IDENTIFICATION

Product Code:	MAINDEC-08-D3EB-D
Product Name:	TC01 Extended Memory Exerciser
Date Created:	January 5, 1968
Maintainer:	Diagnostic Group
Author:	Edward P. Steinberger

MAINDEC-08-D3EB-D

1. ABSTRACT

TC01 EXTENDED MEMORY EXERCISER is a test program for the PDP-8 Computer which tests the transfer to data between the TC01 DECtape Control and extended memory fields (more than 4K). It does this by storing a data pattern in an extended memory field, transferring the data onto DECtape and then reading the data back into the field and checking it for correct transfer.

2. REQUIREMENTS

2.1 Equipment

Standard PDP-8 Computer
TC01 DECtape Control with at least 1 Transport (TU55)
183 Memory Extension Control with at least 1 Memory Module (184)

2.2 Storage

The program occupies the first 6 pages of Bank 0 and uses 2000 to 5777 of each memory bank for data storage. All of memory not occupied by the program in Bank 0 with the exception of the last page is filled with "HLT".

2.3 Preliminary Programs

DECtape Basic Exerciser
DECtape Random Exerciser

3. LOADING PROCEDURE

3.1 Method

This test is loaded by the standard Binary Loader (SA = 7777).

4. STARTING PROCEDURE

4.1 Control Switch Settings

The following is a table of control switch settings and their action on the program.

SR	Set As	Action
0 1 2		Unit Select bits for DECtape transport
6 7 8		Number of ADDITIONAL memory fields (must be non-zero)
9	1	Halt on Error
	0	Don't Halt on Error
10	1	Don't Print Errors
	0	Print Errors
11	1	Don't Ring Bell on Error
	0	Ring Bell on Error

4.2 Starting Address

The starting address of the program is 00200.

4.3 Program and/or Operator Action

4.3.1 Load program into Memory Bank 0 per 3.1.

4.3.2 Set SR to 00200, depress "Load Address".

4.3.3 Set SR 9 to 11 per 4.1.

4.3.4 Depress "Start".

5. OPERATING PROCEDURE

5.1 Operational Switch Settings

See 4.1

5.2 Subroutine Abstracts

None

5.3 Operating Procedure

After starting the program per 4.3 the computer will halt at location 00223 if no error occurred after performing static tests on the TC01 "Field" register.

5.3.1 Set SR 0 to 2 to unit select bits of transport to be exercised.

5.3.2 Place a standard PDP-8 certified DECtape on the transport to be exercised, place transport "On Line" with "Write" enabled.

5.3.3 Set SR 6 to 8 to the number of extra memory fields (non-zero).

5.3.4 Depress "Continue".

5.3.5 To run the dynamic tests only:

5.3.5.1 Set SR to 0224, depress "Load Address".

5.3.5.2 Set unit select bit, extra field bits, error option bits in SR (see 4.1).

5.3.5.3 Assure selected transport is ready.

5.3.5.4. Depress "Start".

6. ERRORS

6.1 Error Halts and Description

The following is a table of error halts and the reason for each.

Location	Reason
0227	No extended memory indicated by SR 6 to 8
0351 (HALT 2)	"B" register not properly set
0527 (HALT 3)	Data Error
0735 (HALT 1)	DECtape Error
Outside of Program	Extended Memory Control Error (either non-existent of defective memory)

6.2 Error Recovery

6.2.1 Reset SR if necessary.

6.2.2 Depress "Continue" for any error except "Outside of program".

6.3 Error Typeouts

6,3.1 "B" Register Error.

```
MEMORY FIELD ERROR
RIGHT        WRONG
0070         0030
```

The above example shows that an attempt was made to set the "B" register to 0070, however the most significant bit (0040) did not set.

6.3.2 Data Error

```
DATA ERROR
FIELD 0003
FIRST BLOCK 0040
LOC. DATA
2000 7402
2001 7402
```

The aove example shows that a data error occurred in Memory Bank 3, the transfer started at block 0040, location 2000 contains 7402 (should contain 2000).

6.3.3 DECtape Error

```
THE FOLLOWING UNEXPECTED ERRORS OCCURRED:
MARK TRACK
END ZONE
SELECT
PARITY
TIMING
```

The above typeout (with at least one error indicated) will be typed out if there is a DECtape control error.

7. RESTRICTIONS

7.1 Starting Restrictions

None

7.2 Operating Restrictions

SR6 to 8 may be set to less than the number of additional memory fields but not more than that number. (SR6 to 8 must be non-zero), otherwise unpredictable results may occur (attempts to reference non-existent memory).

8. MISCELLANEOUS

8.1 Execution Time

Not applicable - 1 Pass down tape allows each memory field (other than 0) to be exercised at least 34 (Dec.) times (takes 8 minutes).

9. PROGRAM DESCRIPTION

9.1 The first portion of the test performs static tests on the memory field portion of the "B Register". The "B Register" is tested to assure that it may be set to all values (0 to 7). Any error will cause an error typeout and error halt unless these are suppressed by Switch Register settings.

9.2 The second portion of the test performs dynamic tests on the DECtape control, transfers are made to and from DECtape and extended memory.

9.2.1 The program first obtains the maximum field size from SR 6 to 8 and checks to make sure it is non-zero. The program then extracts the unit select bits from SR 0 to 2 for the DECtape drive being exercised.

9.2.2 The program then sets a location so that the first block sought is block 0 ("current block").

9.2.3 The program then sets a location so that field 1 is exercised ("current memory field").

9.2.4 The "current memory field" is then checked to assure that it is not larger than the maximum available field. If it is larger, the program goes to 9.2.3, otherwise the program goes to 9.2.5.

9.2.5 "HLT" is stored in all memory locations in field 0 not occupied by the program or the Binary or Rim Loaders. Also a location in an error typeout routine is initialized to provide error header typeout.

9.2.6 "HLT" is stored in all memory locations in the "current memory field", then data (addresses) are stored in locations 2000 through 5777 of the "current memory field".

9.2.7 The "current block" is then searched for. If a DECtape error occurs, an error typeout occurs and the search process is repeated.

9.2.8 After the "current block" has been found, the data in the "current memory field" is written on DECtape starting at that block. If an error occurs, the program goes back to 9.2.7. otherwise it goes to 9.2.9.

9.2.9 All locations in the "current memory field" are then set to "HLT".

9.2.10 The "current block" is sought again.

9.2.11 The data just written on DECtape is then read back into "current memory field" at the locations from which it came. A DECtape error at this point returns the program to 9.2.10.

9.2.12 The data in the "current memory field" is then checked to assure correctness of transfer.

9.2.13 All locations in the "current memory field" are set to "HLT".

9.2.14 The "current block" is the incremented by 10 and checked to assure that it does not equal 2670. If it does, the "current block" is then set back to 0.

9.2.15 The "current memory field" is then incremented by 10 (effectively 1) and the program goes back to 9.2.4.

```
                        /PROGRAM TO EXERCISE THE TC01 AND EXTENDED MEMORY

        0020            *20

                        /CONSTANTS AND VARIABLES
0020    0000            BLOCK,  0               /CURRENT BLOCK
0021    0000            CNTR,   0
0022    0000            ERROR,  0               /ERROR STATUS
0023    0000            FIELD,  0               /CURRENT FIELD
0024    0002            K0002,  2
0025    0003            K0003,  3
0026    0004            K0004,  4
0027    0007            K0007,  7
0030    0010            K0010,  10
0031    0070            K0070,  70
0032    0130            K0130,  130
0033    0150            K0150,  150
0034    0200            K0200,  200
0035    0201            K0201,  201             /MINUS 7577
0036    0207            K0207,  207             /BELL
0037    0212            K0212,  212             /LF
0040    0215            K0215,  215             /CR
0041    0240            K0240,  240             /SPACE
0042    0260            K0260,  260             /DIGIT CODE
0043    0400            K0400,  400             /FWD-REV
0044    0600            K0600,  600             /GO-REV
0045    0610            K0610,  610             /GO REV SEARCH
0046    1777            K1777,  1777    /FIRST ADDRESS-1 OF DATA
0047    2670            K2670,  2670
0050    4000            K4000,  4000    /NUMBER OF DATA WORDS
0051    7000            K7000,  7000
0052    7401            K7401,  7401            /MINUS ROBOUT
0053    7754            K7754,  7754            /WC
0054    7755            K7755,  7755            /CA
0055    7774            K7774,  7774            /MINUS 4
0056    0000            MAX,    0               /HIGHEST FIELD AVAILABLE
0057    1000            PMESS1, MESS1           /DECTAPE ERROR HEADER
0060    1056            PMESS2, MESS2           /MARK TRACK
0061    1073            PMESS3, MESS3           /END ZONE
0062    1106            PMESS4, MESS4           /SELECT
0063    1117            PMESS5, MESS5           /PARITY
0064    1130            PMESS6, MESS6           /TIMING
0065    1141            PMESS7, MESS7           /"B" REGISTER ERROR HEADER
0066    1205            PMESS8, MESS8           /DATA ERROR HEADER
0067    1232            PMESS9, MESS9           /MORE DATA ERROR HEADER
0070    1251            PMES10, MESS10          /END OF DATA ERROR HEADER
0071    0000            PNTR1,  0               /MSPRNT POINTER
0072    0000            PNTR2,  0               /DATERR POINTER
0073    7410            SKIP,   SKP
0074    7402            STOP,   HLT
0075    0000            TEMP,   0
0076    0000            UNIT,   0               /UNIT BEING OPERATED UPON
0077    0400            E1,     SET
0100    0416            E2,     STORE
```

```
0101  0437              E3,     CHECK
0102  0466              E4,     DATERR+4
0103  0000              E5,     SEARCH
0104  0651              E6,     WAIT
0105  1266              E7,     END
```

```
                        /MESSAGE PRINT SUBROUTINE

 0106  0000             MSPRNT, 0
 0107  3071                     DCA PNTR1
 0110  1471                     TAD I PNTR1
 0111  4117                     JMS TYPE
 0112  1052                     TAD K7401
 0113  7650                     SNA CLA
 0114  5506                     JMP I MSPRNT
 0115  2071                     ISZ PNTR1
 0116  5110                     JMP MSPRNT+2

 0117  0000             TYPE,   0
 0120  6046                     TLS
 0121  6041                     TSF
 0122  5121                     JMP .-1
 0123  5517                     JMP I TYPE

 0124  0000             CRLF,   0
 0125  7200                     CLA
 0126  1040                     TAD K0215
 0127  4117                     JMS TYPE
 0130  7200                     CLA
 0131  1037                     TAD K0212
 0132  4117                     JMS TYPE
 0133  7200                     CLA
 0134  5524                     JMP I CRLF

                        /PRINT SUBROUTINE

 0135  0000             PRINT,  0
 0136  7004                     LAS
 0137  7012                     RTR
 0140  7430                     SZL CLA
 0141  5535                     JMP I PRINT
 0142  2135                     ISZ PRINT
 0143  5535                     JMP I PRINT

                        /BELL SUBROUTINE

 0144  0000             BELL,   0
 0145  7004                     LAS
 0146  7010                     RAR
 0147  7430                     SZL CLA
 0150  5544                     JMP I BELL
 0151  1036                     TAD K0207
 0152  4117                     JMS TYPE
 0153  5544                     JMP I BELL
```

```
                        /TYPE OUT THE NUMBER IN THE AC

0154  0000            NUMBER, 0
0155  3075                    DCA TEMP
0156  1055                    TAD K7774
0157  3021                    DCA CNTR
0160  1075                    TAD TEMP
0161  7104                    RAL CLL
0162  7004                    RAL
0163  7006                    RTL
0164  3075                    DCA TEMP
0165  1075                    TAD TEMP
0166  0027                    AND K0007
0167  1042                    TAD K0200
0170  4117                    JMS TYPE
0171  7200                    CLA
0172  1075                    TAD TEMP
0173  2021                    ISZ CNTR
0174  5162                    JMP .-12
0175  7200                    CLA
0176  5554                    JMP I NUMBER

      6761              UTRA=6761
      6762              UTCA=6762
      6764              UTXA=6764
      6766              UTLA=6766
      6771              UTSF=6771
      6772              UTRB=6772
      6774              UTLB=6774
      6201              CUF=6201
```

```
0200                    *200

                        /STATIC - SET "B" TESTS AND READ BACK

0200  7300    BEGIN,    CLA CLL
0201  3023              DCA FIELD               /CLEAR FIELD
0202  6774              DTLB                    /LOAD "B"
0203  7200              CLA
0204  6772              DTRB                    /READ "B"
0205  0031              AND K0070
0206  3056              DCA MAX                 /AND SAVE
0207  1056              TAD MAX
0210  7041              CIA
0211  1023              TAD FIELD
0212  7040              SZA CLA                 /SAME AS NUMBER SET?
0213  4327              JMS BERROR              /NO, ERROR
0214  1023              TAD FIELD
0215  1030              TAD K0010                       /INCREMENT FIELD SETTING
0216  0031              AND K0070
0217  3023              DCA FIELD
0220  1023              TAD FIELD
0221  7440              SZA                     /DONE ALL FIELDS?
0222  5202              JMP BEGIN+2             /NO
0223  7402              HLT

                        /DYNAMIC TESTS

0224  7604    START,    LAS
0225  0031              AND K0070               /GET MAXIMUM FIELD SIZE
0226  7450              SNA                     /NON-ZERO?
0227  7402              HLT                     /NO
0230  3056              DCA MAX                 /YES, STORE
0231  7604              LAS
0232  0051              AND K7000               /GET UNIT NUMBER
0233  3076              DCA UNIT                /AND SAVE
0234  3020              DCA BLOCK               /CLEAR BLOCK
0235  1030              TAD K0010               /SET TO OPERATE
0236  3023              DCA FIELD               /ON FIELD 1
0237  1023              TAD FIELD               /COMPARE CURRENT
0240  7041              CIA                     /FIELD AGAINST
0241  1056              TAD MAX                 /MAXIMUM FIELD
0242  7110              SPA CLA                 /IS CURRENT FIELD TOO LARGE?
0243  5235              JMP .-6                 /YES, RESET TO FIELD 1
0244  4353              JMS HALTS               /STORE HALT IN MEMORY FIELD 0
0245  1073              TAD SKIP
0246  3502              DCA I Z4
0247  1023              TAD FIELD               /STORE HALT IN
0250  4477              JMS I Z1                /MEMORY FIELD "N"
0251  1023              TAD FIELD               /SET INTO FIELD "N"
0252  4500              JMS I Z2                /DATA (ADDRESSES) TO BE WRITTEN ON TAPE
                                                /SET UP DECTAPE TO
0253  4503              JMS I Z3                /ATTACK BLOCK IN FORWARD DIRECTION
0254  4366              JMS ERR                 /CHECK FOR ERROR
0255  5253              JMP .-2                 /REPEAT SEARCH
```

```
0256  1023                    TAD FIELD               /RETURN HERE WHEN BLOCK IS FOUND AND NO ERRORS
0257  6774                    DTLB            /LOAD MEMORY FIELD REGISTER
0260  1033                    TAD K0130
0261  6764                    DIXA            /CHANGE FROM SEARCH TO WRITE DATA CONT.
0262  1046                    TAD K1777
0263  3454                    DCA I K7755     /SET UP CA
0264  1050                    TAD K4000
0265  3453                    DCA I K7754     /AND WC
0266  4504                    JMS I Z6                /WAIT FOR DECIAPE FLAG AND NO ERRORS
0267  4366                    JMS ERR
0270  5253                    JMP .-13
0271  1023                    TAD FIELD               /SET THE CURRENT MEMORY FIELD TO HLT
0272  4477                    JMS I Z1
0273  4503                    JMS I Z5                /FIND BLOCK AGAIN
0274  4366                    JMS ERR
0275  5273                    JMP .-2
0276  1023                    TAD FIELD               /SET MEMORY FIELD REGISTER
0277  6774                    DTLB
0300  1032                    TAD K0120               /SEARCH TO READ DATA CONT
0301  6764                    DIXA
0302  1046                    TAD K1777
0303  3454                    DCA I K7755     /SET UP CA
0304  1050                    TAD K4000
0305  3453                    DCA I K7754     /AND WC
0306  4504                    JMS I Z6                /WAIT FOR DECIAPE FLAG AND NO ERRORS
0307  4366                    JMS ERR
0310  5273                    JMP .-13
0311  1023                    TAD FIELD               /CHECK FOR CURRENT DATA
0312  4501                    JMS I Z3
0313  1023                    TAD FIELD               /SET IT TO HALT AGAIN
0314  4477                    JMS I Z1
0315  1020                    TAD BLOCK               /INCREMENT BLOCK
0316  1030                    TAD K0010               /BY 10
0317  3020                    DCA BLOCK
0320  1020                    TAD BLOCK
0321  7041                    CIA
0322  1047                    TAD K2670
0323  7750                    SPA SNA CLA     /END OF TAPE?
0324  3020                    DCA BLOCK               /YES, ZERO BLOCK
0325  1023                    TAD FIELD
0326  5235                    JMP START+11    /RETURN TO TEST NEXT MEMORY FIELD

                      /"B" REGISTER ERROR SUBROUTINE
0327  0000                BERROR, 0
0330  4144                        JMS BELL
0331  4135                        JMS PRINT
0332  5346                        JMP HALT2-3
0333  1065                        TAD PMESS7
0334  4106                        JMS MSPRNT
0335  1023                        TAD FIELD
0336  4154                        JMS NUMBER
0337  1041                        TAD K0240
0340  4117                        JMS TYPE
0341  4117                        JMS TYPE
```

```
0342  7200                    CLA
0343  1056                    TAD MAX
0344  4154                    JMS NUMBER
0345  4124                    JMS CRLF
0346  7604                    LAS
0347  0026                    AND K0004
0350  7640                    SZA CLA
0351  7402            HALT,   HLT
0352  5727                    JMP I BERROR
```

```
0400                    *400

                        /SUBROUTINE TO STORE HALTS IN MEMORY BANK "N" (N=NONZERO), IN AC(6-8)

0400  0000    SET,      0
0401  7450              SNA
0402  5600              JMP I SET
0403  1214              TAD .+11
0404  3206              DCA .+2
0405  3010              DCA 10
0406  6201              CDF
0407  1074              TAD STOP
0410  3410              DCA I 10
0411  1010              TAD 10
0412  7640              SZA CLA
0413  5207              JMP .-4
0414  6201              CDF
0415  5600              JMP I SET
                        /SUBROUTINE TO STORE ADDRESSES IN MEMORY BANK "N" (N=NONZERO, IN AC6-8)

0416  0000    STORE,    0
0417  7450              SNA
0420  5616              JMP I STORE
0421  1235              TAD .+14
0422  3227              DCA .+5
0423  1046              TAD K1777
0424  3010              DCA 10
0425  1050              TAD K4000
0426  3012              DCA 12
0427  6201              CDF
0430  1010              TAD 10
0431  7001              IAC
0432  3410              DCA I 10
0433  2012              ISZ 12
0434  5230              JMP .-4
0435  6201              CDF
0436  5616              JMP I STORE

                        /SUBROUTINE TO CHECK MEMORY BANK "N" TO ASSURE PROPER DATA STORED

0437  0000    CHECK,    0
0440  7450              SNA
0441  5637              JMP I CHECK
0442  1260              TAD .+16
0443  3252              DCA .+7
0444  1046              TAD K1777
0445  3010              DCA 10
0446  1050              TAD K4000
0447  3012              DCA 12
0450  1010              TAD 10
0451  7040              CMA
0452  6201              CDF
0453  1410              TAD I 10
0454  7640              SZA CLA
```

```
                        /SUBROUTINE TO STORE HALTS IN MEMORY BANK 0

353  0000               HALTS, 0
354  6201                      CDF
355  1105                      TAD Z/
356  3011                      DCA 11
357  1074                      TAD STOP
360  3411                      DCA I 11
361  1011                      TAD 11
362  1035                      TAD K0201
363  7640                      SZA CLA
364  5357                      JMP .+3
365  5753                      JMP I HALTS

                        /DECTAPE ERROR REPEAT TEST SUBROUTINE
366  0000               ERR,   0
367  7200                      CLA
370  6772                      DTRB
371  7700                      SMA CLA
372  2366                      ISZ ERR
373  5766                      JMP I ERR
```

```
                        /DATA ERROR SUBROUTINE

0462  0000                DATERR, 0
0463  4144                        JMS BELL
0464  4135                        JMS PRINT
0465  5324                        JMP HALT3-3
0466  7410                        SKP                 /PRINT MESSAGE HEADER?
0467  5312                        JMP .+23                    /NO
0470  6201                        CDF
0471  1066                        TAD PMESS8          /YES, TYPE FIRST PART
0472  4106                        JMS MSPRNT
0473  1023                        TAD FIELD
0474  7112                        CLL RTR
0475  7010                        RAR
0476  4154                        JMS NUMBER          /TYPE OUT FIELD
0477  1067                        TAD PMESS9
0500  4106                        JMS MSPRNT          /MORE HEADER
0501  1020                        TAD BLOCK
0502  4154                        JMS NUMBER          /FIRST BLOCK NUMBER
0503  1070                        TAD PMES10
0504  4106                        JMS MSPRNT          /REST OF HEADER
0505  1051                        TAD K7000
0506  3266                        DCA DATERR+4
0507  1252                        TAD CHECK+13        /FORM "CDF"
0510  3511                        DCA .+1
0511  6201                        CDF                 /CHANGE FIELD
0512  1010                        TAD 10
0513  3072                        DCA PNTR2
0514  1072                        TAD PNTR2
0515  4154                        JMS NUMBER                  /TYPE OUT LOCATION
0516  1041                        TAD K0240
0517  4117                        JMS TYPE                    /1 SPACE
0520  7200                        CLA
0521  1472                        TAD I PNTR2
0522  4154                        JMS NUMBER                  /TYPE OUT DATA
0523  4124                        JMS CRLF                    /CRLF
0524  7604                        LAS
0525  0026                        AND K0004
0526  7640                        SZA CLA             /HALT?
0527  7402                HALT3,  HLT                 /YES
0530  5662                        JMP I DATERR
```

```
0455  4262          JMS DATERR      /DATA ERROR
0456  2012          ISZ 12
0457  5250          JMP .-7
0460  6201          CDF
0461  5637          JMP I CHECK
```

```
                    *600

                    /SEARCH SUBROUTINE

0600  0000 SEARCH, 0
0601  7200          CLA
0602  3454          DCA I K7755       /BLOCK# TO LOC 0
0603  1076          TAD UNIT                /COMBINE UNIT
0604  1045          TAD K0610               /AND SEARCH, NORM, REV
0605  6766          DTLA              /LOAD A
0606  6774          DILB              /CLEAR B
0607  6771          DISF              /WAIT FOR
0610  5207          JMP .-1           /SOME FLAG
0611  6772          DIRB              /READ B
0612  7006          RIL
0613  7700          SMA CLA           /END ZONE?
0614  5220          JMP .+4           /NO
0615  1044          TAD K0600               /YES, TURN
0616  6764          DIXA              /AROUND
0617  5207          JMP SEARCH+7
0620  6772          DIRB              /READ STATUS B
0621  7700          SMA CLA           /DECTAPE ERROR?
0622  5225          JMP .+3           /NO
0623  4251          JMS WAIT                /YES, STOP TRANSPORT, ETC.
0624  5201          JMP SEARCH+1      /TRY SEARCHING AGAIN
0625  6761          DIRA              /READ A
0626  7006          RIL               /MOVE DIRECTION
0627  7006          RIL               /BIT INTO LINK
0630  7200          CLA               /CLEAR AC
0631  1000          TAD 0             /GET CURRENT BLOCK NUMBER
0632  7041          CIA
0633  1020          TAD BLOCK
0634  7450          SNA               /CORRECT BLOCK?
0635  5245          JMP FOUND               /YES, CHECK DIRECTION
0636  7041          CIA               /NO, TAKE 2'S COMPLEMENT
0637  7420          SNL               /LINK IS 1 IF BKWD AND NOT AT OR LOWER THAN BLOCK
0640  1024          TAD K0002               /ADD TWO TO ENABLE TURN AROUND
0641  7620          SNL CLA           /TURN AROUND (3 BEYOND)?
0642  1043          TAD K0400               /YES
0643  6764          DIXA              /CLEAR FLAG
0644  5207          JMP SEARCH+7      /WAIT FOR NEXT FLAG
0645  7620 FOUND,   SNL CLA           /FOUND BLOCK FORWARD?
0646  5243          JMP .+3           /NO
0647  6764          DIXA              /YES, CLEAR FLAG
0650  5600          JMP I SEARCH      /EXIT
```

```
                        /SUBROUTINE TO WAIT FOR DECTAPE FLAG AND NO ERROR
                        /EXIT WITH TRANSPORT STOPPED

0651  0000    WAIT,     0
0652  6771              DISF              /WAIT FOR SOME FLAG
0653  5252              JMP .-1
0654  6761              DIRA              /READ STATUS A
0655  0034              AND K0200
0656  1025              TAD K0003
0657  6764              DIXA              /CLEAR GO
0660  6772              DIRB
0661  7700              SMA CLA
0662  5651              JMP I WAIT
0663  4144              JMS BELL
0664  4135              JMS PRINT
0665  5332              JMP HALT1-3
0666  1057              TAD PMESS1        /TYPE OUT ERROR MESSAGE HEADER
0667  4106              JMS MSPRNT
0670  6772              DIRB
0671  7006              RTL
0672  3022              DCA ERROR
0673  7420              SNL               /MARK TRACK ERROR?
0674  5277              JMP .+3           /NO
0675  1060              TAD PMESS2
0676  4106              JMS MSPRNT
0677  1022              TAD ERROR
0700  7104              RAL CLL
0701  3022              DCA ERROR
0702  7420              SNL               /END ZONE?
0703  5306              JMP .+3           /NO
0704  1061              TAD PMESS3
0705  4106              JMS MSPRNT
0706  1022              TAD ERROR
0707  7104              RAL CLL
0710  3022              DCA ERROR
0711  7420              SNL               /SELECT ERROR?
0712  5315              JMP .+3           /NO
0713  1062              TAD PMESS4
0714  4106              JMS MSPRNT
0715  1022              TAD ERROR
0716  7104              RAL CLL
0717  3022              DCA ERROR
0720  7420              SNL               /PARITY ERROR?
0721  5324              JMP .+3
0722  1063              TAD PMESS5
0723  4106              JMS MSPRNT
0724  1022              TAD ERROR
0725  7104              RAL CLL
0726  7620              SNL CLA           /TIMING ERROR?
0727  5332              JMP .+3
0730  1064              TAD PMESS6
```

```
0731  4106                    JMS MSPRNT
0732  7604                    LAS
0733  0026                    AND K0004
0734  7640                    SZA CLA          /HALT ON ERROR?
0735  7402            HALT1,  HLT
0736  5651                    JMP I WAIT
```

```
      1000                    *1000

                              /MESSAGES

1000  0215                    MESS1,  215     /CR
1001  0212                            212     /LF
1002  0324                            324     /T
1003  0310                            310     /H
1004  0305                            305     /E
1005  0240                            240     /SP
1006  0306                            306     /F
1007  0317                            317     /O
1010  0314                            314     /L
1011  0314                            314     /L
1012  0317                            317     /O
1013  0327                            327     /W
1014  0311                            311     /I
1015  0316                            316     /N
1016  0307                            307     /G
1017  0240                            240     /SP
1020  0325                            325     /U
1021  0316                            316     /N
1022  0305                            305     /E
1023  0330                            330     /X
1024  0320                            320     /P
1025  0305                            305     /E
1026  0303                            303     /C
1027  0324                            324     /T
1030  0305                            305     /E
1031  0304                            304     /D
1032  0240                            240     /SP
1033  0305                            305     /E
1034  0322                            322     /R
1035  0322                            322     /R
1036  0317                            317     /O
1037  0322                            322     /R
1040  0323                            323     /S
1041  0240                            240     /SP
1042  0317                            317     /O
1043  0303                            303     /C
1044  0303                            303     /C
1045  0325                            325     /U
1046  0322                            322     /R
1047  0322                            322     /R
1050  0305                            305     /E
1051  0304                            304     /D
1052  0272                            272     /:
1053  0215                            215     /CR
1054  0212                            212     /LF
1055  0377                            377     /RO
```

```
1056  0315              MESS2,  315     /M
1057  0301                      301     /A
1060  0322                      322     /R
1061  0313                      313     /K
1062  0240                      240     /SP
1063  0324                      324     /T
1064  0322                      322     /R
1065  0301                      301     /A
1066  0303                      303     /C
1067  0313                      313     /K
1070  0215                      215     /CR
1071  0212                      212     /LF
1072  0377                      377     /RO

1073  0305              MESS3,  305     /E
1074  0316                      316     /N
1075  0304                      304     /D
1076  0240                      240     /SP
1077  0332                      332     /Z
1100  0317                      317     /O
1101  0316                      316     /N
1102  0305                      305     /E
1103  0215                      215     /CR
1104  0212                      212     /LF
1105  0377                      377     /RO

1106  0323              MESS4,  323     /S
1107  0305                      305     /E
1110  0314                      314     /L
1111  0305                      305     /E
1112  0303                      303     /C
1113  0324                      324     /T
1114  0215                      215     /CR
1115  0212                      212     /LF
1116  0377                      377     /RO

1117  0320              MESS5,  320     /P
1120  0301                      301     /A
1121  0322                      322     /R
1122  0311                      311     /I
1123  0324                      324     /T
1124  0331                      331     /Y
1125  0215                      215     /CR
1126  0212                      212     /LF
1127  0377                      377     /RO
```

```
1150  0324              MESS6,  324     /T
1151  0311                      311     /I
1152  0315                      315     /M
1153  0311                      311     /I
1154  0316                      316     /N
1155  0307                      307     /G
1156  0215                      215     /CR
1157  0212                      212     /LF
1160  0377                      377     /RO

1161  0215              MESS7,  215     /CR
1162  0212                      212     /LF
1163  0315                      315     /M
1164  0305                      305     /E
1165  0315                      315     /M
1166  0317                      317     /O
1167  0322                      322     /R
1170  0331                      331     /Y
1171  0240                      240     /SP
1172  0306                      306     /F
1173  0311                      311     /I
1174  0305                      305     /E
1175  0314                      314     /L
1176  0304                      304     /D
1177  0240                      240     /SP
1200  0305                      305     /E
1201  0322                      322     /R
1202  0322                      322     /R
1203  0317                      317     /O
1204  0322                      322     /R
1205  0215                      215     /CR
1206  0212                      212     /LF
1207  0322                      322     /R
1210  0311                      311     /I
1211  0307                      307     /G
1212  0310                      310     /H
1213  0324                      324     /T
1214  0240                      240     /SP
1215  0327                      327     /W
1216  0322                      322     /R
1217  0317                      317     /O
1220  0316                      316     /N
1221  0307                      307     /G
1222  0215                      215     /CR
1223  0212                      212     /LF
1224  0377                      377     /RO
```

```
1205  0215              MESS8,  215     /CR
1206  0212                      212     /LF
1207  0304                      304     /D
1210  0301                      301     /A
1211  0324                      324     /T
1212  0301                      301     /A
1213  0240                      240     /SP
1214  0305                      305     /E
1215  0322                      322     /R
1216  0322                      322     /R
1217  0317                      317     /O
1220  0322                      322     /R
1221  0215                      215     /CR
1222  0212                      212     /LF
1223  0306                      306     /F
1224  0311                      311     /I
1225  0305                      305     /E
1226  0314                      314     /L
1227  0304                      304     /D
1230  0240                      240     /SP
1231  0377                      377     /RO

1232  0215              MESS9,  215     /CR
1233  0212                      212     /LF
1234  0306                      306     /F
1235  0311                      311     /I
1236  0322                      322     /R
1237  0323                      323     /S
1240  0324                      324     /T
1241  0240                      240     /SP
1242  0302                      302     /B
1243  0314                      314     /L
1244  0317                      317     /O
1245  0303                      303     /C
1246  0313                      313     /K
1247  0240                      240     /SP
1250  0377                      377     /RO
```

```
1251  0215              MESS10, 215     /CR
1252  0212                      212     /LF
1253  0314                      314     /L
1254  0317                      317     /O
1255  0303                      303     /C
1256  0256                      256     /,
1257  0240                      240     /SP
1260  0304                      304     /D
1261  0301                      301     /A
1262  0324                      324     /T
1263  0301                      301     /A
1264  0215                      215     /CR
1265  0212                      212     /LF
1266  0377              END.    377             /RO
```

$

RE ARE NO ERRORS

SYMBOL TABLE

BLOCK	0020
CNTR	0021
ERROR	0022
FIELD	0023
G0002	0024
G0003	0025
G0004	0026
G0007	0027
G0010	0030
G0070	0031
G0130	0032
G0150	0033
G0200	0034
G0201	0035
G0207	0036
G0212	0037
G0215	0040
G0240	0041
G0260	0042
G0400	0043
G0600	0044
G0610	0045
G1777	0046
G2670	0047
G4000	0050
L7000	0051
L7401	0052
L7754	0053
L7755	0054
L7774	0055
MAX	0056
MESS1	0057
MESS2	0060
MESS3	0061
MESS4	0062
MESS5	0063
MESS6	0064
MESS7	0065
MESS8	0066
MESS9	0067
MES10	0070
NTR1	0071
NTR2	0072
SKIP	0073
STOP	0074
TEMP	0075
UNIT	0076
1	0077
2	0100
3	0101
4	0102
5	0103
6	0104

SYMBOL TABLE

E7	0105
MSPRNT	0106
TYPE	0117
CRLF	0124
PRINT	0135
BELL	0144
NUMBER	0154
BEGIN	0200
START	0224
BERROR	0327
HALT2	0351
HALTS	0353
ERR	0366
SET	0400
STORE	0416
CHECK	0437
DATERR	0462
HALT3	0527
SEARCH	0600
FOUND	0645
WAIT	0651
HALT1	0735
MESS1	1000
MESS2	1050
MESS3	1073
MESS4	1100
MESS5	1117
MESS6	1130
MESS7	1141
MESS8	1205
MESS9	1232
MESS10	1251
END	1266
CUF	6201
DTRA	6761
DTCA	6762
DTXA	6764
DTLA	6766
DTSF	6771
DTRB	6772
DTLB	6774

SYMBOL TABLE

BEGIN	0200
BELL	0144
BERROR	0327
BLOCK	0020
CUF	6201
CHECK	0437
CNTR	0021
CRLF	0124
DATERR	0462
DICA	6762
DILA	6766
DILB	6774
DIRA	6761
DIRB	6772
DISP	6771
DIXA	6764
END	1266
ERR	0366
ERROR	0022
FELD	0023
FOUND	0645
HALT5	0355
HALT1	0735
HALT2	0351
HALT3	0527
H0002	0024
H0003	0025
H0004	0026
H0007	0027
H0010	0030
H0070	0031
H0130	0032
H0150	0033
H0200	0034
H0201	0035
H0207	0036
H0212	0037
H0215	0040
H0240	0041
H0260	0042
H0400	0043
H0600	0044
H0610	0045
H1777	0046
H2670	0047
H4000	0050
H7000	0051
H7401	0052
H7754	0053
H7755	0054
H7774	0055
MAX	0056
MESS1	1000

SYMBOL TABLE

MESS10	1251
MESS2	1056
MESS3	1073
MESS4	1106
MESS5	1117
MESS6	1130
MESS7	1141
MESS8	1205
MESS9	1232
MSPRNT	0106
NUMBER	0154
PMESS1	0057
PMESS2	0060
PMESS3	0061
PMESS4	0062
PMESS5	0063
PMESS6	0064
PMESS7	0065
PMESS8	0066
PMESS9	0067
PMES10	0070
PNTR1	0071
PNTR2	0072
PRINT	0135
SEARCH	0600
SET	0400
SKIP	0073
START	0224
STOP	0074
STORE	0416
TEMP	0075
TYPE	0117
UNIT	0076
WAIT	0051
£1	0077
£2	0100
£3	0101
£4	0102
£5	0103
£6	0104
£7	0105