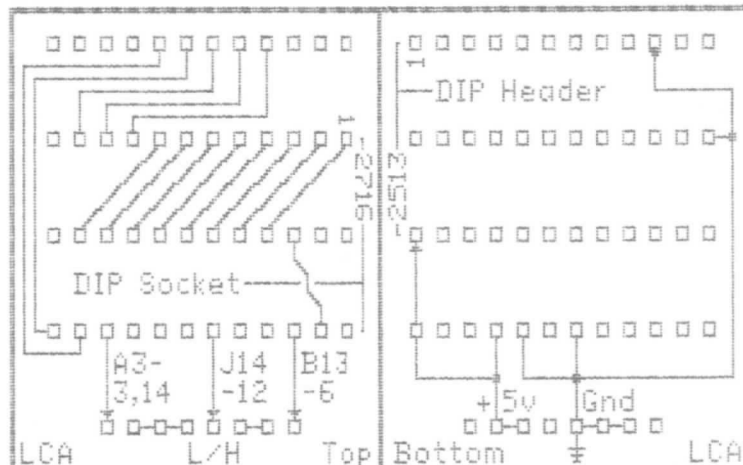
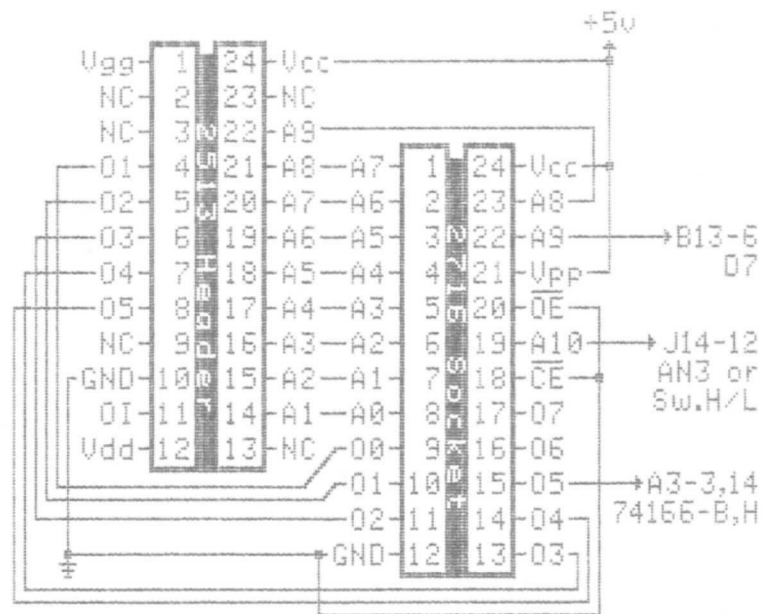
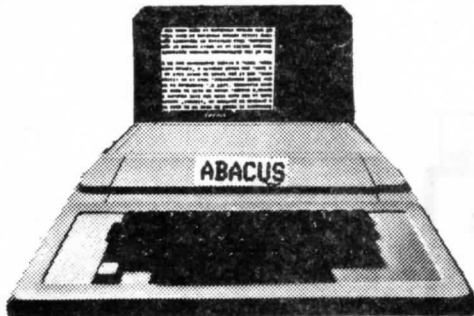


L.C.A.



A.B.A.C.U.S.-Macdougall Lower-Case Adapter  
 Printed Circuit Board by James P. Davis from  
 article in The ABACUS II, April 1980, Vol. 2, #4.  
 (The 2716 DIP Socket attaches to the top &  
 the 2513 DIP Header attaches to the bottom)



### APPLE BAY AREA COMPUTER USERS SOCIETY

This article describes a simple modification to the Apple II which can be used to display, either upper/lower case letters, when using the Apple Writer Text Editor, or can be used to display an alternate character set. The modification consists of removing the existing 2513 character generator ROM and replacing it with a 2716 EPROM. The 2716 contains two character sets. *The first is the standard duplicate of the 2513 and the second is a special set which, for example, works with the Text Editor characters.*

Since the 2716 is not pin compatible with the 2513, an interconnect pattern is needed. In addition, certain connections must be made to the main board. To do this effectively, a small circuit board is used which holds the 2716 and plugs into the 2513 socket. Three wires from this board then go to "piggyback" socket extensions on the main board. By this means, the modification is simply plug-in and no modifications are required to the main board. A circuit diagram of this small board and its interconnections is presented in figure 1.

### How the Circuit Works:

Imagine that your character generator ROM has two character areas. The first of these is an upper case area and the second is a lower case area. Switching between these two areas can be accomplished by using a high address bit. This turns out to be very appropriate to the Apple Text Editor since it in fact stores the characters such that upper case characters have the high bit set low so that they will display in inverse video. This bit is picked up from pin 6 of B13 and is used to select the ROM area from which the display character is selected. There is one problem with this method, and that is that the high bit set low tells the Apple hardware to set an inverse character. The result of this simple modification is that we now have lower case but the upper case is still in inverse video. The solution is to put into the ROM the inverse characters so that although the Apple thinks it is displaying an inverse character it is really displaying the inverse of an inverse.

There is still a problem when you come to observe the resulting characters. They have funny lines and extra information which is very distracting. This is solved by getting at the shift register parallel load inputs and setting them with a sixth bit from the ROM. To do this they must be lifted from ground and connected to the little board. Thus pins 3 and 14 are cut and the lead from the 2716 is connected to the 74166 pins.

A final refinement to the system is to make the selection of mode software selectable. So rather than put a switch on the circuit board, the mode select address pin is connected to the game socket at annunciator pin 3. The latch which provides this output always comes up with a low output on power-on. The addressing is arranged so that this gives the normal character set in Apple. The result is that to the unsuspecting user, the system configuration looks exactly as he has always seen it and he will never know that there is lower case present. The case can be set and reset as follows:

## MODIFICATIONS TO THE APPLE II DISPLAY UPPER AND LOWER CASE LETTERS

by  
John Macdougall

For use with the text editor, the conversion to lower case can be made automatic by putting the lower case PEEK into the editor HELLO program as follows:

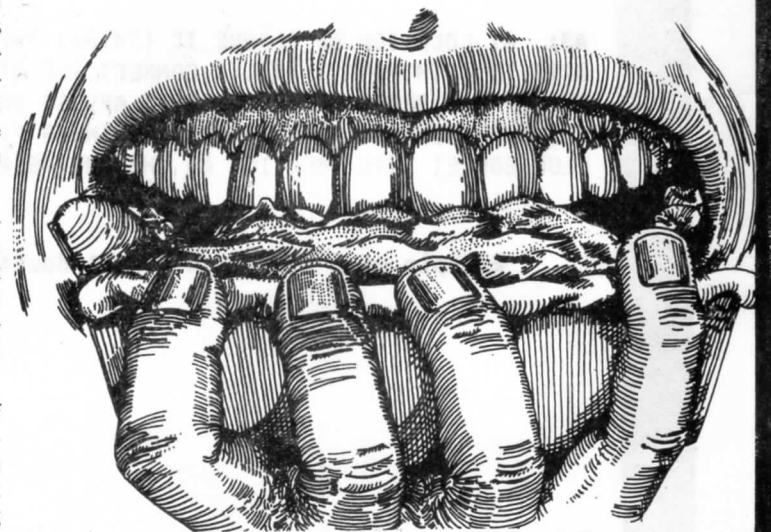
```
5 D$="": REM CONTROL-D
10 PRINT D$; "NOMON I,O,C": CALL -936
20 POKE 1010, 191: POKE 1011,157: POKE 1012,56
30 POKE -16289,0
40 PRINT D$; "BRUNTEEDITOR"
50 END
```

### Other Features.

Because of the independent character sets with this system, it is possible to have additional characters. You may have noticed the odd brackets used above. The special characters, which can be accessed by this system, as currently implemented, are as follows:

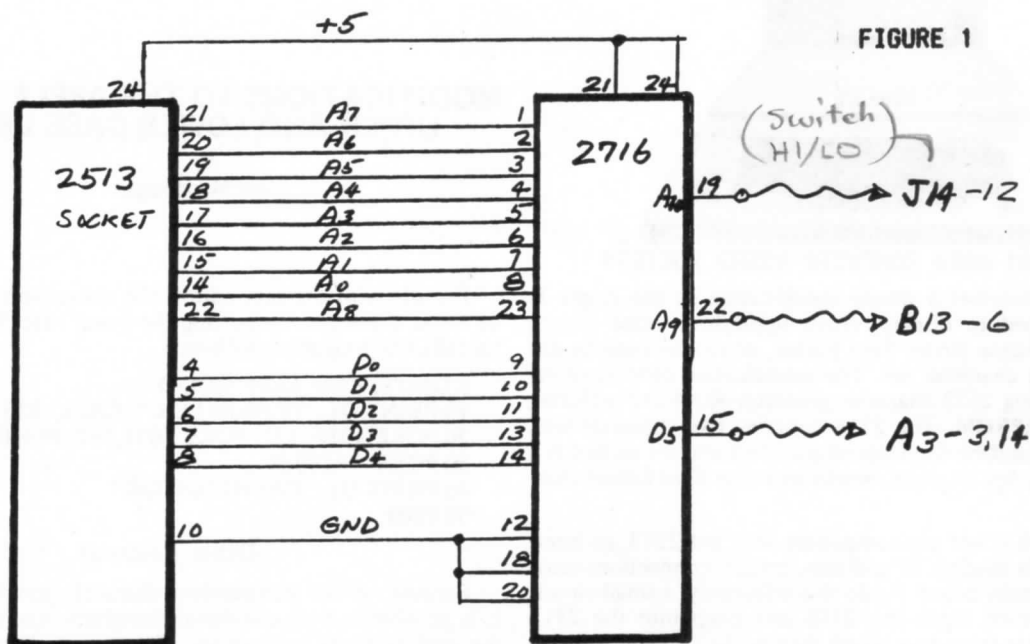
- [ - esc-control-n
- ] - esc-shift-m
- { - control-n
- }
- ~ - shift-n
- ^ - esc-shift-n

## Easy as Pie?



# APPLE-PIE!

CIRCUIT FOR DISPLAYING UPPER/LOWER CASE  
LETTERS USING THE APPLE TEXT EDITOR.



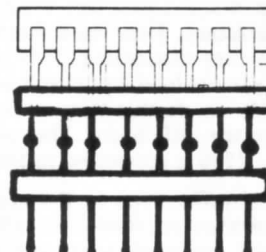
J14: USE A 16 PIN SOCKET, ATTACH PIN 12 TO THE 2716 at PIN 19. PLUG THIS SOCKET INTO GAME PADDLE SOCKET, GAME PADDLES MAY THEN BE PLUGGED INTO TOP OF THIS SOCKET

B13: AT LOCATION B13, REMOVE THE IC (74LS02) THEN TAKE A 14 PIN SOCKET AND ATTACH A WIRE TO PIN 6, CONNECT THE OTHER END OF THIS WIRE TO PIN #22 OF THE 2716. NOW INSERT THIS SOCKET INTO LOCATION B13, THEN REINSTALL IC (74LS02) INTO THIS SOCKET.

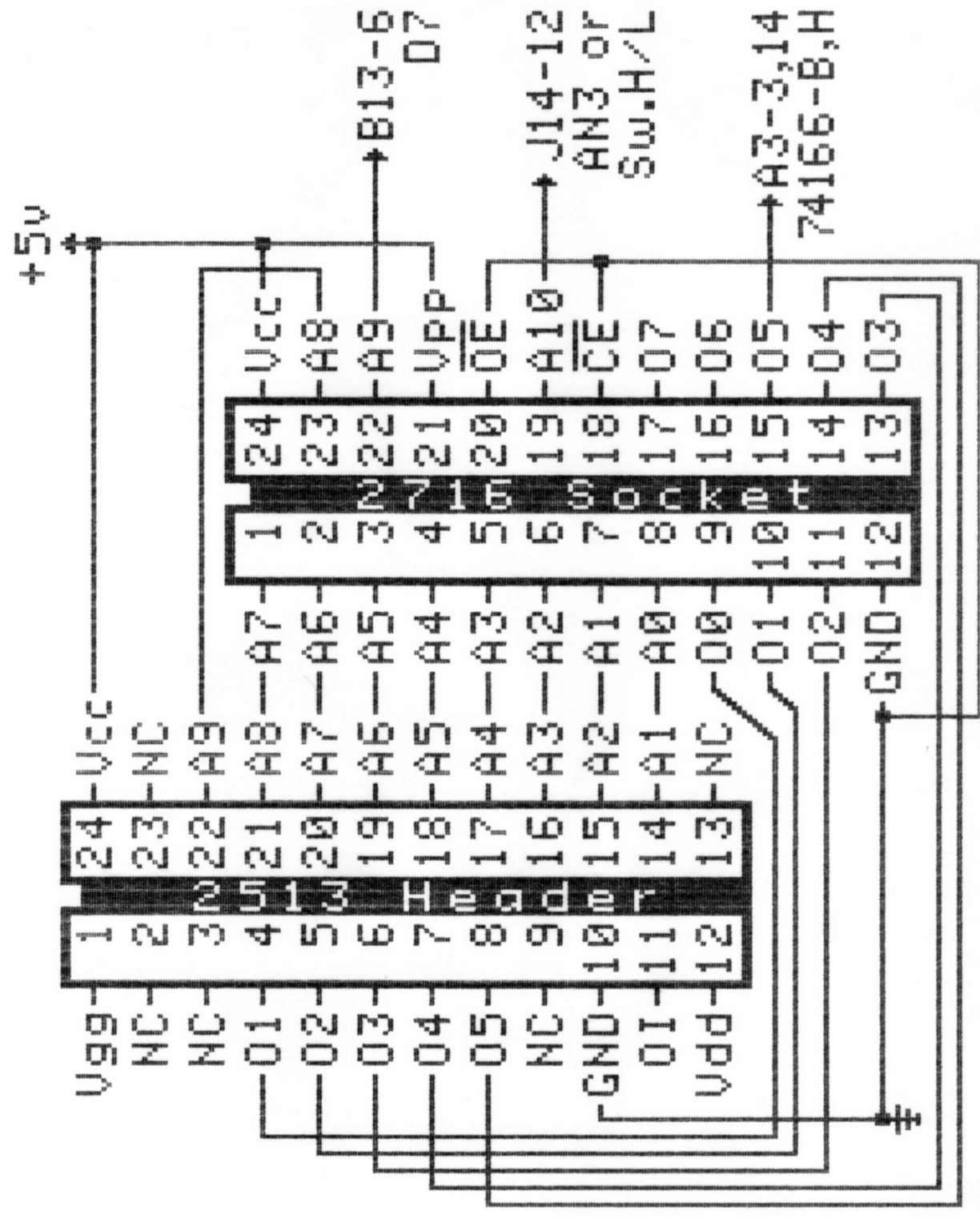
A3: AT LOCATION A3 REMOVE IC (74166) THEN TAKE A 16 PIN SOCKET AND CONNECT A WIRE TO BOTH PINS 3 AND 14, CONNECT THE OTHER END OF THIS WIRE TO PIN #15 OF THE 2716. BE SURE TO CUT PINS 3 AND 14 SHORT SO THEY DO NOT GO THRU AND INTO THE BOARD SOCKET, HOWEVER ALL REMAINING PINS MUST CONNECT TO BOARD SOCKET. NOW PLUG SOCKET INTO LOCATION A3 THEN REINSERT IC (74166) INTO THIS SOCKET.

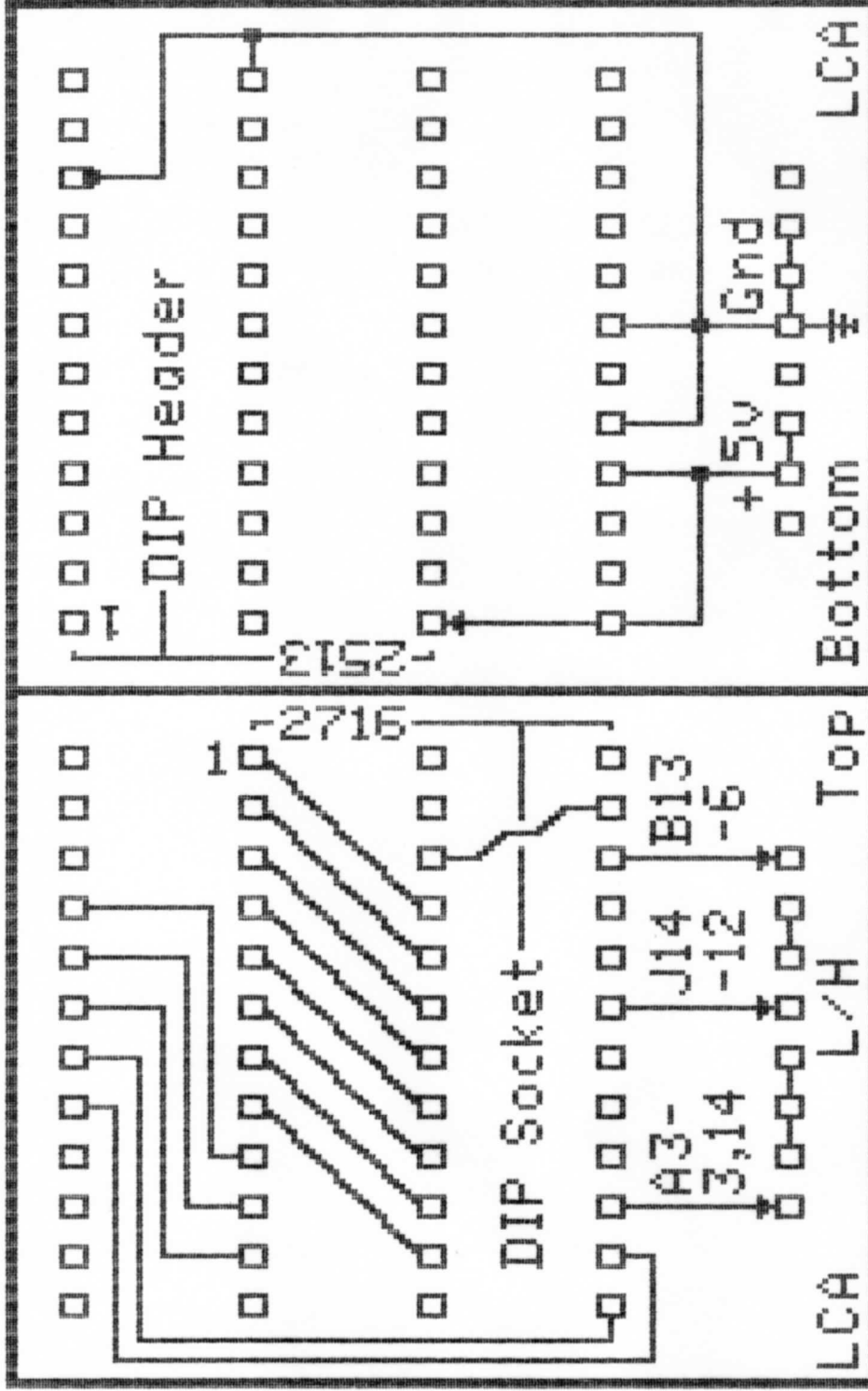
Example of a Piggyback Socket Mounting.

DEVICE----->  
SOCKET----->  
SOLDER----->  
HEADER----->

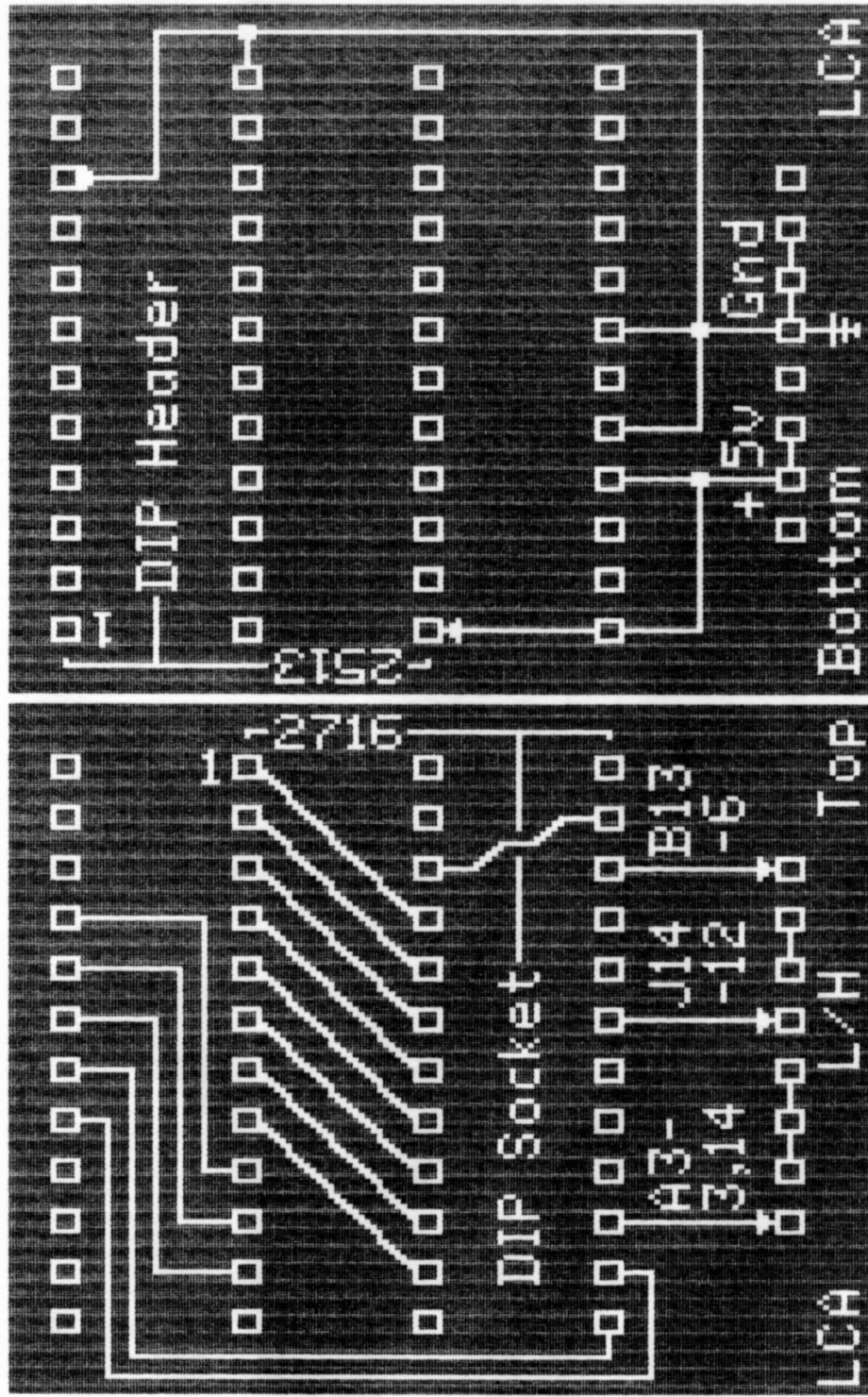


A listing of the hex code for the character ROM is presented on the following pages.

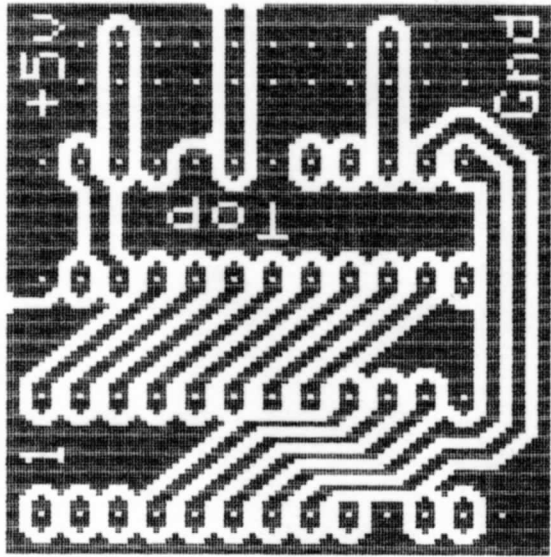




A.B.A.C.U.S.-Macdougall Lower-Case Adapter  
 Printed Circuit Board by James R. Davis from  
 Article in The ABACUS II, April 1980, Vol.4, #4.  
 (The 2716 DIP Socket attaches to the top &  
 the 2513 DIP Header attaches to the bottom)



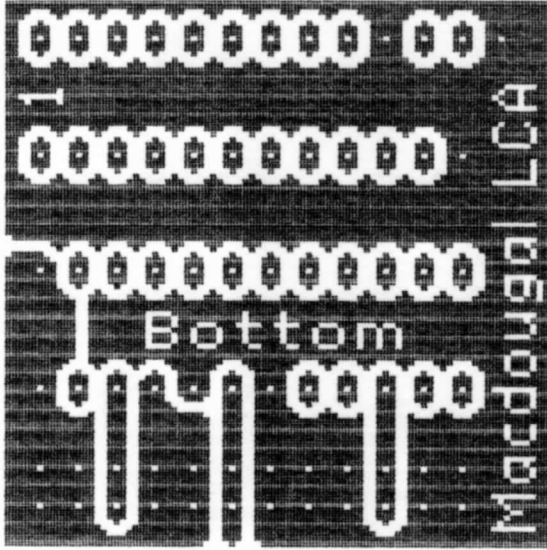
A.B.A.C.U.S.-Macdougall Lower-Case Adapter  
 Printed Circuit Board by James P. Davis from  
 article in The ABACUS II, April 1980, Vol.4, #4.  
 (The 2716 DIP Socket attaches to the top &  
 the 2513 DIP Header attaches to the bottom)



B13-6

J14-12

A3-3,14



A.B.A.C.U.S.-Macdougall Lower-Case Adapter  
 Printed Circuit Board by James P. Davis from  
 an article in The ABACUS II, April 1980, volume  
 number 4, issue number 4.  
 A 2716 DIP IC (socket) attaches to the top of  
 the PCB in the center.

A 24 DIP header attaches to the bottom of  
 the PCB at the right-hand edge (as shown  
 above). This plugs in to the Apple character  
 generator socket at A5 on the mother board.



For the lower case adapter in this article to work both like a "Dan Paymar" and "The Apple Writer" lower case adapter, the code from \$300 to \$3FF should duplicate the code from \$600 to \$6FF in the following listings, with the exception that the "\$7F" codes from \$6F0 to \$6FF (and its duplicate at \$3F8 - \$3FF) be changed to represent the "delete" character as a block instead of a blank space.

000- 0E 11 15 17 16 10 0F 00  
008- 04 0A 11 11 1F 11 11 00  
010- 1E 11 11 1E 11 11 1E 00  
018- 0E 11 10 10 10 11 0E 00  
020- 1E 11 11 11 11 11 1E 00  
028- 1F 10 10 1E 10 10 1F 00  
030- 1F 10 10 1E 10 10 10 00  
038- 0F 10 10 10 13 11 0F 00  
040- 11 11 11 1F 11 11 11 00  
048- 0E 04 04 04 04 04 0E 00  
050- 01 01 01 01 01 11 0E 00  
058- 11 12 14 18 14 12 11 00  
060- 10 10 10 10 10 10 1F 00  
068- 11 1B 15 15 11 11 11 00  
070- 11 11 19 15 13 11 11 00  
078- 0E 11 11 11 11 11 0E 00  
080- 1E 11 11 1E 10 10 10 00  
088- 0E 11 11 11 15 12 0D 00  
090- 1E 11 11 1E 14 12 11 00  
098- 0E 11 10 0E 01 11 0E 00  
0A0- 1F 04 04 04 04 04 04 00  
0A8- 11 11 11 11 11 11 0E 00  
0B0- 11 11 11 11 11 0A 04 00  
0B8- 11 11 11 15 15 1B 11 00  
0C0- 11 11 0A 04 0A 11 11 00  
0C8- 11 11 0A 04 04 04 04 00  
0D0- 1F 01 02 04 08 10 1F 00  
0D8- 1F 18 18 18 18 18 1F 00  
0E0- 00 10 08 04 02 01 00 00  
0E8- 1F 03 03 03 03 03 1F 00  
0F0- 00 00 04 0A 11 00 00 00  
0F8- 00 00 00 00 00 00 00 3F  
100- 00 00 00 00 00 00 00 00  
108- 04 04 04 04 04 00 04 00  
110- 0A 0A 0A 00 00 00 00 00  
118- 0A 0A 1F 0A 1F 0A 0A 00  
120- 04 0F 14 0E 05 1E 04 00  
128- 18 19 02 04 08 13 03 00  
130- 08 14 14 08 15 12 0D 00  
138- 04 04 04 00 00 00 00 00  
140- 04 08 10 10 10 08 04 00  
148- 04 02 01 01 01 02 04 00  
150- 04 15 0E 04 0E 15 04 00  
158- 00 04 04 1F 04 04 00 00  
160- 00 00 00 00 04 04 08 00  
168- 00 00 00 1F 00 00 00 00  
170- 00 00 00 00 00 00 04 00  
178- 00 01 02 04 08 10 00 00  
180- 0E 11 13 15 19 11 0E 00  
188- 04 0C 04 04 04 04 0E 00  
190- 0E 11 01 06 08 10 1F 00  
198- 1F 01 02 06 01 11 0E 00  
1A0- 02 06 0A 12 1F 02 02 00  
1A8- 1F 10 1E 01 01 11 0E 00  
1B0- 07 08 10 1E 11 11 0E 00  
1B8- 1F 01 02 04 08 08 08 00  
1C0- 0E 11 11 0E 11 11 0E 00  
1C8- 0E 11 11 0F 01 02 1C 00  
1D0- 00 00 04 00 04 00 00 00  
1D8- 00 00 04 00 04 04 08 00  
1E0- 02 04 08 10 08 04 02 00

1E8- 00 00 1F 00 1F 00 00 00  
1F0- 08 04 02 01 02 04 08 00  
1F8- 0E 11 02 04 04 00 04 00  
200- 0E 11 15 17 16 10 0F 00  
208- 04 0A 11 11 1F 11 11 00  
210- 1E 11 11 1E 11 11 1E 00  
218- 0E 11 10 10 10 11 0E 00  
220- 1E 11 11 11 11 11 1E 00  
228- 1F 10 10 1E 10 10 1F 00  
230- 1F 10 10 1E 10 10 10 00  
238- 0F 10 10 10 13 11 0F 00  
240- 11 11 11 1F 11 11 11 00  
248- 0E 04 04 04 04 04 0E 00  
250- 01 01 01 01 01 11 0E 00  
258- 11 12 14 18 14 12 11 00  
260- 10 10 10 10 10 10 1F 00  
268- 11 1B 15 15 11 11 11 00  
270- 11 11 19 15 13 11 11 00  
278- 0E 11 11 11 11 11 0E 00  
280- 1E 11 11 1E 10 10 10 00  
288- 0E 11 11 11 15 12 0D 00  
290- 1E 11 11 1E 14 12 11 00  
298- 0E 11 10 0E 01 11 0E 00  
2A0- 1F 04 04 04 04 04 04 00  
2A8- 11 11 11 11 11 11 0E 00  
2B0- 11 11 11 11 11 0A 04 00  
2B8- 11 11 11 15 15 1B 11 00  
2C0- 11 11 0A 04 0A 11 11 00  
2C8- 11 11 0A 04 04 04 04 00  
2D0- 1F 01 02 04 08 10 1F 00  
2D8- 1F 18 18 18 18 18 1F 00  
2E0- 00 10 08 04 02 01 00 00  
2E8- 1F 03 03 03 03 03 1F 00  
2F0- 00 00 04 0A 11 00 00 00  
2F8- 00 00 00 00 00 00 00 3F  
300- 00 00 00 00 00 00 00 00  
308- 04 04 04 04 04 00 04 00  
310- 0A 0A 0A 00 00 00 00 00  
318- 0A 0A 1F 0A 1F 0A 0A 00  
320- 04 0F 14 0E 05 1E 04 00  
328- 18 19 02 04 08 13 03 00  
330- 08 14 14 08 15 12 0D 00  
338- 04 04 04 00 00 00 00 00  
340- 04 08 10 10 10 08 04 00  
348- 04 02 01 01 01 02 04 00  
350- 04 15 0E 04 0E 15 04 00  
358- 00 04 04 1F 04 04 00 00  
360- 00 00 00 00 04 04 08 00  
368- 00 00 00 1F 00 00 00 00  
370- 00 00 00 00 00 00 04 00  
378- 00 01 02 04 08 10 00 00  
380- 0E 11 13 15 19 11 0E 00  
388- 04 0C 04 04 04 04 0E 00  
390- 0E 11 01 06 08 10 1F 00  
398- 1F 01 02 06 01 11 0E 00  
3A0- 02 06 0A 12 1F 02 02 00  
3A8- 1F 10 1E 01 01 11 0E 00  
3B0- 07 08 10 1E 11 11 0E 00  
3B8- 1F 01 02 04 08 08 08 00  
3C0- 0E 11 11 0E 11 11 0E 00  
3C8- 0E 11 11 0F 01 02 1C 00

3D0- 00 00 04 00 04 00 00 00  
3D8- 00 00 04 00 04 04 08 00  
3E0- 02 04 08 10 08 04 02 00  
3E8- 00 00 1F 00 1F 00 00 00  
3F0- 08 04 02 01 02 04 08 00  
3F8- 0E 11 02 04 04 00 04 00  
400- F1 EE EA E8 E9 EF F0 FF  
408- FB F5 EE EE E0 EE EE FF  
410- E1 EE EE E1 EE EE E1 FF  
418- F1 EE EF EF EF EE F1 FF  
420- E1 EE EE EE EE EE E1 FF  
428- E0 EF EF E1 EF EF E0 FF  
430- E0 EF EF E1 EF EF E0 FF  
438- F0 EF EF EF EC EE F0 FF  
440- EE EE EE E0 EE EE EE FF  
448- F1 FB FB FB FB FB F1 FF  
450- FE FE FE FE FE EE F1 FF  
458- EE ED EB E7 EB ED EE FF  
460- EF EF EF EF EF EF E0 FF  
468- EE E4 EA EA EE EE EE FF  
470- EE EE E6 EA EC EE EE FF  
478- F1 EE EE EE EE EE F1 FF  
480- E1 EE EE E1 EF EF EF FF  
488- F1 EE EE EE EA ED F2 FF  
490- E1 EE EE E1 EB ED EE FF  
498- F1 EE EF F1 FE EE F1 FF  
4A0- E0 FB FB FB FB FB FB FF  
4A8- EE EE EE EE EE EE F1 FF  
4B0- EE EE EE EE EE F5 FB FF  
4B8- EE EE EE EA EA E4 EE FF  
4C0- EE EE F5 FB F5 EE EE FF  
4C8- EE EE F5 FB FB FB FB FF  
4D0- E0 FE FD FB F7 EF E0 FF  
4D8- E0 E7 E7 E7 E7 E7 E0 FF  
4E0- FF EF F7 FB FD FE FF FF  
4E8- E0 FC FC FC FC FC E0 FF  
4F0- FF FF FB F5 EE FF FF FF  
4F8- FF FF FF FF FF FF FF CO  
500- FF FF FF FF FF FF FF FF  
508- FB FB FB FB FB FF FB FF  
510- F5 F5 F5 FF FF FF FF FF  
518- F5 F5 E0 F5 E0 F5 F5 FF  
520- FB F0 EB F1 FA E1 FB FF  
528- E7 E6 FD FB F7 EC FC FF  
530- F7 EB EB F7 EA ED F2 FF  
538- FB FB FB FF FF FF FF FF  
540- FB F7 EF EF EF F7 FB FF  
548- FB FD FE FE FE FD FB FF  
550- FB EA F1 FB F1 EA FB FF  
558- FF FB FB E0 FB FB FF FF  
560- FF FF FF FF FB FB F7 FF  
568- FF FF FF E0 FF FF FF FF  
570- FF FF FF FF FF FF FB FF  
578- FF FE FD FB F7 EF FF FF  
580- F1 EE EC EA E6 EE F1 FF  
588- FB F3 FB FB FB FB F1 FF  
590- F1 EE FE F9 F7 EF E0 FF  
598- E0 FE FD F9 FE EE F1 FF  
5A0- FD F9 F5 ED E0 FD FD FF  
5A8- E0 EF E1 FE FE EE F1 FF  
5B0- FB F7 EF E1 EE EE F1 FF

```

5B8- E0 FE FD FB F7 F7 F7 FF
5C0- F1 EE EE F1 EE EE F1 FF
5C8- F1 EE EE F0 FE FD E3 FF
5D0- FF FF FB FF FB FF FF FF
5D8- FF FF FB FF FB FB F7 FF
5E0- FD FB F7 EF F7 FB FD FF
5E8- FF FF E0 FF E0 FF FF FF
5F0- F7 FB FD FE FD FB F7 FF
5F8- F1 EE FD FB FB FF FB FF
600- 08 04 02 00 00 00 00 00
608- 00 00 0E 01 0F 11 0F 00
610- 10 10 1E 11 11 11 1E 00
618- 00 00 0F 10 10 10 0F 00
620- 01 01 0F 11 11 11 0F 00
628- 00 00 0E 11 1F 10 0F 00
630- 06 09 08 1E 08 08 08 00
638- 00 00 0E 11 11 0F 01 0E
640- 10 10 1E 11 11 11 11 00
648- 04 00 0C 04 04 04 0E 00
650- 02 00 06 02 02 02 1E 0C
658- 10 10 11 12 1C 12 11 00
660- 0C 04 04 04 04 04 0E 00
668- 00 00 1B 15 15 15 11 00
670- 00 00 1E 11 11 11 11 00
678- 00 00 0E 11 11 11 0E 00
680- 00 00 1E 11 11 1E 10 10
688- 00 00 0F 11 11 0F 01 01
690- 00 00 17 18 10 10 10 00
698- 00 00 0F 10 0E 01 1E 00

```

```

6A0- 08 08 1E 08 08 09 06 00
6A8- 00 00 11 11 11 13 0D 00
6B0- 00 00 11 11 11 0A 04 00
6B8- 00 00 11 11 15 15 1B 00
6C0- 00 00 11 0A 04 0A 11 00
6C8- 00 00 11 11 11 0F 01 0E
6D0- 00 00 1F 02 04 08 1F 00
6D8- 07 0C 0C 18 0C 0C 07 00
6E0- 04 04 04 04 04 04 04 04
6E8- 1C 06 06 03 06 06 1C 00
6F0- 0D 16 00 00 00 00 00 00
6F8- 7F 7F 7F 7F 7F 7F 7F 7F
700- 00 00 00 00 00 00 00 00
708- 04 04 04 04 04 00 04 00
710- 0A 0A 0A 00 00 00 00 00
718- 0A 0A 1F 0A 1F 0A 0A 00
720- 04 0F 14 0E 05 1E 04 00
728- 18 19 02 04 08 13 03 00
730- 08 14 14 08 15 12 0D 00
738- 04 04 04 04 00 00 00 00
740- 04 08 10 10 10 08 04 00
748- 04 02 01 01 01 02 04 00
750- 04 15 0E 04 0E 15 04 00
758- 00 04 04 1F 04 04 00 00
760- 00 00 00 00 04 04 08 00
768- 00 00 00 1F 00 00 00 00
770- 00 00 00 00 00 00 04 00
778- 00 01 02 04 08 10 00 00
780- 0E 11 13 15 19 11 0E 00

```

```

788- 04 0C 04 04 04 04 0E 00
790- 0E 11 01 06 08 10 1F 00
798- 1F 01 02 06 01 11 0E 00
7A0- 02 06 0A 12 1F 02 02 00
7A8- 1F 10 1E 01 01 11 0E 00
7B0- 07 08 10 1E 11 11 0E 00
7B8- 1F 01 02 04 08 08 08 00
7C0- 0E 11 11 0E 11 11 0E 00
7C8- 0E 11 11 0F 01 02 1C 00
7D0- 00 00 04 00 04 00 00 00
7D8- 00 00 04 00 04 04 08 0G
7E0- 02 04 08 10 08 04 02 00
7E8- 00 00 1F 00 1F 00 00 00
7F0- 08 04 02 01 02 04 08 00
7F8- 0E 11 02 04 04 00 04 00

```

After construction is complete, carefully check all connections. Then install the board, making doubly sure the proper locations are selected.

Be sure to add the previously mentioned POKES to the Apple-writer program. Then resave for future use.

You now have a very sophisticated text editor for your Apple. You will now enjoy typing letters, since what you see on your screen is what you get on the printer.

good luck . . .

**Stanton has two Apple computers** for use in its Title III program. Some fourth, fifth and sixth-grade students at Stanton recently started a computer programming class on Friday afternoons.

"Computers make learning more fun and more stimulating — more like a game," said Conner. "The children really respond to the instant feedback. Spelling becomes much more exciting when you're learning how to spell by playing 'Hangman' with the computer."

The Lawrence Hall of Science in Berkeley and the Marin Computer Center in San Rafael provide access to large and sophisticated computer facilities. About 85 percent of those who use the computers are teenagers.

Members of Clifton's staff will be trained to operate the computer. It is hoped that parents will volunteer their time to be trained and to help run the computer center.

# CRAE

A new Co-Resident Applesoft Editor for applesoft programmers. Now perform global changes/finds to anything in your applesoft programs. Quote ranges of lines from one part of your program to another. A fully optimized stop-list command that lists your program to the screen with no spaces added and forty columns wide. Append other applesoft programs from disk. Get a formatted memory dump to help debugging. Renumber applesoft programs 5 times faster than most available renumber routines. Automatic line numbering. All utilities invoked with one key commands.

C.R.A.E. changes your applesoft program right in memory and only needs to be loaded once.

Hardware requirements for all utilities are 48K Apple II or Apple II Plus, applesoft ROM and Disk.

C.R.A.E. 1....Includes global find/change, quote, dump and List renumber, autoline, and append. Disk - \$14.95

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of Apple Computers Inc.





\$200 - \$2FF

0E 11 11 15 17 16 10 0F 00     ###  
## # ## ## # ## ## ##  
# # # # # # # # # #  
04 04 11 1F 11 11 11 00     #  
## # ## ## # #  
# # # # # # # # # #  
1E 11 11 1E 11 11 1E 00     #  
## # ## ## # # ## ##  
## # ## ## # ## ## # #  
0E 11 10 10 11 0E 00     #  
## # ## ## # # ## ##  
## # ## ## # # ## ##  
1E 11 01 01 01 01 11 0E 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
0E 04 04 04 04 04 0E 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
11 11 11 1F 11 11 11 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
0F 10 10 10 13 11 0F 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
0E 11 11 11 11 11 0E 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
11 11 11 11 15 13 11 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
1F 10 1E 10 10 10 10 00     #  
## # # ## ## # # # # # #  
## # # # # # # # # # #  
1F 10 1E 10 10 1F 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #

11 11 11 1F 11 11 11 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
0E 04 04 04 04 04 0E 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
11 11 11 11 15 13 11 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
11 11 11 11 11 11 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
11 18 15 11 11 11 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
11 11 11 11 11 0E 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
11 11 11 11 11 11 00     #  
## # # # # # # # # # #  
## # # # # # # # # # #  
11 18 15 11 11 11 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
11 11 11 11 11 0E 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #

1E 11 11 1E 10 10 10 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
0E 11 11 11 15 12 00 00     #  
## # # ## ## # # ## ##  
## # # # # # # # # # #  
11 11 11 11 15 15 18 11 00     #  
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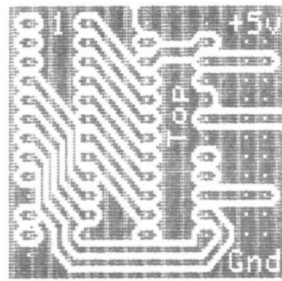




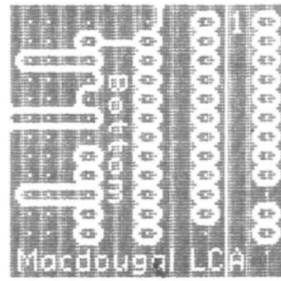






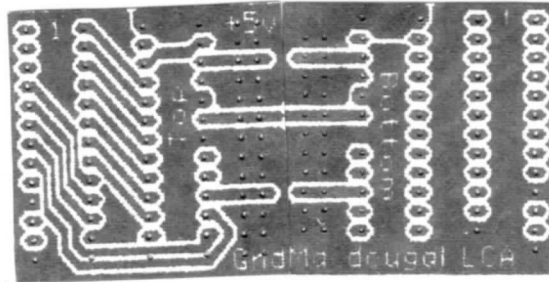


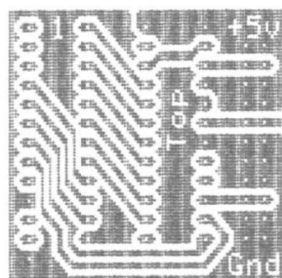
B13-6  
 J14-12  
 A3-3,14



A.B.A.C.U.S.-MacDougall Lower-Case Adapter  
 Printed Circuit Board by James P. Davis from  
 an article in The ABACUS II, April 1980, volume  
 number 2, issue number 4.  
 A 2716 DIP IC (socket) attaches to the top of  
 the PCB in the center.  
 A 24 DIP header attaches to the bottom of  
 the PCB at the right-hand edge (as shown  
 above). This plugs in to the Apple character  
 generator socket at A5 on the mother board.

*Davis/Paymar/Mac-  
 Dougal LCA*

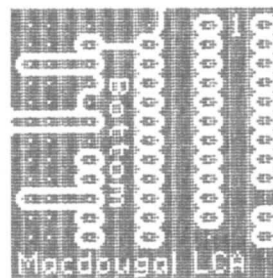




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