECtape, how to use some auxiliary functions provided on the minimonitor system tape, how core images are organised on DECtape by the minimonitor, and how the minimonitor system is organised in core.

You are strongly advised to read the Users Manual before proceeding with the write-up, to get some idea of what the minimonitor can do. (See SECTION B)

1. Getting the system onto DECtape

It is important to distinguish between binary tapes containing the entire minimonitor system, including the DECtape read and write routines, a routine for bootstrapping the system onto DECtape, etc., and binary tapes containing just the core-resident part of the minimonitor. DECUS supplies a paper tape of the complete system. (This tape includes a routine for punching the core-resident part alone: see Section 2.)

To bootstrap the system onto DECtape, load the minimonitor system tape using the normal BIN loader procedure. (It is imperative that the BIN loader is used, because the minimonitor system writes the top page of core onto DECtape and uses this subsequently for loading programs from the teletype.) Next, mount a formatted DECtape on TD8E Drive 0, put the switches to REMOTE and WRITE ENABLE, and start the minimonitor system at location 7000. This will cause the program to move the BIN loader to another part of core, move the minimonitor command decoder and read routine to the top page of core, and write the first 37 core pages onto the first few blocks of DECtape (minimonitor core image 0). The program exits to the minimonitor command decoder, which responds with a # . (See the Users Manual.)

2. Punching tapes of the core-resident part of the minimonitor

Users of the minimonitor system normally need a BIN paper tape of the core-resident part only, and not the full system tape issued to you by DECUS. Such a tape can be punched after the system has been written to DECtape by stopping the computer and starting it at location 1000, with the SR set to 0. Further tapes can be punched at any time by using the minimonitor to read back core image 0, and starting the computer at location 1000 with the SR set to 0. If the SR is set to 1 before the computer is started, a paper tape is punched in a format suitable for the Bootstrap Loader (DECUS 5/8-27).

3. Organisation of core images on DECtape

Becuase the minimonitor is such a small program, it necessarily uses DECtape in a very naive manner. 37-page core images (all but the top page of core) are stored on 40-block chunks of DECtape, so that core image 0 is stored on tape blocks 0-36, core image 1 is stored on blocks 40-76, core image 2 on blocks 100-136, ..., core image ']' is stored on blocks 2640-2676. Block identification characters are in order of ASCII codes, from code 260 (0) to code 335 (]). Thus the legal block identifications are:

0123456789:;< = >?@ABCDEFGHUJKLMNOPQRSTUVWXYZ[\]

The minimonitor ignores checksums from DECtape, and so it is essential to ensure that the tape drives are working properly before using the program.

SECTION B

USERS MANUAL

0. Introduction

The TD8E Minimonitor enables 4K core images to be stored on DEC tape and loaded when required. The monitor comprises:

a) A command decoder and DECtape read routine, normally occupying core locations 7600-7777;

b) a-modified version of the BIN loader, a 200 word routine capable of being executed in any core page;

c) a DECtape write routine, a 200 word routine capable of being executed in any core page.

The TD8E minimonitor is incompatible with the OS8 DECtape file structure.

1. Identification of Core Images

The minimonitor deals with core images comprising the first 37 pages of core (all but locations 7600-7777). It is oblivious to the core bank structure of PDP8s with more than 4K.

Core images are identified by 1-character names: 0-9 and A-Z are normally used. Core image 0 is reserved for use by the system.

2. The Command Decoder

This has starting address 7600, and identifies itself by printing a #.

There are three commands:

a) R, for read. Followed by a core image name: the appropriate core image is read into core.

b) L, for load. The switch register must be set to the first address of a page in core, and the computer halts with AC=7777 to enable this to be done. Pressing CONTINUE causes the loader to be read into the indicated page.

c) W, for write. The computer halts as for (b), and the DECtape write routine is read into the indicated page.

Any character which is typed in response to the monitor's # will be taken as L, R, or W; according to whether its ASCII code is < , =, or > 322.

3. The BIN Loader

Once the loader is in core, it halts to enable bit 0 of the SR to be set for low or high speed reader. Loading commences when CONTINUE is pressed. After the tape is loaded, the checksum is examined. If it is zero, the monitor is entered immediately, and it responds with a # . The machine halts with the checksum in the AC if it is nonzero.

4. The DECtape Write Routine

When the write routine is in core, it expects a core image name to be typed. It then proceeds to write the current core image onto tape, under that name. Writing on core image 0 is prohibited.

5. Loading the Minimonitor, and Restoring the BIN Loader

The minimonitor is loaded using the BIN loader, as normal. It must be executed, starting at 7600, immediately it is loaded - without loading other tapes first.

To get back to the BIN loader, core image 0 should be read, and the computer started at location 7777 as usual.

6. Examples of Use

Suppose it is wished to load the Editor into core, store it in core image 6, and return to the BIN loader.

Load minimonitor using the BIN loader

Start it at location 7600

Minimonitor types "#"

Type L (for load)

Computer stops with AC=7777

Set SR to 7000 (Editor does not use locations 7000-7177)

Press CONTINUE

Computer stops with AC=7777

Set Bit 0 of SR to 0; place Editor tape in high-speed reader

Press CONTINUE. Tape reads in

Minimonitor types "#"

6. Examples of Use cont'd

Type W (for write)

Computer stops with AC=7777

Set SR to 7000; press CONTINUE

Type 6 (core image 6)

Minimonitor writes on DECtape, and then types "#"

Type R0 (read system block)

Computer now contains BIN loader, ready to start at 7777.

To load core image 6 back into core, just load the minimonitor, start it at 7600, and type R6 in response to the #. Then press HALT; load address 200, and start.

Appendix: Halt Locations for the Minimonitor

The minimonitor may halt in any of the following locations. (For Load and Write routines, addresses are given relative to the beginning of the routine.)

Address	AC	Reason for Halt	Effect of pressing CONTINUE
Command decoder and read routine:			
7614	7777	Set SR to first locn of page to accept Load or Write routine	Load or Write routine is read into that page
7644	0	DECtape unit 0 not selected	Attempts to read again
7704	0	DECtape in end zone going forward	No effect
7734	0	DECtape timing error	No effect
Load routine:			
0003	checksum	Checksum error on loading	Attempts loading again
0176	7777	Set SR bit 0 to select reader	Loads tape from that reader
Write routine:			
0004	0	Tried to write on core image 0	Exits to command decoder
0022	0	DECtape unit 0 not selected, or write locked	Attempts to write again
0062	0	DECtape in end zone going forward	No effect
0123	0	DECtape timing error	No effect

```
                 *7000
                 /CODE TO BOOTSTRAP SYSTEM ONTO DECTAPE
 7000   4114     XG01,    JMS XMOVE          /MOVE BIN LOADER TO LOCS 200-377
 7001   7610              7610
 7002   0210              0210
 7003   0160              160
                 /
                 /
 7004   4114              JMS XMOVE          /MOVE MONITOR TO TOP OF CORE
 7005   0600              600
 7006   7600              7600
 7007   0200              200
                 /
                 /
 7010   7200              CLA                /EXIT TO 'WRITE' WITH AC=0 TO PUT TH
 7011   5612              JMP I  .+1         /CORE IMAGE ONTO SYSTEM AREA OF TAPE
 7012   0406              WRENT
                 /
                 /
                 /CODE TO MERELY MOVE MONITOR TO TOP OF CORE, WITHOUT WRITING
                 /SYSTEM UP ON TAPE
 7013   4114     XG02,    JMS XMOVE
 7014   0600              600
 7015   7600              7600
 7016   0200              200
 7017   5620              JMP I  .+1         /EXIT TO MONITOR
 7020   7600              XG03
                 /
                 /
                 *7600
 7600   5601     XG03,    JMP I  .+1         /IF PROGRAM IS STARTED AT 7600, XG02
 7601   7013              XG02               /IS EXECUTED TO BRING MONITOR TO TOP
                                             /OF CORE
                 /
                 /
                 *0
                 /MOVE BIN LOADER BACK TO TOP OF CORE
 0000   5100              JMP BINMOV
                 /
                 /
                 *10
                 /ODDS AND ENDS FOR BOOTSTRAP MONITOR
 0010   0000     AUTO00,  0
 0011   0000     AUTO01,  0
                 /
                 /
                 *100
                 /MOVE BIN LOADER BACK TO TOP OF CORE
 0100   4114     BINMOV, JMS XMOVE
 0101   0200              200
 0102   7600              7600
 0103   0200              200
 0104   5505              JMP I  .+1         /EXIT TO BIN LOADER
 0105   7777              7777
                 /
                 /
```

```
                /MOVE MONITOR TO TOP OF CORE--THIS ROUTINE
                /IS USED BY PUNCHED VERSIONS OF THE MONITOR ALONE
0106  4114      MONMOV, JMS XMOVE
0107  0600              600
0110  7600              7600
0111  0200              200
0112  5513              JMP I .+1
0113  7600              7600            /EXIT TO MONITOR
                /
                /
                /XMOVE
                /SR TO MOVE A PIECE OF CORE.    FOLLOW WITH 3 ARGS:
                /       ARG1 = 1ST ADDRESS OF SOURCE AREA
                /       ARG2 = 1ST ADDRESS OF DESTINATION AREA
                /       ARG3 = NUMBER OF LOCS TO BE MOVED
0114  0000      XMOVE,  0
0115  7240              CLA CMA
0116  1514              TAD I XMOVE
0117  3010              DCA AUTO0
0120  2114              ISZ XMOVE
0121  7240              CLA CMA
0122  1514              TAD I XMOVE
0123  3011              DCA AUTO1
0124  2114              ISZ XMOVE
0125  1514              TAD I XMOVE
0126  7041              CIA
0127  3136              DCA XMOVE0
0130  2114              ISZ XMOVE
0131  1410      XMLOOP, TAD I AUTO0
0132  3411              DCA I AUTO1
0133  2136              ISZ XMOVE0
0134  5131              JMP XMLOOP
0135  5514              JMP I XMOVE
0136  0000      XMOVE0, 0
                /
                /
                *200
                /
                /MODIFICATIONS TO BIN LOADER, SO THAT IT
                /       1. STARTS AT 1ST LOCN OF PAGE, AND HALTS TO ENABLE
                /       SR OPTIONS TO BE SET
                /       2. EXITS TO 7600 AFTER CHECKING THAT CHECKSUM IS 0
0200  5372      BIN1,   JMP BIN3
0201  7450      BIN2,   SNA
0202  5772              JMP I BIN3      /EXIT TO MONITOR
0203  7402              HLT             /CHECKSUM IS NON-ZERO
0204  5301              JMP 301         /RESTART LOADER
                /
                *371
0371  5201              JMP BIN2
0372  7600      BIN3,   7600            /(CLA) REPLACE HLT INSTRN IN LOADER
0373  1371              TAD BIN3-1      /BY JMP BIN2
0374  3300              DCA 300
0375  7240              CLA CMA         /HLT TO ENABLE SETTING OF SR
0376  7402              HLT
0377  5301              JMP 301         /LAST INSTRN OF REAL BIN LOADER
```

```
                     /
                     SDSS=6771
                     SDST=6772
                     SDSQ=6773
                     SDLC=6774
                     SDLD=6775
                     SDRC=6776
                     SDRD=6777
                     /
                     /
                     *400
                     /WRITE ROUTINE


0400  4741  WRITE1, JMS I IACPT
0401  1362          TAD WM260
0402  7440          SZA
0403  5206          JMP .+3
0404  7602          HLT CLA             /TRIED TO WRITE ON SYSTEM PART
0405  5745          JMP I WWCOUNT       /EXIT TO MONITOR
0406  7002  WRENT,  7002
0407  7110          CLL RAR
0410  7000          NOP                 /UNUSED LOCATION
0411  3343          DCA WBLOCK
0412  3344          DCA WBUFF
0413  1361          TAD WM37            /PGCT=-37
0414  3346          DCA WPGCT
0415  6774  WSTART, SDLC
0416  6776          SDRC
0417  0354          AND WP100
0420  7650          SNA CLA
0421  5224          JMP .+3
0422  7402  WSELER, HLT                 /SELECT ERROR, OR WRITE LOCK
0423  5215          JMP WSTART          /PRESSING CONT GIVES ANOTHER LIFE
0424  7232  WGO,    CLA CML RTR
0425  1351          TAD WP1000
0426  6774          SDLC
0427  4742          JMS I IRDQUA
0430  4742          JMS I IRDQUA
0431  6771  WSRCH,  SDSS
0432  5231          JMP .-1
0433  6776          SDRC
0434  7106          CLL RTL
0435  0352          AND WP374
0436  1254          TAD WM110
0437  7450          SNA
0440  5256          JMP WENDZ
0441  1357          TAD WM20
0442  7640          SZA CLA
0443  5231          JMP WSRCH
```

```
0444  6777            SDRD
0445  7430            SZL
0446  1356            TAD WP3
0447  7040            CMA
0450  1343            TAD WBLOCK
0451  7040            CMA
0452  7450            SNA
0453  5264            JMP WFOUND
0454  7670  WM110,    SZL SNA CLA
0455  5231            JMP WSRCH
0456  6776  WENDZ,    SDRC
0457  7106            CLL RTL
0460  7630            SZL CLA
0461  5224            JMP WGO
0462  7402            HLT             /IN ENDZONE GOING FORWARD
0463  5262            JMP .-1         /A REAL STOPPER
0464  7630  WFOUND,   SZL CLA
0465  5224            JMP WGO
0466  1345            TAD WWCOUNT
0467  3347            DCA WWORDS
0470  6771  WREVGR,   SDSS
0471  5270            JMP .-1
0472  6776            SDRC
0473  0355            AND WP77
0474  1360            TAD WM32
0475  7640            SZA CLA
0476  5270            JMP WREVGR
0477  6776  WRITE2,   SDRC
0500  0353            AND WP300
0501  7640            SZA CLA
0502  5222            JMP WSELER      /SELECT ERROR OR WRITE LOCK
0503  4742            JMS I IRDQUA
0504  7200            CLA
0505  1350            TAD WP1400
0506  6774            SDLC
0507  7240            CLA CMA
0510  4333            JMS WRQUAD
0511  1744  WRLP,     TAD I WBUFF
0512  4333            JMS WRQUAD
0513  2344            ISZ WBUFF
0514  7000            NOP
0515  2347            ISZ WWORDS
0516  5311            JMP WRLP
0517  6773            SDSQ            /WAIT FOR LAST DATA WORD
0520  5317            JMP .-1         /TO BE WRITTEN
0521  6772            SDST
0522  5325            JMP .+3
0523  7402            HLT             /TIMING ERROR
0524  5323            JMP .-1         /A REAL STOPPER
0525  7320            CLA CLL CML     /FORCES MOTION FORWARD
0526  2343            ISZ WBLOCK      /NEXT BLOCK TO TRANSFER
0527  2346            ISZ WP3CT       /DONE YET ?
0530  5224            JMP WGO         /NO
0531  6774            SDLC            /YES. STOP UNIT
0532  5745            JMP I WWCOUNT   /GET OUT
```

```
                  /
0533  0000  WRQUAD, 0
0534  6773          SDSQ
0535  5334          JMP .-1
0536  6775          SDLD
0537  7200          CLA
0540  5733          JMP I WRQUAD
            /
            /
0541  7751  IACPT,  ACPT+7000
0542  7744  IRDQUA, RDQUAD+7000
0543  0000  WBLOCK, 0
0544  0000  WBUFF,  0
0545  7600  WWCOUNT,7600
0546  0000  WPGCT,  0
0547  0000  WWORDS, 0
0550  1400  WP1400, 1400
0551  1000  WP1000, 1000
0552  0374  WP374,  374
0553  0300  WP300,  300
0554  0100  WP100,  100
0555  0077  WP77,   77
0556  0003  WP3,    3
0557  7760  WM20,   -20
0560  7746  WM32,   -32
0561  7741  WM37,   -37
0562  7520  WM260,  -260
            /
            /
            /
            SDSS=6771
            SDST=6772
            SDSQ=6773
            SDLC=6774
            SDLD=6775
            SDRC=6776
            SDRD=6777
            /
            *600
0600  7300  BEGIN,  CLA CLL
0601  1370          TAD P243
0602  6044          TPC
0603  4351          JMS ACPT        /COUGH
0604  1376          TAD M322        /LOAD, READ, OR WRITE ?
0605  7450          SNA
0606  5224          JMP READ1       /R FOR READ
0607  7700          SMA CLA
0610  7101  WRITE,  IAC CLL         />R = W, FOR WRITE
```

```
0611  7001  LOAD,   IAC                     /<R = L, FOR LOAD
0612  3360          DCA BLOCK
0613  7240          CLA CMA
0614  7402          HLT                     /WAIT WITH AC=-1 FOR SR
0615  7604          LAS                     /GET SA OF FREE CORE PAGE
0616  0364          AND WCOUNT
0617  3361          DCA BUFF
0620  1361          TAD BUFF
0621  3357          DCA LEAVE               /PREPARE SA FOR EXIT
0622  7040          CMA                     /PGCT=-1
0623  5236          JMP START-1
0624  4351  READ1,  JMS ACPT                /GET DUMP NUMBER
0625  1375          TAD M260                /STRIP IT
0626  7002          7002                    /BSW. MULTIPLY IT BY 40
0627  7110          CLL RAR                 /GET BLOCK NUMBER
0630  7000          NOP                     /UNUSED LOCATION
0631  3360          DCA BLOCK
0632  3361          DCA BUFF
0633  1364          TAD WCOUNT              /SET EXIT ADDRESS TO 7600
0634  3357          DCA LEAVE
0635  1374          TAD M37                 /PGCT=-37
0636  3362          DCA PGCT
0637  6774  START,  SDLC                    /TRY TO SELECT UNIT 0
0640  6776          SDRC
0641  0377          AND P100
0642  7650          SNA CLA
0643  5246          JMP GO                  /LINK STILL SET FOR DIRN
0644  7402          HLT                     /SELECT ERROR
0645  5237          JMP START               /'CONTINUE' GIVES ANOTHER LIFE
0646  7232  GO,.    CLA CML RTR
0647  1366          TAD P1000
0650  6774          SDLC
0651  4344          JMS RDQUAD
0652  4344          JMS RDQUAD
0653  6771  SRCH,   SDSS
0654  5253          JMP .-1
0655  6776          SDRC
0656  7106          CLL RTL
0657  0367          AND P374
0660  1276          TAD M110
0661  7450          SNA
0662  5300          JMP ENDZ
0663  1372          TAD M20
0664  7640          SZA CLA
0665  5253          JMP SRCH
0666  6777          SDRD
0667  7430          SZL
```

```
0670  1371             TAD P3
0671  7040             CMA
0672  1360             TAD BLOCK
0673  7040             CMA
0674  7450             SNA
0675  5306             JMP FOUND
0676  7670  M110,      SZL SNA CLA
0677  5253             JMP SRCH
0700  6776  ENDZ,      SDRC
0701  7106             CLL RTL
0702  7630             SZL CLA
0703  5246             JMP GO
0704  7402             HLT                 /IN ENDZONE GOING FORWARD
0705  5304             JMP .-1             /A REAL STOPPER
0706  7630  FOUND,     SZL CLA
0707  5246             JMP GO
0710  1364             TAD WCOUNT
0711  3363             DCA WORDS
0712  6771  REVGRD,    SDSS
0713  5312             JMP .-1
0714  6776             SDRC
0715  0327             AND P77
0716  1373             TAD M32
0717  7640             SZA CLA
0720  5312             JMP REVGRD
0721  4344  READ,      JMS RDQUAD
0722  4344             JMS RDQUAD
0723  4344             JMS RDQUAD
0724  4344  RDLP,      JMS RDQUAD
0725  3761             DCA I BUFF
0726  2361             ISZ BUFF
0727  0077  P77,       77
0730  2363             ISZ WORDS
0731  5324             JMP RDLP
0732  6772             SDST
0733  5336             JMP .+3
0734  7402             HLT                 /TIMING ERROR
0735  5334             JMP .-1             /A REAL STOPPER
0736  7120             CLL CML             /FORCES MOTION FORWARD
0737  2360             ISZ BLOCK           /NEXT BLOCK TO TRANSFER
0740  2362             ISZ PGCT            /DONE YET ?
0741  5246             JMP GO              /NO
0742  6774             SDLC                /YES. STOP UNIT
0743  5757             JMP I LEAVE         /GET OUT
            /
0744  0000  RDQUAD,    0
0745  6773             SDSQ
0746  5345             JMP .-1
0747  6777             SDRD
0750  5744             JMP I RDQUAD
            /
0751  0000  ACPT,      0
0752  6031             KSF
0753  5352             JMP .-1
0754  6036             KRB
0755  6044             TPC                 /ECHO
0756  5751             JMP I ACPT
```

```
                /
                /
0757  0000      LEAVE,  0
0760  0000      BLOCK,  0
0761  0000      BUFF,   0
0762  0000      PGCT,   0
0763  0000      WORDS,  0
0764  7600      WCOUNT, 7600
0765  0000              0                       /UNUSED LOCATION
0766  1000      P1000,  1000
0767  0374      P374,   374
0770  0243      P243,   243
0771  0003      P3,     3
0772  7760      M20,    -20
0773  7746      M32,    -32
0774  7741      M37,    -37
0775  7520      M260,   -260
0776  7456      M322,   -322
                /
                /
                *777
0777  0100      P100,   100
                /
                /
                MQL=7421
                MQA=7501
                ACL=7701
                /ROUTINES TO PUNCH THE MONITOR ALONE IN BOTH
                /BIN AND BOOTSTRAP FORMATS.     ENTER AT *1000
                /WITH SR=0 FOR BIN AND SR=1 FOR BOOTSTRAP
                /EXITS TO MONITOR AFTER PUNCHING
                *1000
1000  7200      PNCH,   CLA
1001  6046              TLS
1002  7604              LAS
1003  7450              SNA
1004  5264              JMP BINFOR      /PUNCH IN BIN FORMAT IF SR=0
1005  1250              TAD PM1
1006  7450              SNA
1007  5211              JMP BSTRAP      /PUNCH OUT BOOTSTRAP IF SR=1
1010  5374              JMP PPEXIT      /EXIT TO MONITOR
1011  4361      BSTRAP, JMS PMANY       /PUNCH OUT 0 CODE
1012  4347              JMS PLST        /PUNCH FOLLOWING LIST
1013  0317              317
1014  0272              272
1015  0367              367
1016  0127              127
1017  0107              107
1020  0061              061
1021  0050              050
1022  0317              317
1023  0102              102
1024  0367              367
```

```
1025  0067              067
1026  0067              067
1027  0067              067
1030  0051              051
1031  0317              317
1032  0172              172
1033  0367              367
1034  0054              054
1035  0231              231
1036  0075              075
1037  0106              106
1040  0066              066
1041  0102              102
1042  0034              034
1043  0007              007
1044  0074              074
1045  0002              002
1046  0075              075
1047  0077              077
1050  7777   PM1,       -1
1051  1315              TAD PP577        /PUNCH CONTENTS OF LOCS 600-777
1052  3010              DCA AUTO0
1053  7100              CLL
1054  1410              TAD I AUTO0
1055  4327              JMS BINP
1056  1010              TAD AUTO0
1057  0316              AND PP777
1060  7640              SZA CLA          /DONE YET ?
1061  5253              JMP .-6
1062  4361              JMS PMANY        /YES. PUNCH 0 CODE
1063  5374              JMP PPEXIT       /EXIT TO MONITOR
             /
             /
1064  3321   BINFOR,    DCA CHKSUM
1065  1302              TAD PP200        /PUNCH 200 CODE
1066  4361              JMS PMANY
1067  1317              TAD PP7600
1070  7120              STL
1071  4327              JMS BINP         /PUNCH '*7600'
1072  1320              TAD PPINS
1073  7100              CLL
1074  4327              JMS BINP         /PUNCH 'JMP MONMOV'
1075  4712              JMS I IBPUN      /PUNCH CODE TO MOVE MONITOR
1076  0106              MONMOV
1077  0031              XMOVE0-MONMOV+1
1100  4712              JMS I IBPUN      /PUNCH LOCS 600-777
1101  0600              600
1102  0200   PP200,     200
1103  1321              TAD CHKSUM       /PUNCH CHECKSUM
1104  7100              CLL
1105  4327              JMS BINP
1106  1302              TAD PP200
1107  4361              JMS PMANY        /PUNCH 200 CODE
1110  5374              JMP PPEXIT       /EXIT TO MONITOR
```

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                /
                /
 1111   1225    ICRLF,   CRLF
 1112   1200    IBPUN,   BPUN
 1113   0077    PP77,    77
 1114   0177    PP177,   177
 1115   0577    PP577,   577
 1116   0777    PP777,   777
 1117   7600    PP7600,  7600
 1120   5106    PPINS,   JMP MONMOV
 1121   0000    CHKSUM,  0
                /
                /
                /PUNCH OUT AC
 1122   0000    PUN,     0
 1123   6041             TSF
 1124   5323             JMP .-1
 1125   6046             TLS
 1126   5722             JMP I PUN
                /
                /
                /PUNCH OUT AC & L IN BINARY
 1127   0000    BINP,    0
 1130   7421             MQL
 1131   7501             MQA
 1132   7012             RTR
 1133   7012             RTR
 1134   7012             RTR
 1135   0314             AND PP177          /MAY BE ADDRESS
 1136   4322             JMS PUN
 1137   1321             TAD CHKSUM
 1140   3321             DCA CHKSUM
 1141   7701             ACL
 1142   0313             AND PP77           /CAN'T BE ADDRESS
 1143   4322             JMS PUN
 1144   1321             TAD CHKSUM
 1145   3321             DCA CHKSUM
 1146   5727             JMP I BINP
                /
                /
                /PUNCH OUT LIST FOLLOWING JMS, TERMINATED WITH -1
 1147   0000    PLST,    0
 1150   7200             CLA
 1151   1747             TAD I PLST
 1152   7001             IAC
 1153   2347             ISZ PLST
 1154   7450             SNA
 1155   5747             JMP I PLST         /RETURN
 1156   1250             TAD PM1
 1157   4322             JMS PUN
 1160   5350             JMP PLST+1         /GO GET ANOTHER
```

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                 /
                 /
                 /PUNCH OUT AC 200 TIMES
 1161   0000     PMANY,  0
 1162   7421             MQL
 1163   1317             TAD PP7600
 1164   3373             DCA PMANY1
 1165   7701             ACL
 1166   4322             JMS PUN
 1167   2373             ISZ PMANY1
 1170   5366             JMP .-2
 1171   7200             CLA
 1172   5761             JMP I PMANY
 1173   0000     PMANY1, 0
                 /
                 /
 1174   4711     PPEXIT, JMS I ICRLF
 1175   5717             JMP I PP7600
                 /
                 /
                 *1200
                 /PUNCH OUT BLOCK OF CORE IN BIN FORMAT
                 /CALL BY 'JMS BPUN; START ADDRESS; NO.OF LOCNS'
 1200   0000     BPUN,   0
 1201   7240             CLA CMA
 1202   1600             TAD I BPUN
 1203   3010             DCA AUTO0         /CORE POINTER
 1204   2200             ISZ BPUN
 1205   1600             TAD I BPUN        /COUNT
 1206   2200             ISZ BPUN
 1207   7041             CIA
 1210   3223             DCA BPUN1
 1211   1010             TAD AUTO0         /PUNCH INITIAL ADDRESS
 1212   7001             IAC
 1213   7120             STL
 1214   4624             JMS I IBINP
 1215   1410             TAD I AUTO0       /PUNCH OUT NEXT CONTENTS WORD
 1216   7100             CLL
 1217   4624             JMS I IBINP
 1220   2223             ISZ BPUN1
 1221   5215             JMP .-4
 1222   5600             JMP I BPUN
 1223   0000     BPUN1,  0
 1224   1127     IBINP,  BINP
```

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                 /
                 /
1225   0000   CRLF,    0
1226   7200            CLA
1227   1241            TAD PP215
1230   4640            JMS I CRLF1
1231   7200            CLA
1232   1242            TAD PP212
1233   4640            JMS I CRLF1
1234   7200            CLA
1235   6041            TSF                    /WAIT FOR FLAG
1236   5235            JMP .-1
1237   5625            JMP I CRLF
1240   1122   CRLF1,   PUN
1241   0215   PP215,   215
1242   0212   PP212,   212
              /
              /
```