dec PERMANENT MEMORANDUM

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SUBJECT Checkerboard Program For 1,024 and 4,096 Word Memories

TO PDP Distribution List

ABSTRACT

This is a maintenance program for checking the performance and reliability of magnetic core memory and its sense amplifiers. The program is designed for Ferrite Core memories to give maximum noise on the sense windings while a margin test is performed on the sense amplifiers.

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INTRODUCTION

There are four possible configurations of checkerboard patterns generated by this program. Each pattern is designed for a particular type of memory, i.e., one for every read, write and sense winding configuration. To select a checkerboard pattern, put up one of the sense switches as mentioned in the notes. After selecting the desired pattern, place the checkerboard tape in the reader, turn reader on, and activate the read-in switch. If one of the following sense switches is up (3,4,5, or 6), the program will begin immediately loading the selected pattern. However, if no sense switches are selected, then the reader will continue to read in the next program on tape.

CHECKING AND COMPLEMENT CHECKING

During the initial loading of the selected checkerboard pattern, a test is made on each register for errors resulting from bits lost or gained. After the checker pattern has been written into memory, an individual register complement and check test is made. Should an error be found either during initial loading or individual complement and checking, the computer will come to a halt, the address of the register being tested will appear in the In-Out and its contents in the accumulator. Should an error appear during testing, it is recommended that one press the continue button to find other falty registers. Once memory has been completely checked and no errors found, the program restarts itself, this time writing the complement of the present pattern. The program continues indefinitely within this closed loop unitl the operator stops the program or a falty component brings the computer to a halt.

It is possible to determine what part of the program the computer is executing by observing the program flags. When program flag 1 is on, checkerboard is either writing or checking the pattern as shown in the notes. If program flag 1 is off, then checkerboard is writing the complement of this pattern. During the time that program flag 2 is on, the program is doing the initial loading or complement loading of the selected pattern. When 2 is off, the program is complementing and checking individual registers. When a register is complement checked, the contents of this register are first checked, then complemented, and written back into the same register, brought out again and checked, complemented, written in, brought out and checked. To determine whether or not the program is doing a first or second complement, program flag 6 is on during the first complement and off during the second complement.

NOTES:

When complement checking individual addresses with sense switch 1 up, one cannot check register 7777 on the low checkerboard or 7600 on the high for 4,096 word memories. This is due to an indexing feature within the program.

Checkerboard

SS #1 Up, gives the operator the option of selecting a register from 0 to 7600 with test word switches for a continuous complement and check.

SS #2 Down, is for 4096 memory locations. Up, is for 1024 word memory.

SS #3	Pattern A	1001100110011100. . . .
		01100110011
		011001100
		1001100
		10011
		011
		0
		1
SS #4	Pattern B	11001100110011100. . . .
		11001100110011
		0011001100
		00110011
		1100
		11
		0
		0
SS #5	Pattern C	11001100110011100. . . .
		001100110011
		0011001100
		11001100
		110011
		0011
		00
		1
		0
SS #6	Pattern D	1001100110011100. . . .
		10011001100

011001100
0110011
10011
100
0
0

OPERATING INSTRUCTIONS

1. Set the sense switches to the desired positions.

2. Turn on the marginal check switch, Panel 3D. Be sure that the switch marked +a+b is thrown to the +a side.

3. Read in the checkerboard tape.

4. Begin varying the margins in the positive direction until the computer halts. There are two normal halts in the checkerboard program, either high or low version. In the high version, the first halt, which is in the checking part of the program, is at register 7623. The other halt is register 7634, which is in the complement checking part of the program.

5. After a halt has occured, write down the address at which the halt appeared and the contents of this address. Reset the margins to +10 and start the program at either 0 or 7700 depending on which checkerboard you are using. To verify the positive margin, increase +10 again until the computer halts. Record the results in the computer log book and bring the +10 back down to normal. Now vary the positive margin towards 0 until the computer halts. Note the memory address at which the halt occured. Record all test information in the computer log book.

6. Should bit errors occur when varying the margins + or -, note which bit it is and then check with a scope both the slice and gain in the sense amplifier packages located in Bay 3D. The best method is to look with a scope on the checkpoints of the sense amplifiers while syncing the scope on the defer level, either pin R or Z on 1K13. After varying either the slice or gain controls or both, recheck the margins.

```
,Checkerboard for 1024 & 4096 word memories
,generates 4 checker patterns
,HIGH CHECKER
,7/18/61
,s. Lambert
opd             nop 760000
org 7600
start           764207   cla + cli + clf
                stf 11
                stf 12
                dzm q
write           jsp pattern          ,initial load & complement load
                lac n
isop2           nop                  ,inst. is determined by pat. gen.
                dac * q
                jmp check
                idx q
                sas final
                jmp write
                clf 2
                dzm q
check           jsp pattern          ,load check
                lio q
                lac * q
isop            nop                  ,inst. is determined by pat. gen.
                sas n
                halt
                szf 2
                jmp isop2 & 3
comp            stf 16               ,individual reg. complementing &
                                     ,checking
                lac * q
                cma
                dac * q
                xor * q
                sza
                hlt
                szf * 6
                jmp ¢ & 3
                clf 6
                jmp comp & 1
                idx q
                szs 10
                lat                  ,hit same reg with compliment check
                dpa q
                sas final
```

```
                jmp check
                lac 0
                sza *
                jmp ¢ & 5
                cla
                dac n
                clf 1
                jmp start & 2
                cma
                dac n
                jmp start & 1
pattern         dap exit
                szs 20
                jmp chg
                law 5077
                dap ch1             ,sets pattern for 4096 word memory
                law 3077
                dap ch2
                dap ch3
                lac q
                dac m
                szs 60
                jmp pd
ch1             sar s6
                szs 50
                jmp pc
                szs 40
                jmp pb
                szs 30
                jmp pa
                jmp read            ,reads in new machine language tape
pa              xor m               ,pattern a
                dac m
                rar s1
                xor m
                rar s1
                jmp out
pc              sza *               ,pattern c
                jmp pa
                sub one
                jmp pa
pb              xor m               ,pattern b
                rar s2
                jmp out
pd              cli                 ,pattern d
ch2             rcr s6
```

```
                sza *
                jmp pb
                sub one
                dap m
ch3             rcl s6
                xor m
                rar s2
                cma
out             spa *
                jmp ¢ & 5
                law 1000
                dap isop
                dap isop2
exit            jmp
                cla
                jmp ¢ - 4
chg             law 3037
                dap ch2
                dap ch3
                law 5037            ,sets pattern for 1024 word memory
                dap ch1
                jmp ch1 - 4
one             1
q               0
m               0
n               777777
final           7600
read            rpb
                dio m
                lac m
                dap stop
                dap stop & 2
                and stop
                sad stop
stop            jmp
                rpb
                dio
                jmp read
jmp start end .
```

Select the proper sense switch before reading in checker board.

SS ~ 1 Up, gives the operator the option of selecting a register from 0 to 7600 with test word switches for a continuous complement and check.

SS ~ 2 Down, is for 4096 memory locations. Up, is for 1024 word memory.

SS ~ 3 Pattern A
```
100110011001100....
01100110011
011001100
1001100
10011
011
0
1
```

SS ~ 4 Pattern B
```
1100110011001100....
11001100110011
0011001100
00110011
1100
11
0
0
```

SS ~ 5 Pattern C
```
1100110011001100....
001100110011
0011001100
11001100
110011
0011
00
1
0
```

SS ~ 6 Pattern D
```
100110011001100....
10011001100
011001100
0110011
10011
100
0
0
```

PF ~ 1 On, checkerboard is writing ones

PF ~ 2 On, complement of ones.

PF ~ 3 On, and checking one reg at a time.

PF ~ 4 On, checking all reg from 0 to 7600.

Now select the desired sense switch or switches. The program will begin immediately after this typeout has completed.