TEST ROUTINES

for the

CONTROL DATA
160-A Systems

CONTROL DATA
CORPORATION

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160-A Systems

The following information has been added to this manual:

Equipment section 161-F (new section)

Test Routine - T009-F, Flexowriter Input, Punch and Verify Test

Equipment section 165

Test Routine - T650-1, Plotter Retrace Test

Equipment section 1610

Test Routine - T1610-1, Quality Assurance Test (1610)

Paper tapes for the 160-A Systems Maintenance Test Routines are available through Customer Engineering Department, Control Data Corporation, 8100 - 34th Avenue South, Minneapolis 20, Minnesota.

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or use Comment Sheet located in the rear of this book.

Record of Revisions

REVISION	NOTES
A	Modification for T682.
B	Addition of Memory Test for the 8090 Computer System.

CONTENTS

CONTENTS (Cont'd)

T002 C
Memory Test for 8090 Computer System

This memory test is used to test any arbitrary number of banks, up to the maximum number present, in an 8090 Computer System. It will test the storage in both the 8091 Data Processor and the 8094 Auxiliary Memory. The program may be located in any bank. It will test the next bank in sequence by storing worst pattern in it, checking the pattern, then storing and checking the complement worst pattern. The program then transfers itself to the bank which has just been tested, and the test progresses through the memory.

The program checks itself via a checksum subroutine upon starting in a new bank, and prior to transferring itself to the next bank in sequence. If the checksum is not correct, an error stop will occur. This condition is indicated by:

P = 0173 A = bits failing in program Z = 0000.

The MCS mode indicator indicates which bank the program is currently in. When an error is detected while checking worst pattern or its complement, a stop occurs with:

P = 0101 A = bits failing in worst pattern Z = 7700.

If the computer is placed in run again, it will stop again with:

P = 0103 A = address failing in worst pattern Z = 7777.

The bank being tested will be indicated by the MCS mode indicator when the IND button is pushed.

Several optional stops are available to monitor the progress of the program. If Selective Stop 1 is selected, the computer will stop every time a new pattern is stored in the bank being tested. If Selective Stop 2 is selected, the computer will stop when worst pattern (not the complement pattern) is stored in the bank being tested. If Selective Stop 4 is selected, the computer will stop when worst pattern (not the complement pattern) is stored in bank 1. At this time the program is located in bank 0. The selective stops may be selected in any desired combination.

If Selective Jump 1 is selected, the bank containing the program and the bank being tested do not change.

The program may be loaded into any bank that is present. The check sum for the paper tape is 0002. The tape loads from location r0000 through r0175. When starting the program it is necessary to set the relative bank selection only. The direct and indirect bank selections are set automatically by the program.

When starting the program the first time after it has been loaded from the paper tape, the highest bank number present must be entered in the A register. When the program is started following this, the A register may be clear, and the highest bank number used previously will be saved.

An annotated program listing follows. The locations in parentheses are normally modified by the computer during execution of the program.

T002 C
Memory Test for 8091 Computer and 8094 Auxiliary Memory

```
0000    0207
0001    6003    Get Number of Highest Bank
0002    0601
0003    4271
0004    7100    Enter Check Sum Subroutine
0005    0143
0006    0130
0007    0207

0010    0601
0011    1474    Set IND to Next Bank in Sequence
0012    6002
0013    1474
0014    0320
0015    4201
0016    (0000)
0017    0400

0020    4076
0021    0400
0022    4077
0023    2076
0024    4177    Write Pattern in Bank
0025    5477    Locations 0000 through 7776
0026    6011
0027    1071

0030    6003
0031    0277
0032    6407
0033    2476
0034    4076
0035    7101
0036    0023
0037    2476

0040    4172    Store Pattern at Location 7777
0041    6310
0042    0130    Determine Stop Options
0043    0207
0044    6104
0045    7704    Selective Stop 4  Stop on Full Cycle thru Max. Number of Bank
0046    0001
0047    0001

0050    7702    Selective Stop 2  Stop on Every Bank
0051    7701    Selective Stop 1  Stop on Every Pattern
0052    0400
0053    4077
0054    2076
0055    1577
0056    6122
0057    5477
```

```
0060    6026
0061    1071    Check Pattern
0062    6003
0063    0277
0064    6410
0065    2476
0066    4076
0067    7101

0070    0054
0071    0777
0072    7777    Constant = 7777
0073    5424    Check Sum Adjustment
0074   (0000)   Highest Bank Number Allowable + 1
0075    0176    Constant = Number of Words in Program
0076   (0000)   Test Word
0077   (0077)   Test Address

0100    2177
0101    7700    Error Stop - Indicate Bits Which Failed
0102    2077
0103    7777    Stop - Indicate Location of Failure
0104    7101    Check Next Word
0105    0057
0106    2476
0107    6567    Repeat Program for Both Patterns

0110    7100    Enter Check Sum Subroutine
0111    0143    When Both Patterns are Checked
0112    4077
0113    7710    Test Selective Jump for Bank Change
0114    0006
0115    0130
0116    0207
0117    0320

0120    4212
0121    0320
0122    0601
0123    1474
0124    6002    Set Bank Change Instructions
0125    1474
0126    0320
0127    4205

0130    0330
0131    4210
0132   (0000)
0133    2177    Transfer Program to Next Bank
0134   (0000)
0135    4177
0136    5477
0137    1475
```

```
0140    6506
0141   (0000)  Jump to Next Bank
0142    7101   Exit Check Sum Subroutine
0143   (0000)  Entrance Check Sum Subroutine
0144    0130
0145    0207
0146    0360
0147    4201

0150   (0000)  Set All Bank Selections Same as Relative
0151    0400
0152    4016   Clear All Locations Modified by Program
0153    4321
0154    4320
0155    4314
0156    4306
0157    4300   Clear Previous Check Sum

0160    4077   Set Initial Address
0161    2177
0162    5300   Form Check Sum Location 07777
0163    5477
0164    1475
0165    6504
0166    2723   Subtract Exit Address from Check Sum
0167    3474   Subtract Maximum Bank Number + 1 from Check Sum

0170    5300
0171    0702
0172    6430   Exit if Check Sum is OK
0173    0000   Check Sum Error
0174    6501   Hang up on Check Sum Error
0175    6433   Unless A Register is Cleared
```

NUMBER: T002-A
TITLE: Memory Test - Worst Pattern
CATEGORY: 160-A
MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

The memory test creates in memory the pattern of information which will cause the memory to be most susceptible to internally generated noise.

DESCRIPTION

1. See flow chart.
2. Noise will be detected by the picking up or dropping bits in a location.
3. The test does a check sum periodically to determine if the program has picked up or dropped bits.
4. The test uses both banks of memory; one bank for the program, the other bank for the worst pattern information.

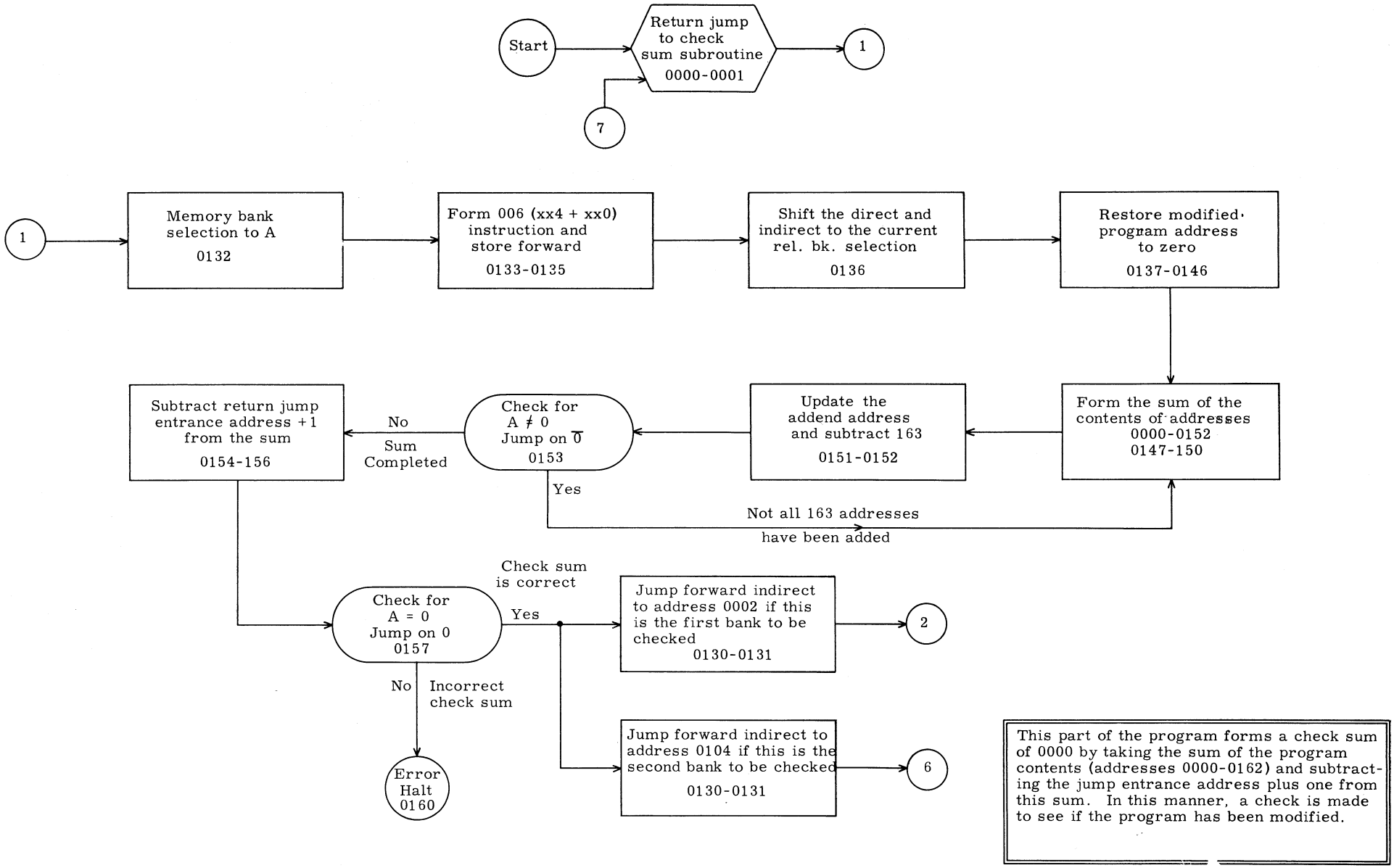
   The program and worst pattern information alternate between banks. If the program is in bank 0 the worst pattern information is in bank 1.

OPERATING INSTRUCTIONS

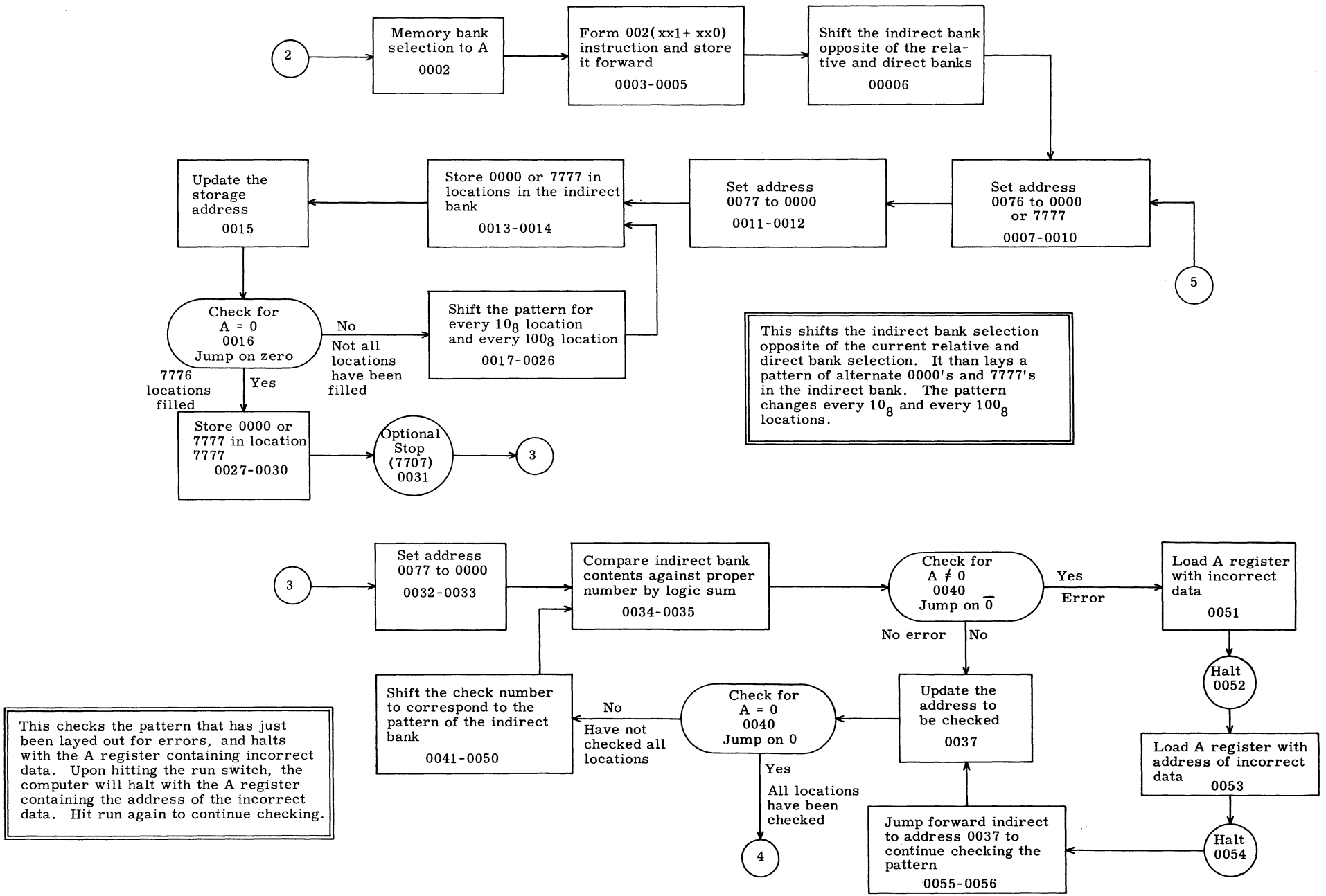
LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: 0000
TERMINAL ADDRESS: 0162
CHECK SUM: 0001
STARTING ADDRESS: 0000

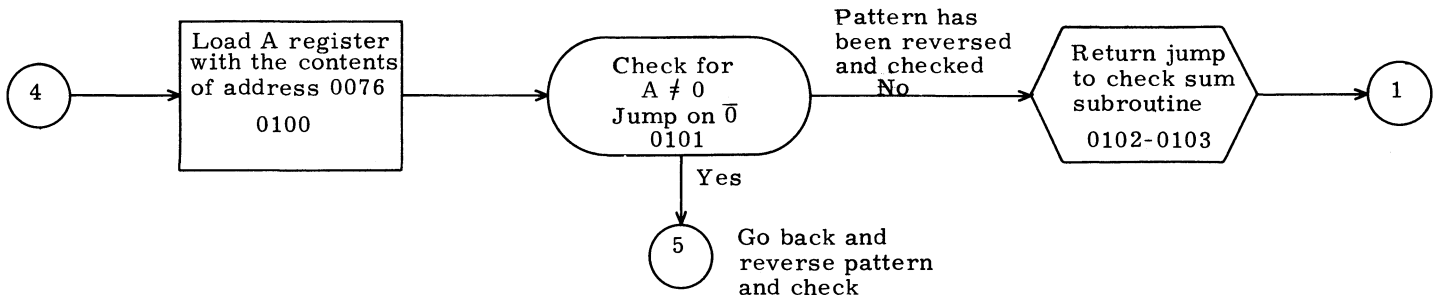
HALTS	EXPLANATION
0000	Check sum error at 0160.
7700	Incorrect data in A at 0052.
7707	Optional stop after one pass at 0031.
7777	Address of incorrect data in A at 0054.

The program will stop if any error occurs. Check with the coding sheet to locate cause of error. With any SLS switch ON, the program will stop each time the worst pattern has been written in memory.

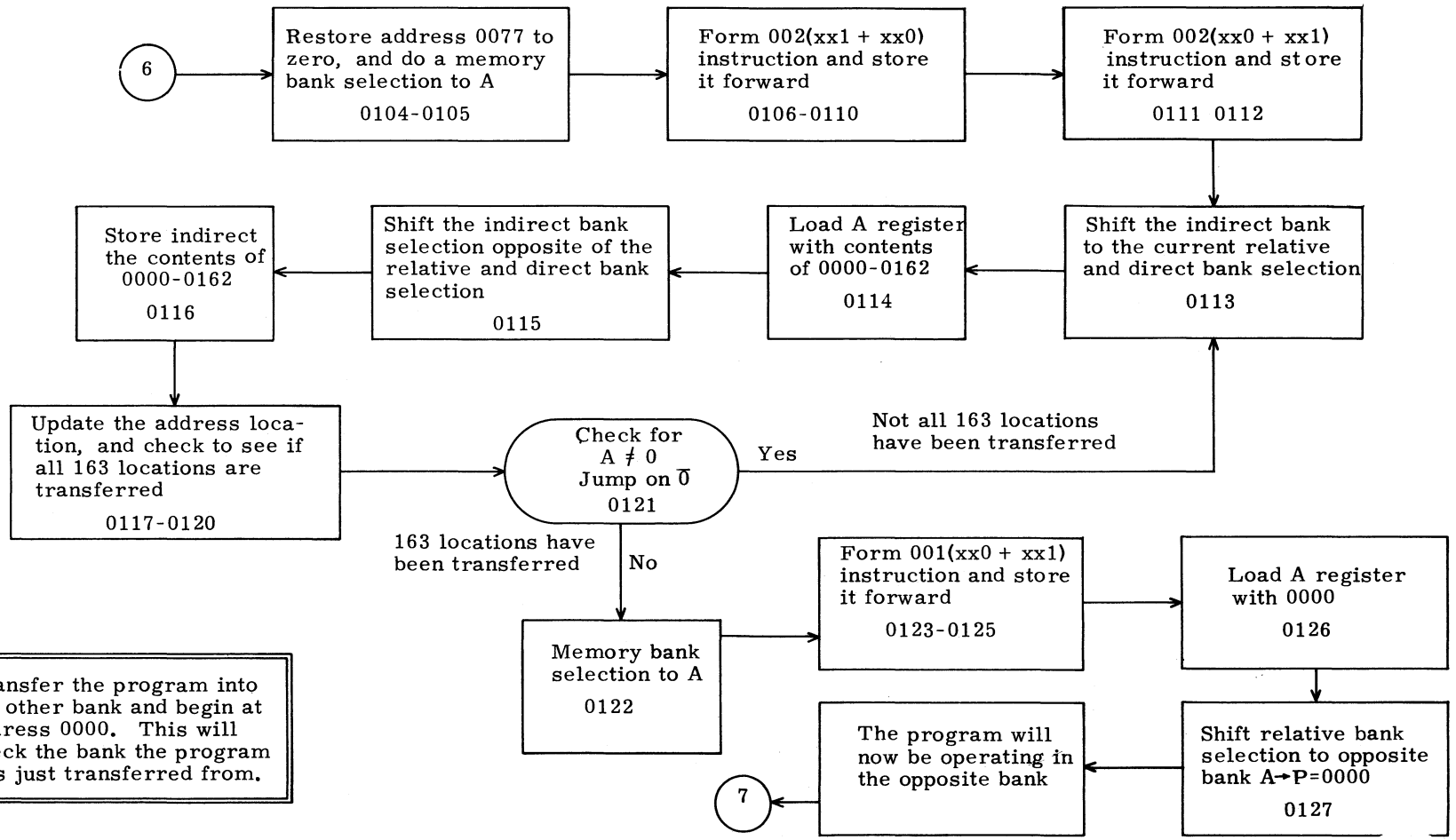


This part of the program forms a check sum of 0000 by taking the sum of the program contents (addresses 0000-0162) and subtracting the jump entrance address plus one from this sum. In this manner, a check is made to see if the program has been modified.


2
Memory bank selection to A
0002
Form 002(xx1+ xx0) instruction and store it forward
0003-0005
Shift the indirect bank opposite of the relative and direct banks
00006
Set address 0076 to 0000 or 7777
0007-0010
5
Set address 0077 to 0000
0011-0012
Store 0000 or 7777 in locations in the indirect bank
0013-0014
Update the storage address
0015
Check for A = 0
0016
Jump on zero
No
Not all locations have been filled
Shift the pattern for every 10_8 location and every 100_8 location
0017-0026
Yes
7776 locations filled
Store 0000 or 7777 in location 7777
0027-0030
Optional Stop (7707)
0031
3
This shifts the indirect bank selection opposite of the current relative and direct bank selection. It than lays a pattern of alternate 0000's and 7777's in the indirect bank. The pattern changes every 10_8 and every 100_8 locations.
3
Set address 0077 to 0000
0032-0033
Compare indirect bank contents against proper number by logic sum
0034-0035
Check for A ≠ 0
0040
Jump on $\overline{0}$
Yes
Error
Load A register with incorrect data
0051
No error
No
Halt
0052
Update the address to be checked
0037
Load A register with address of incorrect data
0053
Check for A = 0
0040
Jump on 0
No
Have not checked all locations
Shift the check number to correspond to the pattern of the indirect bank
0041-0050
Yes
All locations have been checked
4
Jump forward indirect to address 0037 to continue checking the pattern
0055-0056
Halt
0054
This checks the pattern that has just been layed out for errors, and halts with the A register containing incorrect data. Upon hitting the run switch, the computer will halt with the A register containing the address of the incorrect data. Hit run again to continue checking.



This changes the beginning pattern number from 0000 to 7777, and jumps back to lay out a pattern in the indirect bank that is the complement of the first pattern. Upon completing this and checking it, the program makes a return jump from address 0103 into the check sum subroutine.



Transfer the program into the other bank and begin at address 0000. This will check the bank the program was just transferred from.

160-A MEMORY TEST

```
0000    7100    Enter check sum subroutine
0001    0131    Location check sum subroutine
0002    0130
0003    0207    Select indirect selection
0004    0321    to opposite memory bank
0005    4201    of module
0006    (002X)
0007    0400

0010    4076    Set initial data
0011    0400    Set starting address
0012    4077
0013    2076
0014    4177
0015    5477
0016    6011    Finished setting pattern
0017    0277

0020    6003
0021    0207
0022    6407
0023    2476
0024    4076
0025    7101
0026    0013
0027    2476

0030    4154
0031    7707    Optional stop
0032    0400
0033    4077
0034    2076
0035    1577
0036    6113    Error detected
0037    5477

0040    6040    Pattern checked:  See if both patterns were used
0041    0277
0042    6003
0043    0207
0044    6410
0045    2476
0046    4076
0047    7101
```

```
0050        0034
0051        2177
0052        7700    Error stop.  Bit data in A
0053        2077
0054        7777    Display address of location that failed
0055        7101    Test next location
0056        0037
0057        0037

0060        0000
0061        0000
0062        0000
0063        0000
0064        0000
0065        0000
0066        0000
0067        0000

0070        0000
0071        0000
0072        0000
0073        0000
0074        1311    Check sum constant
0075        0163    Final address
0076        0000    Data
0077        0077    Current address

0100        2476
0101        6571    Lay down complement worst pattern
0102        7100    Enter check sum subroutine
0103        0131    Location of check sum subroutine
0104        4077    Reset initial address
0105        0130
0106        0207
0107        0320    Set bank selection up to transfer

0110        4203    program to other bank
0111        0301
0112        4203
0113        (002X)
0114        2177
0115        (002X)  Transfer program to other
0116        4177    bank
0117        5477
```

```
0120        3475
0121        6506
0122        0130
0123        0207
0124        0311
0125        4202
0126        0400
0127        (001X)   Repeat program in other bank

0130        7101
0131        (XXXX)   Check sum entrance
0132        0130
0133        0207
0134        0360
0135        4201
0136        (006X)   Set all bank selections to relative bank
0137        0400

0140        4006     Clear all locations
0141        4326     Modified by program
0142        4325
0143        4314
0144        4306
0145        4300     Clear previous check sum
0146        4077     Set initial address
0147        2177

0150        5300     Form check sum in location 07777
0151        5477
0152        3475
0153        6504
0154        2723
0155        5300     Substract exit address from check sum
0156        0701
0157        6427     Exit if check sum if OK

0160        0000     Check sum error
0161        7101     Hang up on check sum error
0162        0160
0163        0000
0164        0000
0165        0000
0166        0000
0167        0000
```

NUMBER: T034-A
TITLE: Logic Test
CATEGORY: 160-A
MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This program will test the instructions not checked by Input/Output tests, Buffer tests, and Memory bank selection tests.

DESCRIPTION

1. See flow chart.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: 0000 Spares located from 2100 to 3500
TERMINAL ADDRESS: 3772
CHECK SUM: 0160
STARTING ADDRESS: 0000 in bank 0

HALTS	EXPLANATION
3677 through 3702	Memory locations containing selective stops. With any selective stop up, the program will run approximately 30 seconds and stop at the appropriate selective stop. If no selective stop or selective jump switches are up, the program running time will be determined by the count in memory location 1375 as follows: The complement of the contents of memory location 1375 converted to decimal and multiplied by 30 seconds determines the running time.
P = 3705, Z = 7777, A = 0000	Program stop Memory Location 1375 - Running time 7776 - 30 seconds

HALTS	EXPLANATION (Cont'd.)

7767 - 4 minutes
0000 - 34 hours, 15 minutes

Running time may also be controlled with (SLJ) selective jump switches.

Switch	Position	Program Run time
SLJ1	UP	1 minute
SLJ2 only	UP	2 minutes
SLJ4 only	UP	4 minutes

P = 3705, Z = 7777
A = 0000

Program stop
If an error occurs in this test, "A" register will display the most logical instruction that failed.

If an error occurs or if a master clear follows a stop other than the stops described, it may be necessary to reload the program.

```
00000  2206   Load A with content of 0005   -7643(A)
       4160   Store Content of A in location 7777 which is stored at 0060
       4161   Store A at location 3504
       0400   Load A with 0000
       7101   Jump to location 0100
       0100
       7643
       0000

00010  0000
       0041
       0000
       0000
       0000
       0000
       0000
       0000

00020  0000
       0000
       0000
       0000
       0000
       3724
       0000
       0000

00030  0000
       0000
       0000
       0000
       0000
       0000
       0530
       0667

00040  4062
       5473
       5473
       7643
       1171
       5624
       1230
       0000

00050  1303
       1355
       7070
       1375
       0000
       0000
       0000
       0000
```

```
00060   7777
        3504
        0000
        0000
        0000
        0000
        0000
        1673

00070   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00100   6005    If A = 0 Jump to 0105                          A=0000
        0460    Load A with 0060
        0000    Error Stop
        0465    Load A with 0065
        0000    Error Stop
        6502    If A ≠ 0 Jump to 0103
        6205    If A is pos. Jump to 0113  (0 is pos.)
        0462    Load A with 0062

00110   0000    Error Stop
        0467    Load A with 0067
        0000    Error Stop
        6702    If A is neg. Jump to 0111
        0577    Load A with 7700                               A=7700
        6105    If A is non-zero Jump to 0122
        0461    Load A with 0061
        0000    Error Stop

00120   0464    Load A with 0064
        0000    Error Stop
        6402    If A = 0 Jump to 0120
        6305    If A is neg. Jump to 0130
        0463    Load A with 0063
        0000    Error Stop
        0466    Load A with 0066
        0000    Error Stop

00130   6602    If A is pos. Jump to 0126
        0110    Left shift 3 places                            A=7007
        6303    If A is neg. Jump to 0135
        0463    Load A with 0063
        0000    Error Stop
        0110    Left shift 3 places                            A=0077
        6205    If A is pos. Jump to 0143
        0462    Load A with 0062
```

00140	0000	Error Stop	
	0467	Load A with 0067	
	0000	Error Stop	
	6702	If A is neg. Jump to 0141	A=0077
	0400	Load A with 0000	A=0000
	6005	If A = 0 Jump to 0152	
	0400	Load A with 0000	
	6003	If A = 0 Jump to 0152	
00150	0404	Load A with 0004	
	0000	Error Stop	
	2307	Load A with the content of 0143	A=6702
	6304	If A is neg. Jump to 0157	
	0423	Load A with 0023	
	0000	Error Stop	
	1075		
	2301	Load A with the content of 0156	A=1075
00160	3315	Add to A the content of 0143	A=0000
	6003	If A = 0 Jump to 0164	
	0433	Load A with 0033	
	0000	Error Stop	
	2706	Load A with complement of content of Loc. 0156	A=6702
	3307	Add content of Loc. 0156 to content of A	A=0000
	6003	If A = 0 Jump to 0171	
	0427	Load A with 0027	
00170	0000	Error Stop	
	2313	Load A with the content of 0156	A=1075
	3714	Subtract cont. of 0156 from A	A=0000
	6003	If A = 0 Jump to 0176	
	0437	Load A with 0037	
	0000	Error Stop	
	2320	Load A with content of 0156	A=1075
	4035	Store content of A at Loc. 0035	A=1075
00200	3435	Subtr. cont. of 0035 from A	A=0000
	6003	If A = 0 Jump to 0204	
	0434	Load A with 0034	
	0000	Error Stop	
	2313	Load A with cont. of 0171	A=2313
	0102	Left shift 1	A=4626
	6303	If A is neg. Jump to 0211	
	0401	Load A with 0001	
00210	0000	Error Stop	
	0102	Left shift 1	A=1455
	6203	If A is pos. Jump to 0215	
	0401	Load A with 0001	
	0000	Error Stop	
	0102	Left shift 1	A=3132
	6203	If A is pos. Jump to 0221	
	0401	Load A with 0001	

```
00220   0000    Error Stop
        0102    Left shift 1                                    A=6264
        6303    If A is neg. Jump to 0225
        0401    Load A with 0001
        0000    Error Stop
        0102    Left shift 1                                    A=4551
        6303    If A is neg. Jump to 0231
        0401    Load A with 0001

00230   0000    Error Stop
        0102    Left shift 1                                    A=1323
        6203    If A is pos. Jump to 0235
        0401    Load A with 0001
        0000    Error Stop
        0102    Left shift 1                                    A=2646
        6203    If A is pos. Jump to 0241
        0401    Load A with 0001

00240   0000    Error Stop
        0102    Left shift 1                                    A=5514
        6303    If A is neg. Jump to 0245
        0401    Load A with 0001
        0000    Error Stop
        0102    Left shift 1                                    A=3231
        6203    If A is pos. Jump to 0251
        0401    Load A with 0001

00250   0000    Error Stop
        0102    Left shift 1                                    A=6462
        6303    If A is neg. Jump to 0255
        0401    Load A with 0001
        0000    Error Stop
        0102    Left shift 1                                    A=5145
        6303    If A is neg. Jump to 0261
        0401    Load A with 0001

00260   0000    Error Stop
        0102    Left shift 1                                    A=2313
        6204    If A is pos. Jump to 0266
        0401    Load A with 0001
        0000    Error Stop
        0404
        2301    Load A with cont. of 0265                       A=0404
        0110    Left Shift 3                                    A=4040

00270   6303    If A is neg. Jump to 0273
        0401    Load A with 0001
        0000    Error Stop
        0110    Left shift 3                                    A=0404
        6203    If A is pos. Jump to 0277
        0401    Load A with 0001
        0000    Error Stop
        0110    Left shift 3                                    A=4040
```

```
00300   6303    If A is neg. Jump to 0303
        0401    Load A with 0001
        0000    Error Stop
        0110    Left Shift 3                                    A=0404
        6203    If A is pos. Jump to 0307
        0401    Load A with 0001
        0000    Error Stop
        2303    Load in A the content of 0304                   A=6203

00310   1301    Log. prod of A and contents of 0307             A=2203
        6203    If A is pos. Jump to 0314
        0413    Load A with 0013
        0000    Error Stop
        0102    Left Shift 1                                    A=4406
        6303    If A is neg. Jump to 0320
        0413    Load A with 0013
        0000    Error Stop

00320   0102    Left Shift 1                                    A=1015
        6203    If A is pos. Jump to 0324
        0413    Load A with 0013
        0000    Error Stop
        0102    Left Shift 1                                    A=2032
        6203    If A is pos. Jump to 0330
        0413    Load A with 0013
        0000    Error Stop

00330   0102    Left Shift 1                                    A=4064
        6303    If A is neg. Jump to 0334
        0413    Load A with 0013
        0000    Error Stop
        0102    Left Shift 1                                    A=0151
        6203    If A is pos. Jump to 0340
        0413    Load A with 0013
        0000    Error Stop

00340   0102    Left Shift 1                                    A=0322
        6203    If A is pos. Jump to 0344
        0413    Load A with 0013
        0000    Error Stop
        0102    Left Shift 1                                    A=0644
        6203    If A is pos. Jump to 0350
        0413    Load A with 0013
        0000    Error Stop

00350   0102    Left Shift 1                                    A=1510
        6203    If A is pos. Jump to 0354
        0413    Load A with 0013
        0000    Error Stop
        0102    Left Shift 1                                    A=3220
        6203    If A is pos. Jump to 0360
        0413    Load A with 0013
        0000    Error Stop
```

```
00360   0102    Left Shift 1                                    A=6440
        6303    If A is neg. Jump to 0364
        0413    Load A with 0013
        0000    Error Stop
        0102    Left Shift 1                                    A=5101
        6303    If A is neg. Jump to 0370
        0413    Load A with 0013
        0000    Error Stop

00370   2307    Load A with content of 0361                     A=6303
        1764    Logical sum of A and content of 0305            A=6702
        6303    If A is neg. Jump to 0375
        0417    Load A with 0017
        0000    Error Stop
        0102    Left Shift 1                                    A=5605
        6303    If A is neg. Jump to 0401
        0417    Load A with 0017

00400   0000    Error Stop
        0102    Left Shift 1                                    A=3413
        6203    If A is pos. Jump to 0405
        0417    Load A with 0017
        0000    Error Stop
        0102    Left Shift 1                                    A=7026
        6303    If A is neg. Jump to 0411
        0417    Load A with 0017

00410   0000    Error Stop
        0102    Left Shift 1                                    A=6055
        6303    If A is neg. Jump to 0415
        0417    Load A with 0017
        0000    Error Stop
        0102    Left Shift 1                                    A=4133
        6303    If A is neg. jump to 0421
        0417    Load A with 0017

00420   0000    Error Stop
        0102    Left Shift 1                                    A=0267
        6203    If A is pos. Jump to 0425
        0417    Load A with 0017
        0000    Error Stop
        0102    Left Shift 1                                    A=0556
        6203    If A is pos. Jump to 0431
        0417    Load A with 0017

00430   0000    Error Stop
        0102    Left Shift 1                                    A=1334
        6203    If A is pos. Jump to 0435
        0417    Load A with 0017
        0000    Error Stop
        0102    Left Shift 1                                    A=2670
        6203    If A is pos. Jump to 0441
        0417    Load A with 0017
```

```
00440   0000    Error Stop
        0102    Left Shift 1                                        A=5560
        6303    If A is neg. Jump to 0445
        0417    Load A with 0017
        0000    Error Stop
        0102    Left Shift 1                                        A=3341
        6204    If A is pos. Jump to 0452
        0417    Load A with 0017

00450   0000    Error Stop
        5252
        2701    Load complement of content 0451                     A=2525
        6203    If A is pos. Jump to 0456
        0427    Load A with 0027  (0446) cont. during 46 instr. check
        0000    Error Stop
        0102    Left Shift 1                                        A=5252
        6303    If A is neg. Jump to 0462

00460   0427    Load A with 0027  (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=2525
        6203    If A is pos. Jump to 0466
        0427    Load A with 0027  (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=5252
        6303    If A is neg. Jump to 0472

00470   0427    Load A with 0027   (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=2525
        6203    If A is pos. Jump to 0476
        0427    Load A with 0027  (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=5252
        6303    If A is neg. Jump to 0502

00500   0427    Load A with 0027  (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=2525
        6203    If A is pos. Jump to 0506
        0427    Load A with 0027   (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=5252
        6303    If A is neg. Jump to 0512

00510   0427    Load A with 0027  (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=2525
        6203    If A is pos. Jump to 0516
        0427    Load A with 0027  (0446)
        0000    Error Stop
        0102    Left Shift 1                                        A=5252
        6303    If A is neg. Jump to 0522
```

00520	0427	Load A with 0027 (0446)	
	0000	Error Stop	
	0102	Left Shift 1	A=2525
	6203	If A is pos. Jump to 0526	
	0427	Load A with 0027 (0446)	
	0000	Error Stop	
	0102	Left Shift 1	A=5252
	6303	If A is neg. Jump to 0532	
00530	0427	Load A with 0027 (0446)	
	0000	Error Stop	
	0404	Load A with 0004	A=0004
	0704	Subtr. 0004 from content of A	A=0000
	6003	If A=0 Jump to 0537	
	0407	Load A with 0007	
	0000	Error Stop	
	7101	Jump to Loc. stored in 0540	
00540	0563	0566	
	2211	Load A with content of 0552	A=0446
	4366	Store content of A at Loc. 0454	A=0446
	2301	Load A with content of 0542	A=4366
	0704	Subtr. 0004 from content of A	A=4362
	4303	Store content of A at 0542	A=4362
	3607	Subtr. content of 0555 from A	A=0054
	6506	If A $\neq$ 0 Jump to 0541	
00550	4604	Shift Left 1 the content of Loc. 0554	A=2525
	6576	If A $\neq$ 0 Jump to 0453	
	0446	Load A with 0046	
	0000	Error Stop	
	5252	2525	
	4306		
	0427		
	0530		
00560	0450		
	0563		
	0566		
	2301	Load A with content of 0562	A=0566
	4324	Store content of A at Loc. 0540	A=0566
	6524	If A $\neq$ 0 Jump to 0541	
	2305	Load A with content of 0561	A=0563
	4327	Store content of A at Loc. 0540	
00570	2312	Load A with content of 0556	A=0427
	4136	Store content of A in Loc. stored at Loc. 0036	
	2036	Load A with the content of Loc. 0036	A=0530
	0704	Subtract 0004 from A	A=0524
	4036	Store content of A in Loc. 0036	
	1715	Logical sum of A and content of Loc. 0560	A=0174
	6506	If A $\neq$ 0 Jump to Loc. 0570	
	2320	Load A with content of Loc. 0557	A=0530

00600	4036	Store A at Loc. 0036	A=0530
	2725	Load Compl. of content of Loc. 0554	A=5252
	4326	Store A at Loc. 0554	
	6103	If A ≠ 0 Jump to 0606	
	2525	Load Compl. of content of Loc. stored at 0025	A=7325
	7777	Stop	
	0460	Load A with 0060	A=0060
	5345	Add to content of Loc. 0542	A=4366
00610	2303	Load content of 0605	A=7777
	3705	Subtr. content of Loc. 0604 from A	A=5252
	6303	If A is neg. Jump to 0615	
	0437	Load A with 0037 (1234)	
	0000	Error Stop	
	0102	Left Shift 1	A=2525
	6203	If A is pos. Jump to 0621	
	0437	Load A with 0037	
00620	0000	Error Stop	
	0102	Left shift 1	A5252
	6303	If A is neg. Jump to 0625	
	0437	Load A with 0037	
	0000	Error Stop	
	0102	Left shift 1	A=2525
	6203	If A is pos. Jump to 0631	
	0437	Load A with 0037	
00630	0000	Error Stop	
	0102	Left shift 1	A=5252
	6303	If A is neg. Jump to 0635	
	0437	Load A with 0037	
	0000	Error Stop	
	0102	Left Shift 1	A=2525
	6203	If A is pos. Jump to 0641	
	0437	Load A with 0037	
00640	0000	Error Stop	
	0102	Left Shift 1	A=5225
	6303	If A is neg. Jump to 0645	
	0437	Load A with 0037	
	0000	Error Stop	
	0102	Left shift 1	A=2525
	6203	If A is pos. Jump to 0651	
	0437	Load A with 0037	
00650	0000	Error Stop	
	0102	Left shift 1	A=5252
	6303	If A is neg. Jump to 0655	
	0437	Load A with 0037	
	0000	Error Stop	
	0102	Left Shift 1	A=2525
	6203	If A is pos. Jump to 0661	
	0437	Load A with 0037	

00660	0000	Error Stop	
	0102	Left Shift 1	A=5252
	6303	If A is neg. Jump to 0665	
	0437	Load A with 0037	
	0000	Error Stop	
	0102	Left shift 1	A=2525
	6203	If A is pos. Jump to 0671	
	0437	Load A with 0037	
00670	0000	Error Stop	
	7101	Jump to Loc. stored in 0672	
	0721	0724	
	2217	Load A with content of Loc. 0712	A=0432
	4361	Store contents of A in 0613 (0617)	A=0432
	2301	Load A with the contents of Loc. 0674	A=4361
	0704	Subtr 0004 from contents of A	A=4355
	4303	Store contents of A in Loc. 0674	
00700	3613	Subtr. from A the contents of Loc. 0713	A=0054
	6506	If A ≠ 0 Jump to 0673	
	2205	Load A with contents of Loc. 0707	A=4016
	3205	Add to A contents of Loc. 0710	A=5252
	6572	If A ≠ 0 Jump to 0612	
	0432	Load A with 0032	
	0000	Error Stop	
	4016		
00710	1234		
	0437		
	0432		
	4301		
	4361		
	0607		
	0667		
	0721		
00720	0724		
	2301	Load A with contents of Loc. 0720	A=0724
	4330	Store Contents of A at Loc. 0672	
	6530	If A ≠ 0 Jump to 0673	
	2310	Load A with contents of Loc. 0714	A=4361
	4331	Store contents of A at Loc. 0674	
	2307	Load A with contents of Loc. 0717	A=0721
	4335	Store contents of A at Loc. 0672	
00730	2317	Load A with contents of Loc. 0711	A=0437
	4137	Store A at Loc. stored in 0037 (0667)	
	2037	Load A with contents of Loc. 0037	A=0667
	0704	Subtr. 0004 from A	A=0663
	4037	Store A at Loc. 0037	
	3720	Subtr. 0607 from A	
	6506	If A ≠ 0 Jump to 0730	
	2321	Load A with contents of Loc. 0716	A=0667

00740	4037	Store A at Loc. 0037	
	0425	Load A with 0025	A=0025
	0252	Logical prod. of 0052 and A	A=0000
	0652	Add 0052 to A	A=0052
	0225	Logical prod. of 0025 and A	A=0000
	6002	If A = 0 Jump to 0747	
	0000	Error Stop	
	2452	Load A with compl. of contents of 0052	A=0707
00750	1052	Logical prod. of content of 0052 and A	A=0000
	6003	If A = 0 Jump to 0754	
	0410	Load A with 0010	A=0010
	0000	Error Stop	
	2233	Load A with contents of 1007	A=2304
	1111	Logical prod. of A and contents of loc. stored at 0011 (5473)	A=0000
	6107	If A ≠ 0 Jump to 0765	
	2302	Load A with 1111	A=1111
00760	1206	Logical prod. of A and contents of Loc. 0766 (6666)	A=0000
	6104	If A ≠ 0 Jump to 0765	
	2204	Load A with 6666	A=6666
	1306	Log. prod. of A and contents of Loc. 0755 (1111)	A=0000
	6003	If A = 0 Jump to 0767	
	0000	Error Stop	
	6666		
	0452	Load A with 0052	A=0052
00770	0352	Log. sum of A and 0052	A=0000
	0625	Add 0025 to A	A=0025
	0325	Log. sum of A and 0025	A=0000
	6002	If A = 0 Jump to 0775	
	0000	Error Stop	
	2714	Load compl. of contents of Loc. 0761	A=1673
	1467	Log. sum of A and contents of 0067 (1673)	A=0000
	6003	If A = 0 Jump to 1002	
01000	0414	Load A with 0014	
	0000	Error Stop	
	2371	Load A with contents of Loc. 0711	A=0437
	1537	Log. sum of A and cont. of Loc. stored at 0037 (0437)(0664)	A=0000
	6003	If A = 0 Jump to 1007	
	0415	Load A with 0015	
	0000	Error Stop	
	2304	Load A with contents of Loc. 1003	A=1537
01010	1604	Log. sum of A and contents of 1014 (1537)	A=0000
	6004	If A = 0 Jump to 1015	
	0416	Load A with 0016	
	0000	Error Stop	
	1537		
	2041	Load A with contents of Loc. 0041	A=5473
	3604	Subtr. contents of Loc. 1022 from A (5473)	A=0000
	6004	If A = 0 Jump to 1023	

```
01020   0420    Load A with 0020
        0000    Error Stop
        5473
        2137    Load A with cont. of Loc. stored at 0037                A=0437
        3604    Subtr. cont. of Loc. 1030 from 1030  (0437)             A=0000
        6004    If A = 0 Jump to 1031
        0421    Load A with 0021
        0000    Error Stop

01030   0437
        2205    Load A with contents of Loc. 1036                       A=5473
        3710    Subtr. from A cont. of Loc. 1022  (5473)                A=0000
        6004    If A = 0 Jump to 1037
        0422    Load A with 0022
        0000    Error Stop
        5473
        0552    Load A with compl. of 0052                              A=7725

01040   3604    Subtr. from A cont. of Loc. 1044  (7725)                A=0000
        6004    If A = 0 Jump to 1045
        0405    Load A with 0005
        0000    Error Stop
        7725
        2441    Load A with compl. of cont. of Loc. 0041  (5473)        A=2304
        3310    Add to A cont. of Loc. 1036  (5473)                     A=0000
        6003    If A = 0 Jump to 1052

01050   0424    Load A with 0024
        0000    Error Stop
        2537    Load A with compl. of cont. of Loc. stored at 0037 (0437  A=7340
        3323    Add to A cont. of Loc. 1030 (0437)              0667)   A=0000
        6003    If A = 0 Jump to 1057
        0425    Load A with 0025
        0000    Error Stop
        2605    Load A with compl. of cont. of Loc. 1064 (3323)         A=4454

01060   3305    Add to A cont. of Loc. 1053  (3323)                     A=0000
        6004    If A = 0 Jump to 1065
        0426    Load A with 0026
        0000    Error Stop
        3323
        2305    Load A with cont. of Loc. 1060                          A=3305
        0616    Add to A 0016                                           A=3323
        3703    Subtr. from A cont. of Loc. 1064  (3323)                A=0000

01070   6003    If A = 0 Jump to 1073
        0406    Load A with 0006
        0000    Error Stop
        2735    Load A with compl. of cont. of Loc. 1036 (5473)         A=2304
        3041    Add to A cont. of Loc. 0041  (5473)                     A=0000
        6003    If A = 0 Jump to 1100
        0430    Load A with 0030
        0000    Error Stop
```

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01100   2750    Load A with compl. of cont. of Loc. 1030  (0437)          A=7340
        3137    Add to A cont. of Loc. stored at 0037  (0667)             A=0000
        6003    If A = 0 Jump to 1105
        0431    Load A with 0031
        0000    Error Stop
        2705    Load A with compl. of cont. of Loc. 1100                  A=5027
        3204    Add to A the cont. of Loc. 1112  (2750)                   A=0000
        6004    If A = 0 Jump to 1113

01110   0432    Load A with 0032
        0000    Error Stop
        2750
        2313    Load A with cont. of Loc. 1100                            A=2750
        0743    Subtr. from A 0043                                        A=2705
        3710    Subtr. from A cont. of Loc. 1105  (2705)                  A=0000
        6003    If A = 0 Jump to 1121
        0407    Load A with 0007

01120   0000    Error Stop
        2363    Load A with cont. of Loc. 1036                            A=5473
        3441    Subtr. from A cont. of Loc. 0041  (5473)                  A=0000
        6003    If A = 0 Jump to 1126
        0434    Load A with 0034
        0000    Error Stop
        2376    Load A with cont. of Loc. 1030                            A=0437
        3537    Subtr. from A the cont. of Loc. stored at 0037 (0667)     A=0000

01130   6003    If A = 0 Jump to 1133
        0435    Load A with 0035
        0000    Error Stop
        2304    Load A with cont. of Loc. 1127 (3537)                     A=3537
        3604    Subtr. from A cont. of Loc. 1140 (3537)                   A=0000
        6004    If A = 0 Jump to 1141
        0436    Load A with 0036
        0000    Error Stop

01140   3537
        2041    Load A with cont. of 0041                                 A=5473
        4042    Store A at 0042
        2041    Load A with cont. of 0041                                 A=5473
        3442    Subtr. from A cont. of Loc. 0042                          A=0000
        6003    If A = 0 Jump to 1150
        0440    Load A with 0040
        0000    Error Stop

01150   2312    Load A with cont. of Loc. 1136                            A=0436
        0601    Add 0001 to A                                             A=0437
        4137    Store A at Loc. 0667 (ind)
        2137    Load A with cont. of Loc. stored at 0037 (0667)           A=0437
        3604    Subtr. from A cont. of Loc. 1160  (0437)                  A=0000
        6004    If A = 0 Jump to 1161
        0441    Load A with 0041
        0000    Error Stop
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01160   0437
        2305    Load A with cont. of Loc. 1154                          A=3604
        4206    Store A at Loc. 1170
        2707    Load A with compl. of cont. of Loc. 1154 (3604)         A=4173
        3204    Add to A the cont. of Loc. 1170 (3604)                  A=0000
        6007    If A = 0 Jump to 1174
        0442    Load A with 0042
        0000    Error Stop

01170   0000
        7507
        2470
        7507
        4443    Shift 1 cont. of Loc. 0043 (7643)                       A=7507
        3702    Subtr. from A cont. of Loc. 1173 (7507)                 A=0000
        6003    If A = 0 Jump to 1201
        0444    Load A with 0044

01200   0000    Error Stop
        2306    Load A with cont. of Loc. 1173 (7507)                   A=7507
        0102    Left shift 1                                            A=7217
        4310    Store A at Loc. 1173                                    A=7217
        4544    Shift 1 left cont. of Loc. stored at 0044 (1171)        A=7217
        3712    Subtr. from A cont. of Loc. 1173 (7207)                 A=0000
        6004    If A = 0 Jump to 1212
        0445    Load A with 0045

01210   0000    Error Stop
        4321    0643
        2320    Load A with cont. of Loc. 1172                          A=2470
        0102    Left shift 1                                            A=5160
        4322    Store A at Loc. 1172
        2304    Load A with cont. of Loc. 1211                          A=4321
        0102    Left shift 1                                            A=0643
        4206    Store A at Loc. 1225

01220   4707    Shift left 1 cont. of Loc. 1211                         A=0643
        3604    Subtr. from A cont. of Loc. 1225 (0643)                 A=0000
        6007    If A = 0 Jump to 1231
        0447    Load A with 0047
        0000    Error Stop
        0643
        5624    5643
        0435

01230   0435    526
        2303    Load A with cont. of Loc. 1226                          A=5624
        0617    Add to A 0017                                           A=5643
        4305    Store A at Loc. 1226
        0417    Load A with 0017                                        A=0017
        5045    Add to A cont. of Loc. 0045 and store at 0045           A=5643
        3710    Subtr. from A cont. of Loc. 1226  (5643)                A=0000
        6003    If A = 0 Jump to 1242
```

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01240   0450    Load A with 0050
        0000    Error Stop
        2211    Load A with cont. of Loc. 1253                  A=0435
        0671    Add 0071 to A                                   A=0526
        4207    Store A at Loc. 1253
        0471    Load A with 0071                                A=0071
        5146    Add A to cont. of Loc. 1230 (stored at 0046)    A=0526
        3604    Subtr. cont. of Loc. 1253 from A                A=0000

01250   6004    If A = 0 Jump to 1254
        0451    Load A with 0051
        0000    Error Stop
        0435    0526
        2211    Load A with cont. of 1265                       A=0451
        0644    Add 0044 to A                                   A=0515
        4207    Store A at Loc. 1265
        0444    Load A with 0044                                A=0044

01260   5206    Add A to cont. of Loc. 1266 (0451)              A=0515
        3604    Subtr. cont. of Loc. 1265 from A (0516)         A=0000
        6007    If A = 0 Jump to 1271
        0452    Load A with 0052
        0000    Error Stop
        0451    0515
        0451    0515
        2431    2456

01270   2431    2456
        2301    Load A with cont. of 1270                       A=2431
        0625    Add 0025 to A                                   A=2456
        4303    Store A at Loc. 1270
        0425    Load A with 0025                                A=0025
        5306    Add A to cont. of Loc. 1267                     A=2456
        3706    Subtr. cont. of Loc. 1270 from A                A=0000
        6010    If A = 0 Jump to 1307

01300   0453    Load A with 0053
        0000    Error Stop
        0000    0001
        0772    0773
        0772    0773
        4101    4102
        4101    4102
        2305    Load A with cont. of 1302                       A=0000

01310   0601    Add 0001 to A                                   A=0001
        4307    Store A at Loc. 1302
        5447    Add one to content of Loc. 0047                 A=0001
        3711    Subtr. cont. of 1302 from A                     A=0000
        6003    If A = 0 Jump to 1317
        0454    Load A with 0054
        0000    Error Stop
        2313    Load A with cont. of 1304                       A=0772
```

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01320   0601    Add 0001 to A                                          A=0773
        4315    Store A at Loc. 1304
        5550    Add 1 to cont. of Loc. (1303) stored at 0055           A=0773
        3717    Subtr. cont. of Loc. 1304 from A (0773)                A=0000
        6003    If A = 0 Jump to 1327
        0455    Load A with 0055
        0000    Error Stop
        2212    Load A with cont. of Loc. 1341                         A=3720

01330   4210    Store A at Loc. 1340
        0601    Add 0001 to A                                          A=3721
        4207    Store A at Loc. 1341
        5605    Add 1 to cont. of Loc. 1340                            A=3721
        3605    Subtr. cont. of Loc. 1341 from A                       A=0000
        6005    If A = 0 Jump to 1342
        0456    Load A with 0056
        0000    Error Stop

01340   3720    3721
        3720    3721
        2335    Load A with cont. of Loc. 1305                         A=4101
        0601    Add 1 to A                                             A=4102
        4337    Store A at Loc. 1305
        5737    Add 1 to cont. of Loc. 1306                            A=4102
        3741    Subtr. cont. of Loc. 1305 from A                       A=0000
        6003    If A = 0 Jump to 1352

01350   0457    Load A with 0057
        0000    Error Stop
        7051    Jump to Loc. stored at 0051 (1355)
        0470    Load A with 0070
        0000    Error Stop
        7101    Jump to Loc. 1361
        1361
        0471    Load A with 0071

01360   0000    Error Stop
        5611    Add 1 to cont. of Loc. 1372
        6303    If A is neg. Jump to 1365
        0400    Load A with 0000                                       A=0000
        7112    Jump to Loc. 0100
        2212    Load A with cont. of Loc. 1377                         A=0314
        4204    Store A at Loc. 1372
        0400    Load A with 0000

01370   7101    Jump to 1400
        1400
        1000
        7101    Jump to 1400
        1400
        0000
        0100
        1000
```

01400	2200	Load A with constant stored at 1401	A=7643
	7643	7505	
	3701	Subtr. cont. of Loc. 1401 from A (7643)	A=0000
	6002	If A = 0 Jump to 1405	
	0000	Error Stop	
	2304	Load A with cont. of Loc. 1401	A=7643
	4203	Store A at Loc. 1411	
	4706	Shift left 1 cont. of Loc. 1401 (7643)	A=7507
01410	4600	Shift left 1 cont. of Loc. 1411 (7643)	A=7507
	7507	7643 - 7507	
	2311	Load A with cont. of Loc. 1401	A=7507
	3702	Subtr. cont. of Loc. 1411 (7507)	A=0000
	6002	If A = 0 Jump to 1416	
	0000	Error Stop	
	2305	Load A with cont. of Loc. 1411	A=7507
	4200	Store A at Loc. 1420	
01420	7507		
	1710	Logical sum of A and cont. of Loc. 1411 (7507)	A=0000
	6002	If A = 0 Jump to 1424	
	0000	Error Stop	
	2704	Load A with compl. of cont. of Loc. 1420 (7507)	A=0270
	4202	Store A at Loc. 1427	
	5600	Add 1 to constant at 1427	A=0271
	0270	0271	
01430	0701	Subtr. 0001 from A	A=0270
	3311	Add cont. of Loc. 1420 (7507)	A=0000
	6003	If A = 0 Jump to 1435	
	0000	Error Stop	
	7643	7507	
	5200	Add A to constant at 1436	A=7643
	7643	7507	
	3703	Subtr. from A cont. of Loc. 1434 (7643)	A=0000
01440	6002	If A = 0 Jump to 1442	
	0000	Error Stop	
	4706	Shift left 1 cont. of Loc. 1434 (7643)	A=7507
	4305	Store A at Loc. 1436	
	2706	Load A with compl. of Loc. 1436 (7507)	A=0270
	4203	Store A at Loc. 1450	
	2312	Load A with cont. of Loc. 1434	A=7507
	1200	Log. prod. of A and const. at 1450 (0270)	A=0000
01450	0560	0270	
	6002	If A = 0 Jump to 1453	
	0000	Error Stop	
	2303	Load A with cont. of Loc. 1450	A=0270
	4202	Store A at 1456	
	1600	Log. sum of A and constant at 1456 (0270)	A=0000
	0506	0270	
	6002	If A = 0 Jump to 1461	

01460	0000	Error Stop	
	2303	Load A with cont. of Loc. 1456	A=0270
	4202	Store A at Loc. 1464	
	2600	Load A with compl. of const. at 1464	A=7570
	0506	0270	
	3307	Add cont. of Loc. 1456 to A (0270)	A=0000
	6002	If A = 0 Jump to 1470	
	0000	Error Stop	
01470	2304	Load A with cont. of Loc. 1464	A=0270
	4202	Store A at Loc. 1473	
	3600	Subtr. const. at 1473 (0270) from A	A=0000
	0506	0270	
	6002	If A = 0 Jump to 1476	
	0000	Error Stop	
	2703	Load A with compl. of cont. of Loc. 1473 (0270)	A=7507
	4203	Store A at Loc. 1502	
01500	2305	Load A with cont. of Loc. 1473	A=0270
	3200	Add to A constant stored at 1502	A=0000
	7271	7507	
	6002	If A = 0 Jump to 1505	
	0000	Error Stop	
	0101	Transfer P to A	A=1505
	0603	Add 0003 to A	A=1510
	4205	Store A at Loc. 1514	
01510	0101	Transfer P to A	A=1510
	3603	Subtr. cont. of Loc. 1514 (1510) from A	A=0000
	6003	If A = 0 Jump to 1515	
	0000	Error Stop	
	1510	1511 - 1523 - 1527	
	5701	Add 1 to cont. of Loc. 1514	A=1511
	0101	Transfer P to A	A=1516
	0705	Subtr. 0005 from A	A=1511
01520	3704	Subtr. cont. of Loc. 1514 from A	A=0000
	6002	If A = 0 Jump to 1523	
	0000	Error Stop	
	0101	Transfer P to A	A=1523
	4310	Store A at 1514	
	0404	Load A with 0004	A=0004
	5312	Add A to cont. of Loc. 1514 (1523)	A=1527
	0101	Transfer P to A	A=1527
01530	3714	Subtr. cont. of Loc. 1514 (1527) from A	A=0000
	6002	If A = 0 Jump to 1533	
	0000	Error Stop	
	0101	Transfer P to A	A=1533
	4212	Store A at Loc. 1546	
	0103	Left shift 2	A=6554
	4211	Store A at Loc. 1547	
	2207	Load A with cont. of Loc. 1546	A=1533

```
01540   3206    Add cont. of Loc. 1546 (1533) to A                  A=3266
        3205    Add cont. of Loc. 1546 (1533) to A                  A=5021
        3204    Add cont. of Loc. 1546 (1533) to A                  A=6554
        3604    Subtr. cont. of Loc. 1547 (6554) from A             A=0000
        6004    If A = 0 Jump to 1550
        0000    Error Stop
        1533
        6154    6554

01550   0101    Transfer P to A                                     A=1550
        4213    Store A at Loc. 1564
        0111    Left shift 6                                        A=5015
        4212    Store A at Loc. 1565
        4610    Shift Left 1 cont. of Loc. 1564 (1550)              A=3320
        4607    Shift Left 1 cont. of Loc. 1564 (3320)              A=6640
        4606    Shift Left 1 cont. of Loc. 1564 (6640)              A=5501
        0103    Shift Left 2                                        A=6406

01560   0102    Shift left 1                                        A=5015
        3604    Subtr. cont. of Loc. 1565 from A (5015)             A=0000
        6005    If A = 0 Jump to 1567
        0000    Error Stop
        1550    3320 - 6640 - 5501
        5300    5015
        0000
        0113    Multiply A by 100(10) (1448)                        A=0000

01570   6003    If A = 0 Jump to 1573
        0000    Error Stop
        0001    0002
        2301    Load A with content of Loc. 1572                    A=0001
        0113    Multiply A by 100(10) (144(8))                      A=0144
        4225    Store A at Loc. 1622
        2304    Load A with cont. of Loc. 1572                      A=0001
        0103    Left shift 2                                        A=0004

01600   0102    Left shift 1                                        A=0010
        4222    Store A at Loc. 1623
        2310    Load A with cont. of Loc. 1572                      A=0001
        0102    Left shift 1                                        A=0002
        5217    Add A to cont. of Loc. 1623                         A=0012
        0103    Left shift 2                                        A=0050
        0102    Left shift 1                                        A=0120
        4215    Store A at Loc. 1624

01610   4613    Shift left 1 cont. of Loc. 1623                     A=0024
        3213    Add content of Loc. 1624 to A                       A=0144
        3610    Subtr. cont. of Loc. 1622 from A                    A=0000
        6002    If A = 0 Jump to 1615
        0000    Error Stop
        5723    Add 1 to cont. of Loc. 1572                         A=0002
        3607    Subtr. cont. of Loc. 1625 from A (0623)             A=7156
        6114    If A ≠ 0 Jump to 1633
```

```
01620   6006    If A = 0 Jump to 1626
        0000    Error Stop
        0000    0144
        0000    0010 - 0012
        0000    0120
        0623
        0401    Load A with 0001                                    A=0001
        4335    Store A at Loc. 1572

01630   6103    If A ≠ 0 Jump to 1633
        1632
        7643    7507 - 7510 - 7533
        2100    Load A with cont. of Loc. 1632                      A=7643
        1632
        3703    Subtr. cont. of Loc. 1632 from A                    A=0000
        6002    If A = 0 Jump to 1640
        0000    Error Stop

01640   2706    Load compl. of cont of Loc. 1632                    A=0134
        1100    Log. prod. of A and cont. of Loc. 1632              A=0000
        1632
        6002    If A = 0 Jump to 1645
        0000    Error Stop
        2313    Load A with cont. of 1632                           A=7643
        1500    Log. sum of A and cont. of Loc. 1632                A=0000
        1632

01650   6002    If A = 0 Jump to 1652
        0000    Error Stop
        2500    Load A with compl. of cont. of Loc. 1632            A=0134
        1632
        3322    Add cont. of Loc. 1632 to A                         A=0000
        6002    If A = 0 Jump to 1657
        0000    Error Stop
        2725    Load compl. of cont. of 1632                        A=0134

01660   3100    Add cont. of Loc. 1632 to A                         A=0000
        1632
        6002    If A = 0 Jump to 1664
        0000    Error Stop
        2332    Load A with cont. of Loc. 1632                      A=7643
        3500    Subtr. cont. of Loc. 1632 from A                    A=0000
        1632
        6002    If A = 0 Jump to 1671

01670   0000    Error Stop
        2337    Load A with cont. of Loc. 1632                      A=7643
        4206    Store A at Loc. 1700                                A=7643
        4100    Store A at Loc. 1632                                A=7643
        1632
        3603    Subtr. cont. of Loc. 1700 from A                    A=0000
        6003    If A = 0 Jump to 1701
        0000    Error Stop
```

```
01700   7643    7507 - 7510 - 7533
        4701    Shift left 1 cont. of Loc. 1700                 A=7507
        4500    Shift left 1 cont. of Loc. 1632                 A=7507
        1632
        3704    Subtr. cont. of Loc. 1700 from A                A=0000
        6002    If A = 0 Jump to 1707
        0000    Error Stop
        5707    Add 1 to cont. of Loc. 1700                     A=7510

01710   5500    Add 1 to cont. of Loc. 1632                     A=7510
        1632
        3712    Subtr. cont. of Loc. 1700 from A                A=0000
        6002    If A = 0 Jump to 1715
        0000    Error Stop
        0423    Load A with 0023                                A=0023
        5316    Add A to cont. of Loc. 1700                     A=7533
        0423    Load A with 0023                                A=0023

01720   5100    Add A to cont. of Loc. 1632                     A=7533
        1632
        1722    Log. sum of cont. of Loc. 1700 and A            A=0000
        6002    If A = 0 Jump to 1725
        0000    Error Stop
        5604    Add one to cont. of Loc. 1731                   A=0001
        6006    If A = 0 Jump to 1734
        7101    Jump to 1740

01730   1740
        0000
        0000
        0000
        7101    Jump to 3500
        3500
        0000
        0000

01740   2200
        4000    "A" "variable"
        3600
        3000    "B" "variable"
        3600
        0700
        0770
        0707

01750   0701
        6004
        0000    Error Pyramid
        7770    Count
        0000    "D" variable.
        5714    Increase A
        5713    Increase B
        2200
```

```
01760   0000    "C" variable
        5305    Increase D
        5707    Increase Count
        6504
        2310    Load Data
        6002
        0000    Error Pyramid
        0507    Load Count

01770   4315    Reset Count
        2200
        1111
        5313    "C" + 1111
        3200    Add Neg. Zero
        7777
        3716
        6002

02000   0000
        7101
        1400
```

3475

03500	2300	Load A with cont. of Loc. 7777	A=7643
	1603	Log. sum of A and cont. of Loc. 3504	A=0000
3503 ·	6003	If A = 0 Jump to 3505	
	0000	Error Stop	
	7643	7507 - 7217 - 7244 = 7245 constant	
	4701	Shift left 1 cont. of Loc. 3504	A=7507
	4560	Shift left 1 cont. of Loc. stored at Loc. 60 (7643)	A=7507
	2303	Load A with cont. of Loc. 3504	A=7507
03510	1700	Log. sum of A and cont. of Loc. 7777 (7507)	A=0000
	6002	If A = 0 Jump to 3513	
	0000	Error Stop	
	2700	Load A with compl. of cont. of Loc. 7777	A=0270
	3310	Add to A cont. of Loc. 3504	A=0000
	6002	If A = 0 Jump to 3517	
	0000	Error Stop	
	2713	Load A with compl. of cont. of Loc. 3504	A=0270
03520	1300	Log. prod. of A and cont. of Loc. 7777	A=0000
	6002	If A = 0 Jump to 3523	
	0000	Error Stop	
	2717	Load A with compl. of cont. of Loc. 3504	A=0270
	3300	Add cont. of Loc. 7777 to A	A=0000
	6002	If A = 0 Jump to 3527	
	0000	Error Stop	
	2323	Load A with cont. of Loc. 3504	A=7507
03530	3700	Subtr. cont. of Loc. 7777 from A	A=0000
	6002	If A = 0 Jump to 3533	
	0000	Error Stop	
	2327	Load A with cont. of Loc. 3504	A=7507
	4300	Store A at Loc. 7777	
	3731	Subtr. cont. of Loc 3504 from A	A=0000
	6002	If A = 0 Jump to 3540	
	0000	Error Stop	
03540	4734	Shift left 1 cont. of Loc. 3504	A=7217
	4700	Shift left 1 cont. of Loc. 7777	A=7217
	3736	Subtr. from A cont. of Loc. 3504	A=0000
	6002	If A = 0 Jump to 3545	
	0000	Error Stop	
	0425	Load A with 0025	A=0025
	5342	Add A to cont. of Loc. 3504	A=7244
	0425	Load A with 0025	A=0025
03550	5300	Add A to cont. of Loc. 7777	A=7244
	3745	Subtr. from A cont. of Loc. 3504	A=0000
	6002	If A = 0 Jump to 3554	
	0000	Error Stop	
	5750	Add 1 to cont. of Loc. 3504	A=7245
	5700	Add 1 to cont. of Loc. 7777	A=7245
	3752	Subtr. from A cont. of Loc. 3504	A=0000
	6004	If A = 0 Jump to 3563	

```
03560   0000    Error Stop
        5461    6306 - 0663
        5461    3143 - 6306 - 0663
        4701    Shift left 1 cont. of Loc. 3562                 A=3143
        4702    Shift left 1 cont. of Loc. 3562                 A=6306
        2304    Load A with cont. of Loc. 3561                  A=5461
        0103    Left shift A 2 places                           A=6306
        4306    Store A at Loc. 3561

03570   3706    Subtr. from A cont. of Loc. 3562                A=0000
        6003    If A = 0 Jump to 3574
        0401    Load A with 0001
        0000    Error Stop
        2312    Load A with cont. of Loc. 3562                  A=6306
        0110    Left shift A 3 places                           A=3066
        0110    Left shift A 3 places                           A=0663
        4315    Store A at Loc. 3562

03600   2317    Load A with cont. of Loc. 3561                  A=6306
        0111    Left shift A 6 places                           A=0663
        4321    Store A at Loc. 3561
        3721    Subtr. from A cont. of Loc. 3562                A=0000
        6003    If A = 0 Jump to 3607
        0401    Load A with 0001
        0000    Error Stop
        0412    Load A with 0012                                A=0012

03610   0112    A times 10 (12_8)                               A=0144
        3604    Subtr. from A cont. of Loc. 3615                A=0000
        6004    If A = 0 Jump to 3616
        0401    Load A with 0001
        0000    Error Stop
        0144
        2206    Load A with cont. of Loc. 3624                  A=2525
        0114    Right shift A 1 place                           A=1252

03620   3605    Subtr. from A cont. of Loc. 3625                A=0000
        6005    If A = 0 Jump to 3626
        0401    Load A with 0001
        0000    Error Stop
        2525
        1252
        2212    Load A with cont. of Loc. 3640                  A=5252
        0114    Right shift A 1 place.                          A=6525

03630   0114    Right shift A 1 place                           A=7252
        4207    Store A at Loc. 3640
        2207    Load A with cont. of Loc. 3641                  A=5252
        0115    Right shift A 2 places                          A=7252
        4205    Store A at Loc. 3641
        3603    Subtr. from A cont. of Loc. 3640                A=0000
        6004    If A = 0 Jump to 3642
        0000    Error Stop
```

03640	5252		
	5252		
	5604	Add 1 to cont. of Loc. 3646	A=7771
	6113	If A ≠ 0 Jump to 3656	
	6026	If A = 0 Jump to 3672	
	5252		
	7770	7771	
	2702	Load A with compl. of Loc. 3645	A=2525
03650	4303	Store A at Loc. 3645	
	4311	Store A at Loc. 3640	
	4311	Store A at Loc. 3641	
	7100	3655 to Loc. 3663 and Jump to	
	3663	Loc. 3664	
	7121	Jump to 3714	
	7101	Jump to 3626	
	3626		
03360	0000	Error Stop 7100 instruction failed	
	0000		
	7101	Jump to Loc. 3655	
	3660	3655	
	5603	Add 1 to cont. of Loc. 3667	
	7101	Jump to 3662	
	3662		
	0000	0001	
03670	7101	Jump to 3500	
	3500		
	0507	Load A with compl. of 0007	A=7770
	4325	Store A at loc. 3646	
	7101	Jump to 3647	
	3647		
	3714		
	7701	Stop when Sel. Stop 1 is up, otherwise P + 1	
03700	7702	Stop when Sel. Stop 2 is up, otherwise P + 1	
	7704	Stop when Sel. Stop 4 is up, otherwise P + 1	
	7707	Recheck Stop 1, 2, and 4	
	5553	Add 1 to cont. of Loc. stored at 0053 (1375)	
	6104	If A ≠ 0 Jump to 3710	
	7777	Halt	
	7101	Jump to 0100	
	0100		
03710	0425	Load A with 0025	A=0025
	6111	If A ≠ 0 Jump to 3722	
	7101	Jump to 6431	
	6431		
	2205	Load A with cont. of Loc. 3721	A=3660
	4332	Store A at Loc. 3663	
	2327	Load A with cont. of Loc. 3667	
	6527	If A ≠ 0 Jump to 3670	

```
03720   6421    If A = 0 Jump to 3662                                   A=3725
        3660
        7625    Replace E part of Loc. 3724 (stored at 0025) with 25
        7101    Jump to 3725
        3752    3725
        0452    Load A with 0052                                        A=0052
        7625    Replace E part of Loc. 3724 (stored at 0025) with 52    A=3752
        7710    If Sel. Jump 1 set jump to 3742
                                (If not jump to 3731)

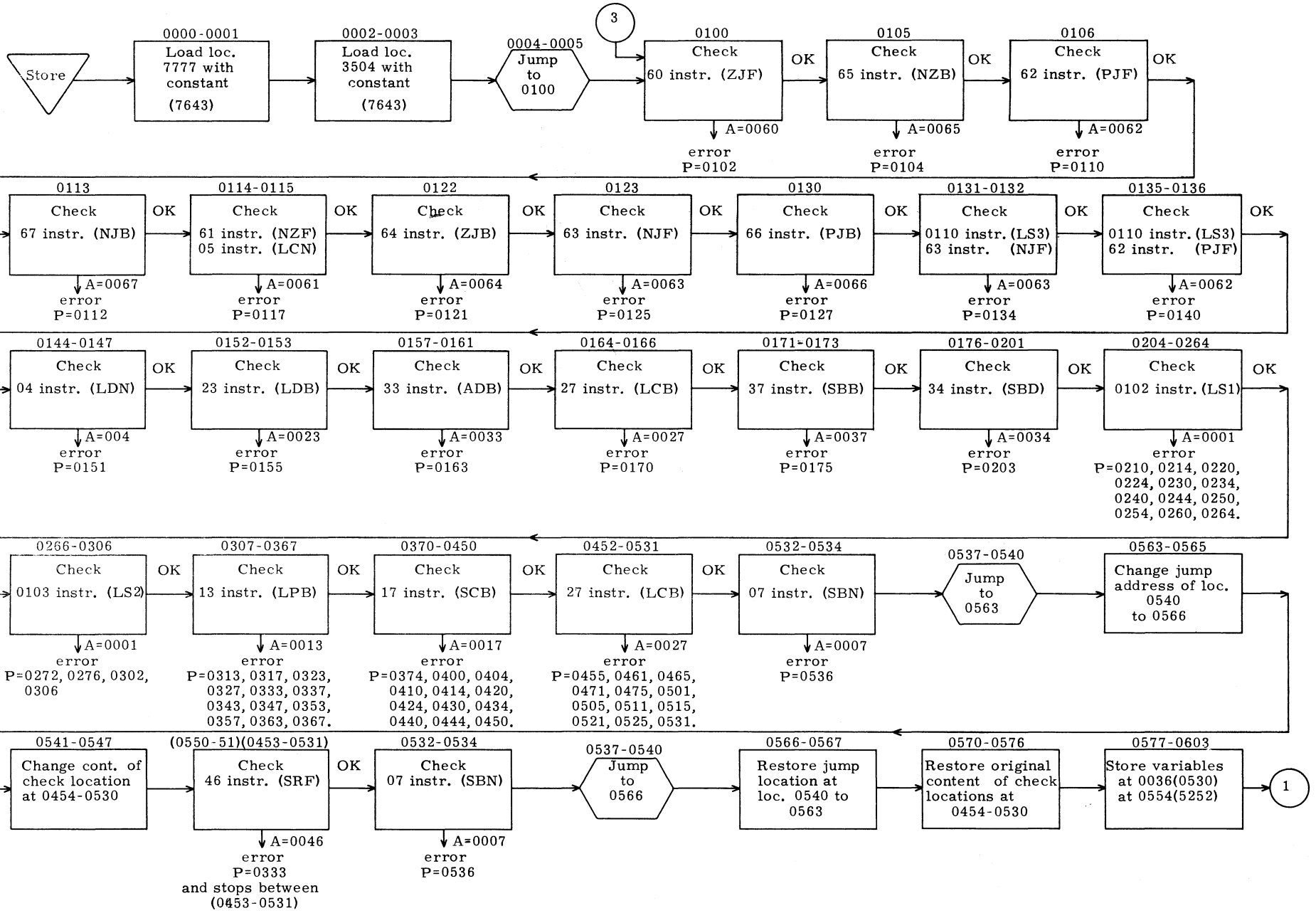
03730   3742
        7720    If Sel. Jump 2 set Jump to 3756
        3756    If not jump to 3733
        7740    If Sel. Jump 4 set jump to 3764
        3764    If not jump to 3735
        0400    Load A with 0000                                        A=0000
        6430    If A=0 Jump to 3706
        7775    Counter for Sel. Jump 1

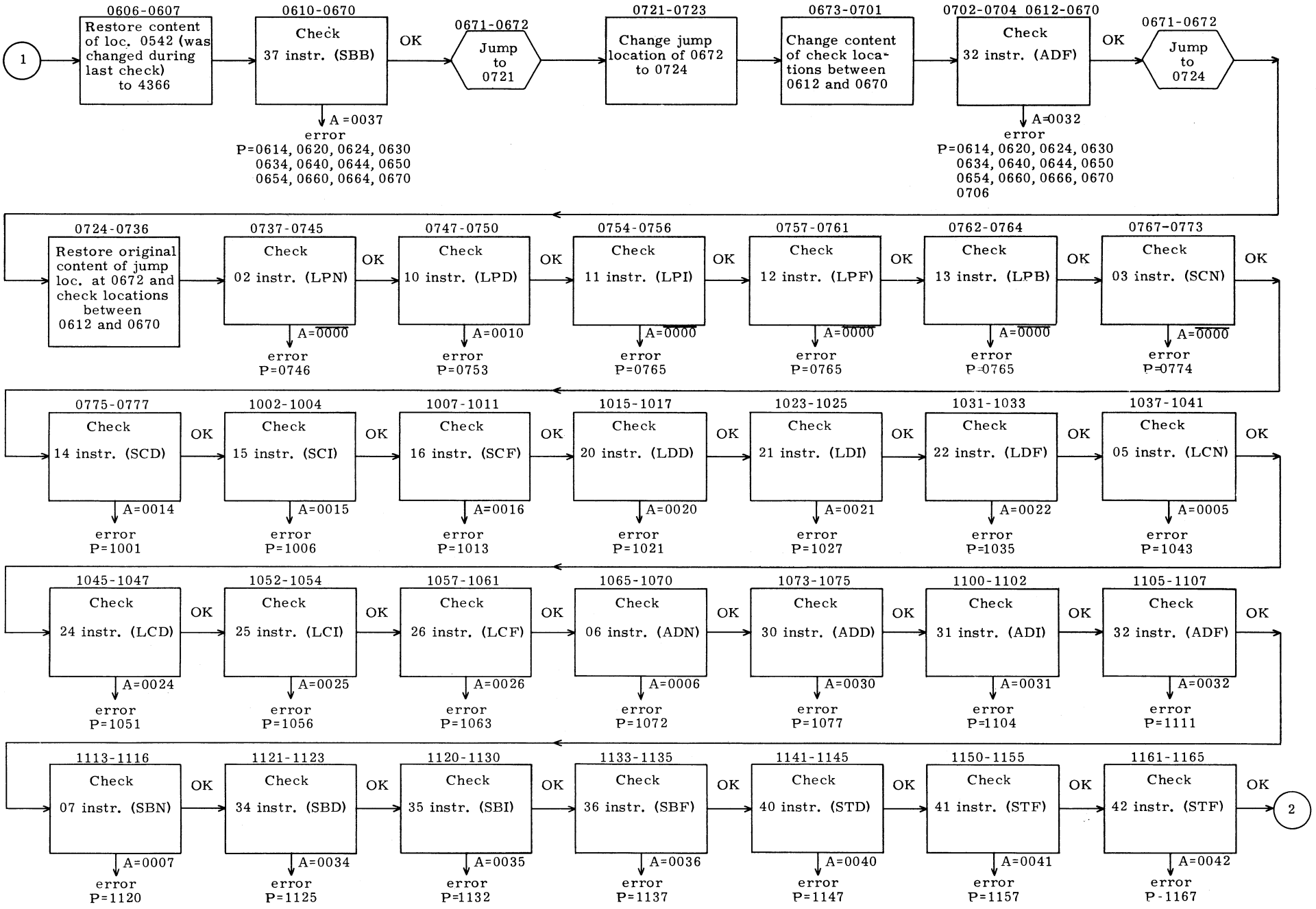
03740   7773    Counter for Sel. Jump 2
        7767    Counter for Sel. Jump 4
        5703    Add 1 to cont. of Loc. 3737                     A=7776 - 0000
        6506    If A ≠ 0 Jump to 3735
        0502    Load A with compl. of 0002                              A=7775
        4306    Store A at Loc. 3737
        0400    Load A with 0000
        6442    If A = 0 Jump to 3705

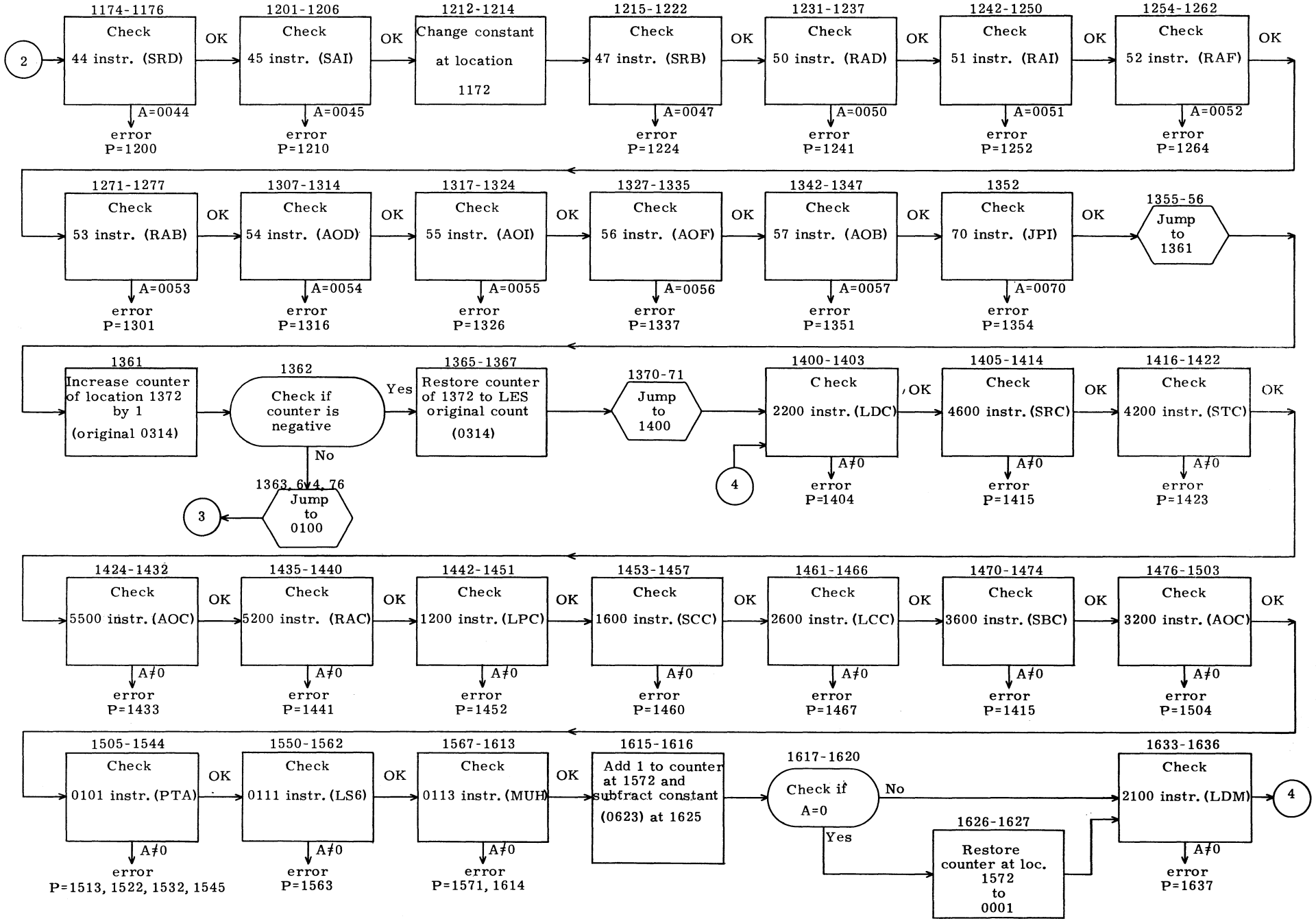
03750   7033    Check sum constant
        0000
        0476    Load A with 0076  HWI Error
        0000    Error Stop
        0400    Load A with 0000
        6447    If A = 0 Jump to 3705
        5716    Add 1 to cont. of Loc. 3740                     A=7774 - 0000
        6522    If A ≠ 0 Jump to 3735

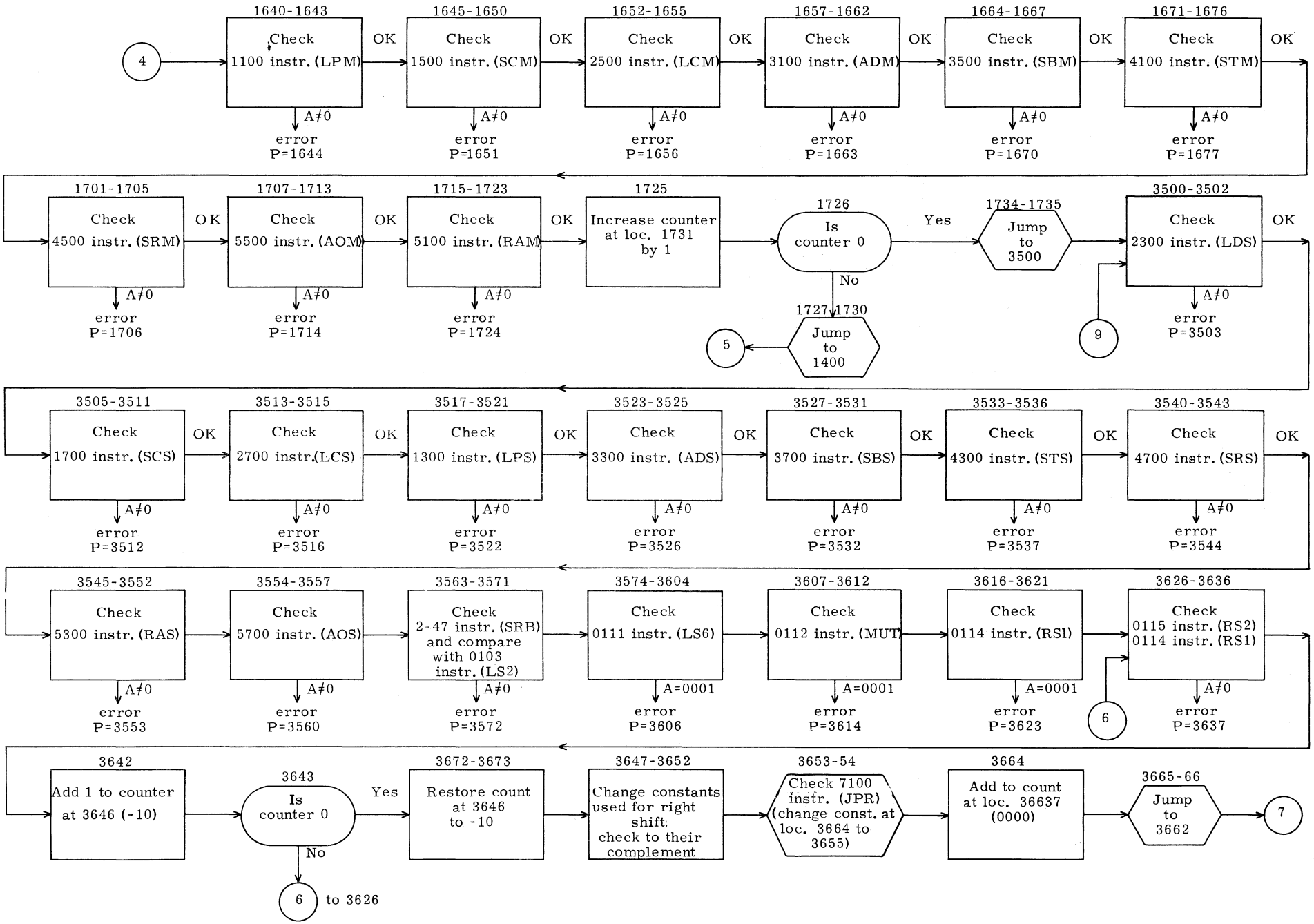
03760   0504    Load A with compl. of 0004                              A=7773
        4321    Store A at Loc. 3740
        0400    Load A with 0000
        6456    If A = 0 Jump to 3705
        5723    Add 1 to cont. of loc. 3741                     A=7767 - 0000
        6530    If A ≠ 0 Jump to 3735                                   A=7767
        0510    Load A with compl. of 0010
        4326    Store A at Loc. 3741

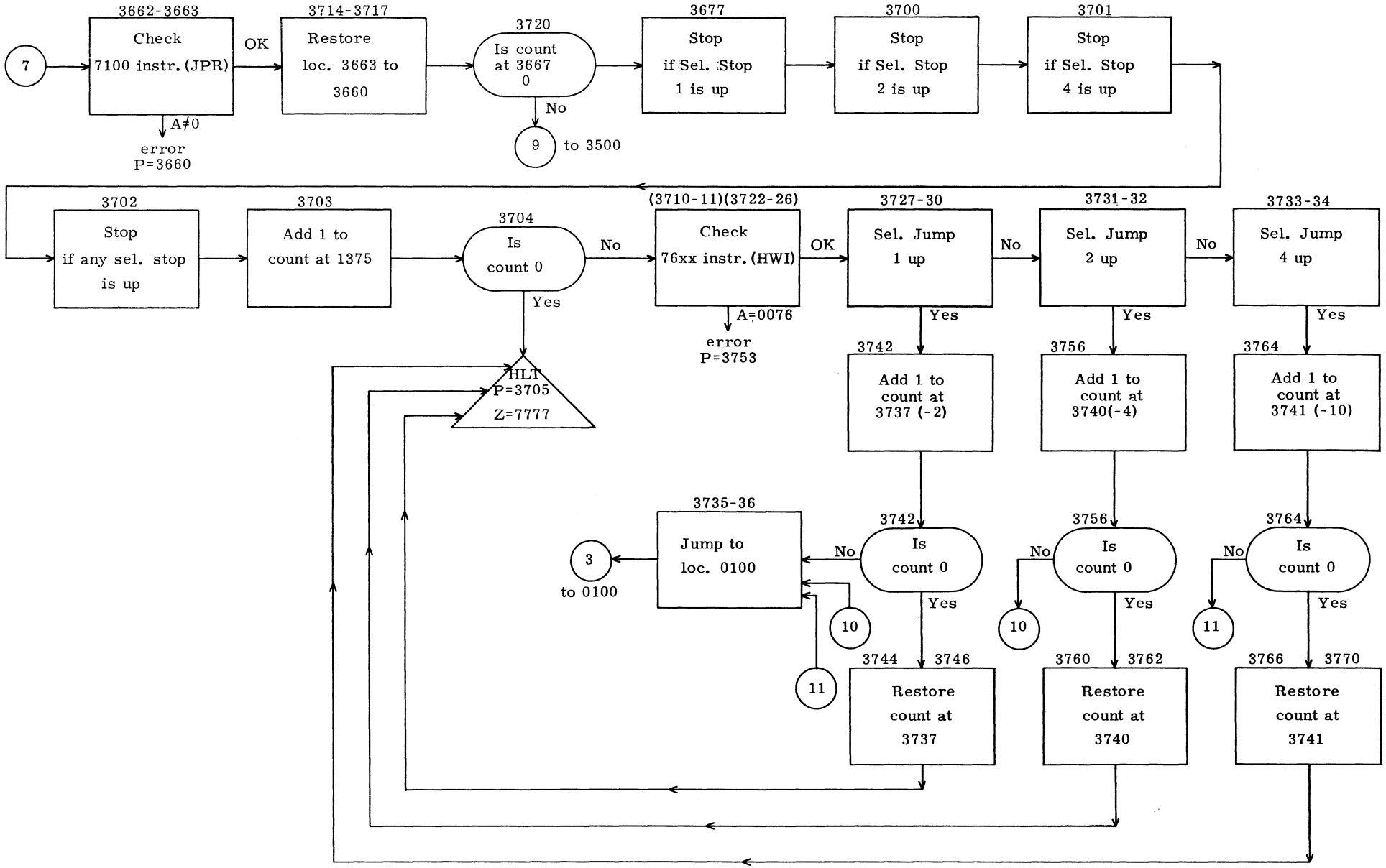
03770   0400    Load A with 0000
        6464    If A = 0 Jump to 3705
  726   5275    Check sum constant
```


Store
0000-0001
Load loc. 7777 with constant (7643)
0002-0003
Load loc. 3504 with constant (7643)
0004-0005
Jump to 0100
3
0100
Check 60 instr. (ZJF)
A=0060
error P=0102
OK
0105
Check 65 instr. (NZB)
A=0065
error P=0104
OK
0106
Check 62 instr. (PJF)
A=0062
error P=0110
OK
0113
Check 67 instr. (NJB)
A=0067
error P=0112
OK
0114-0115
Check 61 instr. (NZF) 05 instr. (LCN)
A=0061
error P=0117
OK
0122
Check 64 instr. (ZJB)
A=0064
error P=0121
OK
0123
Check 63 instr. (NJF)
A=0063
error P=0125
OK
0130
Check 66 instr. (PJB)
A=0066
error P=0127
OK
0131-0132
Check 0110 instr. (LS3) 63 instr. (NJF)
A=0063
error P=0134
OK
0135-0136
Check 0110 instr. (LS3) 62 instr. (PJF)
A=0062
error P=0140
OK
0144-0147
Check 04 instr. (LDN)
A=004
error P=0151
OK
0152-0153
Check 23 instr. (LDB)
A=0023
error P=0155
OK
0157-0161
Check 33 instr. (ADB)
A=0033
error P=0163
OK
0164-0166
Check 27 instr. (LCB)
A=0027
error P=0170
OK
0171-0173
Check 37 instr. (SBB)
A=0037
error P=0175
OK
0176-0201
Check 34 instr. (SBD)
A=0034
error P=0203
OK
0204-0264
Check 0102 instr. (LS1)
A=0001
error P=0210, 0214, 0220, 0224, 0230, 0234, 0240, 0244, 0250, 0254, 0260, 0264.
OK
0266-0306
Check 0103 instr. (LS2)
A=0001
error P=0272, 0276, 0302, 0306
OK
0307-0367
Check 13 instr. (LPB)
A=0013
error P=0313, 0317, 0323, 0327, 0333, 0337, 0343, 0347, 0353, 0357, 0363, 0367.
OK
0370-0450
Check 17 instr. (SCB)
A=0017
error P=0374, 0400, 0404, 0410, 0414, 0420, 0424, 0430, 0434, 0440, 0444, 0450.
OK
0452-0531
Check 27 instr. (LCB)
A=0027
error P=0455, 0461, 0465, 0471, 0475, 0501, 0505, 0511, 0515, 0521, 0525, 0531.
OK
0532-0534
Check 07 instr. (SBN)
A=0007
error P=0536
0537-0540
Jump to 0563
0563-0565
Change jump address of loc. 0540 to 0566
0541-0547
Change cont. of check location at 0454-0530
(0550-51)(0453-0531)
Check 46 instr. (SRF)
A=0046
error P=0333 and stops between (0453-0531)
OK
0532-0534
Check 07 instr. (SBN)
A=0007
error P=0536
0537-0540
Jump to 0566
0566-0567
Restore jump location at loc. 0540 to 0563
0570-0576
Restore original content of check locations at 0454-0530
0577-0603
Store variables at 0036(0530) at 0554(5252)
1


1
0606-0607
Restore content of loc. 0542 (was changed during last check) to 4366
0610-0670
Check 37 instr. (SBB)
A=0037
error
P=0614, 0620, 0624, 0630
0634, 0640, 0644, 0650
0654, 0660, 0664, 0670
OK
0671-0672
Jump to 0721
0721-0723
Change jump location of 0672 to 0724
0673-0701
Change content of check locations between 0612 and 0670
0702-0704 0612-0670
Check 32 instr. (ADF)
A=0032
error
P=0614, 0620, 0624, 0630
0634, 0640, 0644, 0650
0654, 0660, 0666, 0670
0706
OK
0671-0672
Jump to 0724
0724-0736
Restore original content of jump loc. at 0672 and check locations between 0612 and 0670
0737-0745
Check 02 instr. (LPN)
A=0000
error
P=0746
0747-0750
Check 10 instr. (LPD)
A=0010
error
P=0753
0754-0756
Check 11 instr. (LPI)
A=0000
error
P=0765
0757-0761
Check 12 instr. (LPF)
A=0000
error
P=0765
0762-0764
Check 13 instr. (LPB)
A=0000
error
P=0765
0767-0773
Check 03 instr. (SCN)
A=0000
error
P=0774
0775-0777
Check 14 instr. (SCD)
A=0014
error
P=1001
1002-1004
Check 15 instr. (SCI)
A=0015
error
P=1006
1007-1011
Check 16 instr. (SCF)
A=0016
error
P=1013
1015-1017
Check 20 instr. (LDD)
A=0020
error
P=1021
1023-1025
Check 21 instr. (LDI)
A=0021
error
P=1027
1031-1033
Check 22 instr. (LDF)
A=0022
error
P=1035
1037-1041
Check 05 instr. (LCN)
A=0005
error
P=1043
1045-1047
Check 24 instr. (LCD)
A=0024
error
P=1051
1052-1054
Check 25 instr. (LCI)
A=0025
error
P=1056
1057-1061
Check 26 instr. (LCF)
A=0026
error
P=1063
1065-1070
Check 06 instr. (ADN)
A=0006
error
P=1072
1073-1075
Check 30 instr. (ADD)
A=0030
error
P=1077
1100-1102
Check 31 instr. (ADI)
A=0031
error
P=1104
1105-1107
Check 32 instr. (ADF)
A=0032
error
P=1111
1113-1116
Check 07 instr. (SBN)
A=0007
error
P=1120
1121-1123
Check 34 instr. (SBD)
A=0034
error
P=1125
1120-1130
Check 35 instr. (SBI)
A=0035
error
P=1132
1133-1135
Check 36 instr. (SBF)
A=0036
error
P=1137
1141-1145
Check 40 instr. (STD)
A=0040
error
P=1147
1150-1155
Check 41 instr. (STF)
A=0041
error
P=1157
1161-1165
Check 42 instr. (STF)
A=0042
error
P-1167
2


2
1174-1176
Check
44 instr. (SRD)
A=0044
error
P=1200
OK
1201-1206
Check
45 instr. (SAI)
A=0045
error
P=1210
OK
1212-1214
Change constant
at location
1172
OK
1215-1222
Check
47 instr. (SRB)
A=0047
error
P=1224
OK
1231-1237
Check
50 instr. (RAD)
A=0050
error
P=1241
OK
1242-1250
Check
51 instr. (RAI)
A=0051
error
P=1252
OK
1254-1262
Check
52 instr. (RAF)
A=0052
error
P=1264
OK
1271-1277
Check
53 instr. (RAB)
A=0053
error
P=1301
OK
1307-1314
Check
54 instr. (AOD)
A=0054
error
P=1316
OK
1317-1324
Check
55 instr. (AOI)
A=0055
error
P=1326
OK
1327-1335
Check
56 instr. (AOF)
A=0056
error
P=1337
OK
1342-1347
Check
57 instr. (AOB)
A=0057
error
P=1351
OK
1352
Check
70 instr. (JPI)
A=0070
error
P=1354
OK
1355-56
Jump
to
1361
1361
Increase counter
of location 1372
by 1
(original 0314)
1362
Check if
counter is
negative
Yes
No
1363, 64, 76
Jump
to
0100
3
1365-1367
Restore counter
of 1372 to LES
original count
(0314)
1370-71
Jump
to
1400
4
1400-1403
Check
2200 instr. (LDC)
A≠0
error
P=1404
OK
1405-1414
Check
4600 instr. (SRC)
A≠0
error
P=1415
OK
1416-1422
Check
4200 instr. (STC)
A≠0
error
P=1423
OK
1424-1432
Check
5500 instr. (AOC)
A≠0
error
P=1433
OK
1435-1440
Check
5200 instr. (RAC)
A≠0
error
P=1441
OK
1442-1451
Check
1200 instr. (LPC)
A≠0
error
P=1452
OK
1453-1457
Check
1600 instr. (SCC)
A≠0
error
P=1460
OK
1461-1466
Check
2600 instr. (LCC)
A≠0
error
P=1467
OK
1470-1474
Check
3600 instr. (SBC)
A≠0
error
P=1415
OK
1476-1503
Check
3200 instr. (AOC)
A≠0
error
P=1504
OK
1505-1544
Check
0101 instr. (PTA)
A≠0
error
P=1513, 1522, 1532, 1545
OK
1550-1562
Check
0111 instr. (LS6)
A≠0
error
P=1563
OK
1567-1613
Check
0113 instr. (MUH)
A≠0
error
P=1571, 1614
OK
1615-1616
Add 1 to counter
at 1572 and
subtract constant
(0623) at 1625
1617-1620
Check if
A=0
No
Yes
1626-1627
Restore
counter at loc.
1572
to
0001
1633-1636
Check
2100 instr. (LDM)
A≠0
error
P=1637
4


1640-1643
Check
1100 instr. (LPM)
A≠0
error
P=1644
OK
1645-1650
Check
1500 instr. (SCM)
A≠0
error
P=1651
OK
1652-1655
Check
2500 instr. (LCM)
A≠0
error
P=1656
OK
1657-1662
Check
3100 instr. (ADM)
A≠0
error
P=1663
OK
1664-1667
Check
3500 instr. (SBM)
A≠0
error
P=1670
OK
1671-1676
Check
4100 instr. (STM)
A≠0
error
P=1677
OK
4
1701-1705
Check
4500 instr. (SRM)
A≠0
error
P=1706
OK
1707-1713
Check
5500 instr. (AOM)
A≠0
error
P=1714
OK
1715-1723
Check
5100 instr. (RAM)
A≠0
error
P=1724
OK
1725
Increase counter
at loc. 1731
by 1
1726
Is
counter 0
Yes
1734-1735
Jump
to
3500
No
1727-1730
Jump
to
1400
5
3500-3502
Check
2300 instr. (LDS)
A≠0
error
P=3503
OK
9
3505-3511
Check
1700 instr. (SCS)
A≠0
error
P=3512
OK
3513-3515
Check
2700 instr.(LCS)
A≠0
error
P=3516
OK
3517-3521
Check
1300 instr. (LPS)
A≠0
error
P=3522
OK
3523-3525
Check
3300 instr. (ADS)
A≠0
error
P=3526
OK
3527-3531
Check
3700 instr. (SBS)
A≠0
error
P=3532
OK
3533-3536
Check
4300 instr. (STS)
A≠0
error
P=3537
OK
3540-3543
Check
4700 instr. (SRS)
A≠0
error
P=3544
OK
3545-3552
Check
5300 instr. (RAS)
A≠0
error
P=3553
3554-3557
Check
5700 instr. (AOS)
A≠0
error
P=3560
3563-3571
Check
2-47 instr. (SRB)
and compare
with 0103
instr. (LS2)
A≠0
error
P=3572
3574-3604
Check
0111 instr. (LS6)
A=0001
error
P=3606
3607-3612
Check
0112 instr. (MUT)
A=0001
error
P=3614
3616-3621
Check
0114 instr. (RS1)
A=0001
error
P=3623
6
3626-3636
Check
0115 instr. (RS2)
0114 instr. (RS1)
A≠0
error
P=3637
3642
Add 1 to counter
at 3646 (-10)
3643
Is
counter 0
Yes
No
6 to 3626
3672-3673
Restore count
at 3646
to -10
3647-3652
Change constants
used for right
shift.
check to their
complement
3653-54
Check 7100
instr. (JPR)
(change const. at
loc. 3664 to
3655)
3664
Add to count
at loc. 36637
(0000)
3665-66
Jump
to
3662
7


7
3662-3663
Check
7100 instr. (JPR)
OK
A≠0
error
P=3660
3714-3717
Restore
loc. 3663 to
3660
3720
Is count
at 3667
0
No
9
to 3500
3677
Stop
if Sel. Stop
1 is up
3700
Stop
if Sel. Stop
2 is up
3701
Stop
if Sel. Stop
4 is up
3702
Stop
if any sel. stop
is up
3703
Add 1 to
count at 1375
3704
Is
count 0
Yes
No
(3710-11)(3722-26)
Check
76xx instr. (HWI)
OK
A≠0076
error
P=3753
3727-30
Sel. Jump
1 up
No
Yes
3731-32
Sel. Jump
2 up
No
Yes
3733-34
Sel. Jump
4 up
Yes
HLT
P=3705
Z=7777
3742
Add 1 to
count at
3737 (-2)
3756
Add 1 to
count at
3740(-4)
3764
Add 1 to
count at
3741 (-10)
3735-36
Jump to
loc. 0100
3
to 0100
3742
Is
count 0
No
Yes
3756
Is
count 0
No
Yes
3764
Is
count 0
No
Yes
10
10
11
11
3744
3746
Restore
count at
3737
3760
3762
Restore
count at
3740
3766
3770
Restore
count at
3741

NUMBER: T035

TITLE: Punch Power Supply Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This program will test the punch power supply load down and punch residual magnetism.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0142

STARTING ADDRESS: Turn on the punch and start at P=0000

ADDITIONAL INSTRUCTIONS: To change this program from 8 level to 7 level enter 0101 in memory location 0063 and enter 0177 in memory location 0066.

HALTS	EXPLANATION
P=0055, Z=7777	After punch out of leader then allow leader insert into reader. Insert the tape so that the first frame read will be a binary 0. Do not master clear. Put the computer in run. The program will run continuously until the end of tape or until an error occurs.
P=0107, Z=0000	Error halt, error data in "A". Put the computer in run.
P=0111, Z=7700	Halt with correct data in "A". Put the computer in run.

T-035
PUNCH POWER SUPPLY LOAD DOWN & PUNCH RESIDUAL MAGNETISM TEST

0000	0577
0001	4075
0002	7565
0003	7400
0004	5475
0005	6502
0006	0507
0007	4074
0010	0401
0011	4077
0012	0524
0013	4075
0014	7351
0015	0100
0016	5475
0017	6503
0020	2302
0021	0601
0022	6501
0023	7400
0024	4477
0025	1241
0026	4077
0027	6515
0030	0524
0031	4075
0032	7332
0033	0067
0034	5475
0035	6503
0036	2320
0037	0601
0040	6501
0041	7400
0042	5477
0043	2074
0044	6072
0045	5474
0046	6534
0047	6006
0050	0524
0051	4075
0052	7600
0053	6401
0054	6127
0055	7777
0056	7503
0057	6707

```
0060    6610
0061    4102
0062    0000
0063    0201
0064    0066
0065    0077
0066    0377
0067    4104

0070    0000
0071    0000
0072    0000
0073    0000
0074    0101
0075    0001
0076    0142
0077    0077

0100    0524
0101    4075
0102    7600
0103    4076
0104    3477
0105    6005
0106    2076
0107    0000

0110    2077
0111    7700
0112    5475
0113    6511
0114    7600
0115    6002
0116    0000
0117    4477

0120    1066
0121    4077
0122    6005
0123    3463
0124    6724
0125    7101
0126    0132
0127    2066

0130    4077
0131    6531
0132    7503
0133    7101
0134    0010
0135    4104
0136    7503
0137    7101
```

0140	0100
0141	4102
0142	4554

NUMBER: T036

TITLE: Punch and Reader Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

The program checks the reliability of the punch and reader under variable speed operations.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: ~~0303~~ 420

CHECK SUM: ~~0160~~ 2355

STARTING ADDRESS:

Part 1 0001

Turn the punch ON and punch out a small amount of leader. Master clear, set P=0001, and put the computer in run. The punch will run out enough tape to reach the reader and stop with P-0041.

Part 2 0000

Insert the tape into the reader so that the first frame read will be a 0.

Start P=0000. The program will continue to punch and read until an error occurs. A pattern of the binary count is punched from 0000 to 0177, followed by a binary count from 0000 to 0177 with two frames of each count punched. This is followed by 3 then 4 frames of each count.

HALTS	EXPLANATION
770x	x = error frame of a particular count. Error stops are coded to tell which frame of a particular count was read or punched wrong. Observation of the tape by the operator will determine a punch or reader error.

T036
TEST PROGRAM # 1- PUNCH & READER

```
0000    7102
0001    7102
0002    0100
0003    0004
0004    0501
0005    4250
0006    0400
0007    4234

0010    4234
0011    4234
0012    4234
0013    7536
0014    7333
0015    0044
0016    6204
0017    5627

0020    5625
0021    5623
0022    5621
0023    1627
0024    6511
0025    5710
0026    2310
0027    0701

0030    4312
0031    1622
0032    6524
0033    2221
0034    4316
0035    2213
0036    4321
0037    5616

0040    6532
0041    7700
0042    6436
0043    0200
0044    0200
0045    0200
0046    0200
0047    0043

0050    0044
0051    4104
0052    0200
0053    6200
0054    6204
0055    0100
0056    0000
0057    0100
```

```
0060    0270
0061    0062
0062    5606
0063    5606
0064    5606
0065    5606
0066    7060
0067    0200

0070    0040
0071    0040
0072    0040
0073    0200
0074    2121
0075    0021
0076    0303
0077    0077

0100    0400
0101    4070
0102    7504
0103    7204
0104    0075
0105    6103
0106    4102
0107    0074

0110    2074
0111    1470
0112    6113
0113    7504
0114    7304
0115    0071
0116    6103
0117    4104

0120    0070
0121    5470
0122    1467
0123    6521
0124    6003
0125    2074
0126    7701
0127    0400

0130    4070
0131    4071
0132    7504
0133    7204
0134    0076
0135    6103
0136    4102
0137    0074
```

```
0140    2074
0141    1470
0142    6117
0143    2075
0144    1471
0145    6116
0146    7504
0147    7304

0150    0072
0151    6103
0152    4104
0153    0070
0154    5470
0155    5471
0156    1467
0157    6525

0160    6005
0161    2074
0162    7702
0163    2075
0164    7702
0165    0400
0166    4070
0167    4071

0170    4072
0171    7504
0172    7204
0173    0077
0174    6103
0175    4102
0176    0074
0177    2074

0200    1470
0201    6123
0202    2075
0203    1471
0204    6122
0205    2076
0206    1472
0207    6121

0210    7504
0211    7304
0212    0073
0213    6103
0214    4104
0215    0070
0216    5470
0217    5471
```

```
0220    5472
0221    1467
0222    6531
0223    6007
0224    2074
0225    7701
0226    2075
0227    7702

0230    2076
0231    7703
0232    0400
0233    4070
0234    4071
0235    4072
0236    4073
0237    7504

0240    7204
0241    0100
0242    6103
0243    4102
0244    0074
0245    2074
0246    1470
0247    6124

0250    2075
0251    1471
0252    6123
0253    2076
0254    1472
0255    6122
0256    2077
0257    1473

0260    6121
0261    7504
0262    7304
0263    0074
0264    6103
0265    4104
0266    0070
0267    7061

0270    1467
0271    6532
0272    7057
0273    2074
0274    7701
0275    2075
0276    7702
0277    2076
```

0300	7703
0301	2077
0302	7704
0303	2750

NUMBER: T037

TITLE: Q.A. Variable Speed Reader - "76" Instruction Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This test will check the reader at variable speeds.

DESCRIPTION

1. See flow chart.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

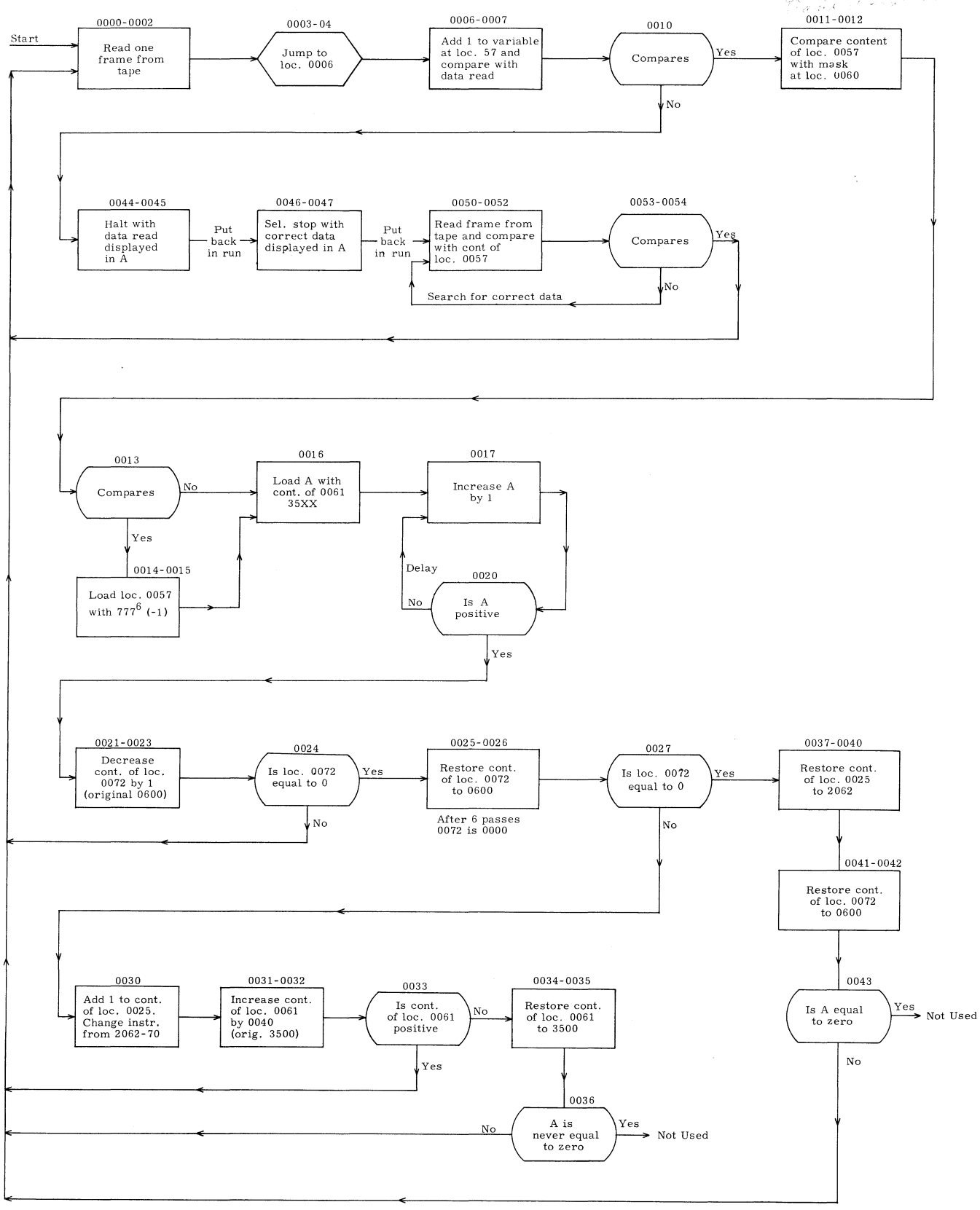
TERMINAL ADDRESS: 0077

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS: Insert a binary count loop into the reader and put the computer in run.

Memory location 0060 contains the reader level mask. If the reader mask is changed to read less than 8 level, then 0000 should be entered in memory location 0057.

HALTS	EXPLANATION
7700	A = error data. Put the computer in run.
7701	A = correct data. Put the computer in run. The reader will search for the correct information and then continue to read at a variable rate until an error occurs.



This test reads 11 binary counts at different speeds

T-037
QUALITY ASSURANCE VARIABLE SPEED READER

0000	7505
0001	7600
0002	4056
0003	7004
0004	0006
0005	4102
0006	5457
0007	3456
0010	6134
0011	2057
0012	3460
0013	6103
0014	0501
0015	4057
0016	2061
0017	0601
0020	6601
0021	2072
0022	0701
0023	4072
0024	6524
0025	2062
0026	4072
0027	6010
0030	5425
0031	2075
0032	5061
0033	6633
0034	2074
0035	4061
0036	6536
0037	2073
0040	4025
0041	2071
0042	4072
0043	6512
0044	2056
0045	7700
0046	2057
0047	7701
0050	7505
0051	7600
0052	3457
0053	6503
0054	6454
0055	4102
0056	0000
0057	0000

0060	0377
0061	3500
0062	0600
0063	0600
0064	0600
0065	0600
0066	0600
0067	0600
0070	0000
0071	0600
0072	0600
0073	2062
0074	3500
0075	0040
0076	0074
0077	2224

NUMBER: T050

TITLE: Manual Variable Speed Reader Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This test will check the clutch, brake adjustments, feed hole and information bias settings.

DESCRIPTION

This program is a manual control of the delay between picking the clutch on the reader. By moving the SLJ switches while the program is running causes various delays to be inserted between frames at random.

Any number is put into Register A. This number is the basic delay. A 0001 in Register A is equivalent to a 12.8 us delay. The number in Register A is now effectively multiplied by the SLJ switches. If SLJ4 and SLJ2 are down the delay between 76 instructions is 6 times the basic delay in Register A.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0077

CHECK SUM: 6755

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS: 125-52 loop is required

HALTS	EXPLANATION
0016	Number read is in Register A. A "52" should have been read.
0027	Number read is in Register A. A "125" should have been read.

```
LOC
0000    4070    Store delay
0001    7500
0002    4102    Select reader
0003    2200
0004    5252    Insures that frame counter is correct
0005    4072
0006    7600
0007    0752
0010    6011    Insures first frame read is 52
0011    6503
0012    7600
0013    0752    Check if frame is 52
0014    6016    Frame is 52 go to delay*
0015    0652    Error stop
0016    0000    Frame read is in RA
0017    7101
0020    0003    Insures proper start after an error stop
0021    7600
0022    3600    Check if frame is a 125
0023    0125
0024    6006    125 read go to delay*
0025    3200
0026    0125
0027    0000    Error stop 125 should have been number
0030    7101
0031    0003    Recover after error
0032    0400    *
0033    7710
0034    0036
0035    0701    Delay X 1
0036    7720
0037    0041
0040    0702    Delay X 2
0041    7740
0042    0044
0043    0704    Delay X 4
0044    6007
0045    4071    Store delay multiplier
0046    2070    Load delay
0047    0701
0050    6501
0051    5471
0052    6504    Do delay again
0053    2072    Load frame checker
0054    6304    NFJ if last frame was 125
0055    4472    Shift frame checker
0056    7101    Jump to input for 125
0057    0021
0060    4472    Shift frame checker
0061    7101
0062    0012    Jump to 52 frame
```

```
0063
0064
0065
0066
0067
0070                            Delay
0071                            Delay multiplier
0072        5252
0073
0074
0075
0076
0077
```

NUMBER: T074

TITLE: Q. A. Block Store Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This program tests the block store (BLS) instruction in various memory locations.

DESCRIPTION

1. See flow chart.
2. The program stores 12 different constants in blocks of 525_8 then checks the pattern and with no selective stops in the up position it is self-looping. After the test pattern has been stored and checked the complete pattern is destroyed by storing 4264 throughout the buffer bank. A check of this number is then accomplished.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0175

CHECK SUM: 0160

ADDITIONAL INSTRUCTIONS: SLS switch 1 up, sweeps memory bank under test. This will cause the program to stop after the pattern has been block stored in memory.

HALTS	EXPLANATION
0140	Error, A equal to error data. Sweep 0055 Dir bank for failure. Put computer in Run. A equal to correct data. Restart at 0000.
0024	Error after storing 4264. Sweep 0021 for memory location of failure. If no error occurs, the original test pattern will be restored and checked.

Test No. 1 will test the BLS instruction in Memory Bank.

LOAD INSTRUCTION: 0000 in Rel bank 0

ADDITIONAL INSTRUCTIONS:
1) Set Rel and Dir bank to 0.
2) Set Bfr and Ind bank to 1.
3) 0000 Run from Rel bank 0.
4) If error occurs master clear Run 0000.
5) For halt see 0140 above.

Test No. 2 will test the BLS instruction in Memory Bank 0.

LOAD INSTRUCTION: 0000 in Rel bank 1

ADDITIONAL INSTRUCTIONS:
1) Set Rel and Dir bank to 1.
2) Set Bfr and Ind bank to 0.
3) 0000 Run from Rel bank 1.
4) If error occurs master clear Run 0000.
5) For halt see 0140 above.

Test No. 3 will test the BLS instruction in External Memory.

LOAD INSTRUCTION: 0000 in bank X

ADDITIONAL INSTRUCTIONS:
1) Set Dir = Rel.
2) Set Bfr ≠ Dir and Rel.
3) Set Ind = Bfr.
4) 0000 Run from Rel bank.
5) If error occurs master clear Run 0000.
6) For halt see 0140 above.

BLOCK STORE TEST

```
00000   6036
        0000    Oper. error
        0000    Error 0105 B. busy
        0000    Error 0106 B. busy
        0000    Error 0100 B. busy
        0000
        0000
        0000

00010   0000
        0501    Set test bank to 4264
        4300
        0106    Set Buffer Exit
        0003    Jump adr.
        2051    (M.L. 0051)
        0100    Block Store
        0004    Jump adr.

00020   2100    Check Pattern
        0000
        3451
        6002
        0000    Error-Halt
        5704    Increase test (1) count
        3700
        6507

00030   0400    Restore test (1) addr.
        4310
        6004
        7575    Check sum correction
        0000
        0000
        0400
        4053    Reset variables

00040   4055
        4062
        2057
        4056
        4063
        2060
        4240
        4272

00050   2061
        4264
        6126
        0000    Check 0153 instruction
        0522    Constant
        0000    Variable
        0525    Variable
        0525    Constant
```

```
00060   2064    Constant
        3464    Constant
        0000    Variable  BER.
        0525    Variable  BXR.
        0000
        7777
        1111
        2222
00070   4444    Constants, Buffer Data.
        5252
        2525
        3131
        1313
        1234
        7650
        6666

00100   2062
        0105    Load BER.
        0002    Jump adr. B. busy
        2063
        0106    Load BXR.
        0003    Jump adr. B. busy
        2064
        0100    BLS.

00110   0004    Jump adr. B. busy
        5703
        0400
        0162
        0107
        6002
        0000    Error Halt (0162)
        2057

00120   5063
        0503    Check BER. limit 7774
        3462
        6523
        2316
        0714
        4320    Reset variable instruction to orig.
        0400

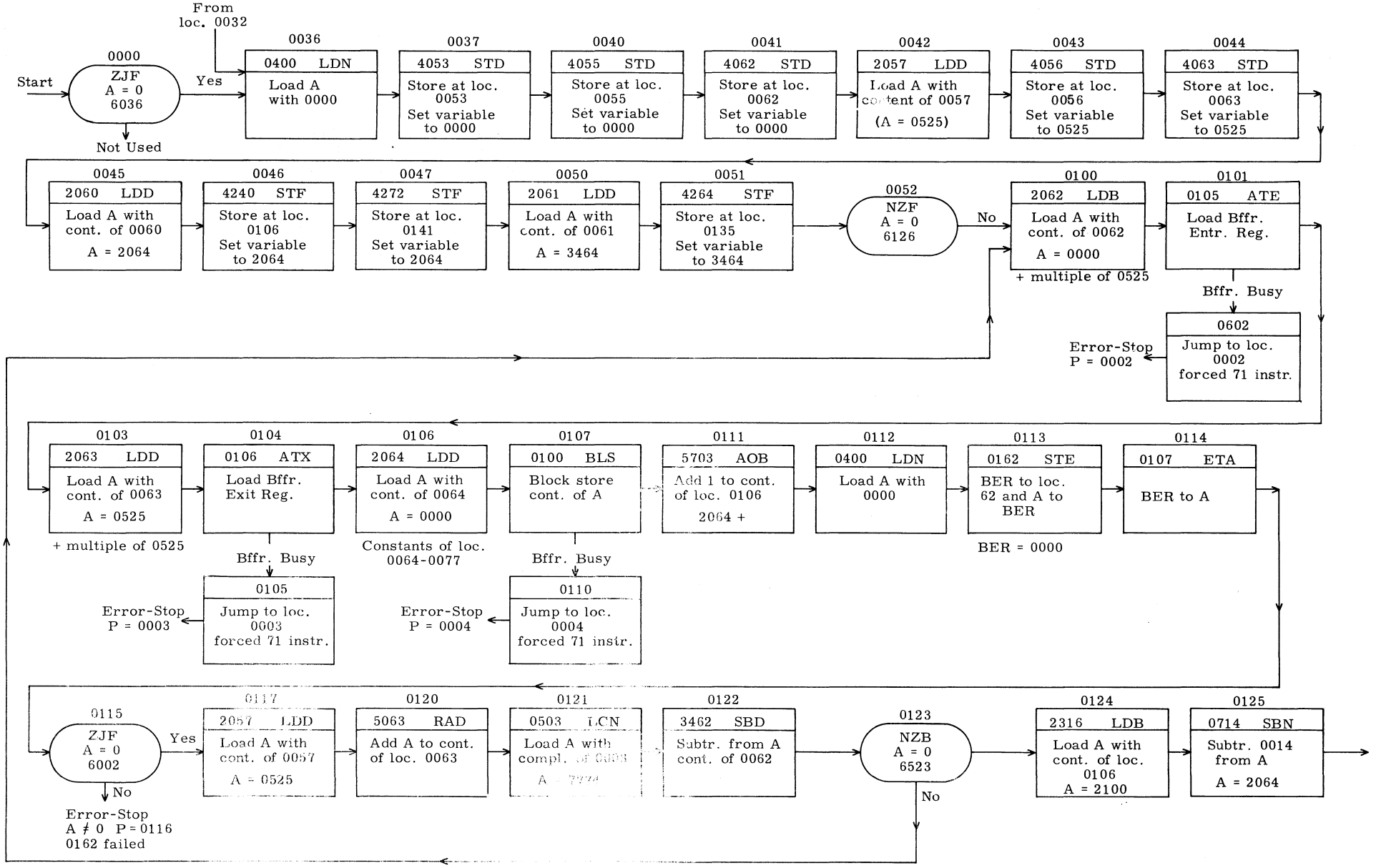
00130   4062    Reset BER. to orig.
        2057
        4063    Reset BXR. to orig.
        7701    Stop Pattern completed.
        2155
        3464
        6005
        2155
```

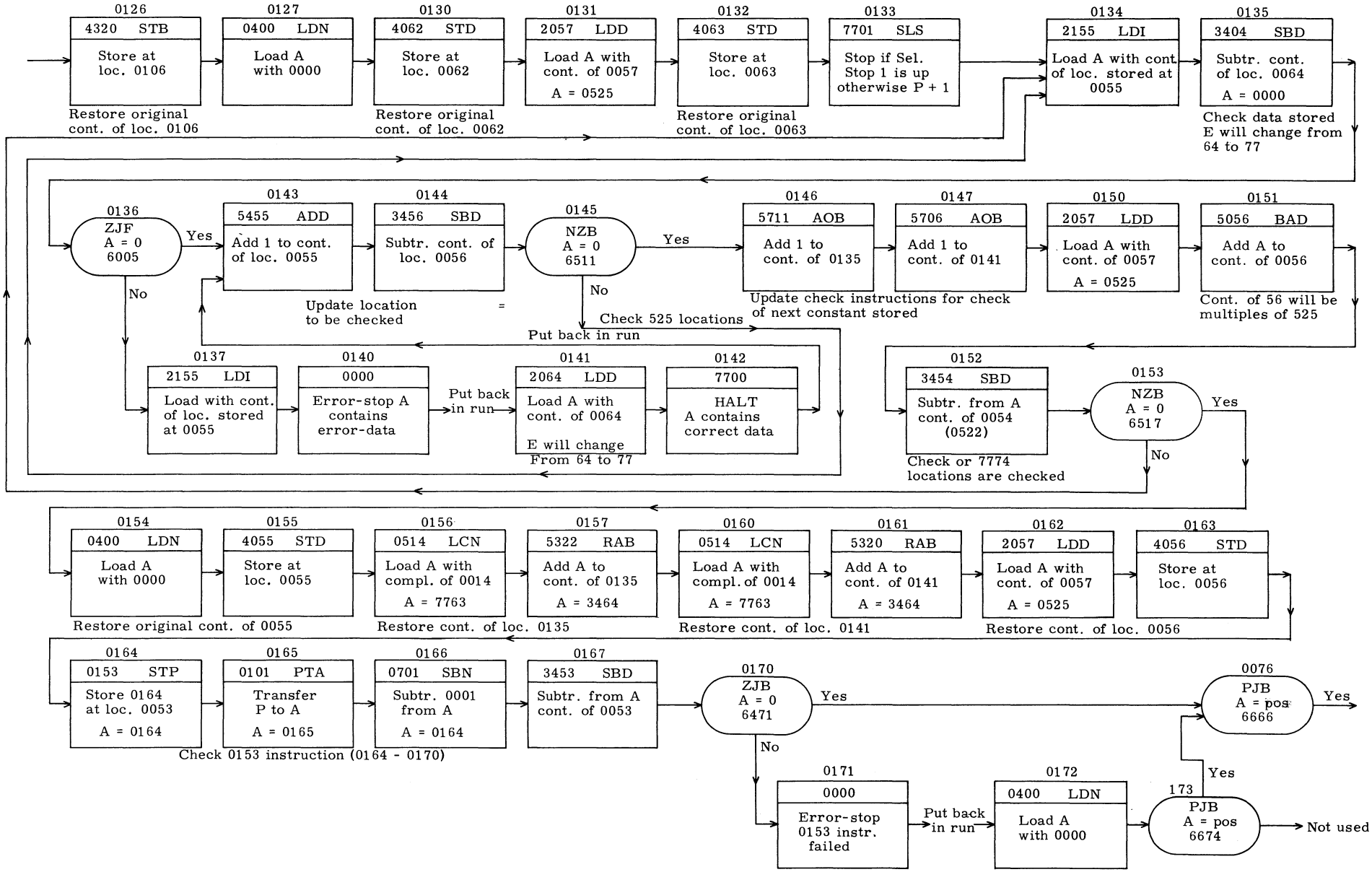
```
00140   0000    Error Halt, Error Data in "A"
        2064
        7700    Correct Data in "A"
        5455
        3456
        6511
        5711    Change variable instruction.
        5706    Change variable instruction.

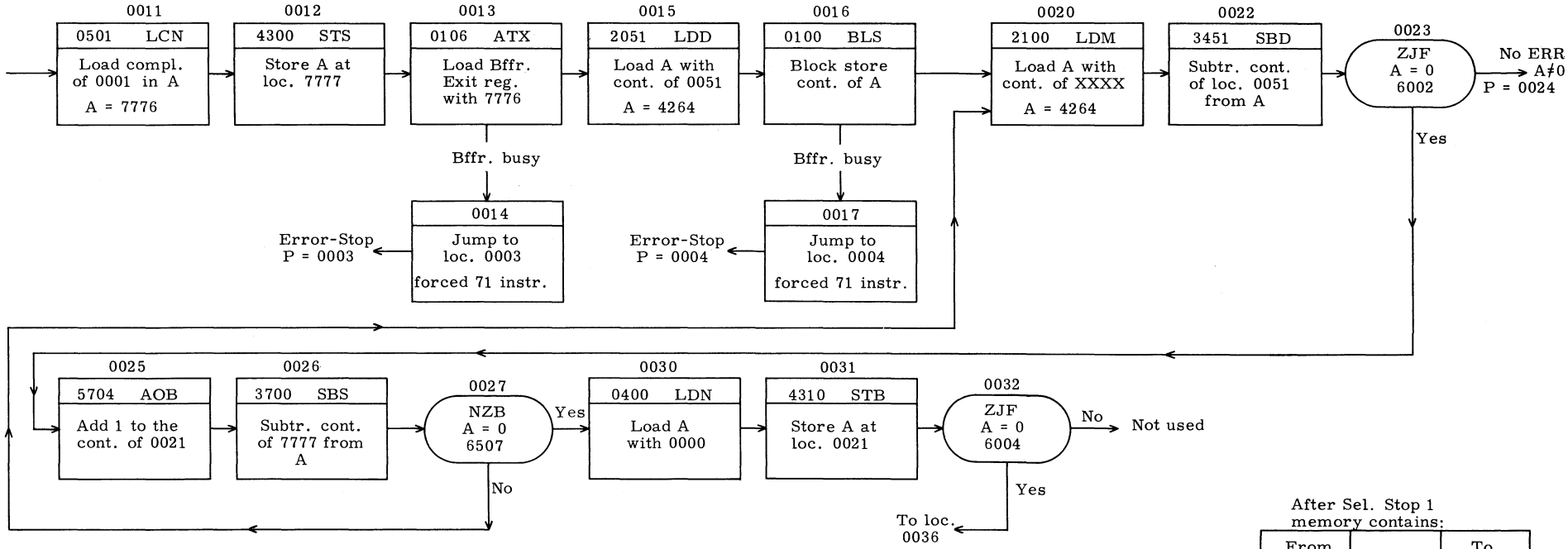
00150   2057
        5056
        3454
        6517    Check BER limit
        0400
        4055    Reset variable
        0514
        5322    Reset variable instruction.

00160   0514
        5320    Reset variable instruction.
        2057
        4056    Reset variable
        0153
        0101
        0701
        3453

00170   6471
        0000    Error Halt (0153 Inst.)
        0400
        6674    Jump back to resume test.
        0000
        2010
```


From loc. 0032
0000
ZJF A = 0 6036
Start
Yes
Not Used
0036
0400 LDN
Load A with 0000
0037
4053 STD
Store at loc. 0053 Set variable to 0000
0040
4055 STD
Store at loc. 0055 Set variable to 0000
0041
4062 STD
Store at loc. 0062 Set variable to 0000
0042
2057 LDD
Load A with content of 0057
(A = 0525)
0043
4056 STD
Store at loc. 0056 Set variable to 0525
0044
4063 STD
Store at loc. 0063 Set variable to 0525
0045
2060 LDD
Load A with cont. of 0060
A = 2064
0046
4240 STF
Store at loc. 0106 Set variable to 2064
0047
4272 STF
Store at loc. 0141 Set variable to 2064
0050
2061 LDD
Load A with cont. of 0061
A = 3464
0051
4264 STF
Store at loc. 0135 Set variable to 3464
0052
NZF A = 0 6126
No
0100
2062 LDB
Load A with cont. of 0062
A = 0000
+ multiple of 0525
0101
0105 ATE
Load Bffr. Entr. Reg.
Bffr. Busy
0602
Jump to loc. 0002 forced 71 instr.
Error-Stop P = 0002
0103
2063 LDD
Load A with cont. of 0063
A = 0525
+ multiple of 0525
0104
0106 ATX
Load Bffr. Exit Reg.
Bffr. Busy
0105
Jump to loc. 0003 forced 71 instr.
Error-Stop P = 0003
0106
2064 LDD
Load A with cont. of 0064
A = 0000
Constants of loc. 0064-0077
0107
0100 BLS
Block store cont. of A
Bffr. Busy
0110
Jump to loc. 0004 forced 71 instr.
Error-Stop P = 0004
0111
5703 AOB
Add 1 to cont. of loc. 0106
2064 +
0112
0400 LDN
Load A with 0000
0113
0162 STE
BER to loc. 62 and A to BER
BER = 0000
0114
0107 ETA
BER to A
0115
ZJF A = 0 6002
Yes
No
Error-Stop
A ≠ 0 P = 0116
0162 failed
0117
2057 LDD
Load A with cont. of 0057
A = 0525
0120
5063 RAD
Add A to cont. of loc. 0063
0121
0503 LCN
Load A with compl. of 0503
0122
3462 SBD
Subtr. from A cont. of 0062
0123
NZB A = 0 6523
No
0124
2316 LDB
Load A with cont. of loc. 0106
A = 2100
0125
0714 SBN
Subtr. 0014 from A
A = 2064


0126
4320 STB
Store at loc. 0106
Restore original cont. of loc. 0106
0127
0400 LDN
Load A with 0000
0130
4062 STD
Store at loc. 0062
Restore original cont. of loc. 0062
0131
2057 LDD
Load A with cont. of 0057
A = 0525
0132
4063 STD
Store at loc. 0063
Restore original cont. of loc. 0063
0133
7701 SLS
Stop if Sel. Stop 1 is up otherwise P + 1
0134
2155 LDI
Load A with cont. of loc. stored at 0055
0135
3404 SBD
Subtr. cont. of loc. 0064
A = 0000
Check data stored E will change from 64 to 77
0136
ZJF
A = 0
6005
Yes
No
0143
5455 ADD
Add 1 to cont. of loc. 0055
Update location to be checked
0144
3456 SBD
Subtr. cont. of loc. 0056
=
0145
NZB
A = 0
6511
Yes
No
Check 525 locations
Put back in run
0146
5711 AOB
Add 1 to cont. of 0135
Update check instructions for check of next constant stored
0147
5706 AOB
Add 1 to cont. of 0141
0150
2057 LDD
Load A with cont. of 0057
A = 0525
0151
5056 BAD
Add A to cont. of 0056
Cont. of 56 will be multiples of 525
0137
2155 LDI
Load with cont. of loc. stored at 0055
0140
0000
Error-stop A contains error-data
Put back in run
0141
2064 LDD
Load A with cont. of 0064
E will change From 64 to 77
0142
7700
HALT
A contains correct data
0152
3454 SBD
Subtr. from A cont. of 0054 (0522)
Check or 7774 locations are checked
0153
NZB
A = 0
6517
Yes
No
0154
0400 LDN
Load A with 0000
Restore original cont. of 0055
0155
4055 STD
Store at loc. 0055
0156
0514 LCN
Load A with compl. of 0014
A = 7763
Restore cont. of loc. 0135
0157
5322 RAB
Add A to cont. of 0135
A = 3464
0160
0514 LCN
Load A with compl. of 0014
A = 7763
Restore cont. of loc. 0141
0161
5320 RAB
Add A to cont. of 0141
A = 3464
0162
2057 LDD
Load A with cont. of 0057
A = 0525
Restore cont. of loc. 0056
0163
4056 STD
Store at loc. 0056
0164
0153 STP
Store 0164 at loc. 0053
A = 0164
Check 0153 instruction (0164 - 0170)
0165
0101 PTA
Transfer P to A
A = 0165
0166
0701 SBN
Subtr. 0001 from A
A = 0164
0167
3453 SBD
Subtr. from A cont. of 0053
0170
ZJB
A = 0
6471
Yes
No
0076
PJB
A = pos
6666
Yes
Yes
0171
0000
Error-stop 0153 instr. failed
Put back in run
0172
0400 LDN
Load A with 0000
173
PJB
A = pos
6674
Not used



After Sel. Stop 1 memory contains:

From loc.	Data	To loc.
0000	0000	0524
0525	7777	1251
1252	1111	1776
1777	2222	2523
2524	4444	3250
3251	5252	3775
3776	2525	4522
4523	3131	5247
5250	1313	5774
5775	1234	6521
6522	7650	7246
7247	6666	7773

NUMBER: T075

TITLE: Memory Bank Selection Test No. 1

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This program will check 160-A computer execution of memory bank selections for banks 0 and 1 only.

DESCRIPTION

The program will follow a binary count of bank selection as follows:

Buffer	Direct	Indirect	Relative
0	0	0	1
0	0	1	0
0	0	1	1
0	1	0	0

continuing to 17. Constants used for arithmetic operations are stored in Memory Location 0 through 7 in bank 0, and 10 through 17 in bank 1.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION:	Paper Tape First Routine	Second Routine
LOADING ADDRESS:	0000 in bank 0	0000 in bank 1
TERMINAL ADDRESS:	0450	0350
CHECK SUM:	0160	0160
STARTING ADDRESS:	0000	

ADDITIONAL INSTRUCTIONS: 1) Master clear set "A" to 0100
2) Put the computer in Run

HALTS	EXPLANATION
P = 0441 Z = 7700	No SLS switches up program will loop 4096 times
P = 0220 Z = 7701	SLS 1 switch up program will check bank selection instructions 0 through 7 (see description)

HALTS	EXPLANATION (Cont'd)
P = 0422 Z = 7702	SLS 2 switch up bank selection instructions 10 through 17 will be checked
	Each error halt is preceded by a bank selection to "A" instruction
	Program annotation shows the correct "A" register display (bank selection) for each error halt

```
00000   0070    Set Rel & Jump to ML 0100
        2552
        5225
        0000
        0000
        0240
        0001
        0002

00010   0011
        0120
        0010
        0000
        0000
        0000
        0000
        0000

00020   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00030   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00040   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00050   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00060   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00070   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00100   2776   LDC (Rel) 2552
        3002   Add Dir ML 0002
        6003   Zero Jump
        0130   Correct Data 0000
        0000   Error Halt
        2107             5225
        0105   ATE
        0075   Buf Busy Adr.

00110   0400   clr. A
        0107   ETA  5225
        3106   Add Ind to ML 0001
        6004   Zero Jump
        0130   Correct Data 0000
        0000   Error Halt
        0100   Constant
        2301

00120   0011   Set Rel to 1 and Jump to ML 0100
        0130
        0000   Error Halt No Jump  Correct Data 0001
        0000
        0000
        0000
        0000
        2552

00130   2301
        3002   ML 0002 Bank 0
        6003
        0130   Correct Data 0010
        0000   Error Halt
        0107   ETA  5225
        3110   Add Ind Bank 1 ML0011  2552
        6003   Zero Jump
```

```
00140   0130   Correct Data 0010
        0000   Error Halt
        2011   Load Dir Bank 0 Jump adr. 0120
        0031   Set Ind & Rel & Jump
        0130
        0000   Error Halt. No Jump. Correct Data 0011
        0140
        2552   Constant

00150   2002   Load Dir Bank 0
        3302   Adb - Bank 0
        6003   Zero Jump
        0130   Correct Data 0000
        0000   Error Halt
        0107   ETA. 5225
        3106   Add Ind ML 0001 - 2552
        6003   Zero Jump

00160   0130   Correct Data 0000
        0000   Error Halt
        2314   Load Jump Adr. 0140
        0051   Set Rel & Dir & Jump
        0000   Error Halt. No Jump
        0170
        2552
        0061   Set Dir & Ind to 1

00170   2103   Ld. Bank 1.  (5225)
        3303   Adb.
        6003   Zero Jump
        0130   Correct Data - 0110
        0000   Error Halt
        2010   (5225)
        3011
        6504   Non Zero Back to Error Halt

00200   2010   5225
        0105   ATE
        0075   Buf Busy Adv.
        0500   LCN 00
        0167   ST. E. in ML 0067 A to BER
        2067   (5225)
        3011   Add Dir Bank 1.
        6003   Zero Jump

00210   0130   Correct Data 0110
        0000   Error Halt - (0167)
        2325   Load Jump Adr (0170)
        0071   Set Rel Ind, Dir to 1 & Jump
        0000   Error Halt. No Jump
        0000
        0000
        0000
```

```
00220   7701    Stop - 0-7 completed.
        7101
        0300    Jump to resume test.
        0000
        0000
        0000
        3106
        0000

00230   2552
        5225
        0000
        0000
        0000
        0000
        0000
        0000

00240   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00250   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00260   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00270   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00300   0141    Set Buf to 1.
        2350    5225
        3001    2552 Bank 0
        6003
        0130    Correct Data 1000
        0000    Error Halt
        2107    LDI Bank 0 5225
        0105    ATE

00310   0075    Buf Busy Adr.
        0400    CIR - A
        0107    ETA
        3106    ADI Bank 1
        6004    Zero Jump
        0130    Correct Data 1000
        0000    Error Halt
        0220    Jump Adr.

00320   2301    Load Jump Adr.
        0011    Set Rel & Jump
        0130    Correct Data 1001
        0000    Error Halt - No Jump
        0000
        0000
        0000
        2552

00330   2301    2552
        3002    Add Bank 0
        6003    Zero Jump
        0130    Correct Data 1010
        0000    Error Halt
        0107    ETA - 5225
        3110    Bank 1
        6003    Zero Jump

00340   0130    Correct Data 1010
        0000    Error Halt
        2005    Load Jump Adr. 0240
        0031    Set Rel & Ind & Jump
        0130    Correct Data 1011
        0000    Error Halt. No Jump
        0260    Jump Adr.
        2552    Constant

00350   2002    (5225)
        3302    Adb
        6003    Zero Jump
        0130    Correct Data - 1000
        0000    Error Halt
        0107    ETA 5225
        3106    Bank 0 - ML 0001
        6003    Zero Jump
```

```
00360  0130  Correct Data 1000
       0000
       2314  Load Jump Adr - 0260
       0051  Set Rel & Dir & Jump
       0000  Error Halt - No Jump - Correct Data - 1101
       0310
       2552
       0061  Set Dir & Ind to 1. 1110

00370  2103  5225  (Bank 1)
       3303
       6003  Zero Jump
       0130  Correct Data 1110
       0000  Error Halt
       2010  5225
       3011
       6504  Jump Back to Error Halt

00400  2010  5225
       0105  ATE
       0075  BFR Busy Adr.
       0400  0167
       0167  0400
       2067  5225
       3011  2552 Bank 1
       6003  Zero Jump

00410  0130  Correct Data 1110
       0000  Error Halt
       2325  Load Jump Adr
       0071  Set Rel, Dir, Ind & Jump
       0000  Error Halt - No Jump
       0000
       0000
       0000

00420  7710  Set Stop to Test Banks 2 & 3
       0430
       7702  Set Stop - Pass through completed
       0140  Set Bfr = 0
       0130
       6011  All Bank Controls = 0
       0000  Error Halt
       0100

00430  2301
       0072  Continue test - Banks 2 & 3
       0000
       0000
       0000
       6011
       5703
       6002
```

```
00440   7102
        7700
        0100
        0000
        0000
        0000
        0000
        4537

00450   0000
```

BANK1

```
10000   0000
.
10000   0000
        0147
        0002
        0010
        0011
        0000
        0000
        0000

10010   5225
        2552
        0000
        5220
        5225
        0000
        0000
        0000

10020   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10030   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10040   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10050   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
10060   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10070   0000
        0000
        0000
        0000
        0000
        0130
        0000
        0000

10100   2001    LDD Bank 0 - 2552
        3371    Add B - ML 0010 Bank 1
        6003    Zero Jump
        0130    Correct Data - - 0001
        0000    Error Halt
        0107    ETA 5225
        3106    Ad Ind to Bank 0 ML 0001
        6003    Zero Jump

10110   0130    Correct Data - 0001      (also Jump Adr.)
        0000    Error Halt.
        2302    Load Back Jump Adr.
        0021    Set Ind to 1
        0010    Set Rel to 0 & Jump
        0000    Error Halt. No Jump
        0150    Constant
        2552    Constant

10120   2301
        3112    Add to Bank 1  ML 0010
        6003    Zero Jump
        0130    Correct Data 0011
        0000    Error Halt
        0107    ETA 5225
        3307    ML  0117 Bank 1
        6003    Zero Jump

10130   0130    Correct Data 0011
        0000    Error Halt
        0040    Set Dir = 0
        2315    Load Jump Adr. 0150
        0030    Set Ind & Rel and Jump
        0167    Constant
        5225    Constant
        5220    Constant
```

```
10140   2411    LCD - Bank 1  (5225)
        3322    Add Back - Bank 1
        6003    Zero Jump
        0130    Correct Data 0101
        0000    Error Halt
        2102    Bank 0  5225
        0106    ATX
        0075    BFR Busy Adr.

10150   2311    LPB 5220
        0105    ATE
        0075    0075 Jump Adr Bfr Busy
        2315    (5225)
        0100    Bls
        0075    BFR Busy Jump
        2513    LCI - Bank 0
        3240    ADF

10160   6003    Zero Jump
        0130    Correct Data 0101
        0000    Error Halt
        2326    Load Jump adr (0167)
        0050    Set Dir-Rel & Jump
        0000    Error Halt.  No Jump.  Correct Data 0000
        0220
        2552

10170   2011    (2552)
        3333    5225 (ML 0136)
        6003    Zero Jump
        0130    Correct Data 0111
        0000    Error Halt
        2010    5225
        0105    ATE
        0075    BFR Busy Adr.

10200   0400    ClR A
        0107    ETA 5225
        3313    2552
        6003    Zero Jump
        0130    Correct Data 0111
        0000    Error Halt
        2320    Load Jump Adr. 0220
        0070    Set Rel, Ind, Dir & Jump

10210   0000
        0000
        0000
        0000
        0000
        0000
        0330
        5225
```

```
10220   2001  2552
        3302  5225
        6003  Zero Jump
        0130  Correct Data 1001
        0000  Error Halt
        0107  ETA 5225
        3106  Bank 0 - 2552
        6003  Zero Jump

10230   0130  Correct Data - 1001
        0000  Error Halt
        2314  Load Jump Adr.
        0021  Set Ind to 1
        0010  Set Rel to 0 & Jump.  ML 0330 Bank 0
        0000  Error Halt.  No Jump.  Correct Data 1010
        0350
        2552

10240   2301
        3112  5225 (ML 10 Bank 1)
        6003  Zero Jump
        0130  Correct Data - 1011
        0000  Error Halt
        0107  ETA - 5225
        3307
        6003  Zero Jump

10250   0130  Correct Data - 1011
        0000  Error Halt
        0040  Set Dir 0
        2315  Load Jump Adr (0350)
        0030  Set Rel & Ind & Jump
        0000  Error Halt - No Jump - Correct Data 1000
        0367
        5220

10260   2411  Bank 1 (5225)
        3322
        6003  Zero Jump
        0130  Correct Data - 1101
        0000  Error Halt
        2102
        0105
        0075

10270   0400
        0107
        3333
        6002
        0000
        2102
        0106
        0075
```

```
10300  2322  (0367)
       0050  Set Dir & Rel & Jump
       0000  Correct Data 1000
       0000  Error Halt
       0000
       0000
       0420
       2552

10310  2010  5225
       3302
       6003
       0130  Correct Data - 1111
       0000  Error Halt
       2010  5225
       0105
       0075

10320  0400
       0107
       3313
       6003
       0130  Correct Data - 1111
       0000
       2320  Load Jump Adr
       0070  Set R, I, D, & Jump

10330  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

10340  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

10350  0000
```

NUMBER: T076
TITLE: Memory Bank Selection Test No. 2
CATEGORY: 160-A
MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

The program will check 160-A computer execution of bank selections for any memory bank available.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: 0000 In Rel Bank X
TERMINAL ADDRESS: 0300
CHECK SUM: 0160
STARTING ADDRESS: 0000
ADDITIONAL INSTRUCTIONS: Master clear Set A to the Indirect Bank desired to test.
Put the computer in Run.

HALTS	EXPLANATION
P = 0002 A = 0000	Set the "A" register to Rel and Dir bank desired to test. Ind bank setting ≠ Rel or Dir bank setting. Put the computer in Run. SLS 4 switch up, pattern will be laid down and the computer will stop prior to checking the pattern.
P = 0160	SLS 1 or 2 switch up pattern will be checked. Approximate test time is 12 seconds. At any of the above stops the computer may be put back into run to continue test. With no SLS up the program is self looping.
0257	Error in testing the pattern. Put the computer in Run.

HALTS	EXPLANATION (Cont'd.)
0263	005X error in A. Put the computer in Run.
0266	005X correction in A. Put the computer in Run.
0273	Error data displayed in A. Put the computer in Run.
0275	Correct data display in A. Put the computer in Run. Resume test.

```
00000   4070    Indirect Bank Setting
        0400
        7700
        4071    Relative and Direct Bank Setting
        0400
        4061    Clear "P" Test Adr.
        2070
        0620

00010   4201
        0020    Set Indirect Bank
        2200 ]
        2300 |  Store 2300 in ML. X7775
        4100 |
        7775 ]
        2071 ]
        0610 |
             |  Store 001X in ML. X7776
00020   4100 |
        7776 ]
        2071
        0650
        4202
        2062
        0050    Set Rel. and Ind. and Jump to Test.
        0000    Error Halt.  No Jump.

00030   0000
        0000
        0000
        0000
        0000
        0000
        0000
        7550    Check Sum Correction.

00040   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00050   0000 ]
        0000 |
        0000 |
        0000 |  Test Area
        0000 |
        0000 |
        0000 |
        0000 ]
```

```
00060   0004    Jump Adr.
        0000    Variable "P" Adr.
        0100 ]
        0160 |
        0170 |
        2300 |
        0010 |
        0040 |  Constants
00070   0000 |
        0000 |
        4060 |
        0150 |
        0157 ]
        0150    Variable  (5X Test Cell)
        4050 ]  Constants
        4057 ]
00100   0400 ]
        4050 |
        5701 |  Clear Test Area
        3472 |
        6504 ]
        2076 ]  Restore Test Area Clear
        4305 ]
        0400 ]
00110   4203 |
        2075 |
        4100 |  Store 015X in Ind. Bank.
        0000 |
        0403 |
        5302 |
        6505 ]
        5603 ]
00120   2065 |
        4100 |  Store 2300 in Ind. Bank
        0000 |
        0403 |
        5302 |
        0602 |
        6506 |
        4305 ]
00130   2071 ]
        4215 |
        2066 |
        5213 |  Store Set Rel. and Jump in Ind. Bank.
        0402 |
        4203 |
        2210 |
        4100 ]
```

```
00140   0000
        0403
        5302    Store Set Rel. and Jump in Ind. Bank
        0601
        6506
        6004
        0000
        0000    Spares
00150   0000
        2064
        4300    Set ML. 7777 to 0170
        2066
        4205
        2070    Form Set Rel. and Jump Instruction
        5203
        2061

00160   7704
        0000    Set Rel. and Jump to Test
        0000    Error Halt - No Jump
        0000
        2060
        2050    Constants
        0000
        0000

00170   2071
        0620
        4201    Set Ind.
        0020
        2100
        0050
        6106
        5702

00200   5711
        0760
        6506
        6015
        2075    Test 005X ML
        0277
        3711
        6150

00210   2100
        0050
        3461
        6144
        5717
        5704
        0760
        6523
```

```
00220   0450
        4324
        4311
        0403
        5061        Up Date "P" Test Cell
        6006
        2070
        0630

00230   4202
        2061
        0030
        2070
        0620
        4201
        0020
        5475        Up Date 005X Test Cell

00240   0277
        0760
        6104
        2073  }     Restore 005X
        4075  }
        7707        Selective Stop Test Completed
        2071  }
        0630  }
              }     Return to Test
00250   4202  }
        2060  }
        0030  }
        0000
        0000
        0000
        0000
        0000        Error Halt

00260   2363
        0277
        4210
        0000        Display 5X error
        2075
        0277
        7700        Display Correct 5X
        0001  }
              }     Spare
00270   0001  }
        2100  }
        0050  }     Display Error Data
        0000  }
        2061  }
        7700  }     Display Correct Data
        0400
        7101  }
              }     Return to Test
00300   0004  }
```

NUMBER: T999

TITLE: Quality Assurance Fortran Test

CATEGORY: 160-A, 161

MINIMUM EQUIPMENT NEEDED: 160-A, 161

PURPOSE

The program check the ability of the 160-A computer to run a known Fortran problem.

DESCRIPTION

See section (1. Explanation of answer).

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

1. Compiler I (AC1.00 - 1E
2. Compiler II (AC1.00 - 2D
3. Compiler III (AC1.00 - 3D
4. Little Lilley Source (program "LATE")
5. Little Lilley Input (MOD XX)

EXECUTION

1. LOADING ADDRESS: Load Compiler I from (P) = 0000.

   CHECK SUM: (A) = 0000, (P) = 7776.
2. Master clear. Turn punch and read on and eject some tape from the punch by pressing the "Tape Leader" button.
3. Return all jump and stop keys to neutral.
4. Insert the Little Lilley source paper tape into the reader.
5. Run from (P) = 0000.

Execution (Cont'd)

6. If no errors have occurred, a stop will occur at (P) = 3775 and (A) = 0000.

   DO NOT CLEAR!

   If a stop other than (P) = 3775 occurs, consult publication BF01 section III.A.3. to determine the type of error that occurred.

7. Insert Compiler II in the reader and run from (P) = 3775.

8. A stop will occur at (P) = 0252 when Compiler II has finished.

9. Master Clear. Remove the Binary object tape from the punch.

10. Load Compiler III from (P) = 0000.

    a. Check sum: (A) = 0000, (P) = 4747.

11. Master Clear. Insert the binary object tape into the reader.

12. Run from (P) = 0000.

13. A stop will occur at (P) = 0151.

    DO NOT CLEAR!

    If a stop occurs at (P) = 0051 a parity error was detected. Refer to publication BF01 section III.B.2.

14. Insert the Little Lilley input tape into the reader.

15. Run from (P) = 0151.

16. If no errors have been detected; a stop will occur at (P) = 1142 and (A) = 4444.

    a. A stop at (P) = 0576 is a Compiler error. Recompile.

Execution (Cont'd)

17. Remove the answer tape from the punch.

18. The answer data tape can now be typed out and compared with the true answer. (See note 1)

NOTE 1. Typical Typeout Program

M.L.	INSTR.	COMMENT
0000	7500	EXF.
0001	4102	SEL. Reader
0002	7600	INA
0003	6401	ZJB Wait for Data
0004	4017	STD Store Data
0005	7500	EXF.
0006	4210	SEL. Type
0007	2017	LDD Load Data
0010	7677	OTA Output Data
0011	7500	EXF
0012	4102	SEL. Reader
0013	7600	INA
0014	4017	STD STORE DATA
0015	6510	NZB Continue Until Data=0
0016	7700	End
0017	XXXX	Data Storage

LITTLE LILLEY ANSWER (mod. 01)

1. Explanation of answer.

   A. A HISTOGRAM is plotted under the following conditions:

      1. Range of numbers

         a. minimum : 001.00

         b. maximum ; 400.00

      2. Steps (for ranges)

         a. intervals of 020.00

      3. Horizontal position

         a. 1% to 60%

      4. Results

         a. The HISTOGRAM gives the percent of numbers (from the Little Lilley input tape) that fall within a specific range set.

         b. Mean

            The mean of all numbers on the input tape.

         c. Sigma

            The maximum variance from the mean.

LITTLE LILLEY Mod. 01

Answer

```
q. a. 160-a fortran test
program little lilley  mod.01

                    1         10        20        30        40        50        60
  1.00-  20.00
 21.00-  40.00  x
 41.00-  60.00  xx
 61.00-  80.00  xxx
 81.00- 100.00  xxxx
101.00- 120.00  xxxxx
121.00- 140.00  xxxxxx
141.00- 160.00  xxxxxxx
161.00- 180.00  xxxxxxxx
181.00- 200.00  xxxxxxxx
201.00- 220.00  xxxxxxxxx
221.00- 240.00  xxxxxxxx
241.00- 260.00  xxxxxxx
261.00- 280.00  xxxxxx
281.00- 300.00  xxxxx
301.00- 320.00  xxxx
321.00- 340.00  xxx
341.00- 360.00  xx
361.00- 380.00  xx
381.00- 400.00

                    mean  203.919
                    sigma  84.295
```

```
c   1 ************160 HISTOGRAM************
c                  p.r.deichelbohrer
c
     1 format (30habcdefghijklmnopqrstuvwxyz1234)
     7 format (f5.2)
     6 format (f7.2,1h-,f7.2,2x,50a1,50a1)
    66 format (f7.2,1h-,f7.2)
     5 format (30x,4hmean,f9.3)
     4 format (30x,5hsigma,f8.3)
     2 format (1x)
    77 format (15a2)
    79 format (17x,1h1,8x,2h10,8x,2h20,8x,2h30,8x,2h40,8x,2h50,8x,
      12h60)
        dimension dig(50),a1(50),a2(50),iprcnt(100),ixray(100),icl(15)
    60 do 11 i=1,50
        a1(i)=0
        a2(i)=0
    11 dig(i)=0
        sum=0
        suma=0
        ip=0
        sums=0
     3 read 1
        punch 1
        read 1
        punch 1
        punch 2
        punch 2
        read 7, alpha
        read 7, omega
        read 7, enc
        read 7, div
        d=(omega-alpha)
        do 100 n=1,100
   100 ixray(n)=23
        ck=1.-enc
        if(ck) 40,40,30
    30 stinc=.01
        go to 8
    40 stinc=1.
     8 read 7, data
        if (div) 200, 201, 201
   201 data=div/data
   200 if(ck) 203,203,204
```

```
203 data= (data/1)
204 if (data) 15, 17, 17
 17 i=((data-alpha)/enc)
      i=i+1
      dig(i)=dig(i)+1.
      sum=sum+1.
      suma=suma+data
      dats=data*data
      sums=sums+datsh                                          go to 8
 15 dmean=suma/sum
      dsigm=sqrtf (sums/sum-dmean*dmean)
      ip=d/enc
      ip=ip+1
      punch 79
      do 18 i=1,ip
 18 iprcnt(i)=dig(i)/sum*100.
      alf=alpha
      do 23 i=1,ip
      a1(i)=alf
      a2(i)=alf+enc-stinc
      alf=a2(i)+stinc
      jprcnt=iprcnt(i)
      if (jprcnt) 20,21,20
 20 punch 6, a1(i), a2(i),(ixray(n), n=1, jprcnt)
      go to 23
 21 punch 66, a1(i), a2(i)
 23 continue
      punch 2
      punch 2
      punch 5, dmean
      punch 4, dsigm
      do 28 i=1,15
 28 icl (i)=0
      punch 77, (icl(i), i=1,15)
      pause 4444
      go to 60
      stop 1111
      end
      end
```

PAPER TAPE DUPLICATOR

for

LITTLE LILLEY DATA

Procedure:

A. Clear memory banks 0 and 1.

B. Clear memory bank selections.

C. Load duplicator at (P) = 0000.
   1. Check sum: (A) = 0160; (P) = 0066

D. Master Clear.

E. Set all stop keys.

F. Put "Little Lilley" data tape in reader and RUN from (P) = 0000. The data will be stored in memory banks 0 and 1.

G. When the input is completed, a stop will occur at (P) = 0020 and (Z) = 7701. DO NOT CLEAR!

H. Turn on the punch and eject some leader.

I. RUN from (P) = 0020. The data will now be punched out of banks 0 and 1.

J. When the output is completed, a stop will occur at (P) = 0037 and (Z) = 7702. DO NOT CLEAR!

K. Insert the new paper tape into the reader. RUN from (P) = 0037.

L. A stop will occur at (P) = 0065 and (Z) = 7704 at the end of the verification.

M. ERRORS
   1. (P) = 0017, (Z) = 7700
      Not enough storage space available
      (more than 2 banks required).

   2. (P) = 0051 or (P) = 0061 and (Z) = 7777
      Verification error.

NUMBER: T038

TITLE: Quality Assurance Typewriter Speed Test

CATEGORY: 160-A, 161

MINIMUM EQUIPMENT NEEDED: 160-A, 161

PURPOSE

The test will insure typing of 10 characters per second.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0777

TERMINAL ADDRESS: 2130

CHECK SUM: 4453

STARTING ADDRESS: 0777

ADDITIONAL INSTRUCTIONS: The "73" instruction is used for typewriter output.

T-038
QUALITY ASSURANCE TYPEWRITER SPEED TEST

0777	7504
1000	7304
1001	2130
1002	7103
1003	4210
1004	1006
1005	0777
1006	0045
1007	0047
1010	0001
1011	0057
1012	0005
1013	0014
1014	0024
1015	0004
1016	0014
1017	0024
1020	0004
1021	0030
1022	0004
1023	0047
1024	0016
1025	0057
1026	0003
1027	0006
1030	0001
1031	0012
1032	0003
1033	0011
1034	0004
1035	0047
1036	0022
1037	0057
1040	0030
1041	0001
1042	0030
1043	0004
1044	0047
1045	0016
1046	0057
1047	0003

1050	0012
1051	0015
1052	0003
1053	0012
1054	0030
1055	0001
1056	0014
1057	0003
1060	0006
1061	0004
1062	0001
1063	0025
1064	0015
1065	0020
1066	0031
1067	0012
1070	0014
1071	0001
1072	0020
1073	0012
1074	0004
1075	0024
1076	0015
1077	0020
1100	0020
1101	0022
1102	0004
1103	0001
1104	0020
1105	0024
1106	0001
1107	0042
1110	0004
1111	0004
1112	0047
1113	0001
1114	0057
1115	0005
1116	0020
1117	0012
1120	0020
1121	0045
1122	0030
1123	0012
1124	0020
1125	0004
1126	0030
1127	0015

1130	0015
1131	0012
1132	0003
1133	0027
1134	0042
1135	0004
1136	0060
1137	0056
1140	0004
1141	0022
1142	0020
1143	0016
1144	0014
1145	0007
1146	0030
1147	0011
1150	0004
1151	0016
1152	0005
1153	0030
1154	0012
1155	0030
1156	0016
1157	0001
1160	0020
1161	0012
1162	0024
1163	0004
1164	0015
1165	0020
1166	0012
1167	0004
1170	0011
1171	0014
1172	0006
1173	0020
1174	0042
1175	0004
1176	0004
1177	0047
1200	0001
1201	0057
1202	0005
1203	0020
1204	0004
1205	0024
1206	0015
1207	0020

1210	0020
1211	0022
1212	0004
1213	0024
1214	0005
1215	0003
1216	0034
1217	0011
1220	0022
1221	0004
1222	0023
1223	0020
1224	0045
1225	0023
1226	0020
1227	0001
1230	0031
1231	0020
1232	0020
1233	0006
1234	0004
1235	0074
1236	0056
1237	0004
1240	0030
1241	0006
1242	0022
1243	0004
1244	0074
1245	0070
1246	0004
1247	0016
1250	0005
1251	0030
1252	0012
1253	0030
1254	0016
1255	0001
1256	0020
1257	0012
1260	0024
1261	0004
1262	0015
1263	0020
1264	0012
1265	0004
1266	0024
1267	0020

1270	0016
1271	0003
1272	0006
1273	0022
1274	0042
1275	0004
1276	0004
1277	0047
1300	0011
1301	0057
1302	0003
1303	0031
1304	0020
1305	0012
1306	0004
1307	0016
1310	0030
1311	0024
1312	0020
1313	0050
1314	0004
1315	0030
1316	0023
1317	0016
1320	0022
1321	0020
1322	0026
1323	0013
1324	0005
1325	0014
1326	0032
1327	0036
1330	0011
1331	0007
1332	0006
1333	0045
1334	0003
1335	0015
1336	0035
1337	0012
1340	0024
1341	0001
1342	0034
1343	0017
1344	0031
1345	0027
1346	0025
1347	0021

1350	0056
1351	0074
1352	0070
1353	0064
1354	0062
1355	0066
1356	0072
1357	0060
1360	0033
1361	0037
1362	0052
1363	0044
1364	0054
1365	0046
1366	0042
1367	0050
1370	0040
1371	0002
1372	0004
1373	0047
1374	0034
1375	0015
1376	0015
1377	0020
1400	0012
1401	0004
1402	0016
1403	0030
1404	0024
1405	0020
1406	0050
1407	0004
1410	0030
1411	0023
1412	0016
1413	0022
1414	0020
1415	0026
1416	0013
1417	0005
1420	0014
1421	0032
1422	0036
1423	0011
1424	0007
1425	0006
1426	0003
1427	0015

1430	0035
1431	0012
1432	0024
1433	0001
1434	0034
1435	0017
1436	0031
1437	0027
1440	0025
1441	0021
1442	0045
1443	0056
1444	0074
1445	0070
1446	0064
1447	0062
1450	0066
1451	0072
1452	0060
1453	0033
1454	0037
1455	0052
1456	0044
1457	0054
1460	0046
1461	0042
1462	0050
1463	0040
1464	0002
1465	0004
1466	0004
1467	0030
1470	0057
1471	0011
1472	0011
1473	0004
1474	0036
1475	0020
1476	0025
1477	0024
1500	0004
1501	0024
1502	0005
1503	0003
1504	0034
1505	0011
1506	0022
1507	0004

1510	0024
1511	0001
1512	0012
1513	0014
1514	0036
1515	0020
1516	0004
1517	0031
1520	0014
1521	0001
1522	0005
1523	0004
1524	0034
1525	0006
1526	0014
1527	0026
1530	0003
1531	0012
1532	0007
1533	0004
1534	0026
1535	0003
1536	0012
1537	0016
1540	0020
1541	0042
1542	0004
1543	0004
1544	0047
1545	0030
1546	0057
1547	0011
1550	0011
1551	0045
1552	0016
1553	0005
1554	0030
1555	0012
1556	0030
1557	0016
1560	0001
1561	0020
1562	0012
1563	0024
1564	0004
1565	0024
1566	0005
1567	0003

1570	0034
1571	0011
1572	0022
1573	0004
1574	0023
1575	0020
1576	0004
1577	0011
1600	0020
1601	0013
1602	0014
1603	0023
1604	0011
1605	0020
1606	0004
1607	0031
1610	0014
1611	0001
1612	0005
1613	0004
1614	0001
1615	0005
1616	0020
1617	0004
1620	0036
1621	0020
1622	0025
1623	0004
1624	0015
1625	0012
1626	0020
1627	0024
1630	0024
1631	0034
1632	0012
1633	0020
1634	0004
1635	0016
1636	0003
1637	0006
1640	0001
1641	0012
1642	0003
1643	0011
1644	0004
1645	0024
1646	0020
1647	0001

1650	0004
1651	0030
1652	0001
1653	0004
1654	0021
1655	0020
1656	0012
1657	0003
1660	0042
1661	0045
1662	0047
1663	0023
1664	0057
1665	0030
1666	0004
1667	0004
1670	0061
1671	0061
1672	0016
1673	0036
1674	0024
1675	0015
1676	0004
1677	0016
1700	0020
1701	0004
1702	0061
1703	0061
1704	0061
1705	0061
1706	0030
1707	0016
1710	0020
1711	0004
1712	0003
1713	0015
1714	0020
1715	0012
1716	0030
1717	0004
1720	0061
1721	0001
1722	0014
1723	0003
1724	0006
1725	0004
1726	0014
1727	0024

1730	0004
1731	0006
1732	0004
1733	0004
1734	0004
1735	0004
1736	0004
1737	0061
1740	0061
1741	0061
1742	0061
1743	0061
1744	0003
1745	0031
1746	0004
1747	0023
1750	0047
1751	0004
1752	0004
1753	0004
1754	0004
1755	0061
1756	0061
1757	0061
1760	0061
1761	0057
1762	0020
1763	0014
1764	0006
1765	0013
1766	0004
1767	0061
1770	0045
1771	0016
1772	0004
1773	0004
1774	0004
1775	0004
1776	0004
1777	0004
2000	0004
2001	0004
2002	0004
2003	0004
2004	0061
2005	0061
2006	0061
2007	0061

2010	0061
2011	0061
2012	0061
2013	0061
2014	0061
2015	0061
2016	0005
2017	0047
2020	0004
2021	0004
2022	0004
2023	0004
2024	0004
2025	0004
2026	0004
2027	0004
2030	0004
2031	0004
2032	0061
2033	0061
2034	0061
2035	0061
2036	0061
2037	0061
2040	0061
2041	0061
2042	0061
2043	0061
2044	0057
2045	0020
2046	0004
2047	0036
2050	0004
2051	0004
2052	0004
2053	0061
2054	0061
2055	0061
2056	0020
2057	0004
2060	0061
2061	0022
2062	0061
2063	0061
2064	0061
2065	0061
2066	0016
2067	0004

2070	0004
2071	0004
2072	0042
2073	0045
2074	0045
2075	0045
2076	0047
2077	0006
2100	0003
2101	0004
2102	0015
2103	0012
2104	0003
2105	0023
2106	0011
2107	0020
2110	0007
2111	0004
2112	0050
2113	0004
2114	0024
2115	0005
2116	0014
2117	0015
2120	0004
2121	0007
2122	0020
2123	0004
2124	0042
2125	0045
2126	0051
2127	0045
2130	0000

•

NUMBER: T009

TITLE: Typewriter Test

CATEGORY: 160-A, 161

MINIMUM EQUIPMENT NEEDED: 160-A, 161

PURPOSE

This is an inclusive typewriter test consisting of three routines:

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

CHECK SUM: 1045

TEN CHARACTER TEST

STARTING ADDRESS: 0300

The routine accepts ten characters typed in from the program and then types out a carriage return followed by the ten characters.

DISCONNECT TEST

STARTING ADDRESS: 0320

This test accepts information until an input disconnect is set either automatically or manually. The program then types out a carriage return followed by the information up to the disconnect.

TYPING TEST

STARTING ADDRESS: 0340

Information for this test is accepted until a carriage return is typed. The same information is then typed out.

```
0300        7511  type in
            7207  10 char
            2012
            7507  type out
            7445  CR
            7303  to char
            2012
            6507

0310        2000
            4220  type in code
            4210  type out code
            0000
            0000
            0000
            0000
            disconnect test

0320        7515  type in
            7213
            2200
            3611
            6404
            3207
            4204
            7507  type out

0330        7445  cr
            7303
            2000
            6513
            2000  start bffr.
            4220  type in code
            4210  type out code
            0000
```

```
0340        2304  preset
            4070  input
            7507  type in
            7600
            4170  store
            0745
            6004  CR
            5470  no

0350        6505
            4220  in code
            5470
            4203
            7504  out
            7304
            2000
            6517

0360        4210  out code
            2000
```

NUMBER: T039-A
TITLE: Quality Assurance I/O Reliability Test
CATEGORY: 160-A, 161, 163, 164
MINIMUM EQUIPMENT NEEDED: 160-A, 161, 163, 164 or 162

PURPOSE

This program checks the following:

1) Reader is checked for proper operation with the 72 and 7600 instructions at normal reader speed and also start, stop operation.
2) Punch is checked for proper operation with the 74, 73 and 7677 instructions, at normal speed and also at various lower speeds down to approximately one-fifth normal speed.
3) The typewriter is checked for output with 73 and 74 instructions.
4) Keyboard input is checked with 72 and 7600 instructions.
5) A logic instruction check is made each cycle of the program.
6) Buffer can also be completely checked if it is desired to run the 162, 163 or 164 Magnetic Tape Units. The typewriter should be connected to the "Normal" I/O channel and the Magnetic Tape to the "Buffer" channel.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: 0000 in bank 0
TERMINAL ADDRESS: 6500
CHECK SUM: 0160
STARTING ADDRESS: 0000 (6300 if Magnetic Tape is to be used)
Set the punch level selection in "A" register
0377 for 8 level,
0177 for 7 level,
0037 for 5 level paper tape
Put the computer in run.

The punch will run sufficient tape to reach the reader and stop with P = 2030. Insert the tape leader into the reader and put the computer back into run (do not master clear after punch stop).

The program will read and punch 50 groups of binary count then jump into a typewriter output routine.

If Magnetic Tape is used on the buffer channel with this program the tape unit will cause asynchronous buffer interruptions.

The Magnetic Tape will write and read an inverse binary count from bank 1. Following the typewriter output, the punch and reader will operate at a variable speed.

At the end of this test, the computer will halt with input in the Status Mode. Type in 10 characters and those 10 characters should be typed back out.

Type in, to a maximum, 127 characters followed by manual disconnect. The same characters should be typed back.

Type in, to a maximum, 127 characters followed by a carriage return. The same characters should be typed back.

The typewriter will then output the entire typewriter repoitoire with a 74 instruction and jump into a punch reader test using the 7600 and 7677 instructions. Following this test, the computer will jump into the logic test.

From the logic test the computer programs will jump to the initial punch-reader test.

At the termination of all tests except typewriter tests, the typewriter will type out the status of the test.

HALT	EXPLANATION
2046	Error data displayed in "A" register. Is indicated if an error occurs in (test 2), the first reader-punch program. Put the computer into run (do not master clear).
2050	Correct data displayed in "A" register. Observation of the paper tape frame immediately behind the read station will determine if the error was due to punch or reader error. The operator may re-synchronize the program by moving the correct data plus 1 count under the read station.

HALT	EXPLANATION (Cont'd.)
4600 or 4633	Error data displayed in "A" register. Is indicated if an error occurs in (test 4) the second reader-punch program. Put the computer back into run.
4602 or 4635	Correct data displayed in "A" register. Observation of the paper tape immediately behind the read station will determine whether it was a punch or reader error. Put the computer back into run (do not master clear). The program will search for synchronization and continue to read and punch at a variable speed.
4154	Error data displayed in "A" register. Is indicated if an error occurs in (test 6) the third reader-punch test. Put the computer back into run (do not master clear).
4156	Correct data displayed in "A" register. Observation of the tape immediately behind the read station will determine whether it was a punch or reader error. The program may be re-synchronized by putting the correct data plus 1 count under the read station and putting the computer back into run. If a parity error occurs on the Magnetic Tape program, the tape unit will backspace a maximum of 3 times to rewrite or re-read the data. If a parity error still exists after 3 trials the computer will stop.
6011	Parity error write.
6226	Parity error read.
6160	If a comparison error occurs, "A" register will contain the address in bank 1 of error data. Correct data should be the complement of the address. The computer may be put into run to continue the test after any of the above stops.

HALT	EXPLANATION (Cont'd.)
1760	Indicates a paper tape level selection different than those described under Operating Instruction.
	If an error occurs in the typewriter tests (test 3 or test 5) the operator may determine the error by observing the data that was typed out.

M.L.	
0000	Initial start without 163 or 164 Magnetic Tape.
6300	Initial start with 163 or 164 Magnetic Tape.
2040	Entrance to Test #2 (Punch and Reader)
2106	Exit from Test #2
2301	Entrance to Test #3 (Typewriter Output)
2351	Exit from Test #3
4570	Entrance to Test #4 (Punch and Reader Var. Speed)
4667	Exit from Test #4
5363	Entrance to Test #5 (Typewriter Input-Output)
5626	Exit from Test #5
4100	Entrance to Test #6 (Punch and Reader)
4151	Exit from Test #6
4200	Entrance to Test #1 (Logic Test)
3715	Exit from Test #1
6431	Entrance to Type Out Status from Test #1
6436	Entrance to Type Out Status from Test #2
6443	Entrance to Type Out Status from Test #4
6454	Entrance to Type Out Status from Test #6

```
00000   4033    Store Reader-Punch Mask
        0601
        4032    Store Limit
        7101    Ind. Jump
        1750
        0000
        0000
        0000

00010   0000
        0000
        0000
        0000
        0000
        4225    Ind. Address for Half Write
        7101
        1750

00020   0000
        4024
        7101
        5734    Variable Address (6052) (6130) (5751) (6250) (6100)
        0000    Data Stored at Interrupt
        3724
        0000
        0000

00030   0000
        0000
        0000
        0000
        0000
        0000
        0530    Ind. Address
        0667    Ind. Address

00040   4062
        5473
        5473
        7643    Variable
        1171    Ind. Address
        5624
        1230    Ind. Address
        0000    Variable

00050   1303    Ind. Address
        1355    Ind. Address
        7070
        1375
        4160    Set Memory Location 7777 to Initial Variable
        4166    Set Memory Location 3504 to Initial Variable
        0400
        6011
```

```
00060   7777
        0400
        0200
        0040
        2011
        7643
        3504    Ind. Address
        2066

00070   4030    Set Punch Output Data to Zero
        4174    Set Punch Output Data to Zero
        7101    Ind. Jump to Start Test #2
        2000
        2066
        0000
        0000
        0000

00100   6005    Test Zero Jump Forward
        0460
        0000    Error
        0465
        0000    Error
        6502    Test Non-Zero Jump Back
        6205    Test Pos. Jump Forward
        0462

00110   0000    Error
        0467
        0000    Error
        6702    Test Neg. Jump Back
        0577
        6105    Test Non-Zero Jump Forward
        0461
        0000    Error

00120   0464
        0000    Error
        6402    Test Zero Jump Back
        6305    Test Neg. Jump Forward
        0463
        0000    Error
        0466
        0000    Error

00130   6602    Test Pos. Jump Back
        0110    Left Shift "A" 3 Bit Positions
        6303    Test Neg. Jump Forward
        0463
        0000    Error
        0110    Left Shift "A" 3 Bit Positions
        6205    Test Pos. Jump Forward
        0462
```

```
00140   0000    Error
        0467
        0000    Error
        6702    Test Neg. Jump Back
        0400    Test LDN Instruction
        6005
        0400
        6001    Pass

00150   0404
        0000    Error
        2307    Test LDB Instruction
        6304
        0423
        0000    Error
        1075
        2301    Test ADB Instruction

00160   3315
        6003
        0433
        0000    Error
        2706    Test LCB Instruction
        3307
        6003
        0427

00170   0000    Error
        2313    Test SBB Instruction
        3714
        6003
        0437
        0000    Error
        2320    Test SBD Instruction
        4035

00200   3435
        6003
        0434
        0000    Error
        2313    Test Left Shift "A" 1 Bit Position
        0102
        6303
        0401

00210   0000    Error
        0102
        6203
        0401
        0000    Error
        0102
        6203
        0401
```

```
00220   0000    Error
        0102
        6303
        0401
        0000    Error
        0102
        6303
        0401

00230   0000    Error
        0102
        6203
        0401
        0000    Error
        0102
        6203
        0401

00240   0000    Error
        0102
        6303
        0401
        0000    Error
        0102
        6203
        0401

00250   0000    Error
        0102
        6303
        0401
        0000    Error
        0102
        6303
        0401

00260   0000    Error
        0102
        6204
        0401
        0000    Error
        0404
        2301    Test Left Shift "A" 3 Bit Positions
        0110

00270   6303
        0401
        0000    Error
        0110
        6203
        0401
        0000    Error
        0110
```

```
00300   6303
        0401
        0000    Error
        0110
        6203
        0401
        0000    Error
        2303    Test Logical Product Backward

00310   1301
        6203
        0413
        0000    Error
        0102
        6303
        0413
        0000    Error

00320   0102
        6203
        0413
        0000    Error
        0102
        6203
        0413
        0000    Error

00330   0102
        6303
        0413
        0000    Error
        0102
        6203
        0413
        0000    Error

00340   0102
        6203
        0413
        0000    Error
        0102
        6203
        0413
        0000    Error

00350   0102
        6203
        0413
        0000    Error
        0102
        6203
        0413
        0000    Error
```

```
00360   0102
        6303
        0413
        0000    Error
        0102
        6303
        0413
        0000    Error

00370   2307    Test Selective Complement Backward
        1764
        6303
        0417
        0000    Error
        0102
        6303
        0417

00400   0000    Error
        0102
        6203
        0417
        0000    Error
        0102
        6303
        0417

00410   0000    Error
        0102
        6303
        0417
        0000    Error
        0102
        6303
        0417

00420   0000    Error
        0102
        6203
        0417
        0000    Error
        0102
        6203
        0417

00430   0000    Error
        0102
        6203
        0417
        0000    Error
        0102
        6203
        0417
```

```
00440   0000    Error
        0102
        6303
        0417
        0000    Error
        0102
        6204
        0417

00450   0000    Error
        5252
        2701    Test Load Complement Backward or Shift Replace Forwa
        6203
        0427
        0000    Error
        0102
        6303

00460   0427
        0000    Error
        0102
        6203
        0427
        0000    Error
        0102
        6303

00470   0427
        0000    Error
        0102
        6203
        0427
        0000    Error
        0102
        6303

00500   0427
        0000    Error
        0102
        6203
        0427
        0000    Error
        0102
        6303

00510   0427
        0000    Error
        0102
        6203
        0427
        0000    Error
        0102
        6303
```

```
00520  0427
       0000   Error
       0102
       6203
       0427
       0000   Error
       0102
       6303

00530  0427
       0000   Error
       0404
       0704
       6003
       0407
       0000   Error
       7101

00540  0563   Variable Jump Address (0566)
       2211   Change Error Stop Codes from 0027 to 0046
       4366
       2301
       0704
       4303
       3607
       6506

00550  4604   Start Shift Replace Forward Test
       6576   Jump Back to Bit Test
       0446
       0000
       5252
       4306
       0427
       0530

00560  0450
       0563
       0566
       2301   Change Jump Address from 0563 to 0566
       4324
       6524
       2305   Change Jump Address from 0566 to 0563
       4327

00570  2312   Change Error Stop Codes from 0046 to 0027
       4136
       2036
       0704
       4036
       1715
       6506
       2320
```

```
00600   4036
        2725    Reset Variable
        4326
        6103    Jump Forward
        2525
        7777
        0460
        5345    Reset Relative Store

00610   2303    Test Subtract Back Instruction
        3705
        6303
        0437
        0000    Error
        0102
        6203
        0437

00620   0000    Error
        0102
        6303
        0437
        0000    Error
        0102
        6203
        0437

00630   0000    Error
        0102
        6303
        0437
        0000    Error
        0102
        6203
        0437

00640   0000    Error
        0102
        6303
        0437
        0000    Error
        0102
        6203
        0437

00650   0000    Error
        0102
        6303
        0437
        0000    Error
        0102
        6203
        0437
```

```
00660   0000    Error
        0102
        6303
        0437
        0000    Error
        0102
        6203
        0437

00670   0000    Error
        7101
        0721    Variable Jump Address (0724)
        2217    Change Error Stop Code from 0037 to 0032
        4361
        2301
        0704
        4303

00700   3613
        6506
        2205    Start Add Forward Test
        3205
        6572    Jump Back to Bit Test
        0432
        0000
        4016

00710   1234
        0437
        0432
        4301
        4361
        0607
        0667
        0721

00720   0724
        2301    Change Variable Jump Address from 0721 to 0724
        4330
        6530    Jump Back
        2310    Reset Relative Store Back
        4331
        2307    Change Jump Address from 0724 to 0721
        4335

00730   2317    Change Error Stop Code from 0032 to 0037
        4137
        2037
        0704
        4037
        3720
        6506
        2321    Set Ind. Address
```

```
00740   4037
        2311    Test Logical Product NO Address Instruction
        0207
        0707
        6003
        0402
        0000    Error
        2304    Test Logical Product Direct Instruction

00750   1052
        6003
        0410
        0000    Error
        2305    Test Logical Product Indirect Instruction
        1111
        6003
        0411

00760   0000    Error
        2304    Test Logical Product Forward Instruction
        1204
        6004
        0412
        0000    Error
        6666
        2326    Test Selective Complement NO Address

00770   0315
        3710
        6003
        0403
        0000    Error
        2714    Test Selective Complement Forward
        1442
        6003

01000   0414
        0000    Error
        2371    Test Selective Complement Indirect
        1537
        6003
        0415
        0000    Error
        2304    Test Selective Complement Forward

01010   1604
        6004
        0416
        0000    Error
        1537
        2041    Test Load Direct Instruction
        3604
        6004
```

```
01100   2750    Test Add Indirect Instruction
        3137
        6003
        0431
        0000    Error
        2705    Test Add Forward Instruction
        3204
        6004

01110   0432
        0000    Error
        2750
        2313    Test Subtract No address Instruction
        0743
        3710
        6003
        0407

01120   0000    Error
        2363    Test Subtract Direct Instruction
        3441
        6003
        0434
        0000    Error
        2376    Test Subtract Indirect Instruction
        3537

01130   6003
        0435
        0000    Error
        2304    Test Subtract Forward Instruction
        3604
        6004
        0436
        0000    Error

01140   3537
        2041    Test Store Direct Instruction
        4042
        2041
        3442
        6003
        0440
        0000    Error

01150   2312    Test Store Indirect Instruction
        0601
        4137
        2137
        3604
        6004
        0441
        0000    Error
```

```
01160   0437
        2305    Test Store Forward Instruction
        4206
        2707
        3204
        6007
        0442
        0000    Error

01170   0000    Stored Data
        7507    Variable
        2470    Variable
        7507    Variable
        4443    Test Shift Replace Direct Instruction
        3702
        6003
        0444

01200   0000    Error
        2306    Shift Variable
        0102
        4310
        4544    Test Shift Replace Indirect Instruction (44 contains 1171)
        3712
        6004
        0445

01210   0000    Error
        4321    Variable
        2320    Test Shift Replace Backward Instruction
        0102
        4322
        2304
        0102
        4206

01220   4707
        3604
        6007
        0447
        0000    Error
        0643
        5624    Variable
        0435

01230   0435
        2303    Test Replace Add Direct Instruction
        0617
        4305
        0417
        5045
        3710
        6003
```

```
01240  0450
       0000  Error
       2211  Test Replace Add Indirect Instruction
       0671
       4207
       0471
       5146  (M.L.46 contains 1230)
       3604

01250  6004
       0451
       0000  Error
       0435  Variable
       2211  Test Replace Add Forward Instruction
       0644
       4207
       0444

01260  5206
       3604
       6007
       0452
       0000  Error
       0451  Variable
       0451  Variable
       2431  Variable

01270  2431  Variable
       2301  Test Replace Add Backward Instruction
       0625
       4303
       0425
       5306
       3706
       6010

01300  0453
       0000  Error
       0000  Variable
       0772  Variable
       0772  Variable
       4101  Variable
       4101  Variable
       2305  Test Replace Add One Direct Instruction

01310  0601
       4307
       5447
       3711
       6003
       0454
       0000  Error
       2313  Test Replace Add One Indirect Instruction
```

```
01320  0601
       4315
       5550   (M.L.50 contains 1303)
       3717
       6003
       0455
       0000   Error
       2212   Test Replace Add One Forward Instruction

01330  4210
       0601
       4207
       5605
       3605
       6005
       0456
       0000   Error

01340  3720   Variable
       3720   Variable
       2335   Test Replace Add One Backward Instruction
       0601
       4337
       5737
       3741
       6003

01350  0457
       0000   Error
       7051   Test Jump Instruction
       0470
       0000   Error
       7101   Test Jump Instruction
       1361
       0471

01360  0000   Error
       5611   Incr. Test Count
       6303
       0400
       7112   Jump Ind. to 0100
       2212   Reset Test Count
       4204
       0400

01370  7101
       1400
       0314   Test Count
       7101   Jump to Expanded Capabilities
       1400
       0000
       0100
       0314
```

```
01400  2200   Test Load Constant Instruction
       7643   Variable
       3701
       6002
       0000   Error
       2304   Set Variable
       4203
       4706

01410  4600   Test Shift Replace Constant Instruction
       7507   Variable
       2311
       3702
       6002
       0000   Error
       2305   Test Store Constant Instruction
       4200

01420  7507
       1710
       6002
       0000   Error
       2704   Set Variable
       4202
       5600   Test Replace Add One Constant Instruction
       0270

01430  0701
       3311
       6003
       0000   Error
       7643   Variable
       5200   Test Replace Add Constant (add zero) Instruction
       7643
       3703

01440  6002
       0000   Error
       4706   Set Variables
       4305
       2706   Set Variable
       4203
       2312   Test Logical Product Constant Instruction
       1200

01450  0560
       6002
       0000   Error
       2303   Set Variable
       4202
       1600   Test Selective Complement Constant Instruction
       0506
       6002
```

```
01460  0000   Error
       2303   Set Variable
       4202
       2600   Test Load Complement Constant Instruction
       0506   Variable
       3307
       6002
       0000   Error

01470  2304   Set Variable
       4202
       3600   Test Subtract Constant Instruction
       0506   Variable
       6002
       0000   Error
       2703   Set Variable
       4203

01500  2305   Test Add Constant Instruction
       3200
       7271   Variable
       6002
       0000   Error
       0101   Test P→A Instruction
       0603
       4205

01510  0101
       3603
       6003
       0000   Error
       1510   Variable
       5701
       0101
       0705

01520  3704
       6002
       0000   Error
       0101
       4310
       0404
       5312
       0101

01530  3714
       6002
       0000   Error
       0101
       4212
       0103   Test Left Shift Two
       4211
       2207
```

```
01540  3206
       3205
       3204
       3604
       6004
       0000   Error
       1533   Variable
       6154   Variable

01550  0101
       4213
       0111   Test Left Shift Six
       4212
       4610
       4607
       4606
       0103

01560  0102
       3604
       6005
       0000   Error
       1550   Variable
       5300   Constant
       0000
       0113   Test Multiply by 100 (X zero)

01570  6003
       0000   Error
       0001   Variable
       2301
       0113   Test Multiply by 100 (X)
       4225
       2304
       0103

01600  0102
       4222
       2310
       0102
       5217
       0103
       0102
       4215

01610  4613
       3213
       3610
       6002
       0000   Error
       5723
       3607   Check Limit of Variable
       6114
```

```
01620  6006   Jump Forward to Reset Variable
       0000
       0000
       0000
       0000
       0623   Constant Limit
       0401   Reset Variable
       4335

01630  6103
       1632
       7643   Variable
       2100   Test Load Memory Instruction
       1632
       3703
       6002
       0000   Error

01640  2706
       1100   Test Logical Product Memory Instruction
       1632
       6002
       0000   Error
       2313
       1500   Test Selective Complement Memory Instruction
       1632

01650  6002
       0000   Error
       2500   Test Load Complement Memory Instruction
       1632
       3322
       6002
       0000   Error
       2725

01660  3100   Test Add Memory Instruction
       1632
       6002
       0000   Error
       2332
       3500   Test Subtract Memory Instruction
       1632
       6002

01670  0000   Error
       2337
       4206
       4100   Test Store Memory Instruction
       1632
       3603
       6003
       0000   Error
```

```
01700  7643   Variable
       4701   Change Variable
       4500   Test Shift Replace Memory Instruction
       1632
       3704
       6002
       0000   Error
       5707   Change Variable

01710  5500   Test Replace Add One Memory Instruction
       1632
       3712
       6002
       0000   Error
       0423   Set Variable
       5316
       0423

01720  5100   Test Replace Add Memory Instruction
       1632
       1722
       6002
       0000   Error
       5604   Incr. Test Count
       6006
       7101   Jump Back to Expanded Capabilities Test

01730  1400
       0000   Test Count
       0000
       0000
       7101   Jump to 160-A Logic
       3500
       0000
       0000

01740  0000
       0000
       0000
       0000
       0000
       0000
       0000
       7736

01750  1461   Check Reader Punch Level Selection
       6010
       2032
       1462
       6006
       2032
       1463
       6004
```

```
01760   0000    Error - Illegal Level Selection Made
        0707    Set Initial Paper Tape Length
        0716
        0604
        3036
        4164
        2065    Load Initial Variable (7643)
        7101    Ind. Jump

01770   0054
        0016
        0004
        0004
        0004
        0004
        0577
        4270

02000   0577    Set Initial Tape Leader Length
        4200
        7700
        0120
        7564    Punch Out Leader
        7400
        0120    Clear Interrupt Lockout
        5705    Incr. Leader Count

02010   6505
        0507    Initial Tape Length (0507 for 8 level selection)
        4200
        7770
        0001
        7553    Punch Output from M.L. 2066
        7353
        2067

02020   0120    Clear Interrupt Lockout
        5645    Incr. Punch Data
        1033    Logical Product with Mask
        4243
        6507
        5712    Incr. Initial Block Count
        6511
        5637

02030   7777    Halt to Load Paper into Reader
        0120
        7535    Leader Search
        7600
        6403
        6104
        0120
        7530
```

```
02040   7600    Reader Input to "A"
        0120    Clear Interrupt Lockout
        4223
        3623    Compare Data
        6005
        2220    Load Error Data
        0000    Error Halt
        2217    Load Correct Data

02050   7700    Halt
        5615    Incr. Data
        1033    Logical Product Mask
        4213
        6516
        0120
        7512    Punch Out from M.L. 2066
        7312

02060   2067
        0120    Clear Interrupt Lockout
        7101    Ind. Jump
        2073
        0000
        0000
        0000    Punch Output Data
        4102    Exf. Code - Reader

02070   4104    Exf. Code - Punch
        2066    Starting Address
        7720
        7100    Return Jump - Check for Mag. Tape Rewind Condition
        6031
        5707    Incr. Data
        1033
        4311

02100   6523
        5707    Incr. -57(8) Block Count
        6544
        0557    Reset Block Count
        4312
        7101    Ind. Jump to Type Out Test Status
        6436
        0011

02110   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
02120   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02130   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02140   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02150   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02160   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02170   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
02200   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02210   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02220   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02230   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02240   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02250   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
02260   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02270   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02300   3476
        7500    Entrance for Test #3
        4210    Exf. Code for Type Out
        7317
        2364    Term. Address (Variable)
        0120    Clear Interrupt Lockout
        2302
        3707    Check Limit

02310   6030    Jump to 2340 at end of Paragraph
        2211
        0610    Add +10 to Starting Address
        4207
        2310
        0610    Add +10 to Term. Address
        4312
        3604    Check Limit

02320   6105
        6007
        2354    Starting Address (Variable)
        3474
        3476
        7100    Return Jump - Check for Mag. Tape Rewind Condition
        6031
        6426    Jump Back to 2301

02330   2304    Complete Block by setting final Term. Address
        4325
        6505
        0000
        0000
        0000
        2354
        2364
```

```
02340   2301    Reset Term. Address
        4335
        2304    Reset Starting Address
        4321
        5606    Incr. Paragraph Count
        6544    NZB to Type Another Paragrap
        0502    Reset Paragraph Count
        4203

02350   7101    Exit to Test #4
        4566
        7775    Paragraph count
        0000
        0045    C.R.
        0047    U.C.
        0001    T
        0057    L.C.

02360   0005    h
        0014    i
        0024    S
        0004    SP.
        0014    i
        0024    S
        0004    SP.
        0030    a

02370   0004    SP.
        0047    U.C.
        0016    C
        0057    L.C.
        0003    o
        0006    n
        0001    t
        0012    r

02400   0003    o
        0011    l
        0004    SP.
        0047    U.C.
        0022    D
        0057    L.C.
        0030    a
        0001    t

02410   0030    a
        0004    SP.
        0047    U.C.
        0016    C
        0057    L.C.
        0003    o
        0012    r
        0015    p
```

```
02420   0003    o
        0012    r
        0030    a
        0001    t
        0014    i
        0003    o
        0006    n
        0004    sp.

02430   0001    t
        0025    y
        0015    p
        0020    e
        0031    w
        0012    r
        0014    i
        0001    t

02440   0020    e
        0012    r
        0004    sp.
        0024    s
        0015    p
        0020    e
        0020    e
        0022    d

02450   0004    sp.
        0001    t
        0020    e
        0024    s
        0001    t
        0042    .
        0004    sp.
        0004    sp.

02460   0047    U.C.
        0001    T
        0057    L.C.
        0005    h
        0020    e
        0012    r
        0020    e
        0045    CR.

02470   0030    a
        0012    r
        0020    e
        0004    sp.
        0030    a
        0015    p
        0015    p
        0012    r
```

```
02500  0003  o
       0027  x
       0042  .
       0004  sp.
       0060  7
       0056  o
       0004  sp.
       0022  d

02510  0020  e
       0016  c
       0014  i
       0007  m
       0030  a
       0011  l
       0004  sp.
       0016  c

02520  0005  h
       0030  a
       0012  r
       0030  a
       0016  c
       0001  t
       0020  e
       0012  r

02530  0024  s
       0004  sp.
       0015  p
       0020  e
       0012  r
       0004  sp.
       0011  l
       0014  i

02540  0006  n
       0020  e
       0042  .
       0004  sp.
       0004  sp.
       0047  U.C.
       0001  T
       0057  L.C.

02550  0005  h
       0020  e
       0004  sp.
       0024  s
       0015  p
       0020  e
       0020  c
       0022  d
```

```
02560   0004   sp.
        0024   s
        0005   h
        0003   o
        0034   u
        0011   l
        0022   d
        0004   sp.

02570   0023   b
        0020   e
        0045   CR.
        0023   b
        0020   e
        0001   t
        0031   w
        0020    e

02600   0020   e
        0006   n
        0004   sp.
        0074   1
        0056   0
        0004   sp.
        0030   a
        0006   n

02610   0022   d
        0004   sp.
        0074   1
        0070   2
        0004   sp.
        0016   C
        0005   h
        0030   a

02620   0012    r
        0030   a
        0016   c
        0001   t
        0020   e
        0012   r
        0024   s
        0004   Sp.

02630   0015   P
        0020   e
        0012   r
        0004   sp.
        0024   s
        0020   e
        0016   c
        0003   o
```

```
02640   0006    n
        0022    d
        0042    .
        0004    sp.
        0004    sp.
        0047    U.C.
        0011    L
        0057    L.C.

02650   0003    o
        0031    w
        0020    e
        0012    r
        0004    sp.
        0016    c
        0030    a
        0024    s

02660   0020    e
        0050    ;
        0004    sp.
        0030    a
        0023    b
        0016    c
        0022    d
        0020    e

02670   0026    f
        0013    g
        0005    h
        0014    i
        0032    j
        0036    k
        0011    l
        0007    m

02700   0006    n
        0045    CR.
        0003    o
        0015    p
        0035    q
        0012    r
        0024    s
        0001     t

02710   0034    u
        0017    v
        0031    w
        0027    x
        0025    y
        0021    z
        0056    0
        0074    1
```

```
02720   0070   2
        0064   3
        0062   4
        0066   5
        0072   6
        0060   7
        0033   8
        0037   9

02730   0052   -
        0044   /
        0054   '
        0046   +
        0042   .
        0050   ;
        0040   ,
        0002   =

02740   0004   sp.
        0047   U.C.
        0034   U
        0015   P
        0015   P
        0020   E
        0012   R
        0004   sp.

02750   0016   C
        0030   A
        0024   S
        0020   E
        0050   :
        0004   sp.
        0030   A
        0023   B

02760   0016   C
        0022   D
        0020   E
        0026   F
        0013   G
        0005   H
        0014   I
        0032   J

02770   0036   K
        0011   L
        0007   M
        0006   N
        0003   O
        0015   P
        0035   Q
        0012   R
```

03000	0024	S
	0001	T
	0034	U
	0017	V
	0031	W
	0027	X
	0025	Y
	0021	Z
03010	0045	CR.
	0056	)
	0074	*
	0070	@
	0064	#
	0062	$
	0066	%
	0072	¢
03020	0060	&
	0033	½
	0037	(
	0052	
	0044	?
	0054	"
	0046	o
	0042	.
03030	0050	:
	0040	,
	0002	←
	0004	sp.
	0004	sp.
	0030	A
	0057	L.C.
	0011	l
03040	0011	l
	0004	sp.
	0036	k
	0020	e
	0025	y
	0024	s
	0004	sp.
	0024	s
03050	0005	h
	0003	o
	0034	u
	0011	l
	0022	d
	0004	sp.
	0024	S
	0001	t

03060	0012	r
	0014	i
	0036	k
	0020	e
	0004	sp.
	0031	w
	0014	i
	0001	t
03070	0005	h
	0004	sp.
	0034	u
	0006	n
	0014	i
	0026	f
	0003	o
	0012	r
03100	0007	m
	0004	sp.
	0026	f
	0003	o
	0012	r
	0016	c
	0020	e
	0042	.
03110	0004	sp.
	0004	sp.
	0047	U.C.
	0030	A
	0057	L.C.
	0011	l
	0011	l
	0045	CR.
03120	0016	C
	0005	h
	0030	a
	0012	r
	0030	a
	0016	c
	0001	t
	0020	e
03130	0012	r
	0024	s
	0004	sp.
	0024	s
	0005	h
	0003	o
	0034	u
	0011	l

```
03140  0022  d
       0004  sp.
       0023  b
       0020  e
       0004  sp.
       0011  l
       0020  e
       0013  g

03150  0014  i
       0023  b
       0011  l
       0020  e
       0004  sp.
       0031  w
       0014  i
       0001  t

03160  0005  h
       0004  sp.
       0001  t
       0005  h
       0020  e
       0004  sp.
       0036  k
       0020  e

03170  0025  y
       0004  sp.
       0015  p
       0012  r
       0020  e
       0024  s
       0024  s
       0034  u

03200  0012  r
       0020  e
       0004  sp.
       0016  c
       0003  o
       0006  n
       0001  t
       0012  r

03210  0003  o
       0011  l
       0004  sp.
       0024  s
       0020  e
       0001  t
       0004  sp.
       0030  a
```

```
03220   0001    t
        0004    sp.
        0021    z
        0020    e
        0012    r
        0003    o
        0042    .
        0045    CR.

03230   0047    U.C.
        0023    B
        0057    L.C.
        0030    a
        0004    sp.
        0004    sp.
        0061    BS.
        0061    BS.

03240   0016    C
        0036    K
        0024    S
        0015    P
        0004    sp.
        0016    C
        0020    E
        0004    sp.

03250   0061    BS.
        0061    BS.
        0061    BS.
        0061    BS.
        0030    a
        0016    c
        0020    e
        0004    sp.

03260   0003    O
        0015    p
        0020    e
        0012    r
        0030    a
        0004    sp.
        0061    BS.
        0001    t

03270   0014    i
        0003    o
        0006    n
        0004    sp.
        0014    i
        0024    s
        0004    sp.
        0006    n
```

03300	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
	0061	BS.
	0061	BS.
	0061	BS.
03310	0061	BS.
	0061	BS.
	0003	o
	0031	w
	0004	sp.
	0023	b
	0047	U.C.
	0004	sp.
03320	0004	sp.
	0004	sp.
	0004	sp.
	0061	BS.
	0061	BS.
	0061	BS.
	0061	BS.
	0057	L.C.
03330	0020	e
	0014	i
	0006	n
	0013	g
	0004	sp.
	0061	BS.
	0045	CR.
	0016	C
03340	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
	0004	sp.
03350	0004	sp.
	0004	sp.
	0061	BS.
	0061	BS.
	0061	BS.
	0061	BS.
	0061	BS.
	0061	BS.

```
03360  0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.
       0005  h
       0047  U.C.
       0004  sp.
       0004  sp.

03370  0004  sp.
       0004  sp.
       0004  sp.
       0004  sp.
       0004  sp.
       0004  sp.
       0004  sp.
       0004  sp.

03400  0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.

03410  0061  BS.
       0061  Bs.
       0057  L.C.
       0020  e
       0004  sp.
       0036  k
       0004  sp.
       0004  sp.

03420  0004  sp.
       0061  BS.
       0061  BS.
       0061  BS.
       0020  e
       0004  sp.
       0061  BS.
       0022  d

03430  0061  BS.
       0061  BS.
       0061  BS.
       0061  BS.
       0016  C
       0004  sp.
       0004  sp.
       0004  sp.
```

```
03440   0042    .
        0045    CR.
        0045    CR.
        0045    CR.
        0047    U.C.
        0006    N
        0003    O
        0004    sp.

03450   0015    P
        0012    R
        0003    O
        0023    B
        0011    L
        0020    E
        0007    M
        0004    sp.

03460   0050    :
        0004    sp.
        0024    S
        0005    H
        0014    I
        0015    P
        0004    sp.
        0007    M

03470   0020    E
        0004    sp.
        0042    .
        0045    CR.
        0051    Tab.
        0045    CR.
        0000
        0004

03500   2300    Test Load Specific Instruction
        1603
        6003
        0000    Error
        7643    Variable
        4701    Set Variables
        4560
        2303

03510   1700    Test Selective Complement Specific Instruction
        6002
        0000    Error
        2700    Test Load Complement Specific Instruction
        3310
        6002
        0000    Error
        2713
```

```
03520  1300  Test Logical Product Specific Instruction
       6002
       0000  Error
       2717
       3300  Test Add Specific Instruction
       6002
       0000  Error
       2323

03530  3700  Test Subtract Specific Instruction
       6002
       0000  Error
       2327
       4300  Test Store Specific Instruction
       3731
       6002
       0000  Error

03540  4734
       4700  Test Shift Replace Specific Instruction
       3736
       6002
       0000  Error
       0425  Set Variable
       5342
       0425  Test Replace Add Specific Instruction

03550  5300
       3745
       6002
       0000  Error
       5750
       5700  Test Replace Add One Specific Instruction
       3752
       6004

03560  0000  Error
       5461  Variable
       5461  Variable
       4701  Set Variables
       4702
       2304  Test Left Shift Two
       0103
       4306

03570  3706
       6003
       0401
       0000  Error
       2312  Set Variable
       0110
       0110
       4315
```

```
03600   2317    Test Left Shift Six
        0111
        4321
        3721
        6003
        0401
        0000    Error
        0412    Test Multiply by Ten

03610   0112
        3604
        6004
        0401
        0000    Error
        0144    Constant
        2206    Test Right Shift One
        0114

03620   3605
        6005
        0401
        0000    Error
        2525
        1252    Constant
        2212    Set Variable
        0114

03630   0114
        4207
        2207    Test Right Shift Two
        0115
        4205
        3603
        6004
        0000    Error

03640   5252    Variable
        5252    Variable
        5604    Incr. Shift Count
        6113    Continue Shift Test
        6026    Jump Out of Shift Test
        5252    Variable
        7770    Shift Count
        2702    Complement Variable

03650   4303    Reset Variables
        4311
        4311
        7100    Test Return Jump
        3663
        7121
        7101    Jump Back to Test Right Shift
        3626
```

```
03660   0000        Error  Ret. Jump
        0000
        7101
        3660        Jump Address (Variable) (3655)
        5603
        6103
        6404
        0000

03670   7101
        3700
        0507        Reset Shift Count
        4325
        7101        Jump Back to Complement Variables
        3650
        3677
        7117

03700   7100        Return Jump - Check for Mag. Tape Rewind Condition
        6031
        7101
        3500
        6104
        7777
        7101
        0100

03710   0425
        6111
        7100        Return Jump - Check for Mag. Tape Rewind Condition
        6031
        7101        Exit to Type Status for Test #1
        6431
        3712
        0000

03720   0000
        0000
        7625
        7101
        3752
        0452
        7625
        0400

03730   6416
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
03740 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

03750 0000
      0000
      0476
      0000
      0400
      6447
      0000
      0000

03760 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

03770 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04000 3131
      3233
      3435
      3637
      4041
      4243
      4445
      4647

04010 5051
      5253
      5455
      5657
      6061
      6263
      6465
      6667
```

```
04020 7071
      7273
      7475
      7677
      0000
      0000
      0000
      0000

04030 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04040 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04050 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04060 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04070 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
```

```
04100   0400    Entrance for Test #6
        4225    Reset Comparison Data
        4226    Reset Punch Data
        7100    Return Jump - Check for Mag. Tape Rewind Condition
        6031
        7500    Exf. - Reader
        4102
        7600    Input to "A"

04110   0120    Clear Interrupt Lockout
        4216    Store Reader Data
        3614    Compare with Punch Data
        6140    Jump forward on Error
        5612    Incr. Data
        7500    Exf. - Punch
        4104
        2211    Load Punch Data

04120   7677    Output
        0120    Clear Interrupt Lockout
        5606    Incr. Punch Data
        3432    Check Limit
        6012    Jump Forward at End of Block
        6522    Jump Back to Read - Punch
        0000    Comparison Data
        0000    Reader Data

04130   0000    Punch Data
        0000
        0000
        0000
        7720    Constant
        7720    Variable Block Count
        0400
        4311    Reset Comparison Data

04140   4310    Reset Punch Data
        5704    Incr. Block Count
        6004    Jump Forward when Block Count = 0
        6540    Jump back if Block Count < 57(8)
        0000
        0000
        2312    Reset Block Count
        4312

04150   7101    Exit to Type Test #6 Status
        6454
        0000
        2324    Load Reader Data
        7701    Halt
        2327    Load Comparison Data
        7702    Halt
        6443    Jump Back to Resume Test #6
```

```
04160   6544    Jump Back to Resume Test #6
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04170   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04200   2200    Entrance for Test #1
        0000    Comparison Data
        7615    Half Write Indirect (ML. 15 contains 4225)
        0400    Clear "A"
        2303    Load Comparison Data
        3620    Compare Data
        6005
        2216    Load "A" with Error Data

04210   0000    Error Halt
        2310    Load Comparison Data
        7700    Halt
        5712    Incr. Comparison Data
        0277    Save Lower 6 Bits
        4314
        5616    Incr. Test Count
        3614    Check Test Count Limit

04220   6006
        7100    Return Jump - Check for Mag. Tape Rewind Condition
        6031
        7101    Jump back to continue H.W.I.
        4200
        0000    H.W.I. Data
        0400    Reset H.W.I. Data
        4302

04230   4327    Reset Comparison Data
        4203    Reset Test Count
        7101    Jump to Continue Test #1
        0100
        0000    Test Count
        0000
        0000
        0000
```

```
04240   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04250   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04260   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04270   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04300   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

04310   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
04320 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04330 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04340 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04350 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04360 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04370 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
```

```
04400 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04410 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04420 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04430 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04440 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04450 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
```

```
04460 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04470 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04500 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04510 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04520 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

04530 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
```

```
04540  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

04550  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

04560  0000
       0000
       0000
       0000
       0000
       0000
       7100   Return Jump - Check for Mag. Tape Rewind Condition
       6031

04570  7564
       7272   Reader Input - one frame
       0030
       0120   Clear Interrupt Lockout
       2027   Compare Data
       3430
       6012
       2027   Load Error Data

04600  0000   Error Stop
       2030   Load Correct Data
       7777   Halt
       7551
       7600   Search for Sync.
       0120   Clear Interrupt Lockout
       3430
       6504

04610  2030
       1246   Mask Off Lower 6 Bits
       6156
       2240   Load 7400
       3030   Add Punch Data
       4202   Set "OTN"
       7537   Output xx00
       7477
```

```
04620   0120   Clear Interrupt Lockout
        5637   Incr. Frame Count
        6154   Jump to Delays
        5430   Incr. Data
        7530   Read and Punch to End of Block
        7600
        0120   Clear Interrupt Lockout
        4027

04630   3430   Compare Data
        6012
        2027   Load Error Data
        0000   Error Stop
        2030   Load Correct Data
        7777   Halt
        7516
        7600   Search for Sync.

04640   0120   Clear Interrupt Lockout
        3430
        6504
        7512   Punch out from M.L. 30
        7335
        0031
        0120   Clear Interrupt Lockout
        2030

04650   3433   Check Level Limit
        6013
        6527
        7400   Constant
        4102   Exf.  Reader Code
        4104   Exf.  Punch Code
        0377   Spare
        7700   Mask

04660   0000   Frame Count
        0000   Delay #2
        7627   Count for Delay #2
        0027
        0400   Reset Data to zero
        4030
        7101   Ind. Jump to Type Out Test Status
        6443

04670   7512   Output 01XX, 02XX, 03XX
        7310
        0031
        0120   Clear Interrupt Lockout
        5714   Incr. Frame Count
        6452
        7101   Ind. Jump
        5003   Variable Address (4705) (4731) (4746)
```

```
04700   0027    Starting Address - Read
        0030    Starting Address - Punch
        4104    Exf. Code - Punch
        7627    Constant
        4731    Constant
        5724    Incr. Delay #2
        6601
        0400    Reset Delay #2

04710   4327
        5430    Incr. Data
        3432    Check Limit
        6103
        0400    Set Data to Zero
        4030
        5734    Incr. Count for Delay #2
        6002

04720   7106    Ind. Jump to Start of Punch - Read
        2316    Reset Count for Delay #2
        4340
        2317    Change Variable Address at M.L. 4677
        4325
        7101    Ind. Jump to Start of Punch - Read
        4566
        7101    Count for Delay #3

04730   4746    Constant
        5430    Incr. Data
        3432    Check Limit
        6103
        0400    Reset Data to Zero
        4030
        5707    Incr. Count for Delay #3
        6002
                I
04740   7127    Ind. Jump to Start Punch - Read
        2314    Reset Count for Delay #3
        4313
        2313    Change Variable Address at M.L. 4677
        4345
        7122    Ind. Jump to Start Punch - Read
        5622    Incr. Delay #4
        6501

04750   2221    Reset Delay #4
        4217
        5430    Incr. Data
        3432    Check Limit
        6103
        0400    Reset Data to Zero.
        4030
        5614    Incr. Count for Delay #4
```

```
04760   6002
        7106   Ind. Jump to Start Read - Punch
        2212   Reset Count for Delay #4
        4210
        2211   Change Variable Address at M.L. 4677
        4366
        7101   Ind. Jump to Start Read-Punch
        4566

04770   6007   Delay #4
        6007   Constant
        0377   Spare
        7477   Count for Delay #4
        7477   Constant
        5003
        7007   Variable
        7007   Constant

05000   7427   Variable
        7327   Constant
        4677
        2301   Set Ind. Address
        4026
        5707   Delay #1
        6501
        2310   Reset Delay

05010   4312
        5430   Incr. Data
        3432   Check Limit
        6103
        0400   Reset Output Data
        4030
        5716   Incr. Count for Delay #1
        6003

05020   7107   Ind. Jump to Start of Read - Punch
        4705
        2321   Reset Count #1
        4323
        2303   Change Variable Address at M.L. 4677
        4126
        7101   Ind. Jump to Start of Read - Punch
        4566

05030   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
05040  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05050  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05060  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05070  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05100  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05110  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
```

```
05120 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

05130 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

05140 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

05150 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

05160 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000

05170 0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
      0000
```

```
05200  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05210  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05220  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05230  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05240  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05250  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
```

```
05260  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05270  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05300  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05310  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05320  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05330  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
```

```
05340  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05350  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05360  0000
       0000
       0000
       7515   Entrance for Test #5 - Type in 10 characters
       7213
       6512   Term. Address
       0120   Clear Interrupt Lockout
       7512   Output 10 Characters

05370  7445
       7306
       6512
       0120   Clear Interrupt Lockout
       7100   Return Jump - Check for Mag. Tape Rewind Condition
       6031
       6011   Jump Forward to 5407
       6500   Starting Address

05400  4220   Exf. Code - Typewriter Input
       4210   Exf. Code - Typewriter Output
       0000
       0000
       0000
       0000
       0000
       7521   Input up to Max. 127 Characters - followed by manual disconnect.

05410  7217
       6700
       0120   Clear Interrupt Lockout
       3614
       6405
       3212   Set Term. Address for Output
       4204
       7512   Type Out
```

```
05420   7445
        7306
        6500    Variable Address
        0120    Clear Interrupt Lockout
        7100
        6031
        6005
        6500

05430   4220    Exf. Code - Typewriter Input
        4210    Exf. Code - Typewriter Output
        0000
        2304
        4025
        7510    Typewriter Input
        7600
        0120

05440   4125
        0745
        6004
        5425
        6507
        4220
        5425
        4203

05450   7505    Typewriter Output
        7305
        6700
        0120
        6103
        4210
        6500
        7100

05460   6031
        7505
        7445
        0001
        7101    Jump to 74XX Typewriter Output
        5470
        4210
        0000

05470   7447    UC
        7401    T
        7457    LC
        7405    h
        7420    e
        7404    sp
        7411    l
        7430    a
```

```
05500   7421   z
        7425   y
        7404   sp
        7422   d
        7403   o
        7413   g
        7404   sp
        7432   j

05510   7434   u
        7407   m
        7415   p
        7424   s
        7404   sp
        7403   o
        7417   v
        7420   e

05520   7412   r
        7404   sp
        7401   t
        7405   h
        7420   e
        7404   sp
        7435   q
        7434   u

05530   7414    i
        7416   c
        7436   k
        7404   sp
        7423   b
        7412   r
        7403   o
        7431   w

05540   7406   n
        7404   sp
        7426   f
        7403   o
        7427   x
        7442   .
        7404   sp
        7404   sp

05550   7456   0
        7474   1
        7470   2
        7464   3
        7462   4
        7466   5
        7472   6
        7460   7
```

```
05560   7433    8
        7437    9
        7452    -
        7444    /
        7454    '
        7446    +
        7420    .
        7450    ;

05570   7440    ,
        7402    =
        7445    CR
        7447    UC
        7456    )
        7474    *
        7470    @
        7464    #

05600   7462    $
        7466    %
        7472    ¢
        7460    &
        7433    ½
        7437    (
        7452
        7444    ?

05610   7454    "
        7446    o
        7442    .
        7450    :
        7440    ,
        7402    +
        7442    .
        7461    BS

05620   7442    .
        7451    Tab
        7445    CR
        0120    Clear Interrupt Lockout
        0400    Clear "A"
        7101    Exit to Test #6
        4100
        0000

05630   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
05640  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05650  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05660  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05670  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

05700  0001  Store Data in Bank 1
       0400
       0021  Set Ind. Bank to 1
       4211  Reset Data
       2610  Complement Data
       4100
       0000  Variable Address (0000 - 7776)
       5605  Incr. Data

05710  5702  Incr. Address
       6505
       0020  Set Ind. Bank to Zero
       6004
       0000
       0000
       0000
       7500  Sel. Mag. Tape - Binary Mode
```

```
05720  1171
       7500   Rewind Load
       1161
       7500   Check for Load Point
       1141
       7600
       0120
       0740

05730  6505
       6020   Load Point Jump Forward
       0000
       6403
       2301   Change Instruction from 7500 to 6403
       4100
       6033
       0400

05740  0601
       6501
       7500   Check for Parity Error
       1141
       7600
       0120
       0704
       6102

05750  6035
       0400   Set Buffer Entrance
       0105
       5753
       0501   Set Buffer Exit
       0106
       5755
       7500   Write A/D

05760  2111
       0120   Clear Interrupt Lockout
       7300   Initiate Buffer Output
       5762
       5605   Incr. Block Count
       6102
       6006
       7101   Jump

05770  6070
       7700   Block Count
       7700
       6052
       2301   Set Jump Address
       4023
       2304   Reset Block Count
       4306
```

06000	2024	Load Data in "A" at Buffer Interrupt
	7020	Jump to Address in ML.20
	0000	
	7774	
	7774	
	5701	
	6104	
	2304	Reset Trial Count
06010	4304	
	7777	
	2321	
	0701	
	4323	
	7500	Backspace for Re-write
	1121	
	7600	
06020	0120	
	5603	
	6501	
	6452	
	0000	
	0000	
	6403	
	0400	
06030	7101	
	0000	
	0400	
	6403	Changed to 7500 while Tape is Rewinding
	1141	
	7600	
	0740	Check for Load Point
	6510	
06040	2307	Change Jump Address
	4020	
	2314	Change Instruction from 7500 to 6403
	4310	
	0601	Delay
	6501	
	4024	
	7101	Jump to Read or Write
06050	6100	Variable Address (5734)
	6100	
	2301	Change Variable Address
	4023	
	0400	
	0601	
	6501	
	7500	Rewind Load

```
06060   1161
        0120
        2303    Change Instruction from 6403 to 7500
        4330
        2313    Reset Variable Address
        4315
        2024    Load Data
        7020    Jump to Address in ML.20

06070   2204    Set Jump Address
        4023
        2024    Load Data Stored at Time of Interrupt (initial data=level selection)
        7020    Jump to Address Determined by Buffer Interrupt (initial address 0000)
        5734    Address
        0000
        0000
        0000

06100   0400    Start Read of Mag. Tape
        0601
        6501
        0400    Set Buffer Entrance
        0105
        6104
        0501    Set Buffer Exit
        0106

06110   6107
        7500    Read A/D
        2131
        0120    Clear Interrupt Lockout
        7200    Initiate Buffer Input
        6114
        2207    Change Jump Address
        4023

06120   2206    Change 7500 Instruction to 6403
        4100
        6033
        2024    Load Data
        7020    Jump to Address in ML.20
        6130    Constant
        6403    Constant
        0000

06130   0400
        6501
        7500    Check for Parity Error
        1141
        7600
        0120
        0704
        6102
```

```
06140   6062
        0400    Comparison Test
        0021    Set. Ind. Bank to One
        4204    Set Ind. Address
        4212    Set Comparison Data
        2611    Load Comparison Data
        3500    Compare
        0000

06150   6002    OK
        6106    Jump to Error Stop
        5703    Incr. Ind. Address
        5603    Incr. Data
        6507
        6007
        0000    Comparison Data
        2310    Load Error Address (Data should be Complement of Address)

06160   7777    Error Halt
        6507
        6410
        0000
        0020    Set Ind. Bank to Zero
        0400
        6501
        0105    Set Buffer Entrance

06170   6167
        0501    Set Buffer Exit
        0106
        6172
        7500    Read A/D
        2131
        0120
        7200    Initiate Buffer Input

06200   6177
        5613    Incr. Block Count
        6003
        2024    Load Data
        7020    Jump to Address in ML.20
        2206    Set Variable Address
        4023
        2206    Reset Block Count

06210   4204
        2024    Load Data
        7020    Jump to Address in ML' 20
        6250    Constant
        7702    Block Count
        7702
        0000
        0000
```

```
06220   7774
        7774    Backspace Count
        5701    Incr. Backspace Count
        6104
        2304    Reset Trial Count
        4304
        7777    Stop after 3 Trial Re-reads after Parity Error
        2313

06230   0701
        4313
        0400
        0601
        6501
        7500    Backspace One Record
        1121
        7600

06240   0120    Clear Interrupt Lockout
        0400
        6501
        7101    Jump to Read Mag. Tape
        6100
        0000
        0000
        0000

06250   0400
        0601
        6501
        7500    Rewind Load
        1161
        0120
        2213    Change Jump Address
        4023

06260   2210    Change Jump Address
        4100
        6050
        2310    Change Instruction from 6403 to 7500
        4100
        6033
        2024    Load Data
        7020    Jump to Address in ML.20

06270   5734    Constant
        5751    Constant
        0000
        0000
        0000
        0000
        0000
        0000
```

```
06300   4024    Start of Mag. Tape Test
        2210    Set Jump Address
        4023
        2207    Set Block Count
        4100
        5771
        0141    Set Buffer Bank to 1
        7101    Jump to Write

06310   5700
        5734
        7700
        0000
        0000
        0000
        0000
        0071

06320   0060
        0000
        0000
        0000
        0000
        0000
        0000
        0000

06330   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

06340   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

06350   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
06360   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

06370   0000
        0000
        0000
        0000
        0000
        7100    Return Jump - Check for Mag. Tape Rewind Condition
        6031
        7506    Type Out Test Status

06400   7306
        6431
        0120    Clear Interrupt Lockout
        7101    Ind. Jump
        5363    Variable Address (2335) (4200) (2036)
        4210    Exf. Code - Typewriter
        6407    Starting Address
        0045

06410   0047
        0001
        0020
        0024
        0001
        0004
        0064
        0004

06420   0057
        0062    Variable Character (70) (72) (74)
        0004
        0047
        0003
        0042
        0036
        0042

06430   0045
        0474    Entrance From Test #1
        4311
        2215
        4330
        6540
        0470    Entrance from Test #2
        4316
```

```
06440   2211
        4335
        6545
        0462    Entrance from Test #4
        4323
        2205
        4342
        6552

06450   2036    Address
        2301    Address
        5363    Address
        4200    Address
        0472    Entrance From Test #6
        4334
        2303
        4353

06460   6563
        0000
        0000
        0000
        0000
        0000
        0000
        0000

06470   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

06500   2562
```

NUMBER: T040

TITLE: Buffer and Interrupt Test

CATEGORY: 160-A, 161

MINIMUM EQUIPMENT NEEDED:

PURPOSE

The buffer and interrupt test employs the typewriter on the buffer input/output channel to test the buffer as well as manual and buffer interrupts.

DESCRIPTION

The routine starts with an initial type-out, establishes an input buffer of 100_8 characters, then goes into a non-terminating subtract routine to keep the computer running while buffering takes place. Buffer input will terminate when 100_8 characters have been received by the computer or when the typewriter delivers a disconnect signal.

At completion of the buffer input the computer will continue to run the non-terminating routine until it receives a manual interrupt. The manual interrupt causes the computer to set up a buffer output of the same characters that were received by the input buffer previously. Visual check of the type-out will show any errors.

The buffer interrupt which occurs following the buffer input is ignored.
The buffer interrupt following the buffer output causes the computer to again establish an input buffer of 100_8 characters and the entire routine is repeated.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0147

CHECK SUM: 7670

STARTING ADDRESS: 0000

Master clear and run. After the initial type-out, IBA should appear in the status display.

The computer is now ready for the typewriter input.

Upon termination of the buffer input IBA will disappear from the status display.

The computer will continue to run awaiting a manual interrupt. Depress any selective jump switch with any selective stop switch to give a manual interrupt. This should cause OBA to appear in the status display and the typewriter will type out the same characters that were typed into the computer.

T 040 BUFFER AND INTERRUPT TEST

```
0000    7101
0001    0100    Jump to program
0002    0120
0003    2200
0004    7776
0005    0701
0006    6501
0007    6404

0010
0011    0120
0012    7101
0013    0064    Jump to buffer output
0014
0015
0016
0017

0020
0021    0107
0022    4043
0023    0120
0024    7101    (7020) Jump following
0025    0050           buffer interrupt
0026
0027

0030    2044
0031    4024
0032    7104
0033    2045
0034    4024
0035    7101
0036    0002
0037

0040    1000    Buffer input starting address
0041    1000    Buffer output starting address
0042    1100    Buffer input terminating address
0043    2000    Buffer output terminating address
0044    7020
0045    7101
0046
0047
```

```
0050        7500    Select typewriter input
0051        4220
0052        2040    Set up input buffer
0053        0105
0054        0050
0055        2042
0056        0106
0057        0050

0060        7200    Initiate input buffer
0061        0050
0062        7101
0063        0030
0064        7500    Select typewriter output
0065        4210
0066        2041
0067        0105

0070        0064
0071        2043
0072        0106
0073        0064
0074        7300    Initiate output buffer
0075        0064
0076        7101
0077        0033

0100        7500    Select typewriter output
0101        4210
0102        7305    Initial type-out
0103        0143
0104        7101
0105        0050    Jump to buffer input
0106
0107        0110

0110        0045
0111        0047
0112        0023
0113        0057
0114        0020
0115        0013
0116        0014
0117        0006
```

0120	0004
0121	0001
0122	0025
0123	0015
0124	0020
0125	0031
0126	0012
0127	0014
0130	0001
0131	0020
0132	0012
0133	0004
0134	0014
0135	0006
0136	0015
0137	0034
0140	0001
0141	0045
0142	0045
0143	
0144	
0145	
0146	
0147	

LOAD AT ZERO

AFTER STOP

P-SHOULD = 362

A-SHOULD = 447

Z = ALL ZEROS

IF YOU DON'T GET COLLECT STOP

TRY AGAIN OR CHECK READER

NUMBER: T009-F

TITLE: Flexowriter Input, Punch and Verify Test

CATEGORY: 160-A, 161-F

MINIMUM EQUIPMENT NEEDED: 160-A, 161-F

PURPOSE

This routine accepts any ten characters on the Flexowriter keyboard. When the tenth character has been typed in, the Flexowriter will give a carriage return and retype the characters.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

CHECK SUM: 0161

TEN CHARACTER TEST

STARTING ADDRESS: 0300

The center light on the Flexowriter will indicate that an input is requested. The ten characters that are typed in will be retyped on the Flexowriter.

DISCONNECT TEST

STARTING ADDRESS: 0320

This test accepts information until an input disconnect is set. An input disconnect is set by the upper case key followed by the carriage return key. At this time the Flexowriter will type out the same information that had been typed in prior to disconnect. This same information will then appear on the tape punch. The tape "off-line" will be verified by comparing the printed copy.

TYPING TEST

STARTING ADDRESS: 0350

This test accepts information until a carriage return is typed. The same information is then typed on the Flexowriter.

```
00300   7511
        7207
        2012
        7507
        7445
        7303
        2012
        6507

00310   2000
        4221
        4211
        0000
        0000
        0000
        0000
        0000

00320   7516
        7214
        2200
        3612
        6404
        3210
        4205
        4215

00330   7507
        7445
        7303
        2000
        6106
        2000
        4221
        4211

00340   0000
        0000
        7504
        7304
        2000
        6525
        4210
        2000

00350   2200
        2000
        4070
        7507
        7600
        4170
        0745
        6004
```

```
00360   5470
        6505
        4221
        5470
        4204
        4212
        7504
        7304

00370   2000
        6521
        4211
        2000
        7317
```

NUMBER: T-6MT
TITLE: Quality Assurance Magnetic Tape Test
CATEGORY: 160-A, 162, 163 and 164
MINIMUM EQUIPMENT NEEDED: 160-A, 162 or 163, or 164, 161 optional

PURPOSE

Comprehensive test of tape transports as well as thorough test of logic circuits.

DESCRIPTION

1. See flow chart.
2. When SLJ1 is dropped, the program will complete 1 pass and do a rewind unload. Another tape transport may be manually selected as Unit No. 1 and the program re-run from P = 0000. After the second rewind unload, the reels of tape from each unit may be changed and checked for compatability by starting at P = 0444.
3. SLJ4 will keep the program in the servo test. When jump 4 is dropped, the program will advance to the creep test.
4. SLJ2 will keep the program in the creep test. During this test the reels should have a slight forward movement. Dropping jump 2 will allow the program to advance.

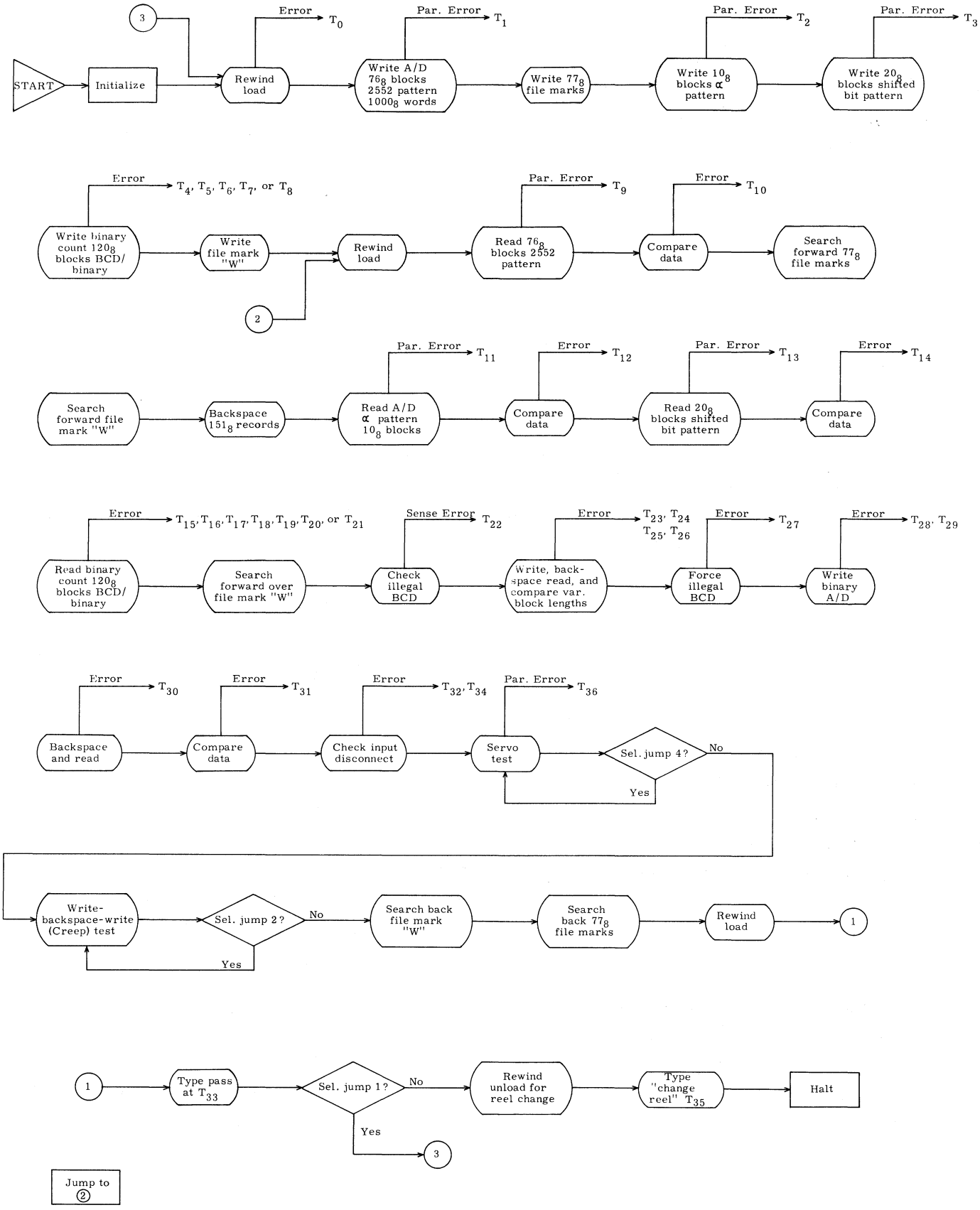
OPERATING INSTRUCTIONS

LOAD INSTRUCTION:	Paper Tape			
LOADING ADDRESS:	1st sect.	0000	2nd sect.	7000
TERMINAL ADDRESS:		1471		7722
CHECK SUM:		0162		0162
STARTING ADDRESS:		0000		

ADDITIONAL INSTRUCTIONS:
1) SLJ1, 2 and 4 on (up).
2) Use typewriter (161) to monitor errors.
3) Program may be run in any available memory bank by manually setting the desired banks.

HALTS	EXPLANATION
SLS 1	"A" = Error data address.

NOTE: For operation without the use of a 161 typewriter, the operator should enter stops in the program at each exit from the main program to the typewriter program. These exits are circled in the program annotation.


3
START
Initialize
Rewind load
Error
T_0
Write A/D 76_8 blocks 2552 pattern 1000_8 words
Par. Error
T_1
Write 77_8 file marks
Write 10_8 blocks ∝ pattern
Par. Error
T_2
Write 20_8 blocks shifted bit pattern
Par. Error
T_3
Write binary count 120_8 blocks BCD/ binary
Error
T_4, T_5, T_6, T_7, or T_8
Write file mark "W"
Rewind load
2
Read 76_8 blocks 2552 pattern
Par. Error
T_9
Compare data
Error
T_{10}
Search forward 77_8 file marks
Search forward file mark "W"
Backspace 151_8 records
Read A/D ∝ pattern 10_8 blocks
Par. Error
T_{11}
Compare data
Error
T_{12}
Read 20_8 blocks shifted bit pattern
Par. Error
T_{13}
Compare data
Error
T_{14}
Read binary count 120_8 blocks BCD/ binary
Error
T_{15}, T_{16}, T_{17}, T_{18}, T_{19}, T_{20}, or T_{21}
Search forward over file mark "W"
Check illegal BCD
Sense Error
T_{22}
Write, back-space read, and compare var. block lengths
Error
T_{23}, T_{24} T_{25}, T_{26}
Force illegal BCD
Error
T_{27}
Write binary A/D
Error
T_{28}, T_{29}
Backspace and read
Error
T_{30}
Compare data
Error
T_{31}
Check input disconnect
Error
T_{32}, T_{34}
Servo test
Par. Error
T_{36}
Sel. jump 4?
No
Yes
Write-backspace-write (Creep) test
Sel. jump 2?
No
Yes
Search back file mark "W"
Search back 77_8 file marks
Rewind load
1
1
Type pass at T_{33}
Sel. jump 1?
No
Yes
3
Rewind unload for reel change
Type "change reel" T_{35}
Halt
Jump to ②

```
00000   7110    Jump to 0100 Ind.
        2552    Constant
        2000    Variable Adr.
        3000    Constant
        2000    Constant
        7701    76 Block count #1
        7700    77 File mark count
        0000    delay count

00010   0100
        3000    Variable Adr.
        4000    Constant
        7770    Consecutive 1's or 0's count
        0000     information
        7767    -10 Block Count
        4000    Variable Adr.
        4014    Constant

00020   0000
        0000
        0000
        0000
        0001    Variable #2
        7757    -20 Block count Var. #3
        0000    Binary count Var. #4
        4015    Variable

00030   4115    Constant
        4015    Constant
        4114    Constant
        7720    Variable #6
        5000    Variable
        6000    Constant
        5000    Constant
        7620    Backspace count Var. #8

00040   2111    Constant
        2511    Constant
        0601    Constant Ind. Adr.
        5015    Variable #9
        5015    Constant
        4114    Constant
        6000    Variable #10
        7000    Constant

00050   0000    Variable #11
        6700    Constant
        7750    Pass count #12
        7626    Constant
        1101    Ind. Adr.
        1076    Ind. Adr.
        7635
        7773    Shift count (Var)
```

```
00060   0000    Reserved for Inp. disconnect test
        7655    Ind. address - Constant
        0000    Inx exit
        7534    Conversion jump address
        0000    Correct data
        0000    Data address
        0505    exit for T10
        0606    exit for T12

00070   0650    exit for T14
        0724    exit for T18
        0761    exit for T21
        1110    exit for T26
        1235    exit for T31
        1335
        0076
        4654    Random number

00100   2004    Reset Var. to 2000
        4002
        0576    Reset - 76 Block count
        4005
        0577    Reset file mark count
        4006
        0400    Reset delay
        4007

00110   4014    Reset ∝
        4026    Reset binary count
        4050    Reset Var. #11
        2003    Reset Var. to 3000
        4011
        0507    Reset 1's or 0's count
        4013
        0510    Reset -10 Block count

00120   4015
        2012    Reset Var. to 4000
        4016
        0401    Reset Var. #2
        4024
        0520    Reset -20 Block count
        4025
        2031    Reset Var. to 4015

00130   4027
        0550    Reset Var. #6
        4033
        2036    Reset Var. #7
        4034
        2053    Reset backspace count
        4037
        2044    Reset Var. #9
```

```
00140   4043
        2035    Reset Var. #10 to 6000
        4046
        0527    Reset pass count #12
        4052
        2041    Reset instruction
        4142
        2036    Reset Var. Start Adr. (read)

00150   4154
        2035    Reset Var. Start Adr. (write)
        4155
        7101    Jump to start test
        0200
        0000
        0000
        0000

00160   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00170   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00200   7554    Sel. Odd parity
        7554    Check for binary mode
        7600
        0301
        6103
        7101
        7157    To (Tc) error select
        2001    Set data to 2552 from ML 2000 to 3000

00210   4102
        5402
        3403
        6504
        2004    Reset Adr. Variable
        4002
        7540    Exf. Rewind load
        7536    Check for load point
```

```
00220   7600
        0340
        6503
        5407    Prog. delay
        6501
        7532    Exf. write A/D
        7332    Output 2000 to 3000
        3000

00230   7525    Check for Par. error write
        7600
        0204
        6003
        7101
        7013    To (T1) Par. error write
        5405    Increase Block count
        6512

00240   0576    Reset -76 Block count
        4005
        7517    Exf - write file mark
        5407
        6501
        5407
        6501
        5406    Increase file mark count

00250   6506
        0577    Reset file mark count
        4006
        6107
        1171    Odd parity
        1141    Status
        1161    Rewind load
        2111    Write A/D

00260   2000    Starting Adr. write
        1111
        2414    Load Compl. ∝
        4111    Store pattern from 3000 thru 3777
        5411
        3412
        6012
        5413

00270   6506
        2014
        4111
        0507
        4013
        5411
        3412
        6515
```

```
00300   0507    Reset Consecutive 1's or 0's count
        4013
        2003    Reset Var. Adr. to 3000
        4011
        2414    Compl. A
        4014
        7553    EXF - write A/D
        7353    Output 3000 thru 3777

00310   4000
        7553    Status - Check for parity error
        7600
        6003
        7101
        7016    To (T2) Parity error write
        5415    Increase Block count
        6535

00320   0510    Reset Block count to -10
        4015
        2024    Store one bit left shifted from 4000 thru 4013
        4116
        4424
        5416
        3417
        6505

00330   2012    Reset Var. Ind. Adr.
        4016
        7527    EXF write A/D
        7330    Output 4000 thru 4013
        4014
        7527    Status - Check for parity error write
        7600
        0204

00340   6003
        7101
        7021    To (T3) Parity error write
        5425
        6512
        0520    Reset Block count to -20
        4025
        5426    Store binary count 1 to 77 from 4015 thru 4113

00350   4127
        5427
        3432
        6504
        0400    Reset Variable #4
        4026
        2031    Reset Variable Adr. to 4015
        4027
```

```
00360   6106
        2111    Write A/D
        3000    Starting Adr. write
        4000    Starting adr. write
        1141    Status
        0000
        7575    EXF - even parity
        7575    Check for BCD Mode

00370   7600
        0301
        6003
        7101
        7220    to (T4) error BCD Status
        7570    EXF write 6 bits
        7370    Output 4015 thru 4113
        4114

00400   7564    EXF Status
        7600
        4205    Store status response
        0204    Check for parity error
        6004
        7101
        7024    To (T5) parity error write
        0001    Response data

00410   2301
        0210    Check for Illegal BCD
        6003
        7101
        7257    To (T6) error Ill. BCD
        7552    EXF Odd parity
        7546    Check for binary mode
        7600

00420   6003
        7101
        7162    To (T7) error binary status
        7542    Write 6 bit
        7342    Output from 4015 thru 4113
        4114
        7536    Check for parity error
        7600

00430   6003
        7101
        7027    To (T8) parity error write
        5433    Increase -50 Block count
        6546
        0550    Reset Block count to -50
        4033
        7526    EXF file mark "W"
```

```
00440   5407
        6501
        5407
        6501
        7524    Rewind load
        7517    Check for load point
        7600
        0740

00450   6503
        5407
        6505
        7516    EXF - Read A/D
        7216    Input 5000 thru 5777
        6000
        7506    Check for parity error
        7600

00460   6020
        7101
        7073    To (T9) parity error read
        1172    BCD mode
        1141    Status
        1111
        4015    Starting Adr.
        1171    Binary mode

00470   1161    Rewind load
        2131    Read A/D
        5000    Starting Adr.
        0000
        0000
        0000
        0000
        0000

00500   2102    Compare 2xxx with 5xxx
        3534
        6003
        7101
        7610    To (T10) comparison error
        5402
        5434
        3435

00510   6510
        2004    Reset Var. Adr. to 2000
        4002
        2036    Reset Var. Adr. to 5000
        4034
        5405    Incr. -76 Block count
        6543
        0576    Reset -76 Block count
```

```
00520   4005
        7553    Search forward for 77 file marks
        5407
        6501
        5407
        6501
        7547    Check for file mark
        7600

00530   0720
        6503
        5406    Incr. file mark count
        6512
        0577    Reset file mark count
        4006
        7536    Search forward for file mark "W"
        5407

00540   6501
        5407
        6501
        7532    Check for file mark
        7600
        0720
        6503
        5407

00550   6501
        7525    Backspace (151)8 records
        7600
        5407
        6501
        5437
        6505
        2053    Reset backspace count

00560   4037
        5407
        6501
        7514    Read A/D beginning at∝ information
        7214    Input from 5000 thru 5777
        6000
        7507    Check for parity error read
        7600

00570   0204
        6010
        7101
        7076    To (T11) parity error read
        1131
        1141
        1121
        2131
```

```
00600   5000
        2511    Compare "d" information (Instruction changes to 2111)
        3534
        6003
        7101
        7621    To (T12) comparison error
        5411
        5434

00610   3435
        6510
        2003    Reset Var. Adr. to 3000
        4011
        2036    Reset Var. Adr. to 5000
        4034
        2315    Check instruction
        3441

00620   6104
        2040    Change Instruction from 2511 to 2111
        4321
        6103
        2041    Change Instruction from 2111 to 2511
        4324
        5415    Incr. -10 Block count
        6544

00630   0510    Reset Block count to -10
        4015
        7541    EXF - Read A/D
        7241
        5014
        7541    Check for parity error
        7600
        0204

00640   6003
        7101
        7101    To (T13) Par. error Read
        2116    Compare Data
        3534
        6003
        7101
        7632    To (T14) Comp. Error

00650   5434    Incr. Ind. Adr.
        5416    Incr. Ind. Adr.
        3417
        6510
        2012    Reset Ind. Addresses
        4016
        2036
        4034
```

```
00660   5425    Incr. Block count
        6527
        0520    Reset -20 Block count
        4025
        7511    Select BCD Mode
        7511    Check for BCD Mode
        7600
        0301

00670   6010
        7101
        7223    To (T15) Error BCD Status
        2131
        5000
        1172
        1141
        0000

00700   7566    EXF - Read 6 bit
        7266
        5114
        7565    Check for parity error
        7600
        0204
        6003
        7101

00710   7104    To (T16) Par. Error Read
        7557    Check for Ill. BCD
        7600
        0210
        6003
        7101
        7262    To (T17) Error Ill. BCD
        2127    Compare Data

00720   3543
        6003
        7101
        7643    To (T18) Comp. Error
        5443    Incr. Ind. Addresses
        5427
        3445    Check 4114 limit
        6510

00730   2044    Reset Ind. Addresses
        4043
        2031
        4027
        7535    Select Bin. Mode
        7533    Check for Bin. Mode
        7600
        0201
```

```
00740   6003
        7101
        7165    To (T19) Error Bin Status
        7523    EXF - Read 6 bit
        7223
        5114
        7522    Check for parity error
        7600

00750   0204
        6003
        7101
        7107    To (T20) par. error read
        2143    Compare Data
        3527
        6003
        7101

00760   7654    To (T21) Comp. Error
        5443    Incr. Ind. Addresses
        5427
        3445    Check limit 4114
        6510
        6007
        1131
        5015

00770   1141
        1171
        0000
        0000
        2044    Reset Ind. Addresses
        4043
        2031
        4027

01000   5433    Incr. Block count
        6003
        7101    Loop back on test
        0664
        0550    Reset Block count
        4033
        2050    Store Number Pattern from 6000 through 6777
        3077

01010   4050
        4146
        5446
        3447
        6506
        0400    Reset Variable #11
        4050
        2035    Reset Ind. Adr.
```

```
01020   4046
        7557    Space over file mark "W"
        5407
        6501
        5407
        6501
        7545    Select BCD Mode
        7545    Check for BCD Mode

01030   7600
        0201
        6103
        7101
        7226    To (T22) Error BCD Status
        7540    Write A/D
        7340
        7000

01040   7534    Check for parity error
        7600
        0204
        6003
        7101
        7032    To (T23) par. error write
        7526    Check for Ill. BCD
        7600

01050   0210
        6003
        7101
        7265    To (T24) error Ill. BCD
        7523    Backspace 1 record
        7600    Delay for backspace
        0600
        0103

01060   0701
        6501
        7516    EXF - READ A/D
        7216
        6000    Term. Address
        7507    Check for Parity Error
        7600
        0204

01070   6013
        7101
        7112    To (T25) par. error read
        1172    EXF - Codes
        1141
        2111
        6000
        1121
```

```
01100   2131
        5000
        1131
        2134    Compare Data
        3546
        6003
        7101
        7665    To (T26) Comp. Error

01110   5434    Incr. Ind. Addresses
        5446
        3447
        6510
        2316    Shorten Block length by (0010)8
        3217
        4320
        2036    Reset Var. Adr.

01120   4034
        2035
        4046
        2322    Shorten Block length by (0010)8
        3210
        4324
        3435    Check Limit
        6006

01130   0600
        0600
        7101
        1026
        0010
        2035    Reset Block lengths to (1000)8
        4340
        4046

01140   2036
        4340
        4034
        7511    EXF - Write 6 bit
        7311    Write Ill. BCD
        1162
        7510    Check for Ill. BCD
        7600

01150   0715
        6013
        7101
        7333    To (T27) Error Ill. BCD not detected
        1111
        1157
        1141
        0077
```

```
01160   0000
        0010
        0000
        0000
        7560    Select Bin Mode
        7560    Check for bin mode
        7600
        6003

01170   7101
        7170    To (T28) Error Bin Status
        7556    EXF 2 Write A/D
        7354
        3000
        7550    Check for Par. Error
        7600
        0204

01200   6003
        7101
        7035    To (T29) Par. Error Write
        5407
        6501
        7541    Backspace 1 record
        7600
        5407

01210   6501
        0525    Condition Disconnect Adr.
        4135
        7536    Check Input Disconnect
        7236
        6500
        4060    Store Term. +1
        0600

01220   0600
        0600
        7523    Check for Par. Error
        7600
        0204
        6003
        7101
        7115    To (T30) Par. Error Read

01230   2134    Compare Data
        3401
        6003
        7101
        7666    To (T31) Comp. Error
        5434    Incr. Ind. Adr.
        3435    Check Limit
        6507
```

```
01240   2134    Check for zero's stored at disconnect
        6012
        7101
        7320    To (T32) Error Inp. disconnect
        11 1
        1141
        1121
        2000

01250   2111
        2131
        5000
        2036    Reset Var. Adr.
        4034
        7101    Jump to continue Input disconnect check
        1335
        0600

01260   7551    Backspace 1 file mark
        5407
        6501
        7545    Check for file mark
        7600
        0320
        6503
        7542    Backspace 77(8) file marks

01270   5407
        6501
        7536
        7600
        0320
        6503
        5406
        6510

01300   0577    Reset file mark count
        4006
        7530    Rewind load
        7525    Check for load point
        7600
        0340
        6503
        7101

01310   7710    To (T33) type pass count
        7710    Optional jump
        0200
        7520    Rewind unload
        7514    Check for not ready
        7600
        0342
        6503
```

```
01320   0600
        0600
        7101
        7367        To (T35) type out reel change
        7777
        7101        Jump to beginning of read
        0444
        1171

01330   1141
        1121
        1161
        1151
        0000
        2060        Check input disconnect
        0701
        3435        Check terminal

01340   6103
        7101        Jump to servo test
        1400
        7101        Jump to (T34) error Inp. Disc
        7323
        7101        Jump to continue program
        1260
        0271

01350   7110
        2552
        2000
        3000
        2000
        0000
        0000
        2102

01360   4103
        5403
        5402
        3404
        6505
        2315
        4000
        2316

01370   4001
        2317
        4002
        2320
        4003
        2321
        4004
        7020
```

```
01400   0507    Set loop count
        4221
        0507    Set block count
        4206
        7540    Sel. odd parity
        7540    Write - A/D
        7335
        7000

01410   5600    Incr. Block count
        0000
        6505
        0507    Reset block count
        4303
        7531    Backspace
        7600
        5706    Incr. Backspace count

01420   6503
        5600    Incr. loop count
        0000
        7145
        7521    Write - A/D
        7316
        3000
        7520    Status

01430   7600
        0204
        6003
        7101    Jump to (T36)
        7040
        7511    Backspace
        7600
        7720    Sel. jump 2 for creep test (should have small net forward creep)

01440   1424
        7101    Continue test
        1260
        2000    Starting Adr.
        1171    Odd parity
        2111    Write
        2121    Backspace
        1141    Status

01450   0501    Shorten backspace count
        5336
        0501    Shorten block count
        5351
        3600    Check limit
        0500
        6554
        2200    Reset instructions
```

```
01460   0507
        4357
        4347
        7740    Sel. Jump 4 (up keeps program in servo test)
        1400
        7101    Jump to creep test
        1424
        0000

01470   1450
        5077
```

07000	7555	EXF - Type
	7445	CR
	7415	P
	7442	.
	7420	E
	7442	.
	7431	W
	7442	.
07010	7445	CR
	7101	
	0236	Var. Address
	2233	Ent. for T_1
	4302	
	6515	
	2231	Ent. for T_2
	4305	
07020	6520	
	2227	Ent. for T_3
	4310	
	6523	
	2225	Ent. for T_5
	4313	
	6526	
	2223	Ent. for T_8
07030	4316	
	6531	
	2221	Ent. for T_{23}
	4321	
	6534	
	2217	Ent. for T_{29}
	4324	
	6537	
07040	2217	T_{36}
	4327	
	6542	
	0000	
	0000	
	0000	
	0236	Ret. for T_1
	0316	Ret. for T_2
07050	0343	Ret. for T_3
	0410	Ret. for T_5
	0433	Ret. for T_8
	1046	Ret. for T_{23}
	1203	Ret. for T_{29}
	4210	EXF - Code
	0000	Spare
	1435	

```
07060   7555    EXF - Type
        7445    CR
        7415    P
        7442    .
        7420    E
        7442    .
        7412    R
        7442    .

07070   7445    CR
        7101
        0500    Var. address
        2233    Ent. for T9
        4302
        6515
        2231    Ent. for T11
        4305

07100   6520
        2227    Ent. for T13
        4310
        6523
        2225    Ent. for T16
        4313
        6526
        2223    Ent. for T20

07110   4316
        6531
        2221    Ent. for T25
        4321
        6534
        2217    Ent. for T30
        4324
        6537

07120   0000    Spares
        0000
        0000
        0000
        0000
        0000
        0500    Ret. for T9
        0601    Ret. for T11

07130   0643    Ret. for T13
        0711    Ret. for T16
        0754    Ret. for T20
        1103    Ret. for T25
        1230    Ret. for T30
        4210    EXF - Code
        0000    Spare
        0000    Spare
```

07140	7540	EXF - Type
	7445	CR
	7420	E
	7442	°
	7424	S
	7420	E
	7411	L
	7404	SP
07150	7423	B
	7414	1
	7406	N
	7442	·
	7445	CR
	7101	
	0207	Var. Address
	2215	Ent. for T_0
07160	4302	
	6521	
	2213	Ent. for T_7
	4305	
	6524	
	2211	Ent. for T_{19}
	4310	
	6527	
07170	2207	Ent. for T_{28}
	4313	
	6532	
	4210	EXF - Code
	0207	Ret. for T_0
	0423	Ret. for T_7
	0743	Ret. for T_{19}
	1172	Ret. for T_{28}
07200	4210	EXF - Code
	7533	EXF - Type
	7445	CR
	7420	E
	7442	°
	7424	S
	7420	E
	7411	L
07210	7404	SP
	7423	B
	7416	C
	7422	D
	7442	·
	7445	CR
	7101	
	0375	Var. Address

```
07220   2211    Ent. for T4
        4302
        6521
        2207    Ent. for T15
        4305
        6524
        2205    Ent. for T22
        4310

07230   6527
        0375    Ret. for T4
        0700    Ret. for T15
        1035    Ret. for T22
        4210    EXF - Code
        0000
        0000
        0000

07240   7533    EXF - Type
        7445    CR
        7420    E
        7442    .
        7414    I
        7411    L
        7411    L
        7442    .

07250   7423    B
        7416    C
        7422    D
        7442    .
        7445    CR
        7101
        0415    Var. Address
        2211    Ent. for T6

07260   4302
        6521
        2207    Ent. for T17
        4305
        6524
        2205    Ent. for T24
        4310
        6527

07270   0415    Ret. for T6
        0717    Ret. for T17
        1054    Ret. for T24
        4210    EXF - Code
        0000
        0000
        0000
        0000
```

07300	7530	EXF - Type
	7445	CR
	7420	E
	7442	.
	7414	I
	7406	N
	7415	P
	7442	.
07310	7422	D
	7414	I
	7424	S
	7416	C
	7442	.
	7445	CR
	7101	
	1253	Var. Address
07320	2206	Ent. for T_{32}
	4302	
	6522	
	2204	Ent. for T_{34}
	4305	
	6525	
	1253	Ret. for T_{32}
	1345	Ret. for T_{34}
07330	4210	EXF - Code
	0000	Spare
	0000	Spare
	7531	Ent. for T_{27}
	7445	CR
	7414	I
	7411	L
	7411	L
07340	7442	.
	7423	B
	7416	C
	7422	D
	7442	.
	7406	N
	7403	O
	7401	T
07350	7404	SP
	7422	D
	7420	E
	7401	T
	7420	E
	7416	C
	7401	T
	7420	E

```
07360   7422    D
        7445    CR
        7101
        1164    Exit for T27
        4210    EXF -Code
        0000    Spare
        0000    Spare
        7520    EXF - Type Ent. for T35

07370   7445    CR
        7416    C
        7405    H
        7430    A
        7406    N
        7413    G
        7420    E
        7404    SP

07400   7412    R
        7420    E
        7420    E
        7411    L
        7445    CR
        7101
        1324    Exit for T35
        4210    EXF - Code

07410   7574
        7445    CR
        7416    C
        7403    O
        7407    M
        7415    P
        7442    .
        7445    CR

07420   7416    C
        7403    O
        7412    R
        7412    R
        7420    E
        7416    C
        7401    T
        7404    SP

07430   0504    Set Shift Count
        4057
        4464    Shift correct Data
        4464
        4464
        0207    Save lower 3 bits
        6103    Conversion
        0456    Zero
```

```
07440   6132
        0701
        6103
        0474    one
        6126
        0701
        6103
        0470    two

07450   6122
        0701
        6103
        0464    three
        6116
        0701
        6103
        0462    four

07460   6112
        0701
        6103
        0466    five
        6106
        0701
        6103
        0472    six

07470   6102
        0460    seven
        0600    spare
        0600    spare
        3211
        4202
        7506
        7400    74xx

07500   5457    Incr. shift count
        6007
        7101
        7432    back to conversion
        4210    EXF - Code
        7400    Constant
        0000    spare
        0000    spare

07510   0504    Reset Shift Count
        4057
        7564    EXF - Type
        7445    CR
        7420    e
        7412    r
        7412    r
        7403    o
```

```
07520   7412    r
        7404    SP
        7404    SP
        7404    SP
        4476    Shift error data
        4476
        4476
        0207    Save lower 3 bits

07530   6103
        0456    Zero
        6132
        0701
        6103
        0474    one
        6126
        0701

07540   6103
        0470    two
        6122
        0701
        6103
        0464    three
        6116
        0701

07550   6103
        0462    four
        6112
        0701
        6103
        0466    five
        6106
        0701

07560   6103
        0472    six
        6102
        0460    seven
        0600    spare
        0600    spare
        3211
        4202

07570   7506    EXT - Type
        7400    74xx
        5457    Incr. shift count
        6005
        7101
        7524
        4210    EXF - Code
        7400    Constant
```

```
07600   2065    Load Data Address
        7701    Sel. Stop
        7062    Exit (Txx)
        0000
        0000
        0000
        7101    Jump to Conversion
        7410

07610   2102    Ent. for T10
        4064
        2002    Load Address
        4065
        2134    Load (Ind.) error data
        4076
        2066    Set exit
        4062

07620   6512
        2111    Ent. for T12
        4064
        2011
        4065
        2134    Load (Ind.)error data
        4076
        2067    Set exit

07630   4062
        6523
        2116    Ent. for T14
        4064
        2016
        4065
        2134
        4076

07640   2070
        4062
        6534
        2127    Ent. for T18
        4064
        2027
        4065
        2143

07650   4076
        2071
        4062
        6545
        2127    Ent. for T21
        4064
        2027
        4065
```

```
07660   2143
        4076
        2072
        4062
        6556
        2146    Ent. for T26
        4064
        2046

07670   4065
        2134
        4076
        2073
        4062
        6567
        2001    Ent. for T31
        4064

07700   2034
        4065
        2134
        4076
        2074
        4062
        6511
        0000
07710   7511    Ent. for "Pass" Type
        7445
        7415
        7430
        7424
        7424
        7445
        7101

07720   1311
        4210
```

NUMBER: T071

TITLE: Magnetic Tape Test

CATEGORY: 160-A and/or 162, 163, 164

MINIMUM EQUIPMENT NEEDED: 160-A and/or 162, 163, 164

PURPOSE

This test is a six bit test of the tape handler that uses a bit by bit comparison.

DESCRIPTION

1. See flow chart.
2. The sequence of numbers written are of a random sort being generated by starting with 0000 in the first address and octal 0011 being added to the contents of each sequential address for 1777 octal address.
3. The initial block written is 10_8 words in length and each following block is increased by 10_8 words with a filemark being written after each 10_8 blocks. The maximum number of blocks that can be written is 200_8.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000 In P register

TERMINAL ADDRESS: 0445

CHECK SUM: 4037

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS:
1) Tape units at load point.
2) Select switches in sequential order.
3) Binary/Coded switch in binary position.
4) SLS switches 1, 2 and 3 in up position.
5) Place in A number of units to be operated.
6) Run.

RESTART ADDRESS: 0200 in P
1) After parity error
2) Clear computer
3) Manually load 0000 into locations 0005 and 0006

RESTART ADDRESS: 0000 in P 1) After compare error
2) Clear computer

HALTS	EXPLANATION
	In the event a parity error occurs the test will rewrite or reread, in either case, three times and then halt. If a rewrite or reread is successful before three operations the test will continue its normal sequence.
7701	Parity error on write
7702	Parity error on read
7703	Comparison error
7705	Parity on write non-stop

PROGRAM FLOW CHART

0007 - Number of Units

0013 - Number of Blocks Maximum 200

0014 - Number of filemarks counter

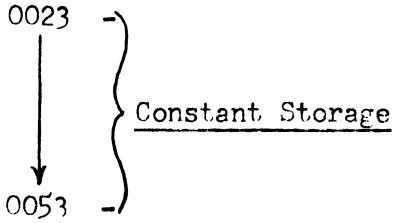
0015 - Number of filemarks constant

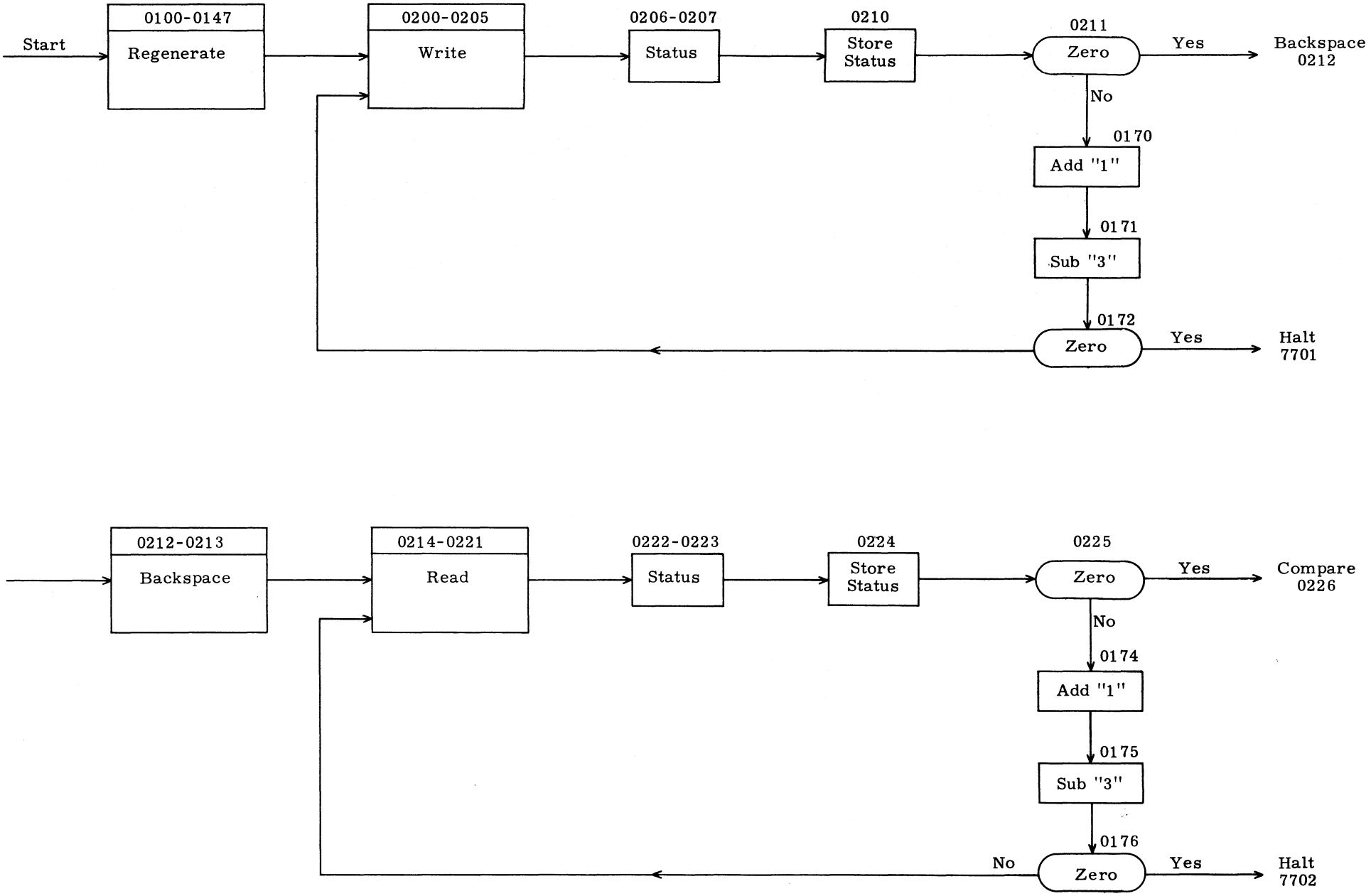
0016 - Status for Write

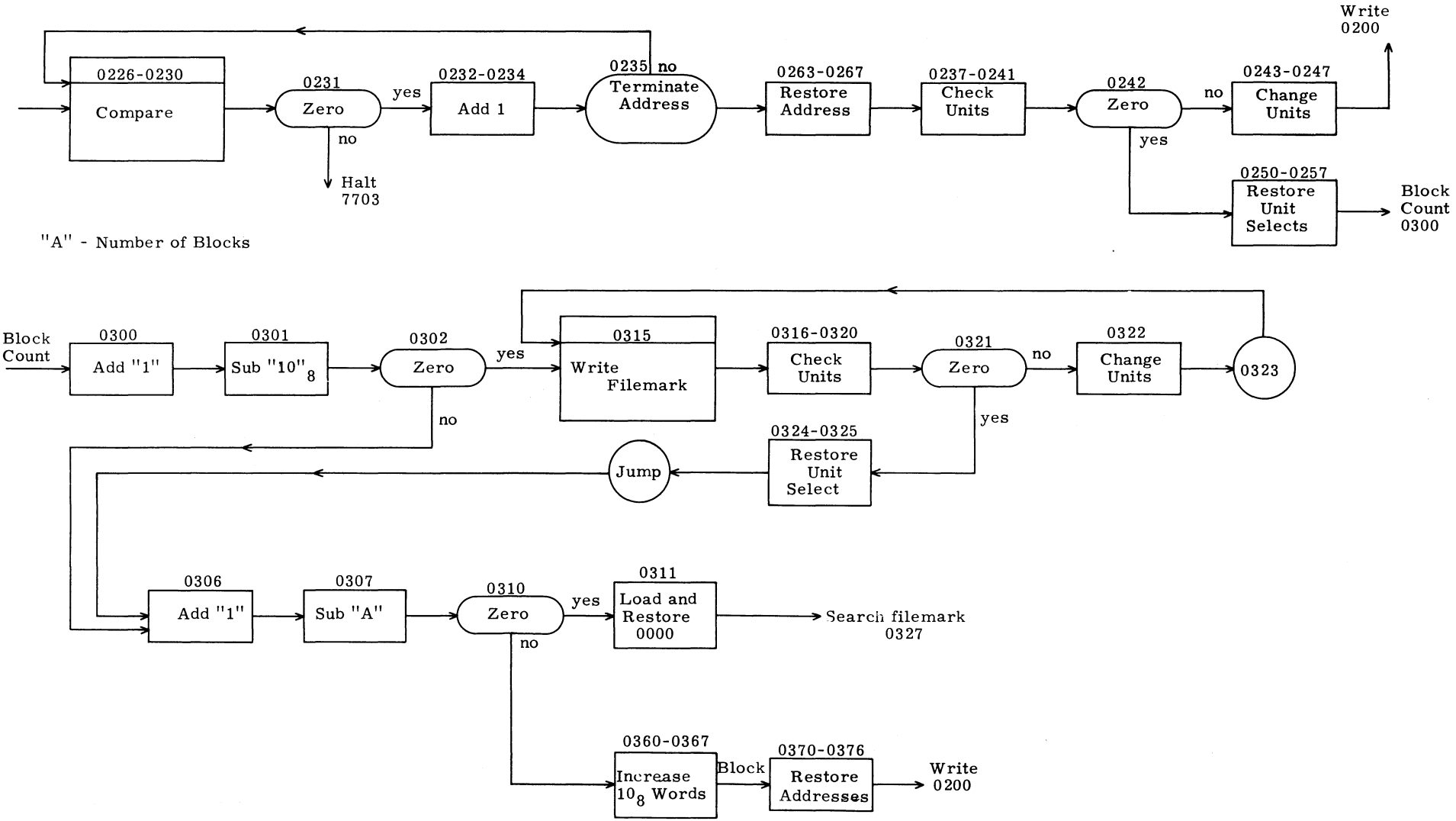
0017 - Status for Read

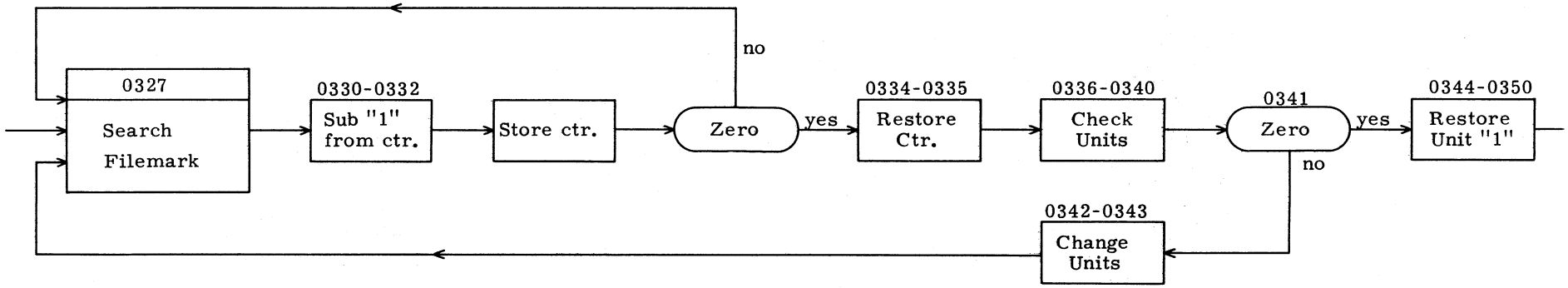
0021 - Address for Compare error - write

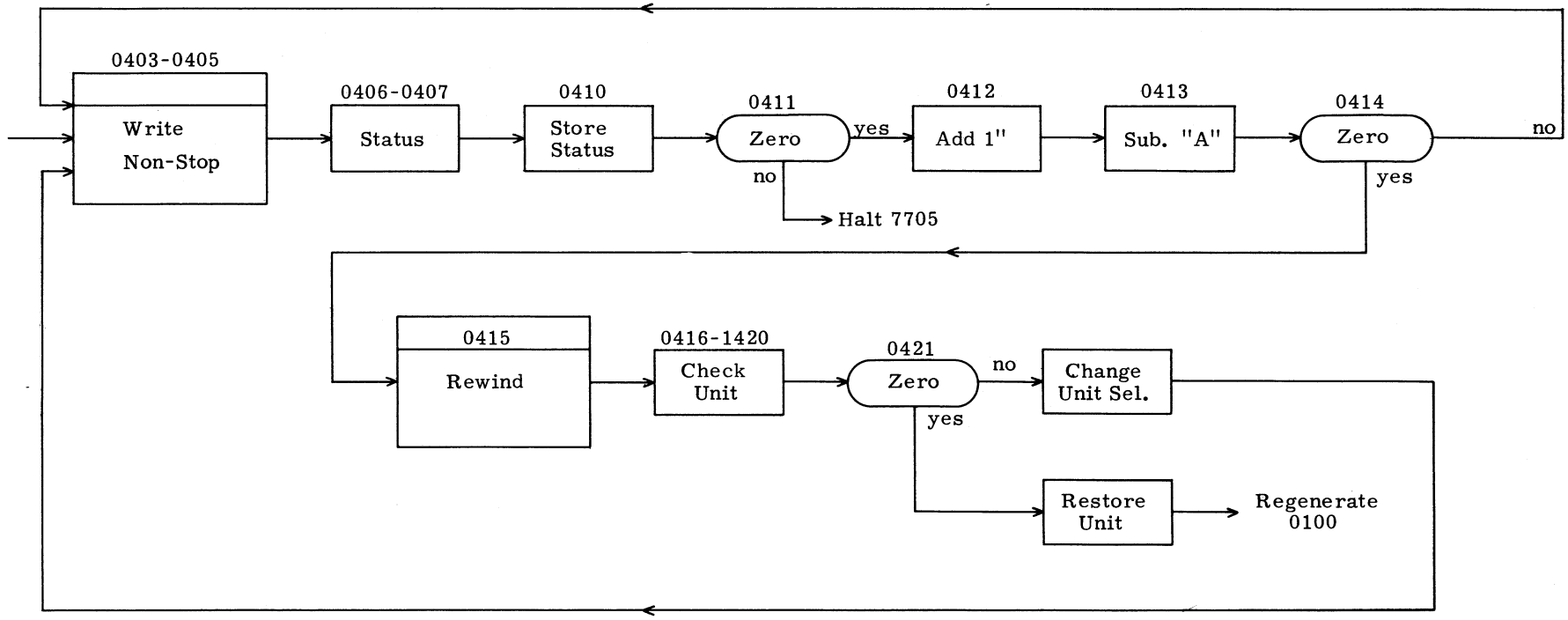
0022 - Address for Compare error - read




Start
0100-0147
Regenerate
0200-0205
Write
0206-0207
Status
0210
Store Status
0211
Zero
Yes
Backspace 0212
No
0170
Add "1"
0171
Sub "3"
0172
Zero
Yes
Halt 7701
0212-0213
Backspace
0214-0221
Read
0222-0223
Status
0224
Store Status
0225
Zero
Yes
Compare 0226
No
0174
Add "1"
0175
Sub "3"
0176
No
Zero
Yes
Halt 7702


0226-0230
Compare
0231
Zero
yes
no
Halt
7703
0232-0234
Add 1
0235
no
Terminate
Address
0263-0267
Restore
Address
0237-0241
Check
Units
0242
Zero
no
yes
0243-0247
Change
Units
Write
0200
0250-0257
Restore
Unit
Selects
Block
Count
0300
"A" - Number of Blocks
Block
Count
0300
Add "1"
0301
Sub "10"8
0302
Zero
yes
no
0315
Write
Filemark
0316-0320
Check
Units
0321
Zero
no
yes
0322
Change
Units
0323
0324-0325
Restore
Unit
Select
Jump
0306
Add "1"
0307
Sub "A"
0310
Zero
yes
no
0311
Load and
Restore
0000
Search filemark
0327
0360-0367
Increase
108 Words
Block
0370-0376
Restore
Addresses
Write
0200


0327
Search
Filemark
0330-0332
Sub "1"
from ctr.
Store ctr.
Zero
no
yes
0334-0335
Restore
Ctr.
0336-0340
Check
Units
0341
Zero
yes
no
0344-0350
Restore
Unit "1"
0342-0343
Change
Units


0403-0405
Write
Non-Stop
0406-0407
Status
0410
Store
Status
0411
Zero
yes
no
Halt 7705
0412
Add 1"
0413
Sub. "A"
0414
Zero
yes
no
0415
Rewind
0416-1420
Check
Unit
0421
Zero
no
yes
Change
Unit Sel.
Restore
Unit
Regenerate
0100

TAPE TEST "X" UNITS
Place number of units in "A" register -- Run

0000	6002	— Set A = No of units	
0001	4007	Store Number of Units	
0002	7101		
0003	0100	Starting Address	
0004	0000		
0005	0000	Number of Times Rewrite	
0006	0000	Number of Times Reread	
0007	0000		
0010	0000		
0011	0000		
0012	0000		
0013	0200	Number of Blocks	
0014	0020	Search Filemarks Counter	
0015	0020	Search Filemarks Constant	
0016	0000	Store Status Wrote	
0017	0000	Store Status Read	
0020	0000		
0021	2000	Output address	comparison error
0022	4000	Input address	
0023	2010		
0024	4010		
0025	2010		
0026	4010		
0027	2000		
0030	4000		
0031	1111	2111	Change for A/D
0032	1121	2121	Change for A/D
0033	1131	2131	Change for A/D
0034	1141	2141	Change for A/D
0035	1161	2161	Change for A/D
0036	0000		
0037	0000		
0040	0270		CONSTANTS
0041	0271		
0042	0272		
0043	0273		
0044	0202		
0045	0216		
0046	0401		
0047	0402		
0050	0443		
0051	0444		
0052	3777		
0053	0445		
0054	0000		
0055	0000		
0056	0000		
0057	0000		

```
0060    0000
0061    0000
0062    0000
0063    0000
0064    0000
0065    0000
0066    0000
0067    0000

0070    0000
0071    0000
0072    0000
0073    0000
0074    0000
0075    0000
0076    0000
0077    0000

0100    0400    D.BANK = 0
0101    4010
0102    4011
0103    4012
0104    4016
0105    4017
0106    4020
0107    2025

0110    4023
0111    4144
0112    2026
0113    4024
0114    4145
0115    2027
0116    4021
0117    2020

0120    4121
0121    2021
0122    3750
0123    6006                                    Initialize Test
0124    2020.
0125    0611
0126    4020
0127    5421

0130    6511
0131    2027
0132    4021
0133    2030
0134    4022
0135    2031
0136    4140
0137    2032
```

0 → store addr.

2010 → A

```
0140  4141                          Initilization
0141  2033                          (Continued)
0142  4142
0143  2034
0144  4143
0145  0400
0146  7101
0147  0200

0150  2205
0151  0701
0152  6501
0153  7101                          Delay Write
0154  0206
0155  7000
0156  0000
0157  0000

0160  2205
0161  0701
0162  6501
0163  7101                          Delay Read
0164  0222
0165  7000
0166  0000
0167  0000

0170  5405
0171  0703                          Rewrite Parity
0172  6106
0173  7701  Write Parity Stop
0174  5406
0175  0703                          Reread Parity
0176  6114
0177  7702  Read Parity Stop

0200  17570
0201  17304
0202  2010
0203  7101
0204  0150
0205  2000                          Write
0206  7565  Write Status Select
0207  7600

0210  4016
0211  6521
0212  7557                          Backspace
0213  7600
0214  7556
0215  7204
0216  4010                          Read
0217  7101
```

0220	0160		
0221	4000		
0222	7551	Read Status Select	Read (continued)
0223	7600		
0224	4017		
0225	6531		
0226	2121		
0227	0277	0600	
			Change for A/D
0230	3522		
0231	6146		
0232	5421		
0233	5422		COMPARE
0234	3716		
0235	6507		
0236	6025		
0237	2231		
0240	0207		
0241	3407		
0242	6006		
0243	5625		Change unit
0244	5625		select
0245	5625		
0246	5625		
0247	6547		
0250	2031		
0251	4140		
0252	2032		
0253	4141		Restore Unit
0254	2033		Select Codes
0255	4142		
0256	2034		
0257	4143		
0260	0400		
0261	7101		
0262	0300		
0263	2027		Restore
0264	4021		Compare
0265	2030		Addresses
0266	4022		
0267	6530		
0270	1111		
0271	1121		
0272	1131		
0273	1141		
0274	0000		
0275	0000		
0276	0000		
0277	7703	Compare Stop	

```
0300  5410
0301  0710
0302  6104
0303  0400
0304  4010          BLOCK
0305  6010          COUNT
0306  5411
0307  3413

0310  6150
0311  0400
0312  4011
0313  0400
0314  6013
0315  7564          Write File Mark
0316  2263
0317  0207

0320  3407
0321  6003          Change Unit Select
0322  5657
0323  6506
0324  2031          Restore Unit
0325  4146          Select Code
0326  6520
0327  7553

0330  2014          SEARCH
0331  0701
0332  4014
0333  6504
0334  2015
0335  4014          Filemark
0336  2244
0337  0207

0340  3407          Change Unit
0341  6003             SELECT
0342  5640
0343  6514
0344  2032          Restore Unit Select
0345  4147                Code
0346  0400
0347  4020

0350  7101
0351  0403
0352  0000
0353  0000
0354  0000
0355  0000
0356  0000
0357  0000
```

```
0360  2023
0361  0610
0362  4023
0363  4144
0364  2024                                  Generate
0365  0610                                  Block
0366  4024                                  Length
0367  4145

0370  2027
0371  4021
0372  2030                                  Restore Compare
0373  4022                                  And Parity Counters
0374  0400
0375  4005
0376  4006
0377  7101

0400  0200
0401  1111    Write F.M. Select Code
0402  1121    Search F.M. Select Code
0403  7540
0404  7335
0405  2100
0406  7537    Non-Stop Status Select        WRITE NON-STOP
0407  7600

0410  4016
0411  6131
0412  5420
0413  3413
0414  6511
0415  7527                                  REWIND
0416  2225
0417  0207

0420  3407
0421  6007                                  CHANGE UNIT
0422  5621                                    SELECT
0423  5621
0424  5621
0425  0400
0426  4020
0427  6424

0430  2031
0431  4150
0432  2035
0433  4151
0434  2034                                  RESTORE UNIT
0435  4153                                  SELECT CODE
0436  0400
0437  7101
```

```
0440    0100
0441    2000
0442    7705    Stop On Status
0443    1111
0444    1161
0445    1141
```

NUMBER: T630

TITLE: Binary-Coded Magnetic Tape Test

CATEGORY: 160-A, 162, 163, 164

MINIMUM EQUIPMENT NEEDED: 160-A, 162 or 163 or 164

PURPOSE

This program provides a comprehensive test of Magnetic Tape units. The program cannot be used on 606 type transports in high density.

DESCRIPTION

1. See flow chart.
2. This program writes information in both coded and binary format, varying the information and the block length. After each block is written the tape is back-spaced and the block is read and compared in the computer.
3. The block length is increased for the first 200_8 blocks, decreased for the next 200_8 blocks and then increased for 200_8 more blocks. This results in a total of 600_8 blocks written on tape. Every 10_8 blocks there is a file mark written on tape for a total of 60_8 file marks. After writing 600_8 blocks, units are searched back for the number of file marks written. Next, each unit writes non-stop 400_8 blocks; rewinds and starts complete test over.
4. Parity is checked on both Read and Write and if an error occurs the unit with the error will try three times to correct itself and then halt. One error in non-stop will give a halt. Complete test is in A/D or 12 bit format.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0777

CHECK SUM: 6727

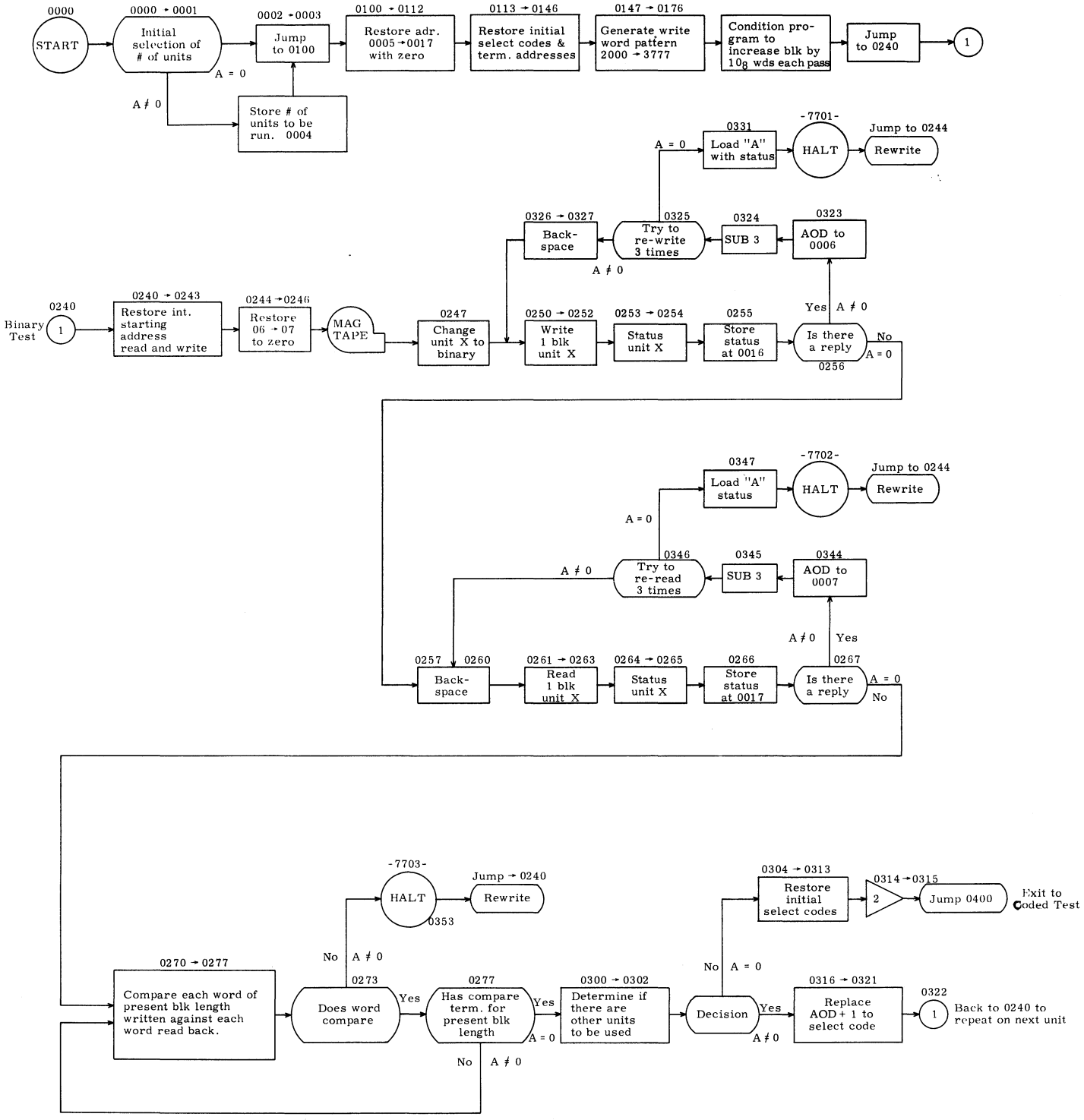
STARTING ADDRESS: 0000

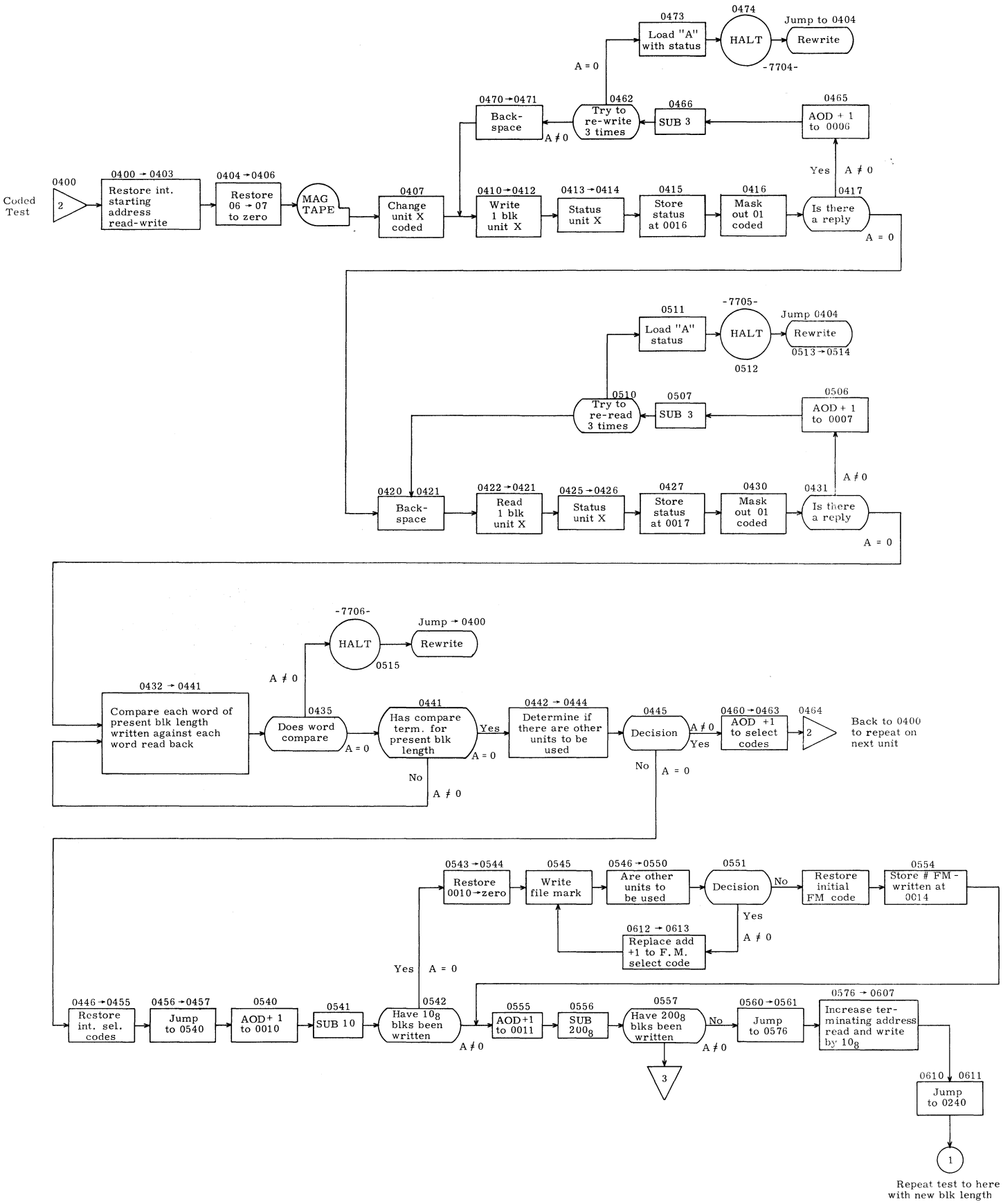
ADDITIONAL INSTRUCTIONS:
1. Enter in 0013 number of blocks to be written.
2. Place in A the number of units to be run.
3. Run.

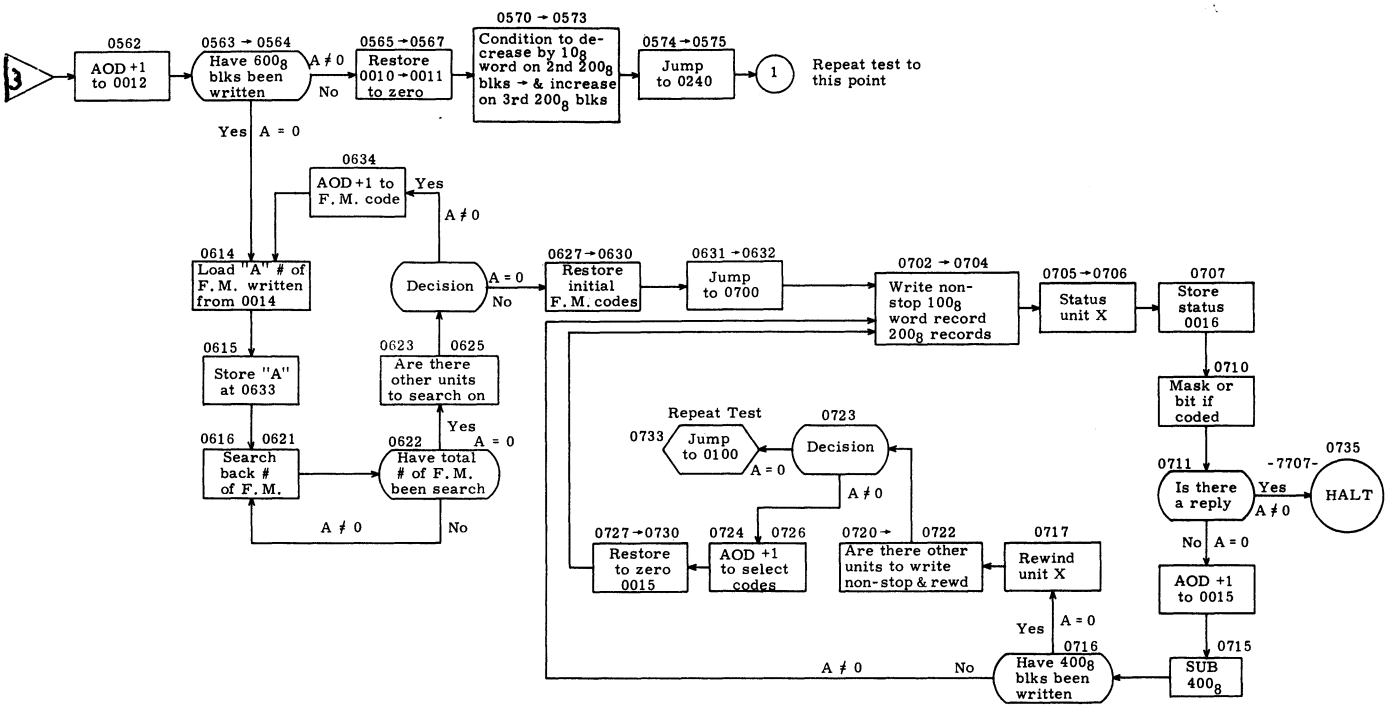
HALTS	EXPLANATION
7701*	Parity error in binary on write
7702*	Parity error in binary on read
7703*	Comparison error binary
7704*	Parity error in coded on write
7705*	Parity error in coded on read
7706*	Comparison error in coded
	* Running again without clearing will rewrite the block with the error and continue the program
7707	Parity error in non-stop

If halt is 7703 or 7706 the word which does not compare may be found in the following manner:

1. Address 0020 contains the address of the valid word written.
2. Address 0021 contains the address of the invalid word read back to the computer.
3. Address 0022 contains the terminating address of the block written during failure.
4. Address 0023 contains the terminating address of the area read into during failure.


0000
START
0000 → 0001
Initial selection of # of units
A = 0
A ≠ 0
0002 → 0003
Jump to 0100
Store # of units to be run. 0004
0100 → 0112
Restore adr. 0005 → 0017 with zero
0113 → 0146
Restore initial select codes & term. addresses
0147 → 0176
Generate write word pattern 2000 → 3777
Condition program to increase blk by 10₈ wds each pass
Jump to 0240
1
-7701-
HALT
0331
Load "A" with status
A = 0
Jump to 0244
Rewrite
0326 → 0327
Back-space
0325
Try to re-write 3 times
A ≠ 0
0324
SUB 3
0323
AOD to 0006
Yes A ≠ 0
0240
Binary Test
1
0240 → 0243
Restore int. starting address read and write
0244 → 0246
Restore 06 → 07 to zero
MAG TAPE
0247
Change unit X to binary
0250 → 0252
Write 1 blk unit X
0253 → 0254
Status unit X
0255
Store status at 0016
Is there a reply
No
A = 0
0256
-7702-
HALT
0347
Load "A" status
Jump to 0244
Rewrite
A = 0
0346
Try to re-read 3 times
A ≠ 0
0345
SUB 3
0344
AOD to 0007
A ≠ 0 Yes
0257
0260
Back-space
0261 → 0263
Read 1 blk unit X
0264 → 0265
Status unit X
0266
Store status at 0017
0267
Is there a reply
A = 0
No
-7703-
HALT
0353
Jump → 0240
Rewrite
No A ≠ 0
0270 → 0277
Compare each word of present blk length written against each word read back.
0273
Does word compare
Yes
0277
Has compare term. for present blk length
Yes
A = 0
No A ≠ 0
0300 → 0302
Determine if there are other units to be used
0304 → 0313
Restore initial select codes
0314 → 0315
2
Jump 0400
Exit to Coded Test
No A = 0
Decision
Yes
A ≠ 0
0316 → 0321
Replace AOD + 1 to select code
0322
1
Back to 0240 to repeat on next unit


Coded Test
0400
2
0400 → 0403
Restore int. starting address read-write
0404 → 0406
Restore 06 → 07 to zero
MAG TAPE
0407
Change unit X coded
0410 → 0412
Write 1 blk unit X
0413 → 0414
Status unit X
0415
Store status at 0016
0416
Mask out 01 coded
0417
Is there a reply
A = 0
Yes
A ≠ 0
0465
AOD + 1 to 0006
0466
SUB 3
0462
Try to re-write 3 times
A = 0
A ≠ 0
0470 → 0471
Back-space
0473
Load "A" with status
0474
HALT
-7704-
Jump to 0404
Rewrite
0420 0421
Back-space
0422 → 0421
Read 1 blk unit X
0425 → 0426
Status unit X
0427
Store status at 0017
0430
Mask out 01 coded
0431
Is there a reply
A = 0
A ≠ 0
0506
AOD + 1 to 0007
0507
SUB 3
0510
Try to re-read 3 times
0511
Load "A" status
-7705-
HALT
0512
Jump 0404
Rewrite
0513 → 0514
0432 → 0441
Compare each word of present blk length written against each word read back
0435
Does word compare
A = 0
A ≠ 0
-7706-
HALT
0515
Jump → 0400
Rewrite
0441
Has compare term. for present blk length
Yes
A = 0
No
A ≠ 0
0442 → 0444
Determine if there are other units to be used
0445
Decision
A ≠ 0
Yes
No
A = 0
0460 → 0463
AOD +1 to select codes
0464
2
Back to 0400 to repeat on next unit
0543 → 0544
Restore 0010 → zero
0545
Write file mark
0546 → 0550
Are other units to be used
0551
Decision
No
Yes
A ≠ 0
0612 → 0613
Replace add +1 to F.M. select code
0554
Store # FM - written at 0014
Restore initial FM code
Yes
A = 0
0446 → 0455
Restore int. sel. codes
0456 → 0457
Jump to 0540
0540
AOD+ 1 to 0010
0541
SUB 10
0542
Have 10₈ blks been written
A ≠ 0
0555
AOD+1 to 0011
0556
SUB 200₈
0557
Have 200₈ blks been written
No
A ≠ 0
3
0560 → 0561
Jump to 0576
0576 → 0607
Increase terminating address read and write by 10₈
0610 0611
Jump to 0240
1
Repeat test to here with new blk length


3
0562
AOD +1 to 0012
0563 → 0564
Have 600₈ blks been written
A ≠ 0
No
0565 → 0567
Restore 0010 → 0011 to zero
0570 → 0573
Condition to decrease by 10₈ word on 2nd 200₈ blks → & increase on 3rd 200₈ blks
0574 → 0575
Jump to 0240
1
Repeat test to this point
Yes A = 0
0634
AOD +1 to F. M. code
Yes
A ≠ 0
0614
Load "A" # of F. M. written from 0014
Decision
A = 0
No
0627 → 0630
Restore initial F. M. codes
0631 → 0632
Jump to 0700
0702 → 0704
Write non-stop 100₈ word record 200₈ records
0705 → 0706
Status unit X
0707
Store status 0016
0710
Mask or bit if coded
0711
Is there a reply
Yes
A ≠ 0
-7707-
0735
HALT
No A = 0
AOD +1 to 0015
0715
SUB 400₈
0716
Have 400₈ blks been written
A ≠ 0
No
Yes
A = 0
0717
Rewind unit X
0720 →
0722
Are there other units to write non-stop & rewd
0723
Decision
A = 0
A ≠ 0
Repeat Test
0733
Jump to 0100
0724
0726
AOD +1 to select codes
0727 → 0730
Restore to zero 0015
0615
Store "A" at 0633
0623
0625
Are there other units to search on
Yes
A = 0
0616
0621
Search back # of F. M.
0622
Have total # of F. M. been search
A ≠ 0
No

```
00000   6002
        4004
        7101
        0100
        0002
        1771
        0000
        0000

00010   0000
        0000
        0000
        0200
        0000
        0000
        0000
        0000

00020   3777
        4000
        2010
        4010
        2000
        4000
        2010
        4010

00030   2111
        2121
        2131
        2141
        1161
        0000
        0000
        0000

00040   0100
        0252
        0412
        0263
        0424
        0335
        0477
        0636

00050   0741
        0336
        0500
        0637
        0337
        0501
        0340
        0502
```

```
00060   0742
        0743
        0610
        0577
        0604
        7777
        7700
        3777

00070   0070
        1001
        0000
        0000
        0000
        0000
        0000
        0000

00100   0400
        4005
        4006
        4007
        4010
        4011
        4012
        4014

00110   4015
        4016
        4017
        2026
        4022
        4141
        4142
        2027

00120   4023
        4143
        4144
        2030
        4145
        4146
        4147
        4150

00130   2031
        4151
        4152
        4153
        2032
        4154
        4155
        2033
```

```
00140   4156
        4157
        4160
        2034
        4161
        2024
        4020
        2005

00150   6016
        1066
        6011
        2005
        0277
        6003
        2005
        6110

00160   2005
        0610
        6105
        2005
        3040
        6102
        2065
        4120

00170   2020
        3467
        6006
        2005
        0611
        4005
        5420
        6530

00200   2062
        4163
        4164
        0400
        7101
        0240
        4007
        7572

00210   7565
        7371
        4000
        7565
        7600
        4016
        6145
        7557
```

```
00220   7600
        7556
        7261
        6000
        7554
        7600
        4017
        6155

00230   2120
        0277
        3521
        6160
        5420
        5421
        3713
        6507

00240   2024
        4020
        2025
        4021
        0400
        4006
        4007
        7572

00250   7565
        7371
        2010
        7565
        7600
        4016
        6145
        7557

00260   7600
        7556
        7261
        4010
        7554
        7600
        4017
        6155

00270   2120
        0600
        3521
        6160
        5420
        5421
        3713
        6507
```

```
00300  2235
       0207
       3404
       6113
       2030
       4145
       2031
       4151

00310  2032
       4154
       2033
       4156
       7101
       0400
       5617
       5617

00320  5617
       5617
       6562
       5406
       0703
       6004
       7510
       7600

00330  6560
       2016
       7701
       7101
       0244
       2111
       2121
       2131

00340  2141
       1171
       2000
       4000
       5407
       0703
       6567
       2017

00350  7702
       7101
       0244
       7703
       7101
       0240
       0000
       0000
```

```
00360  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

00370  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

00400  2024
       4020
       2025
       4021
       0400
       4006
       4007
       7574

00410  7567
       7373
       2010
       7567
       7600
       4016
       0301
       6146

00420  7560
       7600
       7557
       7262
       4010
       7555
       7600
       4017

00430  0301
       6155
       2120
       0600
       3521
       6160
       5420
       5421
```

```
00440  3714
       6507
       2235
       0207
       3404
       6113
       2030
       4146

00450  2031
       4152
       2032
       4155
       2033
       4157
       7101
       0540

00460  5617
       5617
       5617
       5617
       6564
       5406
       0703
       6004

00470  7510
       7600
       6562
       2016
       7704
       7101
       0404
       2111

00500  2121
       2131
       2141
       1172
       2000
       4000
       5407
       0703

00510  6570
       2017
       7705
       7101
       0404
       7706
       7101
       0400
```

```
00520  0000
       0000
       0000
       0000
       0000
       0000
       0000
       0000

00530  7720
       7101
       0540
       0000
       0000
       0000
       0000
       0000

00540  5410
       0710
       6113
       0400
       4010
       7571
       2270
       0207

00550  3404
       6141
       2030
       4147
       5414
       5411
       3413
       6003

00560  7101
       0576
       5412
       0703
       6030
       0400
       4010
       4011

00570  2207
       1440
       4205
       4211
       7101
       0240
       2022
       0610
```

```
00600   4022
        4141
        4142
        2023
        0610
        4023
        4143
        4144

00610   7101
        0240
        5624
        6546
        2014
        4216
        7521
        2214

00620   0701
        4212
        6504
        2214
        0207
        3404
        6106
        2031

00630   4153
        7101
        0700
        0000
        5603
        6521
        2111
        2121

00640   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00650   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00660   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00670   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00700   2240
        0303
        7537
        7341
        2100
        7535
        7600
        4016

00710   0276
        6003
        0301
        6122
        5415
        3413
        6516
        7524

00720   2221
        0207
        3404
        6007
        5615
        5615
        5615
        0400

00730   4015
        6431
        0400
        7101
        0100
        7707
        7101
        0700
```

```
00740   1172
        2111
        2141
        1161
        2000
        0000
        0000
        0000

00750   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00760   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00770   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

01000   0000
```

NUMBER: T-650

TITLE: Plotter Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A, 165

PURPOSE

This test program will check the ability of the plotter, while using all functions, to produce repetitious patterns and will check the input switches.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 3000

TERMINAL ADDRESS: 3150

CHECK SUM: 3205

STARTING ADDRESS: Set all Jumps and Stops, Run from 3060

ADDITIONAL INSTRUCTIONS: Switches 0 thru 12 on the plotter may now be set one at a time for alternating the number of boxes plotted. Each switch from left to right corresponds to the number of boxes plotted. The program shall cause the plotter to home on the starting point.

D. PROGRAM REPERTOIRE

```
03000   2645
        4245
        7542    Select Plot
        0400
        4243
        7440    Pen up
        7405    +X+Y
        5640

03010   1642
        6503
        7420    Pen down
        7405    +X+Y
        5633
        1633
        6503
        7406    -X+Y

03020   5627
        1630
        6503
        5623
        6521
        2620
        4220
        0400

03030   4217
        7412    -X-Y
        5615
        1615
        6503
        7411    +X-Y
        5611
        1612

03040   6503
        5605
        6513
        6015    Exit to Sense Sw.
        4401
        0005
        0000
        0000

03050   0100
        0200
        0030
        0000
        0000
        0000
        0000
```

```
03060   7500    Select INP
        4440
        7600
        4234
        2231
        4071
        2230
        4072

03070   2227
        4073
        2073
        6473    Exit to Plot
        1171
        6004
        2172
        4332

03100   6110    To Add 3110
        5471
        5472
        1611
        6004    To Add 3110
        6313
        0000
        0000

03110   7101    Exit to Plot
        3000
        0000
        0000
        3134
        3120
        3134
        0000

03120   0001
        0002
        0004
        0010
        0020
        0040
        0100
        0200

03130   0400
        1000
        2000
        4000
        0001
        0002
        0003
        0004
```

```
03140          0005
               0006
               0007
               0010
               0011
               0012
               0013
               0014

03150          0000
```

NUMBER: T650-1

TITLE: Plotter Retrace Test

CATEGORY: 160-A, 165

MINIMUM EQUIPMENT NEEDED: 160-A, 165

PURPOSE

This test will check the accuracy of the plotter.

DESCRIPTION

1. See flow chart.
2. The routine lays a pattern of one half inch squares which will resemble a ten inch figure X.
3. The plotter diagonals all the squares and ends by drawing a six inch line vertically through the center of the pattern.
4. The pattern can be retraced to check the pattern accuracy.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

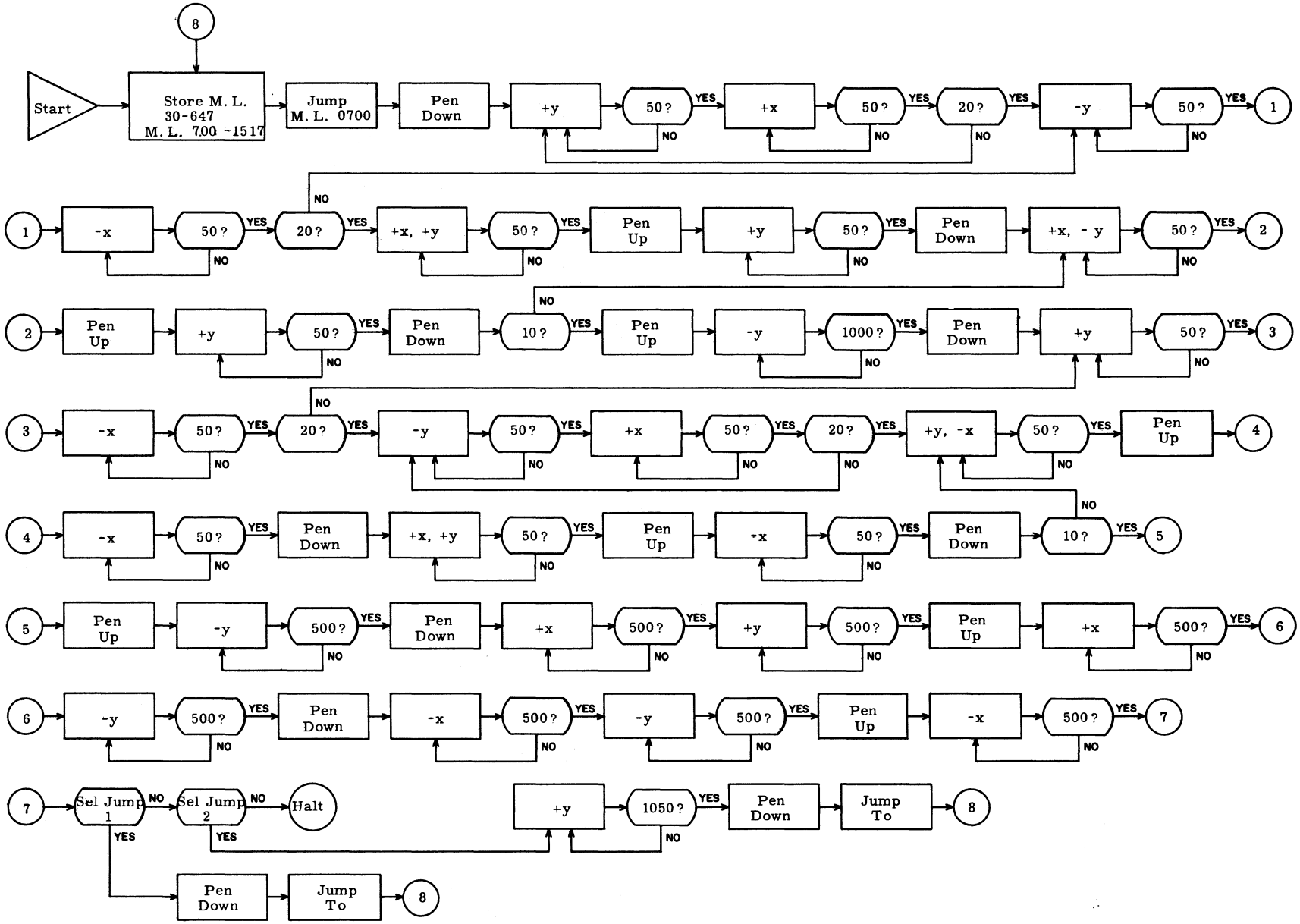
TERMINAL ADDRESS: 0647

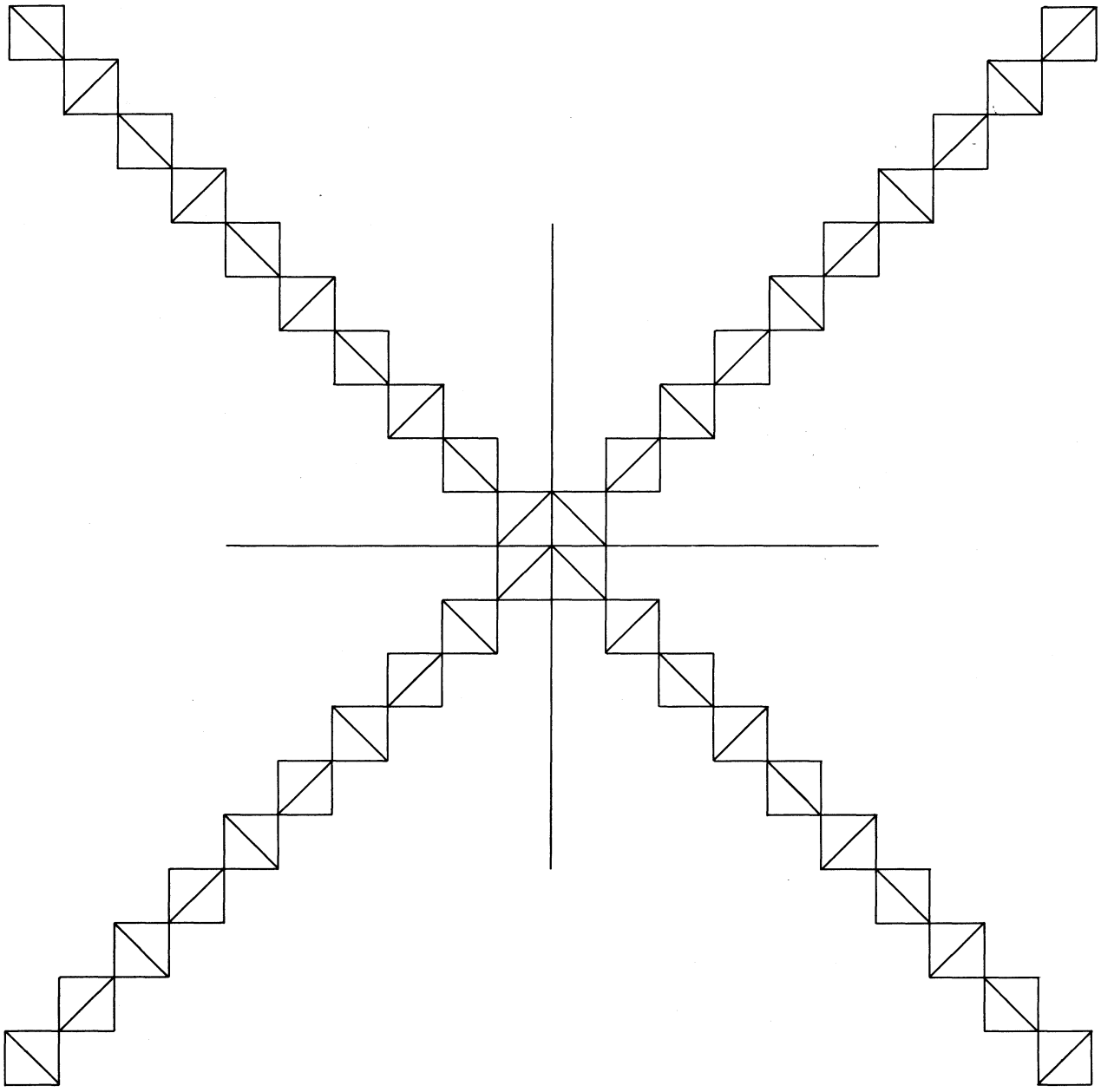
CHECK SUM: 0165

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS:

1) SLJ 1 in up position will cause the pattern to be retraced.
2) SLJ 2 in up position will cause the program to advance 10 1/2 inches and repeat the pattern.


8
Start
Store M. L.
30-647
M. L. 700 -1517
Jump
M. L. 0700
Pen
Down
+y
50?
YES
NO
+x
50?
YES
NO
20?
YES
NO
-y
50?
YES
NO
1
1
-x
50?
YES
NO
20?
YES
NO
+x, +y
50?
YES
NO
Pen
Up
+y
50?
YES
NO
Pen
Down
+x, - y
50?
YES
NO
2
2
Pen
Up
+y
50?
YES
NO
Pen
Down
10?
YES
NO
Pen
Up
-y
1000?
YES
NO
Pen
Down
+y
50?
YES
NO
3
3
-x
50?
YES
NO
20?
YES
NO
-y
50?
YES
NO
+x
50?
YES
NO
20?
YES
NO
+y, -x
50?
YES
NO
Pen
Up
4
4
-x
50?
YES
NO
Pen
Down
+x, +y
50?
YES
NO
Pen
Up
-x
50?
YES
NO
Pen
Down
10?
YES
NO
5
5
Pen
Up
-y
500?
YES
NO
Pen
Down
+x
500?
YES
NO
+y
500?
YES
NO
Pen
Up
+x
500?
YES
NO
6
6
-y
500?
YES
NO
Pen
Down
-x
500?
YES
NO
-y
500?
YES
NO
Pen
Up
-x
500?
YES
NO
7
7
Sel Jump
1
NO
YES
Sel Jump
2
NO
YES
Halt
Pen
Down
Jump
To
8
+y
1050?
YES
NO
Pen
Down
Jump
To
8



Incremental Plotter Pattern (65% actual size)

```
0000  2100
0001  0030
0002  4100
0003  0700
0004  5701
0005  5704
0006  5604
0007  2200
0010  0646
0011  3600
0012  0000
0013  6513
0014  2200
0015  0700
0016  4313
0017  2200
0020  0030
0021  4320
0022  0400
0023  4311
0024  7101
0025  0700
0026  0000
0027  0000
0030  7101
0031  0630
0032  0001
0033  0001
0034  0001
0035  0001
0036  0001
0037  0001
0040  0001
0041  0001
0042  7500
0043  4401
0044  7401
0045  5602
0046  0462
0047  0700
0050  6506
0051  2200
0052  0700
0053  4304
0054  5602
0055  0424
0056  0700
0057  6527
0060  2200
0061  0700
0062  4304
0063  7500
0064  4401
0065  7410
0066  5602
0067  0462
0070  0700
```

```
0071  6506
0072  2200
0073  0700
0074  4304
0075  7500
0076  4401
0077  7402
0100  5602
0101  0462
0102  0700
0103  6506
0104  2200
0105  0700
0106  4304
0107  5602
0110  0424
0111  0700
0112  6527
0113  2200
0114  0700
0115  4304
0116  0001
0117  7500
0120  4401
0121  7405
0122  5604
0123  2200
0124  0062
0125  3600
0126  0000
0127  6510
0130  0400
0131  4303
0132  7500
0133  4401
0134  7440
0135  7500
0136  4401
0137  7404
0140  5602
0141  0462
0142  0700
0143  6506
0144  2200
0145  0700
0146  4304
0147  7500
0150  4401
0151  7420
0152  7500
0153  4401
0154  7411
0155  5604
0156  2200
0157  0062
0160  3600
```

```
0161  0000
0162  6510
0163  0400
0164  4303
0165  7500
0166  4401
0167  7440
0170  7500
0171  4401
0172  7404
0173  5602
0174  0462
0175  0700
0176  6506
0177  2200
0200  0700
0201  4304
0202  7500
0203  4401
0204  7420
0205  5602
0206  0412
0207  0700
0210  6571
0211  2200
0212  0700
0213  4304
0214  7500
0215  4401
0216  7440
0217  0001
0220  0001
0221  0001
0222  0001
0223  0001
0224  7500
0225  4401
0226  7410
0227  5604
0230  2200
0231  1750
0232  3600
0233  0000
0234  6510
0235  0400
0236  4303
0237  7500
0240  4401
0241  7420
0242  7500
0243  4401
0244  7404
0245  5602
0246  0462
0247  0700
0250  6506
```

```
0251  2200
0252  0700
0253  4304
0254  7500
0255  4401
0256  7402
0257  5602
0260  0462
0261  0700
0262  6506
0263  2200
0264  0700
0265  4304
0266  5602
0267  0424
0270  0700
0271  6527
0272  2200
0273  0700
0274  4304
0275  7500
0276  4401
0277  7410
0300  5602
0301  0462
0302  0700
0303  6506
0304  2200
0305  0700
0306  4304
0307  7500
0310  4401
0311  7401
0312  5602
0313  0462
0314  0700
0315  6506
0316  2200
0317  0700
0320  4304
0321  5602
0322  0424
0323  0700
0324  6527
0325  2200
0326  0700
0327  4304
0330  7500
0331  4401
0332  7406
0333  5604
0334  2200
0335  0062
0336  3600
0337  0000
0340  6510
```

```
0341  0400
0342  4303
0343  7500
0344  4401
0345  7440
0346  7500
0347  4401
0350  7402
0351  5602
0352  0462
0353  0700
0354  6506
0355  2200
0356  0700
0357  4304
0360  7500
0361  4401
0362  7420
0363  7500
0364  4401
0365  7405
0366  5604
0367  2200
0370  0062
0371  3600
0372  0000
0373  6510
0374  0400
0375  4303
0376  7500
0377  4401
0400  7440
0401  7500
0402  4401
0403  7402
0404  5602
0405  0462
0406  0700
0407  6506
0410  2200
0411  0700
0412  4304
0413  7500
0414  4401
0415  7420
0416  5602
0417  0412
0420  0700
0421  6571
0422  2200
0423  0700
0424  4304
0425  7500
0426  4401
0427  7440
0430  7500
```

```
0431  4401
0432  7410
0433  5604
0434  2200
0435  0764
0436  3600
0437  0000
0440  6510
0441  0400
0442  4303
0443  7500
0444  4401
0445  7420
0446  7500
0447  4401
0450  7401
0451  5604
0452  2200
0453  0764
0454  3600
0455  0000
0456  6510
0457  0400
0460  4303
0461  7500
0462  4401
0463  7404
0464  5604
0465  2200
0466  0764
0467  3600
0470  0000
0471  6510
0472  0400
0473  4303
0474  7500
0475  4401
0476  7440
0477  7500
0500  4401
0501  7401
0502  5604
0503  2200
0504  0764
0505  3600
0506  0000
0507  6510
0510  0400
0511  4303
0512  7500
0513  4401
0514  7410
0515  5604
0516  2200
0517  0764
0520  3600
```

```
0521  0000
0522  6510
0523  0400
0524  4303
0525  7500
0526  4401
0527  7420
0530  7500
0531  4401
0532  7402
0533  5604
0534  2200
0535  0764
0536  3600
0537  0000
0540  6510
0541  0400
0542  4303
0543  7500
0544  4401
0545  7410
0546  5604
0547  2200
0550  0764
0551  3600
0552  0000
0553  6510
0554  0400
0555  4303
0556  7500
0557  4401
0560  7440
0561  7500
0562  4401
0563  7402
0564  5604
0565  2200
0566  0764
0567  3600
0570  0000
0571  6510
0572  0400
0573  4303
0574  7710
0575  0602
0576  7720
0577  0610
0600  7700
0601  0001
0602  7500
0603  4401
0604  7420
0605  7101
0606  0000
0607  0611
0610  7500
```

```
0611  4401
0612  7404
0613  5604
0614  2200
0615  2032
0616  3600
0617  0000
0620  6510
0621  0400
0622  4303
0623  7500
0624  4401
0625  7420
0626  7101
0627  0000
0630  7500
0631  4401
0632  7420
0633  7500
0634  4401
0635  7404
0636  5602
0637  0462
0640  0700
0641  6506
0642  2200
0643  0700
0644  4304
0645  7101
0646  0712
0647  2771
```

NUMBER: T670

TITLE: Card Reader Test

CATEGORY: 160-A, 167 or 167-2

MINIMUM EQUIPMENT NEEDED: 160-A either 167 or 167-2

PURPOSE

This program will test the card reader.

DESCRIPTION

The test will check the reading ability of the reader using a constant pattern deck under normal, low, and high marginal conditions.

When applicable this will check the Hollerith to binary coded decimal conversion against a pre-stored check list.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

1. Turn on paper tape reader and MC
2. Set Load Clear switch on load
3. Set Run switch

LOADING ADDRESS: 1000

TERMINAL ADDRESS: 1247

CHECK SUM: 4607

STARTING ADDRESS: 1000 Turn on Reader switch "Row 12" (If using column 1, corner cut cards)

HALTS	EXPLANATION
1014	Single Cycle Read One card is read as a check buffer aginst which all other cards are checked. 1) Reset Run switch or start at 1015 to compare consecutive cards with information of first card, stops indicate the following:
1067	7701 = "A" defines status halt
1034	7702 = Bit failure in "A"
1037	7703 = Column failure in "A"

HALTS EXPLANATION (Cont'd)

2) The Run switch may reset after each stop except status for program continuation. All errors detected are displayed before a new card is read. Vary margin switch between tests.

1130 Free Run Read

Three cards are read without a reselection between cards. Information is stored in a 3 card length buffer and is compared with correct information before reselection.

1) Modify program for free run by setting P = 1045 and setting run.

A = 7566 Z = 7704

2) To load check buffer, reset Run switch or start at address 1000.

1117 Hollerith to Binary Coded Decimal

The 167 cannot be used for this section. In order to check conversion, cards are read and compared to the previously stored pattern. Use of a Hollerith punched deck is required according to format listed in the program.

1) Set P = 1104 and set run to modify program for H to BCD

STOPS with A = 6012 Z = 7706

2) Reset Run switch or start at address 1000.
3) Halts at 7701, 7702 and 7703 are similar to 1. a) above.
4) New information may be checked by manually sweeping area 1400 to 1450. Reset run to detect all errors and continue read.

1141 Single Cycle Read Modification

1) Set P = 1053 and set run

A = 7566 Z = 7705

2) Reset run switch to continue, and this will return to 1 above.

```
1000    7566            H to BCD = 6012
1001    7600
1002    6165
1003    7562
1004    7257
1005    XXXX            SC = 2120, FR = 2360
1006    7560
1007    7600

1010    6157
1011    7701            Check sum loaded
1012    7554
1013    7600
1014    6153
1015    7550
1016    7255
1017    XXXX            SC = 1520, FR = 1760, H to BCD = 1450 (1520 for 1617)

1020    7546
1021    7600
1022    6145
1023    2240
1024    4204
1025    2246
1026    4204
1027    2100

1030    XXXX            Check address
1031    1500
1032    XXXX            N.I. address
1033    6005
1034    7702
1035    2305
1036    3625
1037    7703

1040    5706
1041    5711
1042    3622
1043    6514
1044    6432
1045    2225
1046    4341
1047    4215

1050    2225
1051    4332
1052    6147
1053    2216
1054    4347
1055    4207
1056    2216
1057    4340
```

```
1060    6152
1061    6012
1062    7566
1063    XXXX 2000  FWA Check
1064    XXXX 2120  LWA+1 Check
1065    XXXX 11502 Code.     SC = 4502, FR = 4501, H to BCD = 4506
1066    4540
1067    7707

1070    2000
1071    2120
1072    2360
1073    1400
1074    1520
1075    1760
1076    1200
1077    1250 (1320 for 1617)

1100    1450 (1520 for 1617)
1101    4501
1102    4502
1103    4506
1104    2304
1105    4366
1106    2310
1107    4324

1110    2311
1111    4325
1112    2307
1113    4326
1114    2333
1115    4100
1116    1000
1117    7706

1120    6122
1121    2331
1122    4337
1123    2322
1124    4337
1125    2343
1126    4100
1127    1000

1130    7704
1131    6112
1132    2342
1133    4350
1134    2332
1135    4350
1136    2354
1137    4100
```

```
1140    1000
1141    7705
1142    0400
1143    7101
1144    1000

    BCD
1200    0061        Equivalent to A
1201    0062            "     " B
1202    0063            "     " C
1203    0064            "     " D
1204    0065            "     " E
1205    0066            "     " F
1206    0067            "     " G
1207    0070            "     " H
1210    0071            "     " I
1211    0041            "     " J
1212    0042            "     " K
1213    0043            "     " L
1214    0044            "     " M
1215    0045            "     " N
1216    0046            "     " O
1217    0047            "     " P
1220    0050            "     " Q
1221    0051            "     " R
1222    0022            "     " S
1223    0023            "     " T
1224    0024            "     " U
1225    0025            "     " V
1226    0026            "     " W
1227    0027            "     " X
1230    0030            "     " Y
1231    0031            "     " Z
1232    0012            "     " 0
1233    0001            "     " 1
1234    0002            "     " 2
1235    0003            "     " 3
1236    0004            "     " 4
1237    0005            "     " 5
1240    0006            "     " 6
1241    0007            "     " 7
1242    0010            "     " 8
1243    0011            "     " 9
1244    0014            "     " -
1245    0013            "     " =
1246    0034            "     " )
1247    0033            "     " .
1250    0054            "     " *
1251    0053            "     " $
1252    0074            "     " (
1253    0073            "     " ,
```

BCD (continued)

1254	0021	Equivalent to	/	
1255	0060	"	"	+
1256	0040	"	"	-
1257	0020	"	"	0
↓	↓	↓	↓	↓
1317	0020	"	"	0

HOLLERITH

1200	6162	Equivalent to	A,	B
1201	6364	"	C,	D
1202	6566	"	E,	F
1203	6770	"	G,	H
1204	7141	"	I,	J
1205	4243	"	K,	L
1206	4445	"	M,	N
1207	4647	"	O,	P
1210	5051	"	Q,	R
1211	2223	"	S,	T
1212	2425	"	U,	V
1213	2627	"	W,	X
1214	3031	"	Y,	Z
1215	1201	"	0,	1
1216	0203	"	2,	3
1217	0405	"	4,	5
1220	0607	"	6,	7
1221	1011	"	8,	9
1222	1413	"	-	=
1223	3433	"	)	.
1224	5453	"	*	$
1225	7473	"	(	,
1226	2160	"	/	+
1227	4020	"	-	0
1230	2020	"	0,	0
↓	↓	↓	↓	↓
1247	2020	"	0,	0

NUMBER: T670-1
TITLE: Comprehensive Speed and Information Test
CATEGORY: 160-A, 167
MINIMUM EQUIPMENT NEEDED: 160-A, 167 or 167-2

PURPOSE

This test checks the operation of 167 or 167-2 card reader connected to 160-A computer.

DESCRIPTION

The test has 3 sections:
1. Time check
2. Data check, single cycle read
3. Data check, free run read

Sections 2 and 3 are run in non-conversion or H⟶ BCD and pack conversion mode, depending upon a starting parameter in A.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: 0000
TERMINAL ADDRESS: 2140 The routine continues until manually halted
CHECK SUM: 5166
STARTING ADDRESS: 0100
ADDITIONAL INSTRUCTIONS: Set bit 0 in A to omit section 1
Set bit 1 in A to omit section 2
Set bit 2 in A to omit section 3
Set bit 3 in A to test H⟶ BCD and pack mode

HALTS	EXPLANATION
0400	Status response appears in A To re-start: Correct error condition. Master clear if there was a feed failure, program error, or amplifier failure. Set P = 0400. Run.
0410	Timing error A = 0001. There is less than 79 ms of computing time available between the 80th column of one card and the 1st column of the next.

HALTS	EXPLANATION (Cont'd.)
	A = 0002. There is less than 1.5 ms of computing time available between inputting of columns. To restart: Master clear. Set P = 0410. Run.
02x0	Data error section 2.
03x0	Data error section 3.
0200	Error found in 5252 card.
0300	Bit in error appears in A. Step twice to load number of column in error into A. Clear A after loading column number to ship checking remainder of card. To restart: Press run.
0210	Error found in 2525 card.
0310	Same description as for 5252 card.
0220	Error found in random card.
0320	A contains bit in error. A contains zero if logical check sum cannot detect the row in error. To restart: Press run.
0230	Error found in Hollerith card.
0330	BCD code actually read appears in A 6-11. BCD code that should have been read appears in A 0-5. If A is zero the card is not being recognized as a Hollerith card. Step twice to load number of column in error into A. Clear A after loading column number to skip checking remainder of card. To restart: Press run.

```
                        REM                         160-A, 167 AND 167-2 TEST
                        REM                         CARD, READER PROGRAMMED
                        REM                         FOR NORMAL CHANNEL
      0000              ORG   0
      0000              CON   0
0000  0000  STOP              0
0001  0000  CKFLG             0
0002  0000  CKSUP             0
0003  0000  CKSLO             0
0004  0000  CKS3              0
0005  5252  CD52              5252
0006  2525  CD25              2525
0007  3777  LOII              3777
0010  2260  BUFEND            BUF     790
0011  2261  BUFENT            BUF     800
0012  2141  BUFC              BUF
0013  2141  BUFI              BUF
0014  2141  BUFI2             BUF
0015  0000  ACONT             0                   CONTROLS SCR OR FRR ER STOP
0016  0000  DELAY             0
0017  0000  CONT              0                   A PARAMETER
0020  0000  COLCT             0
0021  0000  FCNT              0
0022  2041  TABC              TAB
0023  2041  TABI              TAB
0024  0000  TEMP              0
0025  0000  COL               0
0026  0000  CDCNT             0
0027  0000  STATUS                    0
0030  0000  SAVE                      0
      0100              PRG   100
0100  7101  START       JFI   1
0101  0500              CR167
      0176              PRG   176               ERROR STOPS
0176  7101              JFI   1
0177  0000  ST52              0
0200  7700              HLT
0201  2025              LDD   COL
0202  7101              JFI   1
0203  0176              ST52  -1
```

```
      0206            PRG   206
0206  7101            JFI   1
0207  0000  ST25            0
0210  7700            HLT
0211  2025            LDD   COL
0212  7101            JFI   1
0213  0206                  ST25    -1
      0216            PRG   216
0216  7101            JFI   1
0217  0000  STRA            0
0220  7700            HLT
0221  7101            JFI   1
0222  0216                  STRA    -1
      0226            PRG   226
0226  7101            JFI   1
0227  0000  STH             0
0230  7700            HLT
0231  2025            LDD   COL
0232  7101            JFI   1
0233  0226                  STH     -1
      0276            PRG   276
0276  7101            JFI   1
0277  0000  ST52F           0
0300  7700            HLT
0301  2025            LDD   COL
0302  7101            JFI   1
0303  0276                  ST52F   -1
      0306            PRG   306
0306  7101            JFI   1
0307  0000  ST25F           0
0310  7700            HLT
0311  2025            LDD   COL
0312  7101            JFI   1
0313  0306                  ST25F   -1
      0316            PRG   316
0316  7101            JFI   1
0317  0000  STRAF            0
0320  7700            HLT
0321  7101            JFI   1
0322  0316                  STRAF   -1
      0326            PRG   326
0326  7101            JFI   1
```

```
0327  0000   STHF          0
0330  7700           HLT
0331  2025           LDD    COL
0332  7101           JFI    1
0333  0326                  STHF    -1
      0375           PRG    375
0375  7101           JFI    1
0376  0000   STSTAT        0
0377  2027           LDD    STATUS
0400  7700           HLT
0401  7101           JFI    1
0402  0375                  STSTAT -1
      0406           PRG    406
0406  7101           JFI    1
0407  0000   STTIM         0
0410  7700           HLT
0411  7101           JFI    1
0412  0406                  STTIM  -1
      0500           PRG    500
0500  4017   CR167   STD    CONT
0501  0400           LDN    0
0502  4001           STD    CKFLG
0503  2200           LDC    CR167A
0504  0506
0505  0070           ACJO                    SET BANKS
0506  2017   CR167A  LDD    CONT
0507  0201           LPN    1
0510  6103           NZF    CR167B
0511  7101           JFI    1
0512  0522                  CRTIME
0513  2017   CR167B  LDD    CONT
0514  0202           LPN    2
0515  6103           NZF    CR167C
0516  7101           JFI    1
0517  0674                  CRSCR
0520  7101   CR167C  JFI    1
0521  1043                  CRFRR
0522  7500   CRTIME  EXC    4540            CHECK COL 80-1 TIME
0523  4540
0524  7600           INA
0525  4027           STD    STATUS
```

```
0526  0277          LPN   77
0527  6005          ZJF   CRTM2
0530  7100          JPR   STSTAT
0531  0376
0532  7101          JFI   1
0533  0522                CRTIME
0534  7500  CRTM2   EXC   4502
0535  4502
0536  7254          INP   BUFT
0537  2261                BUF      80D
0540  7500          EXC   4540
0541  4540
0542  7600          INA
0543  4027          STD   STATUS
0544  0277          LPN   77
0545  6005          ZJF   CRTM4
0546  7100          JPR   STSTAT
0547  0376
0550  7101          JFI   1
0551  0522                CRTIME
0552  7500  CRTM4   EXC   4502
0553  4502
0554  2600          LCC   3343            75 MS. DELAY
0555  3343
0556  4016          STD   DELAY
0557  2124  CRTM6   LDI   TEMP
0560  5416          AOD   DELAY
0561  6502          NZB   CRTM6
0562  7230          INP   BUFT
0563  2261                BUF      80D
0564  7500          EXC   4540
0565  4540
0566  7600          INA
0567  4027          STD   STATUS
0570  0210          LPN   10
0571  6007          ZJF   CRTM10
0572  2027          LDD   STATUS
0573  0204          LPN   4
0574  6112          NZF   CRTM12
0575  0401          LDN   1
0576  7100          JPR   STTIM
0577  0407
```

```
0600  7500   CRTM10 EXC   4540            CHECK INTER COL TIME
0601  4540
0602  7600          INA
0603  4027          STD   STATUS
0604  0277          LPN   77
0605  6006          ZJF   CRTM14
0606  7100   CPTM12 JPR   STSTAT
0607  0376
0610  7101          JFI   1
0611  0600                CRTM10
0612  2141   BUFT         BUF
0613  2600   CRTM14 LCC   80D
0614  0120
0615  4024          STD   TEMP
0616  7500          EXC   4502
0617  4502
0620  7237   CRTM16 INP   BUFD
0621  2142                BUF    +1
0622  2600          LCC   70              DELAY 1.5 MS.
0623  0070
0624  4016          STD   DELAY
0625  5416   CRTM18 AOD   DELAY
0626  6501          NZB   CRTM18
0627  5424          AOD   TEMP
0630  6510          NZB   CRTM16
0631  7500          EXC   4540
0632  4540
0633  7600          INA
0634  4027          STD   STATUS
0635  0210          LPN   10
0636  6007          ZJF   CRTM20
0637  2027          LDD   STATUS
0640  0204          LPN   4
0641  6112          NZF   CRTM22
0642  0402          LDN   2
0643  7100          JPR   STTIM
0644  0407
0645  7500   CRTM20 EXC   4540
0646  4540
0647  7600          INA
0650  4027          STD   STATUS
```

```
0651  0277          LPN   77
0652  6006          ZJF   CRTM24
0653  7100  CRTM22  JPR   STSTAT
0654  0376
0655  7101          JFI   1
0656  0645                CRTM20
0657  2141  BUFD          BUF
0660  2017  CRTM24  LDD   CONT
0661  0202          LPN   2
0662  6103          NZF   CRTM26
0663  7101          JFI   1
0664  0674                CRSCR
0665  2017  CRTM26  LDD   CONT
0666  0204          LPN   4
0667  6103          NZF   CRTM28
0670  7101          JFI   1
0671  1043                CRFRR
0672  7101  CRTM28  UFI   1
0673  0522                CRTIME
0674  2600  CRSCR   LCC   200D          READ CARDS SINGLE CYCLE
0675  0310
0676  4026          STD   CDCNT
0677  0400          LDN   0
0700  4015          STD   ACONT
0701  4001          STD   CKFLG
0702  0410  CRSCRZ  LDN   10
0703  1017          LPD   CONT
0704  6003          ZJF   CRBCK
0705  7101          JFI   1
0706  0772                CRSCR2
0707  7500  CRBCK   EXC   4540
0710  4540
0711  7600          INA
0712  4027          STD   STATUS
0713  0274          LPN   74
0714  6004          ZJF   CRBCK4
0715  0400          LDN   0
0716  4001          STD   CKFLG
0717  6011          ZJF   CRBCK6
0720  2001  CRBCK4  LDD   CKFLG
0721  6007          ZJF   CRBCK6
0722  7100          JPR   CB            CHECK CARD
```

```
0723  1276
0724  0400           LDN   0
0725  4001           STD   CKFLG
0726  5426           AOD   CDCNT
0727  6024           ZJF   CRBCK8
0730  7500   CRBCK6  EXC   4540
0731  4540
0732  7600           INA
0733  4027           STD   STATUS
0734  0277           LPN   77
0735  6005           ZJF   CRBCK7
0736  7100           JPR   STSTAT
0737  0376
0740  7101           JFI   1
0741  0730                 CRBCK6
0742  7500   CRBCK7  EXC   4502
0743  4502
0744  7206           INP   BUFS
0745  2261                 BUF     80D
0746  0401           LDN   1
0747  4001           STD   CKFLG
0750  7101           JFI   1
0751  0707                 CRBCK
0752  2141   BUFS          BUF
0753  7701   CRBCK8  SLSI                 END OF SECTION
0754  7710           SLJI  CRSCR           REPEAT SECTION
0755  0674
0756  0404   CRBCK9  LDN   4
0757  1017           LPD   CONT
0760  6103           NZF   CRSCRX
0761  7101           JFI   1
0762  1043                 CRFRR
0763  0401   CRSCRX  LDN   1
0764  1017           LPD   CONT
0765  6103           NZF   CRSCRY
0766  7101           JFI   1
0767  0522                 CRTIME
0770  7101   CRSCRY  JFI   1
0771  0674                 CRSCR
0772  7500   CRSCR2  EXC   4540           167-2 READ CARDS SINGLE CYCLE
0773  4540
```

```
0774  7600          INA
0775  4027          STD   STATUS
0776  0274          LPN   74
0777  6004          ZJF   CRHCK4
1000  0400          LDN   0
1001  4001          STD   CKFLG
1002  6011          ZJF   CRHCK6
1003  2001  CRHCK4   LDD   CKFLG
1004  6007          ZJF   CRHCK6
1005  7100          JPR   CKH             CHECK CARD
1006  1600
1007  0400          LDN   0
1010  4001          STD   CKFLG
1011  5426          AOD   CDCNT
1012  6024          ZJF   CRHCK8
1013  7500  CRHCK6  EXC   4540
1014  4540
1015  7600          INA
1016  4027          STD   STATUS
1017  0277          LPN   77
1020  6005          ZJF   CRHCK7
1021  7100          JPR   STSTAT
1022  0376
1023  7101          JFI   1
1024  1013                CRHCK6
1025  7500  CRHCK7  EXC   4506
1026  4506
1027  7206          INP   BUFF
1030  2211                BUF     40D
1031  0401          LDN   1
1032  4001          STD   CKFLG
1033  7101          JFI   1
1034  0772                CRSCR2
1035  2141  BUFF          BUF
1036  7701  CRHCK8  SLSI                 END OF SECTION
1037  7710          SLJI  CRSCR           REPEAT SECTION
1040  0674
1041  7101          JFI   1
1042  0756                CRBCK9
1043  2600  CRFRR   LCC   15D            READ CARDS FREE RUN
1044  0017
1045  4026          STD   CDCNT
```

```
1046  0400          LDN   0
1047  4001          STD   CKFLG
1050  2200          LDC   100
1051  0100
1052  4015          STD   ACONT
1053  0410          LDN   10
1054  1017          LPD   CONT
1055  6003          ZJF   CRFN
1056  7101          JFI   1                    167-2
1057  1175                CBFRR2
1060  2200    CRFN  LDC   BUF      12000
1061  4421
1062  4100          STM   CRFN3
1063  1146
1064  7500    CRFN1 EXC   4540
1065  4540
1066  7600          INA
1067  4027          STD   STATUS
1070  0274          LPN   74
1071  6004          ZJF   CRFN2
1072  0400          LDN   0
1073  4001          STD   CKFLG
1074  6035          ZJF   CBFN11
1075  2001    CRFN2 LDD   CKFLG
1076  6033          ZJF   CRFN11
1077  2026          LDD   CDCNT
1100  4021          STD   FCNT
1101  2200          LDC   BUF      80D
1102  2261
1103  4014          STD   BUFI2
1104  7100    CRFN5 JPR   CK
1105  1276
1106  5421          AOD   FCNT
1107  6015          ZJF   CRFN10
1110  2012          LDD   BUFC
1111  4013          STD   BUFI
1112  2600          LCC   80D
1113  0120
1114  4020          STD   COLCT
1115  2114    CRFN8 LDI   BUFI2
1116  4113          STI   BUFI
```

```
1117  5414          AOD   BUFI2
1120  5413          AOD   BUFI
1121  5420          AOD   COLCT
1122  6505          NZB   CRFN8
1123  6417          ZJB   CRFN5
1124  2600  CRFN10  LCC   80D
1125  0120
1126  5220          RAF   CRFN3
1127  5426          AOD   CDCNT
1130  6026          ZJF   CRFN12
1131  7500  CRFN11  EXC   4540
1132  4540
1133  7600          INA
1134  4027          STD   STATUS
1135  0277          LPN   77
1136  6005          ZJF   CRFN13
1137  7100          JPR   STSTAT
1140  0376
1141  7101          JFI   1
1142  1131                CRFN11
1143  7500  CRFN13  EXC   4501
1144  4501
1145  7210          INP   BUFI
1146  2140  CRFN3   *
1147  7500          EXC   4500
1150  4500
1151  0401          LDN   1
1152  4001          STD   CKFLG
1153  7101          JFI   1
1154  1064                CRFN1
1155  2141  BUFI    BUF
1156  7701  CRFN12  SLS1                END OF SECTION
1157  7710          SLJ1  CRFRR         REPEAT SECTION
1160  1043
1161  0401          LDN   1
1162  1017          LPD   CONT
1163  6103          NZF   CRFN14
1164  7101          JFI   1
1165  0522                CRTIME
1166  0402  CRFN14  LDN   2
1167  1017          LPD   CONT
1170  6103          NZF   CRFN16
```

```
1171  7101          JFI   1
1172  0674                CRSCR
1173  7101  CRFN16  JFI   1
1174  1043                CRFRR
1175  2200  CRFRR2  LDC   BUF      600D    167≠2
1176  3271
1177  4100          STM   CRFH3
1200  1263
1201  7500  CRFH1   EXC   4540
1202  4540
1203  7600          INA
1204  4027          STD   STATUS
1205  0274          LPN   79
1206  6004          ZJF   CRFH2
1207  0400          LDN   0
1210  4001          STD   CKFLG
1211  6035          ZJF   CRFH11
1212  2001  CRFH2   LDD   CKFLG
1213  6033          ZJF   CRFH11
1214  2026          LDD   CDCNT
1215  4021          STD   FCNT
1216  2200          LDC   BUF      40D
1217  2211
1220  4014          STD   BUFI2
1221  7100  CRFH5   JPR   CKH
1222  1600
1223  5421          AOD   FCNT
1224  6015          ZJF   CRFH10
1225  2012          LDD   BUFC
1226  4013          STD   BUFI
1227  2600          LCC   40D
1230  0050
1231  4020          STD   COLCT
1232  2114  CRFH8   LDI   BUFI2
1233  4113          STI   BUFI
1234  5414          AOD   BUFI2
1235  5413          AOD   BUFI
1236  5420          AOD   COLCT
1237  6505          NZB   CRFH8
1240  6417          ZJB   CRFH5
1241  2600  CRFH10  LCC   40D
```

```
1242  0050
1243  5220          RAF   CRFH3
1244  5426          AOD   CDCNT
1245  6026          ZJF   CRFHI2
1246  7500  CRFHII  EXC   4540
1247  4540
1250  7600          INA
1251  4027          STD   STATUS
1252  0277          LPN   77
1253  6005          ZJF   CRFHI3
1254  7100          JPR   STSTAT
1255  0376
1256  7101          JFI   1
1257  1246                CRFHII
1260  7500  CRFHI3  EXC   4505
1261  4505
1262  7210          INP   BUF2
1263  2140  CRFH3         *
1264  7500          EXC   4500
1265  4500
1266  0401          LDN   1
1267  4001          STD   CKFLG
1270  7101          JFI   1
1271  1201                CRFHI
1272  2141  BUF2          BUF
1273  7101  CRFHI2  JFI   1
1274  1156                CRFNI2
1275  7101          JFI   1
1276  0000  CK            0                 167 CARD CHECK
1277  2112  CK1     LDI   BUFC
1300  3405          SBD   CD52
1301  6103          NZF   CK3
1302  7101          JFI   1                 CARD IS 52
1303  1452                CK20
1304  2112  CK3     LDI   BUFC
1305  3406          SBD   CD25
1306  6103          NZF   CK5
1307  7101          JFI   1                 CARD IS 25
1310  1525                CK30
1311  2012  CK5     LDD   BUFC              CARD IS RANDOM
1312  4013          STD   BUFI
1313  0400          LDN   0
```

```
1314  4002          STD   CKSUP
1315  4003          STD   CKSLO
1316  2407  CK2     LCD   LOII        SIMULATE 924 CARD READER TEST
1317  1113          LPI   BUFI        CHECK SUM
1320  6202          PJF   CK4
1321  5402          AOD   CKSUP
1322  5413  CK4     AOD   BUFI
1323  3410          SBD   BUFEND
1324  6506          NZB   CK2
1325  2012          LDD   BUFC
1326  4013          STD   BUFI
1327  2113  CK6     LDI   BUFI
1330  1007          LPD   LOII
1331  5003          RAD   CKSLO
1332  6204          PJF   CK8
1333  1007          LPD   LOII
1334  4003          STD   CKSLO
1335  5402          AOD   CKSUP
1336  5413  CK8     AOD   BUFI
1337  3410          SBD   BUFEND
1340  6511          NZB   CK6
1341  2002          LDD   CKSUP
1342  0201          LPN   1
1343  4004          STD   CKS3
1344  2007          LDD   LOII
1345  0102          LSI
1346  1002          LPD   CKSUP
1347  0103          LS2
1350  0110          LS3
1351  0111          LS6
1352  5003          RAD   CKSLO
1353  6204          PJF   CK12
1354  1007          LPD   LOII
1355  4003          STD   CKSLO
1356  5404          AOD   CKS3
1357  2004  CK12    LDD   CKS3
1360  0201          LPN   1
1361  4002          STD   CKSUP
1362  2007          LDD   LOII
1363  0102          LSI
1364  1004          LPD   CKS3
```

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1365  0103          LS2
1366  0110          LS3
1367  0111          LS6
1370  5003          RAD   CKSLO
1371  2002          LDD   CKSUP
1372  0201          LPN   1
1373  0103          LS2
1374  0110          LS3
1375  0111          LS6
1376  1403          SCD   CKSLO
1377  4003          STD   CKSLO
1400  2012          LDD   BUFC
1401  3200          ADC   79D
1402  0117
1403  4013          STD   BUFI
1404  2113          LDI   BUFI
1405  1403          SCD   CKSLO
1406  6302          NJF   CK15
1407  6024          ZJF   CK18
1410  2200  CK15    LDC   STRA
1411  0217
1412  3015          ADD   ACONT
1413  4215          STF   CK17    1
1414  2012          LDD   BUFC
1415  4013          STD   BUFI
1416  0400          LDN   0
1417  4024          STD   TEMP
1420  2024  CK16    LDD   TEMP
1421  1513          SCI   BUFI
1422  4024          STD   TEMP
1423  5413          ADD   BUFI
1424  3410          SBD   BUFEND
1425  6505          NZB   CK16
1426  2024          LDD   TEMP
1427  7100  CK17    JBR   *
1430  2140
1431  7101          JFI   1
1432  1275                CK      -1
1433  2012  CK18    LDD   BUFC
1434  4013          STD   BUFI
1435  0400          LDN   0
1436  4024          STD   TEMP
```

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1437  2024  CK19   LDD   TEMP
1440  1513         SCI   BUFI
1441  4024         STD   TEMP
1442  5413         AOD   BUFI
1443  3410         SBD   BUFEND
1444  6505         NZB   CK19
1445  2024         LDD   TEMP
1446  6736         NJB   CK15
1447  6537         NZB   CK15
1450  7101         JFI   1
1451  1275               CK      -1       CARD CHECK COMPLETED
1452  2200  CK20   LDC   ST52             CHECK 52 CARD
1453  0177
1454  3015         ADD   ACONT
1455  4220         STF   CK23Z   1
1456  4100         STM   CK25Z   1
1457  1514
1460  2012         LDD   BUFC
1461  4013         STD   BUFI
1462  2113  CK22   LDI   BUFI
1463  1405         SCD   CD52
1464  6102         NZF   CK23
1465  6013         ZJF   CK24
1466  4024  CK23   STD   TEMP
1467  2013         LDD   BUFI
1470  3412         SBD   BUFC
1471  0601         ADN   1
1472  4025         STD   COL
1473  2024         LDD   TEMP
1474  7100  CK23Z  JPR   *
1475  2140
1476  6302         NJF   CK24
1477  6024         ZJF   CK27
1500  5413  CK24   AOD   BUFI
1501  2113         LDI   BUFI
1502  1406         SCD   CD25
1503  6302         NJF   CK25
1504  6013         ZJF   CK26
1505  4024  CK25   STD   TEMP
1506  2013         LDD   BUFI
1507  3412         SBD   BUFC
```

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1510  0601          ADN   1
1511  4025          STD   COL
1512  2024          LDD   TEMP
1513  7100  CK25Z   JPR   *
1514  2140
1515  6302          NJF   CK26
1516  6005          ZJF   CK27
1517  5413  CK26    AOD   BUFI
1520  3600          SBC   BUF      80D
1521  2261
1522  6540          NZB   CK22
1523  7101  CK27    JFI   1
1524  1275                CK       -1       CARD CHECK COMPLETED
1525  2200  CK30    LDC   ST25               CHECK 25 CARD
1526  0207
1527  3015          ADD   ACONT
1530  4217          STF   CK33Z    1
1531  4235          STF   CK35Z    1
1532  2012          LDD   BUFC
1533  4013          STD   BUFI
1534  2113  CK32    LDI   BUFI
1535  1406          SCD   CD25
1536  6302          NJF   CK33
1537  6013          ZJF   CK34
1540  4024  CK33    STD   TEMP
1541  2013          LDD   BUFI
1542  3412          SBD   BUFC
1543  0601          ADN   1
1544  4025          STD   COL
1545  2024          LDD   TEMP
1546  7100  CK33Z   JPR   *
1547  2140
1550  6302          NJF   CK34
1551  6024          ZJF   CK37
1552  5413  CK34    AOD   BUFI
1553  2113          LDI   BUFI
1554  1405          SCD   CD52
1555  6302          NJF   CK35
1556  6013          ZJF   CK36
1557  4024  CK35    STD   TEMP
1560  2013          LDD   BUFI
1561  3412          SBD   BUFC
```

```
1562  0601          ADN   1
1563  4025          STD   COL
1564  2024          LDD   TEMP
1565  7100  CK35Z   JPR   *
1566  2140
1567  6302          NJF   CK36
1570  6005          ZJF   CK37
1571  5413  CK36    AOD   BUFI
1572  3600          SBC   BUF      800
1573  2261
1574  6540          NZB   CK32
1575  7101  CK37    JFI   1
1576  1275                CK       -1        CARD CHECK COMPLETED
1577  7101          JFI   1
1600  0000  CKH           0                  CHECK 167-2 CARD
1601  2012          LDD   BUFC
1602  4013          STD   BUFI
1603  2022          LDD   TABC
1604  4023          STD   TABI
1605  2113  CKH2    LDI   BUFI
1606  1200          LPC   7700
1607  7700
1610  0111          LS6
1611  4024          STD   TEMP
1612  2024  CKH3    LDD   TEMP
1613  1523          SCI   TABI
1614  6006          ZJF   CKH4
1615  5423          AOD   TABI
1616  3600          SBC   TAB      77
1617  2140
1620  6506          NZB   CKH3
1621  6014          ZJF   CKH10
1622  5423  CKH4    AOD   TABI
1623  3600          BBC   TAB      77
1624  2140
1625  6104          NZF   CKH5
1626  2200          LDC   TAB
1627  2041
1630  4023          STD   TABI
1631  2113  CKH5    LDI   BUFI
1632  0277          LPN   77
```

```
1633  1523          SCI   TABI
1634  6073          ZJF   CKH14
1635  5413  CKH10   AOD   BUFI
1636  2022          LDD   TØBC
1637  4023          STO   TABI
1640  2113          LDI   BUFI
1641  1200          LPC   7700
1642  7700
1643  0111          LS6
1644  4024          STO   TEMP
1645  2024  CKH11   LDD   TEMP
1646  1523          SCI   TABI
1647  6017          ZJF   CKH12
1650  5423          AOD   TABI
1651  3600          SBC   TAB      77
1652  2140
1653  6506          NZB   CKH11
1654  2200  CKH8    LDC   STH
1655  0227
1656  3015          ADD   ACONT
1657  4204          STF   CKH9     1
1660  0400          LDN   0
1661  4025          STO   CØL
1662  7100  CKH9    JPR   *
1663  2140
1664  7101          JFI   1
1665  1577                CKH     -1
1666  5423  CKH12   AOD   TØBI
1667  3600          SBC   TAB      77
1670  2140
1671  6104          NZF   CKH13
1672  2200          LDC   TAB
1673  2041
1674  4023          STO   TABI
1675  2113  CKH13   LDI   BUFI
1676  0277          LPN   77
1677  1523          SCI   TABI
1700  6524          NZB   CKH8
1701  2023          LDD   TABI
1702  0701          SBN   1
1703  4023          STO   TABI
1704  3600          SBC   TAB      -1
```

```
1705  2040
1706  6106          NZF   CKH15
1707  2200          LDC   TAB      74
1710  2135
1711  4023          STD   TABI
1712  7101          JFI   1
1713  1740                CKH17
1714  2023    CKH15 LDD   TABI
1715  0701          SBN   1
1716  4023          STD   TABI
1717  3600          SBC   TAB     -1
1720  2040
1721  6106          NZF   CKH14
1722  2200          LDC   TAB      75
1723  2136
1724  4023          STD   TABI
1725  7101          JFI   1
1726  1740                CKH17
1727  2023    CKH14 LDD   TABI
1730  0701          SBN   1
1731  4023          STD   TABI
1732  3600          SBC   TAB     -1
1733  2040
1734  6104          NZF   CKH17
1735  2200          LDC   TAB      76
1736  2137
1737  4023          STD   TABI
1740  2012    CKH17 LDD   BUFC
1741  4013          STD   BUFI
1742  2200          LDC   STH
1743  0227
1744  3015          ADD   ACONT
1745  4222          STF   CKH25    1
1746  4252          STF   CKH27    1
1747  2113    CKH20 LDI   BUFI
1750  1200          LPC   7700
1751  7700
1752  0111          LS6
1753  1523          SCI   TABI
1754  6020          ZJF   CKH21
1755  2013          LDD   BUFI
```

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1756  3412          SBD   BUFC
1757  0102          LSI
1760  0601          ADN   1
1761  4025          STD   COL
1762  2113          LDI   BUFI
1763  1200          LPC   7700
1764  7700
1765  1523          SCI   TABI
1766  7100  CKH25   UPR   *
1767  2140
1770  6304          NJF   CKH21
1771  6103          NZF   CKH21
1772  7101          JFI   1
1773  1577                CKH     -1
1774  5423  CKH21   AOD   TABI
1775  3600          SBC   TAB      77
1776  2140
1777  6103          NZF   CKH22
2000  2022          LDD   TABC
2001  4023          STD   TABI
2002  2113  CKH22   LDI   BUFI
2003  0277          LPN   77
2004  1523          SCI   TABI
2005  6020          ZJF   CKH23
2006  2013          LDD   BUFI
2007  3412          SBD   BUFC
2010  0102          LSI
2011  0602          ADN   2
2012  4025          STD   COL
2013  2113          LDI   BUFI
2014  0277          LPN   77
2015  0111          LS6
2016  1523          SCI   TABI
2017  7100  CKH27   JPR   *
2020  2140
2021  6304          NJF   CKH23
2022  6103          NZF   CKH23
2023  7101          JFI   1
2024  1577                CKH     -1
2025  5423  CKH23   AOD   TABI
2026  3600          SBC   TAB      77
2027  2140
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2030  6103          NZF   CKH24
2031  2022          LDD   TABC
2032  4023          STO   TABI
2033  5413  CKH24   AOD   BUFI
2034  3600          SBC   BUF      400
2035  2211
2036  6567          NZB   CKH20
2037  7101          JFI   1
2040  1577                CKH     -1        CARD CHECK COMPLETED
                    REM                     TABLE OF LEGAL CODES
2041  0001  TAB             1
2042  0002                  2
2043  0003                  3
2044  0004                  4
2045  0005                  5
2046  0006                  6
2047  0007                  7
2050  0010                  10
2051  0011                  11
2052  0012                  12
2053  0013                  13
2054  0014                  14
2055  0015                  15
2056  0016                  16
2057  0017                  17
2060  0020                  20
2061  0021                  21
2062  0022                  22
2063  0023                  23
2064  0024                  24
2065  0025                  25
2066  0026                  26
2067  0027                  27
2070  0030                  30
2071  0031                  31
2072  0032                  32
2073  0033                  33
2074  0034                  34
2075  0035                  35
2076  0036                  36
2077  0037                  37
```

```
2100  0040                      40
2101  0041                      41
2102  0042                      42
2103  0043                      43
2104  0044                      44
2105  0045                      45
2106  0046                      46
2107  0047                      47
2110  0050                      50
2111  0051                      51
2112  0052                      52
2113  0053                      53
2114  0054                      54
2115  0055                      55
2116  0056                      56
2117  0057                      57
2120  0060                      60
2121  0061                      61
2122  0062                      62
2123  0063                      63
2124  0064                      64
2125  0065                      65
2126  0066                      66
2127  0067                      67
2130  0070                      70
2131  0071                      71
2132  0072                      72
2133  0073                      73
2134  0074                      74
2135  0075                      78
2136  0076                      76
2137  0077                      77
2140  0000  *         BSS       1
2141  0000  BUF       BSS       1
      0000            END
```

NUMBER: T681-1
TITLE Arithmetic Test for 168-1
CATEGORY: 160-A, 168-1
MINIMUM EQUIPMENT NEEDED: 160-A, 168-1

PURPOSE

To ascertain that the arithmetic operations of the 168-1 are functioning properly.

DESCRIPTION

The 160-A generates operands and directs the 168-1. Subtraction is used to check addition and division is used to check multiplication.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION:	Paper Tape	INPUT PARAMETERS
LOADING ADDRESS:	0000	At 7777 stop with P = 0010
TERMINAL ADDRESS:	0770	set A to the number of times
CHECK SUM:	0160	to repeat selected test.
STARTING ADDRESS:	0000	Previously run test
	0001	Add/Subtract only
	0002	Short Multiply/Divide only
	0003	Long Multiply/Divide only
	0004	All tests

ADDITIONAL INSTRUCTIONS:
1) All selective stop switches up
2) All selective jump switches down

HALTS	EXPLANATION
7777	P = 0010, Load number of test runs in A and run
7700	P = 0133, Non-zero status ≠ 0004 in A
7707	P = 0152, Add overflow error
7701	P = 0244, 0266, 0450, and 0647, First word error
7702	P = 0252 and 0655, Second word error
7700	P = 0255, 0326, 0526, Non-zero status in A
7700	P = 0431, and 0623, Non-zero status ≠ 0010 in A
7700	P = 0440 and 0641, Divide fault error

HALTS	EXPLANATION (Cont'd.)
7702	P = 0457, Remainder ≠ zero
7703	P = 0673, Remainder ≠ zero
7777	P = 0754, End of test

```
00000   7140        Same tests
        7140        Add/Subt
        7140        Short Mult/Div
        7140        Long Mult/Div
        7140        All Tests
        0000
        0000
        0000

00010   7777        Load no. of test runs in A and run
        6004        Restore counters, constants
        4100
        0752
        0400
        4100
        1000                        1000-1003   Operands
        4100                        1004-1005   Add result
                                    1006-1007   Sub. result
00020   1001                        1010-1011   Short Mult. result
        4100                        1012-1013   Short Div. result
        1002                        1014-1017   Long Mult. result
        4100                        1020-1023   Long Div. result
        1003
        4100
        0750
        4100

00030   0741
        7101
        0100        - (0300) (0500)
        0000
        0000
        0000
        0000
        0000

00040   0100        (0300) (0500) (0100)
        0160
        0360
        0560
        0050
        0000
        0000
        0000

00050   2200        Establish all tests
        0100
        4312
        4032
        4100
        0731
        2200
        0300
```

```
00060   4100
        0254
        2200
        0500
        4100
        0461
        0400
        6457

00070   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00100   7500        Add
        3323
        7334
        1004
        7101
        0120
        0000
        0000

00110   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00120   7217
        1006
        7500
        3304
        7600
        6053        ZJF if zero - 0200
        0704
        6103

00130   6010
        0000
        0604
        7700        Non-zero status ≠ 0004 in A
        7101
        0100
        1000
        1004
```

```
00140   2100
        1001
        6203
        2500
        1001
        3600
        0316
        6303

00150   7101
        0253
        7707        Add overflow error
        7101
        0100
        0000
        0000
        0000

00160   2200    =   Establish Add/Sub only
        0100
        4040
        6001
        4032
        4155
        2200
        0700

00170   4161
        0400
        7101
        0010
        0000
        0000
        0000
        0000

00200   7500        Subtract
        3363
        7303
        1006
        7353
        1004
        7101
        0220

00210   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00220   7240
        1010
        7500
        3304
        7600
        6130        NZF - 0255
        2100        Compare
        1006

00230   6131
        2100
        1007
        6126
        2100
        1000
        6223
        2100

00240   1006
        3100
        1000
        6002
        7701        First word error
        2100
        1007
        3100

00250   1001
        6002
        7702        Second word error
        7101
        0700        (0300)
        7700        Non-zero status in A
        6503
        1002

00260   1006
        2100
        1006
        3500
        1000
        6002
        7701        First word error
        2100

00270   1007
        3500
        1001
        6420
        6522
        0000
        0000
        0000
```

```
00300   7500        Short Multiply
        3301
        7333
        1001
        7332
        1003
        7101
        0320

00310   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00320   7217
        1012
        7500
        3304
        7600
        6053
        7700        Non-zero status in A
        7101

00330   0300
        0000
        0000
        0000
        0000
        1000
        1002
        1010

00340   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00350   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00360   2200        Establish short multiply /
        0300        Divide only
        4040
        6001
        4032
        4155
        2200
        0700

00370   4165
        0400
        7101
        0010
        0000
        0000
        0000
        0000

00400   7500        Short Divide
        3300
        7363
        1012
        7362
        1003
        7101
        0420

00410   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00420   7247
        1014
        7500
        3304
        7600
        6016
        0710
        6003

00430   0610
        7700        Non-zero status ≠ 0010 in A
        2100
        1002
        6024
        2500
        1002
        6021
```

```
00440   7700        Divide fault (Divide by zero)
        7101
        0300
        2100        Compare
        1012
        3500
        1000
        6002

00450   7701        First word error
        2100
        1013
        6005
        2500
        1013
        6002
        7702        Remainder ≠ zero

00460   7101
        0700        (0500)
        0000
        0000
        0000
        1010
        1002
        1012

00470   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00500   7500        Long multiply
        3303
        7334
        1004
        7101
        0520
        0000
        0000

00510   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00520   7217
        1021        Input disconnect fails if program stops
        7500        here awaiting an input.
        3304
        7600
        6053
        7700        Non-zero status in A
        7101

00530   0500
        0000
        0000
        0000
        0000
        0000
        1000
        1014

00540   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00550   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00560   2200        Establish long multiply /
        0500        Divide only
        4040
        6001
        4032
        4155
        0400
        7101

00570   0010
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00600   7500        Long Divide
        3302
        7373
        1020
        7372
        1004
        7101
        0612

00610   7500
        3310
        7265
        1024
        7500
        3304
        7600
        6023

00620   0710
        6003
        0610
        7700        Non-zero status ≠ 0010 in A
        2100
        1002
        6010
        2500

00630   1002
        6110
        2500
        1003
        6105
        6043
        2100
        1003

00640   6040
        7700        Divide Fault
        2100        Compare
        1020
        3500
        1000
        6002
        7701        First word error

00650   2100
        1021
        3500
        1001
        6002
        7702        Second word error
        2100
        1022
```

```
00660   6010
        2500
        1022
        6110
        2500
        1023
        6105
        6011

00670   2100
        1023
        6006
        7703        Remainder ≠ zero
        6104
        1014
        1002
        1020

00700   2500        Alter first operand
        1000
        4100
        1000
        2500
        1001
        4100
        1001

00710   6320
        0411
        5100
        1000
        6214
        0400
        4100
        1000

00720   0411
        5100
        1001
        6205
        0400
        4100
        1001
        6011

00730   7101
        0100        (0300) (0500)
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00740   2200    Alter second operand
        0000
        0102
        6013
        4303
        3621    Check for end of test
        6112
        5600

00750   0000    Number of tests completed
        3600
        0000    no. of times to repeat
        6523
        7777    End of Test
        7112
        2210
        4316

00760   2317
        4100
        1002
        4100
        1003
        6535
        0715
        0011

00770   1636    Check sum constant
```

NUMBER: T681-2

TITLE: AU Select Test

CATEGORY: 160-A, 168-1

MINIMUM EQUIPMENT NEEDED: 160-A, 168-1

PURPOSE

This test checks, by selecting another external equipment, whether the 168-1 can be interrupted at any point and, upon reselection, resume operation without error. All of the 168-1 status replies are also checked.

DESCRIPTION

Tests all 168-1 functions by intermixing them with paper tape reader codes and I/O instructions. Errors are detected by using fixed operands.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0673

CHECK SUM: 0160

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS:

1. Place a loop of tape in the paper tape reader (any loop is satisfactory since the data is not used).
2. Enter number of test runs in A.

HALTS	EXPLANATION
7777	End of test
7700	Status error
770X	Operation error X = wrong word

```
10000   6104
        4020    clr counter
        7101
        0100
        4021    store new count
        0400
        4020    clr counter
        7101

10010   0100
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10020   0000    counter
        0001    count
        0000
        0000
        0000
        0000
        0000
        0000

10030   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10040   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10050   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

STOPS

7777	End of test
7700	Status error
770X	Operation error

OPERATION

Load a 0000

M. C.; Place number of tests in A; Run stop at end of test (7777)

New number of tests may be established by placing the number in A at the end of test stop and run again without M.C.

If nothing is entered in A, the previous number of tests will run again.

```
10060   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10070   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

10100   7500    sel start
        3304    ready
        7600
        6002
        7700    error
        7500    sel 11 div.
        3300
        7414

10110   7400
        7402
        7600
        0706
        6002
        7701    error
        7600
        6002

10120   7702    error
        7500    sel 11 mult
        3301
        7402
        7403
        7600
        0706
        6002

10130   7701    error
        7600
        6002
        7702    error
        7500    sel 22 div.
        3302
        7414
        7400
```

```
10140   7400
        7400
        7402
        7400
        7600
        0706
        6002
        7701    error

10150   7600
        6002
        7702    error
        7600
        6002
        7703    error
        7600
        6002

10160   7704    error
        7500          sel 22 mult
        3303
        7402
        7400
        7403
        7400
        7600

10170   0706
        6002
        7701    error
        7600
        6002
        7702    error
        7600
        6002

10200   7703    error
        7600
        6002
        7704    error
        7500    sel add
        3323
        7404
        7400

10210   7402
        7400
        7600
        0706
        6002
        7701    error
        7600
        6002
```

```
10220   7702    error
        7500    sel sub.
        3363
        7411
        7400
        7403
        7400
        7600

10230   0706
        6002
        7701    error
        7600
        6004
        7702    error
        0000
        0000

10240   7500    sel ll div.
        3300
        7500    sel reader
        4102
        7600
        7500    re sel
        3310
        7414

10250   7500    sel reader
        4102
        7600
        7500    re sel
        3310
        7400
        7402
        7500    sel reader

10260   4102
        7600
        7500    re sel
        3310
        7600
        0706
        6002
        7701    error

10270   7500    sel reader
        4102
        7600
        7500    sel start
        3304    unload not complete
        7600
        0720
        6002
```

```
10300   7700    error
        7500    re sel
        3310
        7600
        6002
        7702    error
        0477
        0701

10310   6501
        7500    sel start
        3304    ready
        7600
        6002
        7700    error
        7500    sel 11 mult
        3301

10320   7500    sel start
        3304    ready
        7600
        0700
        6002
        7700    error
        7500    sel reader
        4102

10330   7500    re sel
        3310
        7402
        7500    re sel
        3310
        7403
        7500    sel reader
        4102

10340   7600
        7500    re sel
        3310
        7600
        0706
        6002
        7701    error
        7500    sel start    unload not complete

10350   3304
        7600
        0720
        6002
        7700    error
        7500    re sel
        3310
        7600
```

```
10360   6002
        7702    error
        7500    sel 22 div.
        3302
        7414
        7400
        7400
        7500    sel reader

10370   4102
        7500    re sel
        3310
        7400
        7402
        7400
        7500    sel start
        3304    busy compute

10400   7600
        0740
        6002
        7700    error
        7500    re sel
        3310
        7600
        0706

10410   6002
        7701    error
        7600
        6002
        7702    error
        7500    sel reader
        4102
        7500    re sel

10420   3310
        7600
        6002
        7703    error
        7600
        6002
        7704    error
        7500    sel 22 mult.

10430   3303
        7402
        7400
        7403
        7400
        7500    sel start
        3304
        7600    busy compute
```

```
10440   0740
        6002
        7700    error
        7500    re sel
        3310
        7600
        0706
        6002

10450   7701    error
        7500    sel reader
        4102
        7600
        7500    re sel
        3310
        7600
        6002

10460   7702    error
        7600
        6002
        7703    error
        7600
        6002
        7704    error
        7500    sel add

10470   3323
        7404
        7500    sel reader
        4102
        7600
        7500    re sel
        3310
        7400

10500   7402
        7400
        7600
        0706
        6002
        7701    error
        7500    sel start
        3304    unload not complete

10510   7600
        0720
        6002
        7700    error
        7500    sel reader
        4102
        7600
        7500    re sel
```

```
10520   3310
        7600
        6002
        7702    error
        7500    sel reader
        4102
        7600
        7500    sel start

10530   3304
        7600
        6002
        7700    error
        7500    sel sub
        3363
        7500    sel start
        3304    ready

10540   7600
        6002
        7700    error
        7500    re sel
        3310
        7411
        7400
        7403

10550   7400
        7600
        0706
        6002
        7701    error
        7500    sel start
        3304
        7600    unload not complete

10560   0720
        6002
        7700    error
        7500    re sel
        3310
        7600
        6002
        7702    error

10570   7500    sel 11 div for div fault
        3300
        7310
        0606
        7500
        3304    sel start
        7600
        0750    div fault and busy compute
```

```
10600   6006
        7700    error
        0603
        1670
        0001
        0477
        0701

10610   6501
        7500    sel start
        3304
        7600    div fault and unload not complete
        0730
        6002
        7700    error
        7500    sel add for add overflow

10620   3323
        7310
        0636
        7500    sel start
        3304
        7600    add overflow and unload not complete
        0724
        6007

10630   7700    error
        0632
        3777
        3777
        0001
        0000
        7500    sel sub for sub overflow
        3363

10640   7310
        0655
        7500    sel start
        3304
        7600    sub overflow and unload not complete
        0724
        6007
        7700    error

10650   0651
        3777
        3777
        7776
        7777
        5420    advance counter
        2021
        3420    compare to count
```

```
10660   6005
        7500 }
        3301 }   sel. clear MDU
        7101     jump to repeat test
        0100
        7500 }   sel. clear MDU
        3300 }
        0400

10670   7777     end of test
        7101 }
        0000 }   jump to establish new number of tests
        2665     sum
```

NUMBER: T682-1
TITLE: Arithmetic Test for 168-2
CATEGORY: 160-A, 168-2
MINIMUM EQUIPMENT NEEDED: 160-A, 168-2

PURPOSE

To ascertain that the arithmetic operations (including compute result operations) of the 168-2 are functioning properly.

DESCRIPTION

The test routine consists of four separate arithmetic tests. The 160-A generates operands and directs the 168-2. Subtraction is used to check addition and division is used to check multiplication.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION:	Paper Tape	INPUT PARAMETERS
LOADING ADDRESS:	0000	At 7777 stop with P = 0010
TERMINAL ADDRESS:	2500	Set A to number of times
CHECK SUM:	0160	to repeat selected test.
STARTING ADDRESS:	0000	Previously selected test
	0001	Add/Subtract only
	0002	Multiply/Divide only
	0003	Shift/Normalize only
	0004	All tests, including "compute result" operations.

ADDITIONAL INSTRUCTIONS:
1) All selective stop switches up.
2) All selective jump switches down.

HALTS	EXPLANATION
7777	P = 0010, Set A to number of repetitions for test and restart.
7700	P = 0131, 0252, 0326, 0431, 0541, 0560 and 0573, Incorrect status displayed in A.
7700	P = 0144, Incorrect overflow.
7700	P = 0443, Divide fault.

HALTS	EXPLANATION (Cont'd.)
7700	P = 1164, "Compute result" error. See error stops as indicated by contents of A register.
7700	P = 1665, Multiply to normalize 28th bit error.
7701	P = 0233, 0451 and 0610, First word error.
7702	P = 0241, 0451 and 0613, Second word error.
7703	P = 0247, 0465 and 0620, Third word error.
7704	P = 0410, Multiply/Divide error: remainder ≠ zero.
7704	P = 0605, Shift count error.
7777	P = 0775, End of test.

P = 1164
Z = 7700

"A"	Word No.	Condition
1	1	Add/Add
2	2	
3	3	
4	1	Add/Multiply
5	2	
6	3	
7	4	
10	5	
11	6	
12	1	Add/Normalize
13	2	
14	3	
15	1	Add/Left Shift
16	2	
17	3	
20	1	Subtract/Add
21	2	
22	3	
23	1	Subtract/Multiply
24	2	
25	3	
26	4	
27	5	
30	6	
31	1	Subtract/Normalize
32	2	
33	3	
34	1	Subtract/Left Shift
35	2	
36	3	

37	1	Multiply/Add
40	2	
41	3	
42	1	Multiply/Multiply
43	2	
44	3	
45	4	
46	5	
47	6	
50	1	Multiply/Normalize
51	2	
52	3	
53	1	Multiply/Left Shift
54	2	
55	3	
56	1	Divide/Add
57	2	
60	3	
61	1	Divide/Multiply
62	2	
63	3	
64	4	
65	5	
66	6	
67	1	Divide/Normalize
70	2	
71	3	
72	1	Divide/Left Shift
73	2	
74	3	
75	1	Right Shift/Add
76	2	
77	3	

100	1	Right Shift/Multiply
101	2	
102	3	
103	4	
104	5	
105	6	
106	1	Right Shift/Normalize
107	2	
110	3	
111	1	Right Shift/Left Shift
112	2	
113	3	
114	1	Add/Subtract
115	2	
116	3	
117	1	Subtract/Subtract
120	2	
121	3	
122	1	Multiply/Subtract
123	2	
124	3	
125	1	Divide/Subtract
126	2	
127	3	
130	1	Right Shift/Subtract
131	2	
132	3	
133	1	Left Shift/Subtract
134	2	
135	3	
136	1	Add/Divide
137	2	
140	3	

141	1	Subtract/Divide
142	2	
143	3	
144	1	Multiply/Divide
145	2	
146	3	
147	1	Divide/Divide
150	2	
151	3	
152	1	Right Shift/Divide
153	2	
154	3	
155	1	Left Shift/Divide
156	2	
157	3	

```
00000   7140    Repeat same test as before
        7140    Add-subtract only: 10 min.
        7140    Multiply-divide only: 16 min.
        7140    Shift-normalize only: 30 millisec.
        7161    All tests, including compute result op.: 34 min.
        0000
        0676
        0000

00010   7777    HLT: Enter in "A" number of times test is to run
        6004
        4100
        0752
        0400
        4100
        0750
        4100

00020   0741
        4100
        1005
        4100
        1004
        4100
        1003
        0400

00030   4100
        1000
        4100
        1001
        4100
        1002
        6001
        7101

00040   0100
        0160
        0340
        0260
        0050
        1030
        1031
        1032

00050   2200    Establish all tests
        0100
        4040
        6001
        6001
        4100
        0706
        2200
```

```
00060   0300
        4100
        0251
        4100
        0142
        2221
        4100
        0732

00070   0427
        4100
        0770
        2214
        4106
        0400
        6466
        0000

00100   7500    Add
        3321
        7315
        1006
        7101
        0120
        0500
        0707

00110   0000
        0000
        0000
        0000
        0000
        0000
        0000
        1000

00120   7236
        1011
        7500    Status
        3304
        7600
        6053
        1200
        7767

00130   6003
        7700    Error (status in "A")
        0300
        2122    Check if overflow was legal
        0207
        4077
        2535
        3477
```

```
00140   6203
        7101
        0700
        6004
        7700    Overflow error
        7101
        0100
        2533

00150   3524
        6605
        6711
        0000
        0000
        0000
        1006
        0707    Establish Add/Subtract only

00160   2200
        0100
        4040
        4100
        0706
        4100
        0770
        2200

00170   0700
        4260
        4330
        2314
        4167
        0400
        7101
        0010

00200   7500    Subtract
        3361
        7303
        1011
        7313
        1006
        7101
        0220

00210   0000
        0000
        0000
        0000
        0000
        0000
        0000
        1003
```

```
00220   7207
        1014
        7500    Status
        3304
        7600
        6125
        2100    Compare for add-subtract errors
        1011

00230   3500
        1000
        6002
        7701    1st word error
        2100
        1012
        3500
        1001

00240   6002
        7702    2nd word error
        2100
        1013
        3500
        1002
        6002
        7703    3rd word error

00250   7101
        0300
        7700    Error (status in "A")
        6503
        0000
        0000
        0000
        0000

00260   2200    Establish Shift/Normalize only
        0500
        4100
        0732
        4100
        0770
        4040
        2200

00270   0747
        4100
        0676
        0400
        7101
        0010
        0000
        0000
```

```
00300   7500    Multiply
        3301
        7315
        1006
        7101
        0320
        0000
        0000

00310   0000
        0000
        0000
        0000
        0000
        0000
        0000
        1000

00320   7211
        1022
        7500    Status
        3304
        7600
        6053
        7700    Error (status in "A")
        7101

00330   0400
        1014
        0000
        0000
        0000
        0000
        0000
        0000

00340   2200    Establish Multiply-Divide only
        0300
        4040
        4100
        0706
        4100
        0770
        2200

00350   0707
        4100
        0732
        0400
        7101
        2420
        0000
        0000
```

```
00360   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00370   0000
        0000
        0000
        0000
        0000
        7101
        1700    Jump to compute result operations
        0000

00400   7500    Divide
        3300
        7315
        1022
        7312
        1006
        7101
        0420

00410   7704    Error (remainder ≠ 0)
        7101
        0700
        0000
        0000
        4000
        1003
        1014

00420   7225
        1031
        7500    Status
        3304
        7600
        6430
        3711
        6003

00430   3313
        7700    Error (status in "A")
        2100
        1003
        6107
        2100
        1004
        6104
```

```
00440   2100
        1005
        6431
        7700    Divide fault
        2100    Compare answers from multiplication and division
        1022
        3500
        1000

00450   6002
        7701    1st word error
        2100
        1023
        3500
        1001
        6002
        7702    2nd word error

00460   2100
        1024
        3500
        1002
        6002
        7703    3rd word error
        2100
        1025

00470   6560
        2100
        1026
        6563
        2100
        1027
        6566
        6466

00500   0404
        4100
        1032
        0400
        4145
        4146
        4203
        0410

00510   5200
        0000
        3600
        0160
        6103
        7101
        0624
        2306
```

```
00520   0102
        4200
        0000
        2147
        0207
        3303
        4147
        7500    Right shift

00530   3303
        7372
        1033
        7270
        1003
        7500    Status
        3304
        7600

00540   6002
        7700    Error (status in "A")
        2147
        0207
        3333
        4147
        7500    Left shift
        3302

00550   7353
        1033
        7251
        1003
        7500    Status
        3304
        7600
        6002

00560   7700    Error (status in "A")
        7500    Normalize and count
        3342
        7340
        1033
        7236
        1003
        7500    Status

00570   3304
        7600
        6002
        7700    Error (status in "A")
        2325
        3642
        6142
        2147
```

```
00600   0110
        0111
        1234
        3772
        6002
        7704    Shift count error
        2145
        6002

00610   7701    1st word error
        2146
        6002
        7702    2nd word error
        2147
        0207
        0704
        6002

00620   7703    3rd word error
        7101
        0507
        1030
        2355    Exchange Right and Left shift EXF codes
        4375
        0601
        4360

00630   2200
        0660
        4100
        0516
        7101
        0500
        0370
        3302

00640   2200
        0330
        3500
        0511
        4210
        2147
        0110
        0111

00650   1312
        3603
        7101
        0604
        0000
        0000
        0000
        0000
```

```
00660   2200    Exchange Right and Left EXF codes
        0624
        4100
        0516
        2100
        0530
        4100
        0547

00670   5500
        0530
        0400
        6002
        0000
        7101
        0707
        0000

00700   2200    Alter lst operand
        0055
        5100
        1000
        6025
        7101
        0100
        2200

00710   0055
        5100
        1001
        6506
        0407
        1100
        1002
        0707

00720   6005
        5500
        1002
        6416
        6517
        0400
        4100
        1002

00730   6010
        7101
        0500
        0000
        0000
        0000
        0000
        0000
```

```
00740   2200    Alter 2nd operand
        0000
        0102
        6013
        4303
        3624    Check for end of test
        6112
        5600

00750   0000
        3600
        0000    Number of times test is to repeat
        6114
        7101
        0775
        2213
        4316

00760   2317
        4100
        1003
        4100
        1004
        4100
        1005
        7101

00770   0027
        0715
        0000
        0000
        0000
        7777    End of test
        7101
        0011

01000   0040  ┐
        0000  ├ 1st operand
        0000  ┘
        0000  ┐
        0000  ├ 2nd operand
        0000  ┘
        0000  ┐
        0000  ├ Sum
01010   0000  ┘
        0000  ┐
        0000  ├ Difference
        0000  ┘
        0000  ┐
        0000  ├ Product
        0000  ┘
        0000  ┘
```

01020	0000		
	0000		
	0000	Quotient	
	0000	Quotient	
	0000	Quotient	
	0000	Remainder	
	0000	Remainder	
	0000	Remainder	
01030	0000	Shift/Normalize and count	
	0000	Shift/Normalize and count	
	0000	Shift/Normalize and count	
	0000		
	0000		
	0000		
	0000		
	0000		
01040	0000		
	0000		
	0000		
	0000		
	0000		
	0000		
	0000		
	0000		
01050	0000		
	0000		
	0000		
	0001		
	0000		
	0000	Normalized 1st operand	
	0000	Normalized 1st operand	
	0000	Normalized 1st operand	
01060	0000	Normalized 1st operand	
	0000	Sum	
	0000	Sum	
	0000	Sum	
	0000	Product	
	0000	Product	
	0000	Product	
	0000	Product	
01070	0000	Product	
	0000	Product	
	0000	Normalize and count	Divide
	0000	Normalize and count	Divide
	0000	Normalize and count	Divide
	0000	Left shift	Divide
	0000	Left shift	Divide
	0000	Left shift	Divide

```
01100   0000
        0000
        2200    Check result (loc. 1002-1277)
        1006    Check Add result
        4205
        2200
        1061
        4204

01110   2100
        1006
        3500
        1061
        6004
        0101
        7101
        1160

01120   5643
        5710
        5707
        3600
        1064
        6515
        2200    Check Multiply result
        1014

01130   4205
        2200
        1064
        4204
        2100
        1014
        3500
        1064

01140   6004
        0101
        7101
        1160
        5617
        5710
        5707
        3600

01150   1072
        6515
        7101
        1200
        0000
        0000
        0000
        0000
```

```
01160   0603
        4205
        2200
        0001    Error indicator counter
        7700    Error.  Check "A" register for type of error
        7101
        0000
        0000

01170   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

01200   7500    Check Normalize result
        3342
        7356
        1003
        7255
        1061
        2200
        1056

01210   4205
        2200
        1072
        4204
        2100
        1056
        3500
        1072

01220   6004
        0101
        7101
        1160
        5741
        5710
        5707
        3600

01230   1075
        6515
        2200    Check left shift result
        1056
        4205
        2200
        1075
        4204
```

```
01240   2100
        1056
        3500
        1075
        6004
        0101
        7101
        1160

01250   5765
        5710
        5707
        3600
        1100
        6515
        7101
        1440

01260   1000
        1056
        0000
        0000
        0000
        0000
        0000
        0000

01270   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

01300   7500    Initial operation for a compute result selection
        3321
        7375
        1003
        7372
        1053
        7101
        1310

01310   7500    Add to result
        3335
        7363
        1006
        7260
        1064
        2200
        1330
```

```
01320   4311
        7101
        1300
        1474
        1600
        0000
        0000
        0000

01330   7500    Multiply result
        3315
        7343
        1006
        7237
        1072
        2200
        1345

01340   4331
        7101
        1300
        0000
        0000
        7500    Normalize result
        3356
        7223

01350   1075
        2200
        1400
        4344
        7101
        1300
        0000
        0000

01360   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

01370   0000
        0000
        1072
        1064
        1061
        1003
        1050
        1000
```

```
01400   2100    Left shift result
        1074
        1200
        7700
        0111
        0110
        4317
        7500

01410   3316
        7326
        1370
        7223
        1100
        2200
        1440
        4100

01420   1257
        2332
        0110
        4335
        5100
        1077
        2200
        1310

01430   4100
        1307
        7101
        1102
        0000
        0000
        1075
        1367

01440   2200    Establish subtract as initial operation
        3361
        4100
        1301
        2200
        1460
        4100
        1416

01450   7101
        1300
        0000
        0000
        0000
        0000
        0000
        0000
```

```
01460   2200    Establish multiply as initial operation
        7123
        4100
        1300
        7500
        3301
        7351
        1003

01470   7346
        1531
        7243
        1526
        7500
        3301
        7337
        1523

01500   7334
        1532
        0300
        0300
        2200
        1540
        4100
        1416

01510   7101
        1306
        0000
        0000
        0000
        0000
        0000
        0000

01520   0000
        0000
        0000
        0000
        0000
        0000
        0002
        0000

01530   0000
        0004
        0000
        0000
        1527
        1520
        1526
        1000
```

```
01540   2200    Establish divide as initial operation
        7500
        4100
        1300
        2200
        3300
        4100
        1301

01550   0401
        4100
        1053
        2200
        1056
        4100
        1305
        2200

01560   1600
        4100
        1416
        7101
        1300
        0000
        0000
        0000

01570   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

01600   2200    Establish right shift as initial operation
        7124
        4100
        1300
        7500
        3342
        7330
        1003

01610   7500
        3317
        7325
        1370
        2200
        2000
        4100
        1416
```

```
01620   2200
        1053
        4100
        1305
        7101
        1306
        0000
        0000

01630   0000
        0000
        0000
        0000
        0000
        0000
        1000
        1367

01640   7101
        0444
        0000
        0000
        0000
        0000
        0000
        0000

01650   7500
        3301
        7316
        1700
        7500
        3356
        7213
        1650

01660   2100
        1647
        3600
        3304
        6002
        7700    Error (multiply to normalize, 28th bit)
        7101
        1640

01670   1672
        1645
        0001
        0000
        0000
        0000
        0000
        0004
```

```
01700   0401    Establish compute result test conditions
        4100
        1163
        2200
        1440
        4100
        1257
        2200

01710   7500
        4100
        1300
        2200
        3321
        4100
        1301
        2200

01720   1440
        4100
        1416
        2200
        1310
        4100
        1307
        2200

01730   1053
        4100
        1305
        2100
        1002
        0204
        6132
        0300

01740   2200
        1232
        4100
        2023
        2200
        2300
        4100
        2245

01750   5622
        3622
        6116
        0400
        4216
        2200
        3321
        4100
```

```
01760   2001
        2100
        1010
        0214
        6104
        7101
        2060
        0000

01770   7101
        1640
        0000
        0100
        0000
        0000
        0000
        0000

02000   7500    Establish Add as initial operation
        3321
        7334
        1011
        7331
        1053
        7500    Subtract from result
        3375

02010   7324
        1006
        7500
        3356
        7223
        1100
        2200
        2040

02020   4100
        1257
        7101
        1232
        0000
        0000
        0000
        0000

02030   0000
        0000
        0000
        0000
        1003
        1050
        1006
        1075
```

```
02040   2200    Establish subtract as initial operation
        3361
        4100
        2001
        2200
        2100
        4100
        2017

02050   7101
        2000
        0000
        0000
        0000
        0000
        0000
        0000

02060   2200    Establish initial conditions
        2040
        4100
        2017
        2200
        3375
        4100
        2007

02070   2200
        2006
        4100
        2127
        5600
        0000
        7101
        1300

02100   2100    Establish multiply as initial operation
        1010
        0214
        6133
        7500
        3301
        7371
        1011

02110   7354
        1531
        7263
        2173
        7500
        3301
        7357
        2170
```

```
02120   7354
        1532
        2200
        2140
        4100
        2017
        7101
        2000

02130   0000
        0000
        0000
        0000
        0000
        0000
        7101
        1640

02140   7500    Establish divide as initial operation
        3300
        7335
        1011
        7327
        1056
        2200
        2200

02150   4100
        2017
        7101
        2006
        0000
        0000
        0000
        0000

02160   0000
        0000
        0000
        0000
        1526
        0000
        0000
        0000

02170   0000
        0000
        0000
        1050
        1527
        2165
        1527
        1006
```

```
02200   7500    Establish right shift as initial operation
        3303
        7335
        1011
        2200
        2240
        4100
        2017

02210   7101
        2006
        0000
        0000
        0000
        0000
        0000
        0000

02220   0000
        0400    Establish Test #4 conditions
        4100
        2075
        4100
        1772
        2200
        6430

02230   4100
        0425
        7101
        0050
        0000
        0000
        0000
        1006

02240   7500    Establish left shift as initial operation
        3302
        7335
        1011
        2200
        2300
        4100
        2017

02250   7101
        2006
        0000
        0000
        0000
        0000
        0000
        0000
```

```
02260   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02270   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
        1006

02300   2100    Establish divide as 2nd operation
        1003
        6107
        2100
        1004
        6104
        2100
        1005

02310   6026
        2200
        3314
        4100
        2007
        2200
        2340
        4100

02320   2023
        2200
        3321
        4100
        2001
        2200
        2040
        4100

02330   2017
        7101
        2000
        0000
        0000
        0000
        7101
        1640
```

```
02340   2100    Check divide result
        2017
        4253
        7500
        3300
        7372
        1011
        7367

02350   1053
        7364
        1006
        7500
        3356
        7257
        2336
        2200

02360   1075
        4205
        2200
        2333
        4204
        2100
        1075
        3500

02370   2333
        6004
        0101
        7101
        1160
        5500
        1163
        5711

02400   5710
        3600
        2336
        6516
        2200
        1650
        4100
        2245

02410   2200
        2450
        4100
        2127
        7101
        2040
        0000
        0000
```

```
02420   2200    Establish Test #3 conditions
        6017
        4100
        0425
        0400
        7101
        0010
        0000

02430   0000
        0000
        0000
        0000
        2333
        1003
        1050
        1006

02440   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

02450   7500
        3316
        7400
        7500
        3315
        7322
        1056
        2200

02460   2006
        4100
        2127
        7101
        2006
        0000
        0000
        0000

02470   0000
        0000
        0000
        0000
        0000
        0000
        0000
        1053

02500   6436    Check sum const.
```

NUMBER: T682-2

TITLE: AU Select Test

CATEGORY: 160-A, 168-2

MINIMUM EQUIPMENT NEEDED: 160-A, 168-2

PURPOSE

The test checks by selecting another external equipment, whether the 168-2 can be interrupted at any point and upon reselection, resume operation without error. All of the 168-2 status replies are also checked.

DESCRIPTION

Tests all 168-2 functions by intermixing them with paper tape reader codes and I/O instructions. Errors are detected by using fixed operands.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 1014

CHECK SUM: 0160

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS:

1) Turn on the 350 reader.
2) Set A to the desired number of runs through the test.
3) Position all SLS switches up.
4) Place a loop of tape in the reader.

HALTS	EXPLANATION
7777	P=1011 End of test.
7700	Status error.
770X	X = number of word on which error occurred.

```
00000   6104
        4020    Clear Counter
        7101
        0100
        4021    Store New Count
        0400
        4020    Clear Counter
        7101

00010   0100
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00020   0000    Counter
        0001    Count
        0000
        0000
        0000
        0000
        0000
        0000

00030   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00040   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00050   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000
```

```
00060   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00070   0000
        0000
        0000
        0000
        0000
        0000
        0000
        0000

00100   7500
        3304
        7600
        6002
        7700    Status Error
        7500
        3300    Select Divide
        7414    1st Word

00110   7414    2nd Word
        7400    3rd Word
        7400    4th Word
        7400    5th Word
        7400    6th Word
        7402    7th Word
        7402    8th Word
        7400    9th Word

00120   7600
        0706
        6002
        7701    Error
        7600
        6002
        7702    Error
        7600

00130   6002
        7703    Error
        7600
        6002
        7704    Error
        7600
        6002
        7705    Error
```

```
00140   7600
        6002
        7706        Error
        7500
        3301        Multiply
        7402        1st Word
        7402        2nd Word
        7401        3rd Word

00150   7406        4th Word
        7400        5th Word
        7400        6th Word
        7600
        0714
        6002
        7701        Error
        7600

00160   0714
        6002
        7702        Error
        7600
        0706
        6002
        7703        Error
        7600

00170   0700
        6002
        7704        Error
        7600
        6002
        7705        Error
        7600
        6002

00200   7706        Error
        7500
        3321        Add.
        7406        1st Word
        7406        2nd Word
        7401        3rd Word
        7401        4th Word
        7401        5th Word

00210   7401        6th Word
        7600
        0707
        6002
        7701        Error
        7600
        0707
        6002
```

```
00220   7702    Error
        7600
        0702
        6002
        7703    Error
        7500
        3361    Subtract
        7406    1st Word

00230   7406    2nd Word
        7401    3rd Word
        7401    4th Word
        7401    5th Word
        7401    6th Word
        7600
        0705
        6002

00240   7701    Error
        7600
        0705
        6002
        7702    Error
        7600
        6002
        7703    Error

00250   7500
        3302    Left Shift
        7404    1st Word
        7404    2nd Word
        7414    3rd Word
        7600
        0711
        6002

00260   7701    Error
        7600
        0710
        6002
        7702    Error
        7600
        0700
        6002

00270   7703    Error
        7500
        3303    Right Shift
        7402    1st Word
        7402    2nd Word
        7412    3rd Word
        7600
        0701
```

```
00300    6002
         7701    Error
         7600
         0701
         6002
         7702    Error
         7600
         0701

00310    6002
         7703    Error
         7500
         3300    Divide
         7500
         4102    See Reader
         7600
         7500

00320    3310    Reselect
         7414    1st Word
         7414    2nd Word
         7500
         4102
         7600
         7500
         3310    Reselect

00330    7400    3rd Word
         7400    4th Word
         7400    5th Word
         7400    6th Word
         7500
         4102
         7600
         7500

00340    3310    Reselect
         7402    7th Word
         7402    8th Word
         7400    9th Word
         7500
         3304
         7600
         7500

00350    6002
         7700    Status Error
         7500
         3310
         7600
         0706
         6002
         7701    Error
```

```
00360   7500
        4102
        7600
        7500
        3310    Reselect
        7600
        6002
        7702    Error

00370   7600
        6002
        7703    Error
        7500
        3304
        7600
        0720
        6001

00400   7700    Status Error
        7500
        3310    Reselect
        7600
        6002
        7705    Error
        7500
        4102

00410   7600
        7500
        3310    Reselect
        7600
        6002
        7706    Error
        7500
        3301    Multiply

00420   7500
        4102
        7600
        7500
        3310    Reselect
        7402    1st Word
        7402    2nd Word
        7401    3rd Word

00430   7500
        4102
        7600
        7500
        3310    Reselect
        7406    4th Word
        7400    5th Word
        7400    6th Word
```

```
00440   7500
        4102
        7600
        7500
        3310        Reselect
        7600
        0714
        6002

00450   7701        Error
        7500
        4102
        7600
        7500
        3310        Reselect
        7600
        0714

00460   6002
        7702        Error
        7500
        3304
        7600
        0720
        6002
        7700        Status Error

00470   7500
        3310        Reselect
        7600
        0706
        6002
        7003        Error
        7600
        0700

00500   6002
        7704        Error Fourth Word
        7500
        4102
        7600
        7500
        3310        Reselect
        7600

00510   6002
        7705        Error 5th Word
        7600
        6002
        7706        Error 6th Word
        7500
        3321        Add
        7500
```

```
00520   4102
        7600
        7500
        3310        Reselect
        7406        1st Word
        7406        2nd Word
        7500
        4102

00530   7600
        7500
        3310        Reselect
        7401        3rd Word
        7401        4th Word
        7500
        4102
        7600

00540   7500
        3310
        7401        5th Word
        7401        6th Word
        7500
        3304
        7600
        0720

00550   6002
        7700        Status Error
        7500
        3310
        7600
        0707
        6002
        7701        Error

00560   7500
        4102
        7600
        7500
        3310        Reselect
        7600
        0707
        6002

00570   7702        Error
        7600
        0702
        6002
        7703        Error
        7500
        3361        Subtract
        7500
```

```
00600   4102
        7600
        7500
        3310
        7406    1st Word
        7406    2nd Word
        7401    3rd Word
        7500

00610   4102
        7600
        7500
        3310
        7401    4th Word
        7401    5th Word
        7401    6th Word
        7500

00620   3304
        7600
        0720
        6002
        7700    Status Error
        7500
        3310
        7600

00630   0705
        6002
        7701    Error
        7600
        0705
        6002
        7702    Error
        7500

00640   4102
        7600
        7500
        3310    Reselect
        7600
        6002
        7703    Error
        7500

00650   3302    Left Shift
        7500
        4102
        7600
        7500
        3310    Reselect
        7404    1st Word
        7404    2nd Word
```

```
00660   7414    3rd Word
        7500
        4102
        7600
        7500
        3310    Reselect
        7600
        0711

00670   6002
        7701    Error
        7500
        4102
        7600
        7500
        3310    Reselect
        7600

00700   0710
        6002
        7702    Error
        7600
        0700
        6002
        7703    Error
        7500

00710   3303
        7500
        4102
        7600
        7500
        3310    Reselect
        7402    1st Word
        7402    2nd Word

00720   7412    3rd Word
        7500
        4102
        7600
        7500
        3310    Reselect
        7600
        0701

00730   6002
        7701    Error
        7500
        4102
        7600
        7500
        3310    Reselect
        7600
```

```
00740   0701
        6002
        7702    Error
        7500
        4102
        7600
        7500
        3310    Reselect

00750   7600
        0701
        6002
        7703    Error
        7500
        3300
        7414    1st Word
        7414    2nd Word

00760   7414    3rd Word
        7414    4th Word
        7414    5th Word
        7404    6th Word
        7400    7th Word
        7400    8th Word
        7400    9th Word
        7500

00770   3304
        7600
        3600
        4040
        6002
        7700
        5420    Advance Counter
        2021

01000   3420    Compare to Count
        6005
        7500
        3301
        7101
        0100
        7500
        3300

01010   0400
        7777    End of Test
        7101
        0000
        5262    Check Sum
```

NUMBER: T002-B
TITLE: Memory Test for 169 Memory Unit
CATEGORY: 160-A, 169
MINIMUM EQUIPMENT NEEDED: 160-A, 169

PURPOSE

Tests any arbitrary number of bank, up to the maximum number present in the 160-A computer or a 160-A, 169 system.

DESCRIPTION

The program may be located in any bank. The next bank in sequence will be tested by, having the worst pattern stored in it, checking the pattern, then storing and checking the compliment worst pattern. The program then transfers itself to the bank which has been tested, and the test progresses through the memory.

The program checks itself, via a checksum subroutine upon starting a new bank, and prior to transferring itself to the next bank in sequence. If the checksum is not correct an error stop will occur. This condition is indicated by:

P = 1073 A = bits failing in program Z = 0000 (green background)

The MCS mode indicator shows which bank the program is in. The program will stop if any error occurs while checking worst pattern or its compliment with:

P = 0101 A = bits failing in worst pattern Z = 7700 (green background)

If the computer is placed in run again it will stop with:

P = 0103 A = address failing in worst pattern Z = 7777 (green background)

The bank being tested will be indicated by the MCS mode indicator when the IND button is pressed.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: r0000
TERMINAL ADDRESS: r0175

INPUT PARAMETERS

r = Relative bank selected. When starting the program it is necessary to set the relative bank selection only.

CHECK SUM: 0002 The direct and indirect bank selections are set automatically by the program.

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS: When starting the program the first time after it has been loaded from the paper tape, the highest bank number present must be entered in the A register. The next time the program is started, the A register may be clear, and the highest bank number used previously will be saved.

HALTS		EXPLANATION
0051	7701	Selective Stop 1. The computer will stop every time a new pattern is stored in the bank being tested.
0050	7702	Selective Stop 2. Computer will stop when worst pattern (not the compliment pattern) is stored in the bank being tested.
0045	7704	Selective Stop 4. Computer will stop when worst pattern (not the compliment pattern) is stored in bank 1. At this time the program is located in bank 0.
		NOTE: Selective stops may be selected in any desired combination.

T002 B
MEMORY TEST FOR 160-A COMPUTER AND 169 AUXILIARY MEMORY

```
0000    0207
0001    6003        Get Number of Highest Bank
0002    0601
0003    4271
0004    7100        Enter Check Sum Subroutine
0005    0143
0006    0130
0007    0207

0010    0601
0011    1474        Set IND to Next Bank in Sequence
0012    6002
0013    1474
0014    0320
0015    4201
0016    (0000)      (Locations in parentheses are normally modified by the
0017    0400         computer during execution of the program)

0020    4076
0021    0400
0022    4077
0023    2076
0024    4177        Write Pattern in Bank
0025    5477        Locations 0000 through 7776
0026    6011
0027    0277

0030    6003
0031    0207
0032    6407
0033    2476
0034    4076
0035    7101
0036    0023
0037    2476

0040    4172        Store Pattern at Location 7777
0041    6310
0042    0130        Determine Stop Options
0043    0207
0044    6104
0045    7704        Selective Stop 4     Stop on Full Cycle thru Max. No. of bank
0046    0001
0047    0001

0050    7702        Selective Stop 2     Stop on Every Bank
0051    7701        Selective Stop 1     Stop on Every Pattern
0052    0400
0053    4077
0054    2076
0055    1577
```

```
0056        6122
0057        5477
0060        6026
0061        0277        Check Pattern
0062        6003
0063        0207
0064        6410
0065        2476
0066        4076
0067        7101

0070        0054
0071        0000
0072        7777        Constant = 7777
0073        0170        Check Sum Adjustment
0074        (0000)      Highest Bank Number Allowable + 1
0075        0176        Constant = Number of Words in Program
0076        (0000)      Test Word
0077        (0077)      Test Address

0100        2177
0101        7700        Error Stop - Indicate Bits Which Failed
0102        2077
0103        7777        Stop - Indicate Location of Failure
0104        7101        Check Next Word
0105        0057
0106        2476
0107        6567        Repeat Program for Both Patterns

0110        7100        Enter Check Sum Subroutine
0111        0143        When Both Patterns are Checked
0112        4077
0113        7710        Test Selective Jump for Bank Change
0114        0006
0115        0130
0116        0207
0117        0320

0120        4212
0121        0320
0122        0601
0123        1474
0124        6002        Set Bank Change Instructions
0125        1474
0126        0320
0127        4205

0130        0330
0131        4210
0132        (0000)
0133        2177        Transfer Program to Next Bank
0134        (0000)
0135        4177
0136        5477
0137        1475
0140        6506
```

```
0141        (0000)      Jump to Next Bank
0142         7101       Exit Check Sum Subroutine
0143        (0000)      Entrance Check Sum Subroutine
0144         0130
0145         0207
0146         0360
0147         4201

0150        (0000)      Set All Bank Selections Same as Relative
0151         0400
0152         4016       Clear All Locations Modified by Program
0153         4321
0154         4320
0155         4314
0156         4306
0157         4300       Clear Previous Check Sum

0160         4077       Set Initial Address
0161         2177
0162         5300       Form Check Sum in Location 07777
0163         5477
0164         1475
0165         6504
0166         2723       Subtract Exit Address from Check Sum
0167         3474       Subtract Maximum Bank Number  +1 from Check Sum

0170         5300
0171         0702
0172         6430       Exit if Check Sum is OK
0173         0000       Check Sum Error
0174         6501       Hang up on Check Sum Error
0175         6433       Unless A Register is Cleared
```

NUMBER: T690

TITLE: Auxiliary Memory Buffer Interrupt Test

CATEGORY: 169, 160-A

MINIMUM EQUIPMENT NEEDED: 169, 160-A, 161

PURPOSE

This test is used to check the 169 I/O Buffer operation.

DESCRIPTION

The test uses the T033 memory worst pattern to check the ability of the memory to hold alternate ones and zeros. Checks for a buffer complete interrupt (line 30), and reads the buffer entrance register (BER) during the buffer operation. Program and output in X odd, pattern in Y even.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION:	Paper Tape	INPUT PARAMETERS (Register Settings, etc.)
LOADING ADDRESS:	0000	1st portion of program is loaded in bank 0: Sets up all initial conditions and bank selections. 2nd portion is loaded in any odd bank of Module X (X = 1, 2, 3). Before running the program, enter in "A" register the number of the odd bank used.
TERMINAL ADDRESS:	0027	
CHECK SUM:	2704	

STARTING ADDRESS: 0000

ADDITIONAL INSTRUCTIONS: 1) The 169 is connected to the normal or buffer channel of the 160-A with the 161 typewriter connected to the External Buffer Channel. 2) If Selective Jump (SLJ1) is used the Output Buffer area will be the same length as the Input Buffer area. If SLJ1 is not used the Output Buffer length will be determined by the program and will repeat.

HALTS	EXPLANATION
SLS1	Computer will stop every time a new pattern is stored in the even bank of Module X.
SLS2	Computer will stop after an Input Buffer has been set up in the 169.
	NOTE: If an interrupt is received by the computer with any of the Selective Stops used, the computer will stop.

PART 1

```
00000   0206    Make bank selection even
        0361
        4201    Set DIR and IND to odd bank
        0000
        0341
        4174    Preset even bank selections
        4177
        0301
                Preset odd bank selections
00010   4173
        1600
        4020    Preset output area bank
        4176
        0310
        4175    Preset input area bank
        1600
        4000
                Preset bank jump
00020   4210
        0400
        4030    Preset counts to zero
        4067
        7500
        4702    Master Clear external BFR
        2200
        0200    Set bank jump address
```

BK 0

Start 0000 BKX PART 2

```
00000    4056      Set initial data
         2054
         4057      Set start address
         2056
         4157
         5457
         6011      Finished setting pattern
         0277

00010    6003
         0207
         6407
         2456
         4056
         7101
         0003
         2456

00020    4155
         7701      Optional stop
         2054
         4057
         2056
         1557
         7101
         0060

00030    0200      INT
         7101
         0100
         0207
         6410
         2456
         4056
         7101

00040    0024
         2456
         7101
         0000
         0010
         7700 }    Error stop
         2157 }    Non-comparing bits in "A"
         7701 }
                   Data in "A"
00050    2057 }
         7702 }
         7101 }    Address in "A"
         0061
         0000      Starting address
         7777
         0000      Data
         0000      Current address
```

00060	6513	Error detection
	5457	
	6421	
	0277	
	6427	to 0035
	7101	
	0033	
	0000	"A" Worst pattern INT
00070	0000	"A" Input or Output INT
	0230	
	0231	
	0111	Later change (0111–0235)
	0207	
	0213	
	0227	
	0235	
00100	7707	
	4067	
	7500	
	4740	
	7600	
	1200	
	4000	
	6102	
00110	7700	
	0023	→ 002X X = odd bank
	2070	
	0220	
	3200	
	0130	
	4202	
	7710	
00120	0000	
	7101	
	0217	
	0000	
	0000	
	0000	
	0000	
	0000	
00130	7500	
	4704	
	7600	
	1571	
	6044	
	1571	
	4172	
	7101	

```
00140     0217
          0000
          0000
          0000
          0000
          0000
          0000
          0000

00150     7101
          0200
          0000
          0000
          0000
          0000
          0000
          0000

00160     0000
          0000
          0000
          0000
          0000
          0000
          0000
          0000

00170     0000
          0000
          0000
          0000
          0000
          0000
          0000
          0000

00200     7500
          4701
          7310
          0217
          7702
          4070
          2067
          0022  ----->  ZY      Y = even bank

00210     0120
          7030
          0213
          4013          401X    X = odd bank  ⎫
          0300                                ⎬        input
          1423                                ⎪
          4220                                ⎭
          7500
```

00220	4701		
	7305		
	0233		
	7101		
	0233		
	0000		
	0227		
	4003 → 400X	X = odd bank	
00230	0300		Output
	1500		
	4210		
	4070		
	2067		
	0022 → ZY	Y = even bank	
	0120		
	7030		

NUMBER: T170
TITLE: Punch Test
CATEGORY: 160-A
MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

This program checks the punch controller and the control unit.

DESCRIPTION

Section 1, checks all status conditions. This is a looping status test in which the operator can manually cause a NOT READY to determine if the proper response for a specific condition will occur. The manual status errors can be caused by the following:

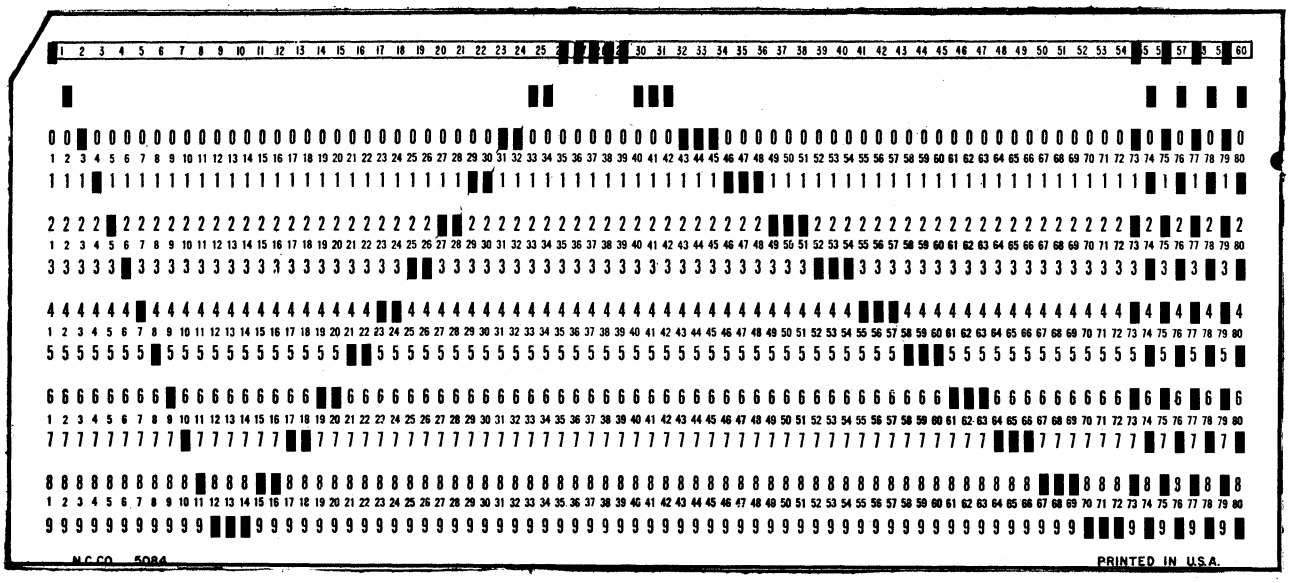
1. Depress the stacker full switch
2. No cards in hopper
3. 523 power off
4. M.S. switch in 1604 position

Section 2, punches all columns of a card with a pattern that can be visually checked. The program will punch one card pattern for all cards. The program will continue to run until a NOT READY is detected.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape
LOADING ADDRESS: 0000
TERMINAL ADDRESS: 0224
CHECK SUM: 0170
STARTING ADDRESS: Sec. 1, P = 0000 A = 0001, Sec. 2, P = 0000 A = 0000

HALTS	EXPLANATION
7700	Sec. 1 Status Test: When a NOT READY occurs the computer will stop and (A) will hold the status response that caused the stop.
7701	Sec. 2 Status Stop: (A) will contain the status that caused the stop. After the error condition has been removed, return the computer to "RUN" to continue.



Sample card

```
0000  3203  ADF     (A) + J                    0060  0005
      4201  STF     set jump address                 0000
      7101  JFI     jump address                     0000
      7102          J                                0000
      0014    M.L. of punch data                     0000
      0006    M.L. of status                         0000
      7505  EXF     status S                         0000
      7600  INA     set (A) = status                 0000

0010  6402  ZJB     wait for not ready         0070  0000
      7700  SLS     display status                   0000
      6504  NZB     continue status test             0000
      3040          S (status)                       0000
      7536  EXF     status                           0000
      7600  INA     set (A) = status                 0000
      6003  ZJF     jump on ready                    0000
      7701  SLS     display not ready                0000

0020  6504  NZB     check status again         0100  0001   Row 9
      7532  EXF     select punch                     6000
      7332  OUT     output punch data                0000
      0224    terminal address                       0000
      7526  EXF     status                           0000
      7600  INA     set (A) = status                 0007
      6502  NZB     wait for ready                   2520
      2055  LDD     delay count (D)                  0002   Row 8

0030  0601  ADN                              0110  1400
      6501  NZB     delay if (A) = 0                 0000
      2055  LDD     (D)                              0000
      0601  ADN                                      0000
      6501  NZB     delay until (A) = 0              0070
      2055  LDD     (D)                              5240
      0601  ADN                                      0004   Row 7
      6501  NZB     delay until (A) = 0              0300

0040  2055  LDD     (D)                        0120  0000
      0601  ADN                                      0000
      6501  NZB     delay until (A) = 0              0000
      2055  LDD     (D)                              0700
      0601  ADN                                      2520
      6501  NZB     delay until (A) = 0              0010   Row 6
      2056  LDD     (CDC)                            0060
      5055  RAD     decrease delay                   0000

0050  7101  JFI                              0130  0000
      0015          punch again                      0000
      3040          status code                      7000
      3002          punch code                       5240
      0100    start M.L. of output block             0020   Row 5
      0000          (D)                              0014
      0100    constant delay change                  0000
      5565    check sum equalizer                    0000
```

```
0140    0007
        0000
        2520
        0040    Row 4
        0003
        0000
        0000
        0070

0150    0000
        5240
        0100    Row 3
        0000
        6000
        0000
        0700
        0000

0160    2520
        0200    Row 2
        0000
        1400
        0000
        7000
        0000
        5240

0170    0400    Row 1
        0000
        0300
        0007
        0000
        0000
        2520
        1000    Row 0

0200    0000
        0060
        0070
        0000
        0000
        5240
        2000    Row 11
        0000

0210    0014
        0700
        0000
        0000
        2520
        4000    Row 12
        0000
        0003

0220    7000
        0000
        0000
        5240
```

NUMBER: T072

TITLE: Reader Test (1610)

CATEGORY: 160-A, 1610 (IBM 533, 521, 088)

MINIMUM EQUIPMENT NEEDED: 160-A, 1610 (IBM 533, 521, 088)

PURPOSE

This test will check the capability of the card reader.

DESCRIPTION

1. The test will cause a simultaneous reading from the first and second stations.
2. The status of the card reader is checked before each reading cycle is initiated.
3. All information read is compared with a block of known information in storage.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0066

CHECK SUM: 6706

STARTING ADDRESS: 0060

ADDITIONAL INSTRUCTIONS:
1) Loads the information from two cards into storage.
2) Start program.
3) Information following will be compared with the first two cards read in.

HALTS	EXPLANATION
7701	Correct information to be compared in A
7702	Actual information read in A
7703	First and second card read in stop
7704	Punch status - not ready
7705	Reader status - not ready

160/160-A READER TEST (IBM 533)

```
0000    7541    Select input status
0001    7600    Input to A
0002    1047
0003    6002
0004    7705    Stop if not ready
0005    7532    Select read
0006    7232    Input
0007    0450

0010    2450    Load comp of 0224
0011    4051    Store word counter
0012    2040    0100 to A
0013    4052    Store 0100
0014    0400    Load A with 0's
0015    2053    7100 to A
0016    4054    Store at 0054
0017    2152    Put info at 0100 in A

0020    1554    Logical sum of 0100 and 7100
0021    6002
0022    6107
0023    5452    Add 1 to new info word
0024    5454    Add 1 to old info word
0025    5451    Add 1 to words compared counter
0026    4051
0027    6427    Exit to status check

0030    6511    Exit to compare next word
0031    2154
0032    7701    Stop - Old info in A
0033    2152
0034    7702    Stop - New info in A
0035    0401    Load A with 1
0036    6536    Exit to status check
0037    0303    Read 1st and 2nd select code

0040    0200    Start Store
0041    0340    Status select code
0042    0000
0043    0000
0044    0000
0045    0000
0046    0000
0047    0021
```

```
0050    0250    Number words to be compared
0051    0000    Counter for words compared
0052    0000    New info add
0053    7100    Old info start address
0054    0000    Old info address
0055    0000
0056    0000
0057    0000

0060    7506    Select input
0061    7204    Input
0062    7350
0063    7703    Stop
0064    6564    Exit to status check
0065    7100
0066    0303    Read 1st and 2nd select code
```

NOTE: When running this program in the 160-A all stop switches must be up.

NUMBER: T072

TITLE: Punch Test (1610)

CATEGORY: 160-A, 1610, (IBM 533, 521, 088)

MINIMUM EQUIPMENT NEEDED: 160-A, 1610, (IBM 533 or 521 or 088)

PURPOSE

This test will check the capability of the punch.

DESCRIPTION

1. This test will cause the punch to pattern the information contained within the block of address from 7100 through 7223.
2. After punching the card information may be verified by the Card Test.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0100

TERMINAL ADDRESS 0114

CHECK SUM: 6706

STARTING ADDRESS: 0100

ADDITIONAL INSTRUCTIONS: All stop and jump switches must be up.

HALT	EXPLANATION
7704	Punch status - not ready.

160/160-A PUNCH TEST (IBM 533)

```
0100    7514    Select output status
0101    7600    Input status to A
0102    1211
0103    6002
0104    7704    Stop if punch not ready
0105    7505    Select punch
0106    7303    Output
0107    7224

0110    6510    Exit to status check
0111    7100    Starting address
0112    3002    Punch select
0113    2200
0114    3040    Punch status
```

NUMBER: T1610

TITLE: 1610 Two Station Read Test

CATEGORY: 160-A

MINIMUM EQUIPMENT NEEDED: 160-A

PURPOSE

A test of the card reader to insure that it will read a constant pattern simultaneously at two read stations.

DESCRIPTION

The program reads two read stations, and will compare information with the known pattern loaded at address 7100 through 7347. The loaded information will be used to check all subsequent information.

Information is stored at address 0200 through 0447.

The program may be modified to read and check only one station as follows:

0007		0324
0037		0301 for read A
	or	0302 for read B
0050		0124
0062		7224
0066	or	0301 for read A
		0302 for read B

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

TERMINAL ADDRESS: 0066

CHECK SUM: 2574

STARTING ADDRESS: 0060

ADDITIONAL INSTRUCTIONS:

1. Manual scan the pattern to verify that program information agrees with the card information.
2. Reset Run switch.

HALTS	EXPLANATION
7701	Error, correct information in A
7702	New information in A
7703	Reading known pattern and storing between 7100 and 7347
	Reset Run switch
7705	Status in A

NOTE: In case of an error stop, 0052 will contain the address of the information which failed.

Check Reader

0000	7541
0001	7600
0002	6154
0003	7534
0004	6104
0005	7233
0006	0450
0007	6507
0010	2450
0011	4051
0012	2040
0013	4052
0014	0400
0015	2053
0016	4054
0017	2152
0020	1554
0021	6002
0022	6107
0023	5452
0024	5454
0025	5451
0026	4051
0027	6422
0030	6511
0031	2154
0032	7701
0033	2152
0034	7702
0035	0401
0036	6142
0037	0303
0040	0200
0041	0340
0042	0000
0043	0000
0044	0000
0045	0000
0046	0000
0047	0021
0050	0250
0051	0000
0052	0000
0053	7100
0054	0000
0055	0000
0056	7707
0057	6121
0060	7506
0061	7204
0062	7350
0063	7703
0064	6114
0065	7100
0066	0303
0067 thru 0077	0000
0100	7500
0101	0303
0102	7203
0103	0450
0104	7102
0105	0200
0106	0000

NUMBER: T1610-1

TITLE: Q. A. Test (1610)

CATEGORY: 160-A, 1610 (IBM 088, 523)

MINIMUM EQUIPMENT NEEDED: 160 A, 1610 (IBM 088, 523)

PURPOSE

These routines provide a program to test the functional capabilities of the card reader under a variety of conditions.

DESCRIPTION

The test sections are listed by numbers as follows:

"0" PUNCH 523 STATUS TEST

This section runs until a status error occurs. A loop back in the test permits the operator to manually cause a not ready condition.

"1" READER 088 STATUS TEST

Same as section "0".

"2" PUNCH TEST

This test section punches two separate patterns on two cards with a delay between each set of two cards.

"3" CHANGE PUNCH TEST DELAY

This section replaces the delay constant.

"4" READER PRIMARY TEST

This section reads primary cards and checks the data. If a pattern other than the punch pattern is to be checked, use sections "7" or "10" to store the pattern desired. Clear and restart from 0000.

"5" READER SECONDARY TEST

Same as test section "4" but using the secondary read station.

"6" CHANGE READER TEST DELAY

This section replaces the delay constant.

"7" CHANGE PUNCH PATTERN AUTOMATICALLY

Two cards are read from the primary read station and stored as the new pattern. To punch this new pattern return to RUN after the 7777 stop. To read the new pattern, master clear after the 7777 stop and select the read program desired.

"10" CHANGE PUNCH PATTERN MANUALLY

A stop will occur after each word has been stored. Continue until Z = 7777 at which time two card images have been stored. A return to RUN will cause a return to the PUNCH test. To go to another test, master clear when Z = 7777, then restart.

OPERATING INSTRUCTIONS

LOAD INSTRUCTION: Paper Tape

LOADING ADDRESS: 0000

CHECK SUM: 1610

STARTING ADDRESS: 0000 Set A equal to the test section desired.

HALTS	SECTION	EXPLANATION
7701	"0"	Wrong printer status (4XXX missing)
7702	"0"	Wrong punch status in A
7703	"1"	Wrong reader status in A
7777	"3"	Enter A with delay N, RUN
7704	"4"	Read word in A
7705	"4"	Correct word in A
7706	"4"	Card word number in A Return to RUN after an error
7777	"6"	Enter A with delay N, RUN
7700	"10"	Enter the pattern in A, RUN

M. L.

```
0000    3214    ADF     form Program jump
0001    4201    STF
0002    7105    JFI
0003    0100            (0) Punch Status Test
0004    0120            (1) Reader Status Test
0005    0130            (2) Punch Test
0006    0211            (3) Change Punch delay
0007    0230            (4) Reader Test Primary
0010    0235            (5) Reader Test Secondary
0011    0350            (6) Change Reader delay
0012    0361            (7) Change Punch Pattern Auto
0013    0404            (10) Change Punch Pattern Manual
0014    7101            Jump Constant
0015    0000
0016    0000
0017    0000
0020    4000            Hold status address
0021    0004            Delay max.      N
0022    0440            Data A initial (DAI)
0023    0440            Data A constant (DAC)
0024    0564            Data A max.  (DAM)
0025    0740            Data read initial (DRI)
0026    0740            Data read constant (DRC)
0027    0600            Data B initial (DBI)
0030    0600            Data B constant (DBC)
0031    0724            Data B max. (DBM)
0032    0001            Delay
0033    0000            Delay Temporary
0034
0035
0036
0037
0040
0041
0042
0043
0044
0045
0046
0047
0050
0051
0052
0053
0054
0055
0056
0057
0060
0061
0062
0063
0064
0065
0066
0067
```

M. L.

```
0070
0071
0072
0073
0074
0075
0076
0077
0100    7500    EXC     Punch Status
0101    3040            Status code
0102    7600    INA     Input Status
0103    4020    STD     Hold Status
0104    1200    LPC     Mask printer status
0105    4000            Constant
0106    6103    NZF     Jump if printer not rdy.
0107    7701    SLS     Wrong printer  status
0110    6410    ZJB     Retry
0111    2020    LDD     Status
0112    1200    LPC     Mask out printer status
0113    3777            Mask constant
0114    6414    ZJB     Status O.K.  loop
0115    7702    SLS     Wrong punch status
0116    6516    NZB     Retry
0117    0000            Spare
0120    7500    EXC     Reader Status
0121    0340            Status code
0122    7600    INA     Input status
0123    6403    ZJB     Status O.K. loop
0124    7703    SLS     Wrong reader status
0125    6505    NZB     Retry
0126    0000            Spare
0127    0000            Spare
0130    7500    EXC     Punch Test
0131    3040            Status code
0132    7600    INA     Input Status
0133    4020    STD     Hold Status
0134    1200    LPC     Mask printer status
0135    4000            Mask constant
0136    6103    NZF     jump if printer not rdy.
0137    7701    SLS     Wrong printer status
0140    6410    ZJB     Retry
0141    2020    LDD     Load Status
0142    1200    LPC     Mask out printer status
0143    3777            Mask constant
0144    6514    NZB     Retry
0145    7500    EXC     Select punch
0146    3002            Punch code
0147    7340    OUT     Output data  (A)
0150    0564            Terminal address
0151    7500    EXC     Select status
0152    3040            Status code
0153    7600    INA     Input status
0154    4020    STD     Hold Status
0155    1200    LPC     Mask printer status
0156    4000            Mask constant
0157    6003    ZJF     Jump if printer not rdy.
```

M. L.

```
0160    7701    SLS     Wrong printer status
0161    6410    ZJB     Retry
0162    2020    LDD     Load Status
0163    3705    SBB     Check ready
0164    6512    NZB     Wait ready
0165    7540    EXF     Select punch
0166    7322    OUT     Output data (B)
0167    0724            Terminal address
0170    2032    LDD     Delay load
0171    4033    STD     Store dt
0172    0400    LDN     Clear (A)
0173    0601    ADN
0174    6501    NZB     Delay
0175    2033    LDD     Load dt
0176    0701    SBN     (dt) - 1
0177    4033    STD     Restore ( (dt) - 1)
0200    6506    NZB     Contine delay
0201    5432    AOD     Increase delay
0202    3421    SBD     Delay - (delay max.)
0203    6103    NZF     Delay ± max.
0204    0401    LDN     Max. limit made
0205    4032    STD     Restore delay
0206    7115    JFI     Go to Punch
0207    0440            Start address data (A)
0210    0600            Start address data (B)
0211    0400    LDN     Clear (A) register
0212    7777    HLT     Enter delay in (A)
0213    6004    ZJF     If A = 0
0214    4021    STD     Set N
0215    7101    JFI     Go to restore delay
0216    0204
0217    0501    LCN     Load - 1
0220    4021    STD     Set N max.
0221    7101    JFI     Go to restore delay
0222    0204
0223    0130            Punch address
0224    0000            Spare
0225    3002            Punch
0226    5217            Ck. sum equalizer
0227    0000            Spare
0230    2200    LDC     Load primary select
0231    0301            Constant
0232    4214    STF     Set select code
0233    4246    STF     Set select code
0234    6105    NZF
0235    2200    LDC     Load secondary select
0236    0302            Constant
0237    4207    STF     Set select code
0240    4241    STF     Set select code
0241    7500    EXC     Reader status
0242    0340            Constant
0243    7600    INA     Input status
0244    6503    NZB     Wait rdy.
0245    7500    EXC     Select read
0246    0301            Select code
0247    7277    INP     Input data (RA)
```

M. L.

```
0250    1064            Terminal address
0251    2023    LDD     Load D. A. C.
0252    4022    STD     Set DAI
0253    2026    LDD     Load DRC
0254    4025    STD     Set DRI
0255    2122    LDI     Load data from DAI
0256    3525    SBI     Sub. data from DRI
0257    6011    ZJF     Jump on no error
0260    2125    LDI     Load read data
0261    7704    SLS     Display error word
0262    2122    LDI     Load correct data
0263    7705    SLS     Display correct data
0264    2025    LDD     Load error address
0265    3600    SBC     Form card word position
0266    0740            Constant
0267    7706    SLS     Display word number
0270    5425    AOD     Increase DRI
0271    5422    AOD     Increase DAI
0272    3424    SBD     DAI - DAM
0273    6516    NZB     Continue check
0274    7500    EXC     Reader status
0275    0340            Constant
0276    7600    INA     Input status
0277    6503    NZB     Wait rdy.
0300    7500    EXC     Select read
0301    0301            Select code
0302    7244    IND     Input data (RB)
0303    1064            Terminal address
0304    2030    LDD     Load DBC
0305    4027    STD     Set DBI
0306    2026    LDD     Load DRC
0307    4025    STD     Set DRI
0310    2127    LDI     Load data from DBI
0311    3525    SBI     Sub data from DRI
0312    6011    ZJF     Jump on no error
0313    2125    LDI     Load read data
0314    7704    SLS     Display error data
0315    2127    LDI     Load correct data
0316    7705    SLS     Display correct data
0317    2025    LDD     Load error address
0320    3600    SBC     Form card word position
0321    0740            Constant
0322    7706    SLS     Display word number
0323    5425    AOD     Increase DRI
0324    5427    AOD     Increase DBI
0325    3431    SBD     DBI - DBM
0326    6516    NZB     Continue data check
0327    2032    LDD     Load delay N
0330    4033    STD     Store dt
0331    0400    LDN     Clear (A)
0332    0601    ADN
0333    6501    NZB     Delay
0334    2033    LDD     Load dt
0335    0701    SBN     (dt) - 1
0336    4033    STD     Restore ( (dt) - 1)
0337    6506    NZB     Continue delay
```

M. L.

```
0340    5432    AOD     Increase Delay
0341    3421    SBD     Delay - (delay max.)
0342    6103    NZF     Delay ± max.
0343    0401    LDN     Max. limit made
0344    4032    STD     Restore delay
0345    7102    JFI     Go to read
0346    0740            Starting address of read
0347    0241            Read
0350    0400    LDN     Clear (A) register
0351    7777    HLT     Enter delay in (A)
0352    6003    ZJF     If A = 0
0353    4021    STD     Set N
0354    7104    JFI     Go to read
0355    0501    LCN     Load - 1
0356    4021    STD     Set N
0357    7101    JFI     Go to read
0360    0343            Read address
0361    7500    EXC     CHANGE Punch Pat. Auto
0362    0340            Status
0363    7600    INA     Input Status
0364    6503    NZB     Wait rdy.
0365    7500    EXC     Read primary
0366    0301            Constant
0367    7241    INP     Input new pattern
0370    0564            Terminal address
0371    7500    EXC     Reader status
0372    0340            Constant
0373    7600    INA     Input status
0374    6503    NZB     Wait rdy.
0375    7500    EXC     Read primary
0376    0301            Constant
0377    7232    INP     Input
0400    0724            Terminal address
0401    7777    HLT     New pattern complete
0402    7101    JFI     Go to punch test
0403    0130
0404    2023    LDD     Load DAC
0405    4022    STD     Set DAI
0406    2030    LDD     Load DBC
0407    4027    STD     Set DBI
0410    0400    LDN     Clear A
0411    7700    HLT     Enter pattern in A
0412    4122    STI     Store data in DAI
0413    5422    AOD     Increase data address
0414    3424    SBD     DAI - DAM
0415    6505    NZB     Set all data
0416    0400    LDN     Clear A
0417    7700    HLT     Enter pattern in A
0420    4127    STI     Store data in DBI
0421    5427    AOD     Increase data address
0422    3431    SBD     DBI - DBM
0423    6505    NZB     Set all data
0424    7777    HLT     New pattern complete
0425    7101    JFI     Go to punch test
0426    0130
0427    0000            Spare
```

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```
0430    0440        Starting add. of A new
0431    0600        Starting add. of B new
0432    0000
0433    0000
0434    0000
0435    0000
0436    0000
0437    0000
0440    2525        Row 9 start of Pattern A
0441    2525
0442    2525
0443    2525
0444    2525
0445    2525
0446    2520
0447    5252        Row 8
0450    5252
0451    5252
0452    5252
0453    5252
0454    5252
0455    5240
0456    2525        Row 7
0457    2525
0460    2525
0461    2525
0462    2525
0463    2525
0464    2520
0465    5252        Row 6
0466    5252
0467    5252
0470    5252
0471    5252
0472    5252
0473    5240
0474    2525        Row 5
0475    2525
0476    2525
0477    2525
0500    2525
0501    2525
0502    2520
0503    5252        Row 4
0504    5252
0505    5252
0506    5252
0507    5252
0510    5252
0511    5240
0512    2525        Row 3
0513    2525
0514    2525
0515    2525
0516    2525
0517    2525
```

M. L.

```
0520    2520
0521    5252            Row 2
0522    5252
0523    5252
0524    5252
0525    5252
0526    5252
0527    5240
0530    2525            Row 1
0531    2525
0532    2525
0533    2525
0534    2525
0535    2525
0536    2520
0537    5252            Row 0
0540    5252
0541    5252
0542    5252
0543    5252
0544    5252
0545    5240
0546    2525            Row 11
0547    2525
0550    2525
0551    2525
0552    2525
0553    2525
0554    2520
0555    5252            Row 12
0556    5252
0557    5252
0560    5252
0561    5252
0562    5252
0563    5240            Last word of Pattern A
0564    0000            Spare
0565    0000            Spare
0566    0000            Spare
0567    0000            Spare
0570    0000            Spare
0571    0000            Spare
0572    0000            Spare
0573    0000            Spare
0574    0000            Spare
0575    0000            Spare
0576    0000            Spare
0577    0000            Spare
0600    5252            Row 9 first word of pattern B
0601    5252
0602    5252
0603    6262
0604    5252
0605    5252
0606    5240
0607    2525            Row 8
```

M. L.

```
0610    2525
0611    2525
0612    2525
0613    2525
0614    2525
0615    2520
0616    5252            Row 7
0617    5252
0620    5252
0621    5252
0622    5252
0623    5252
0624    5240
0625    2525            Row 6
0626    2525
0627    2525
0630    2525
0631    2525
0632    2525
0633    2520
0634    5252            Row 5
0635    5252
0636    5252
0637    5252
0640    5252
0641    5252
0642    5240
0643    2525            Row 4
0644    2525
0645    2525
0646    2525
0647    2525
0650    2525
0651    2520
0652    5252            Row 3
0653    5252
0654    5252
0655    5252
0656    5252
0657    5252
0660    5240
0661    2525            Row 2
0662    2525
0663    2525
0664    2525
0665    2525
0666    2525
0667    2520
0670    5252            Row 1
0671    5252
0672    5252
0673    5252
0674    5252
0675    5252
0676    5240
0677    2525            Row 0
```

M. L.

```
0700    2525
0701    2525
0702    2525
0703    2525
0704    2525
0705    2520
0706    5252            Row 11
0707    5252
0710    5252
0711    5252
0712    5252
0713    5252
0714    5240
0715    2525            Row 12
0716    2525
0717    2525
0720    2525
0721    2525
0722    2525
0723    2520            Last word of Pattern B
0724    0000
0725    0000
0726    0000
0727    0000
0730    0000
0731    0000
0732    0000
0733    0000
0734    0000
0735    0000
0736    0000
0737    0000
0740    0000            Read Area
0741    0000
0742    0000
0743    0000
0744    0000
0745    0000
0746    0000
0747    0000
0750    0000
0751    0000
0752    0000
0753    0000
0754    0000
0755    0000
0756    0000
0757    0000
0760    0000
0761    0000
0762    0000
0763    0000
0764    0000
0765    0000
0766    0000
0767    0000
```

M. L.

0770	0000
0771	0000
0772	0000
0773	0000
0774	0000
0775	0000
0776	0000
0777	0000
1000	0000
1001	0000
1002	0000
1003	0000
1004	0000
1005	0000
1006	0000
1007	0000
1010	0000
1011	0000
1012	0000
1013	0000
1014	0000
1015	0000
1016	0000
1017	0000
1020	0000
1021	0000
1022	0000
1023	0000
1024	0000
1025	0000
1026	0000
1027	0000
1030	0000
1031	0000
1032	0000
1033	0000
1034	0000
1035	0000
1036	0000
1037	0000
1040	0000
1041	0000
1042	0000
1043	0000
1044	0000
1045	0000
1046	0000
1047	0000
1050	0000
1051	0000
1052	0000
1053	0000
1054	0000
1055	0000
1056	0000
1057	0000

M. L.

1060	0000	
1061	0000	
1062	0000	
1063	0000	Last word of read
1064	0000	
1065	0000	
1066	0000	
1067	0000	

CUT ALONG LINE

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