4K RAM Expansion for the DREAM 6800

The long-awaited DREAM 6800 expansion project is here! This uncomplicated circuit allows DREAM users to expand their computer's memory to a total of 4K and fits inside the cabinet of the original DREAM. It's just the thing for those who have gone beyond the initial stages of programming and now wish to write longer programs.

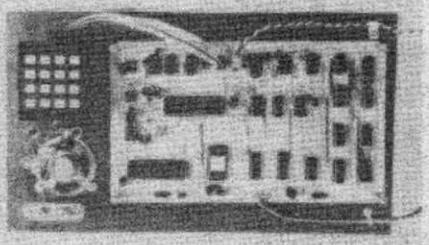
by K. ZALKALNS

Although CHIP-8 is a very memory efficient language, I and no doubt other owner-drivers of Dream computers have had times when the available memory storage is just not large enough. A quick answer is to make simpler therefore shorter programs, but that seems to be a retrograde step.

With more RAM, various possibilities suggest themselves. Often used subroutines could be pre-stored at the top of the stack, and called from a number of programs, a block of programs could be entered at once and a key pressed to select a chosen program, or even "number crunching", etc, etc. But enough of suggestions. After building the board you can dream up your own ideas on how to use it (sorry about the pun).

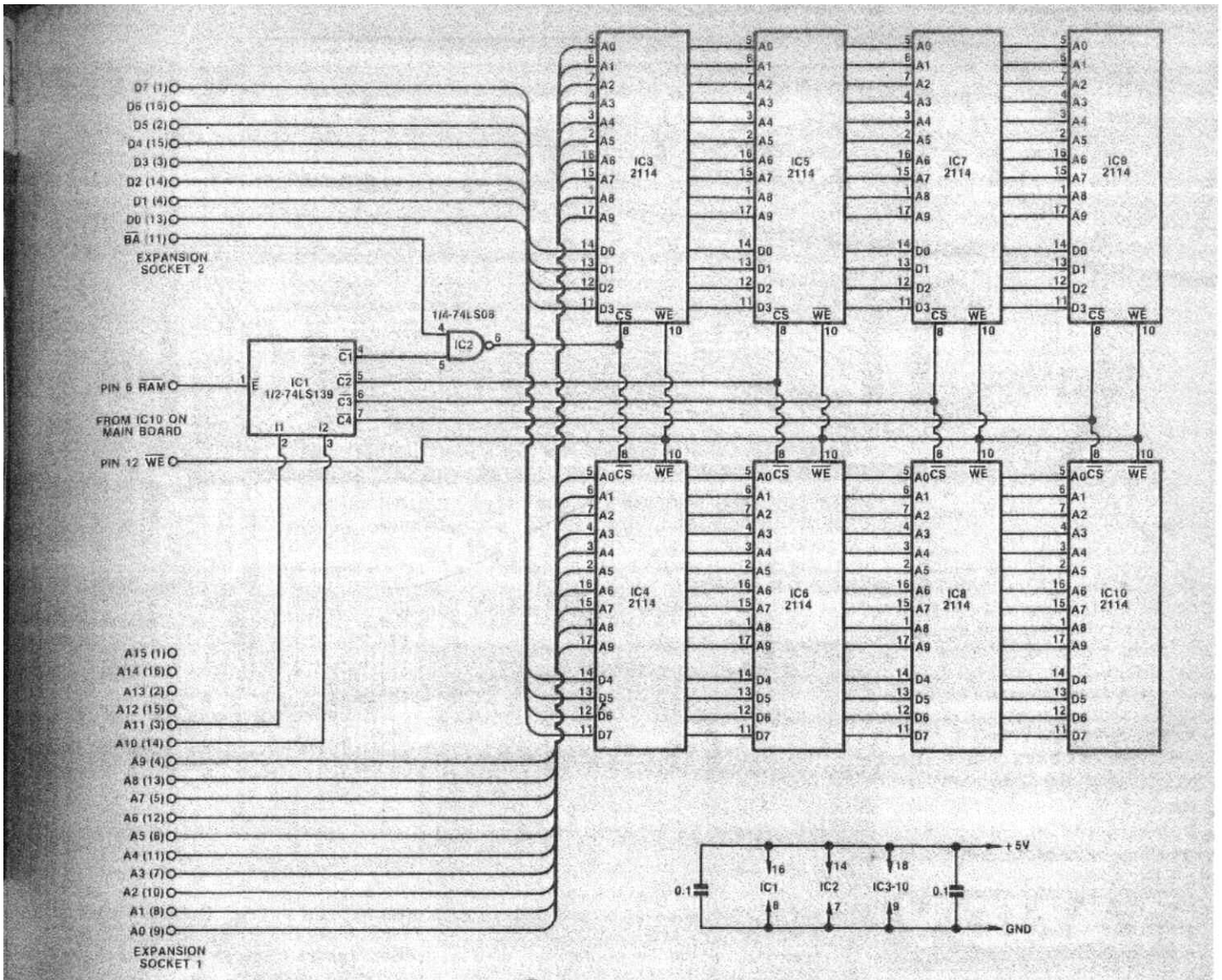
I decided to limit the expansion of memory to a total of 4K. This is the maximum extension which is possible without buffering the data and address lines, and in any case the 12-bit address operand of the CHIP-8 language will only allow addressing up to location OFFF (4095 decimal). Because of the efficiency of the CHIP-8 language, 4K of memory should be ample.

To keep the circuit simple several signals are taken from the main board. The conditions required to address the RAMs for the CHIP-8 use are that address lines 14 and 15 are low and lines 10 and 11 are decoded to select the correct 1K block (see table 1). The signal for the former function is already available at pin 6 of IC10 (74LS10), labelled RAM and can be used as the enable input for the address decoder (½ 74LS139). The four decoded outputs (active low) are then used to select the correct RAM. The Read/Write function is also available at IC10 (pin 12) and is fed to the WE input of all RAMs.



Published in May, June, July and August 1979, the DREAM 6800 was a highly popular project.

The only further decoding required is to supply RAM1 with the BA signal for DMA (Direct Memory Access) use for the video page. This can be achieved in two ways. The first is to cut the track near pin 13 of IC12 and apply the C1 signal from the extension board to the same pin, leaving the main board RAMs in their current location. The other method, which I opted for, is to use one gate of a 74LS08 on the extension board with the BA signal taken from the expansion bus. This does mean most of the package is unused, but the price is low enough and the main board doesn't have to be mangled in the process. If you use this approach there will be no RAM chips on the main board. The entire 4K memory will be on the expansion board.



EA 4K RAM EXPANSION FOR DREAM 6800

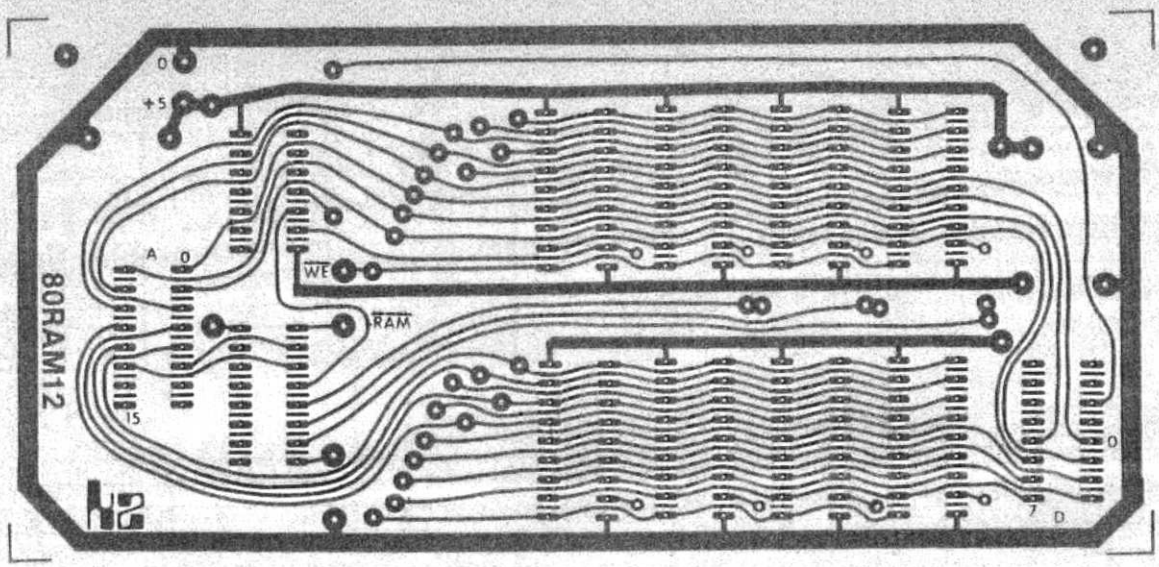
2/CCF

Just two ICs, in addition to the memory chips, are required for this RAM expansion.

As can be seen from the board pattern, a single sided board has again been used to keep the cost down, so there are a number of wire links to install. Whether you make your own board or buy one, the first job should be to check for shorts or breaks in the tracks, as most of them, of necessity, are closely spaced and quite narrow. Next, solder the 23 wire links, using sleeving where necessary. Install IC sockets for the RAMs and bus extension at least, and finally the two capacitors and TTL ICs.

The extra two signals $\overline{RAM}$ and $\overline{WE}$ must now be obtained from the main board. If you didn't follow the advice given for building the main board, and did install sockets for all the ICs a simple method is available. Take a 14 pin header, solder and an IC socket to the top and like magic, you've now got a high rise socket for IC10. Solder leads from pin 6 ($\overline{RAM}$) and pin 12 ($\overline{WE}$) and you're in business. If you did solder the ICs either PC pins will have to be installed at the correct locations, or alternatively, the two leads could be soldered to the bottom of the board. The only other leads required are for power, which can come from the two pads between the expansion sockets on the main board.

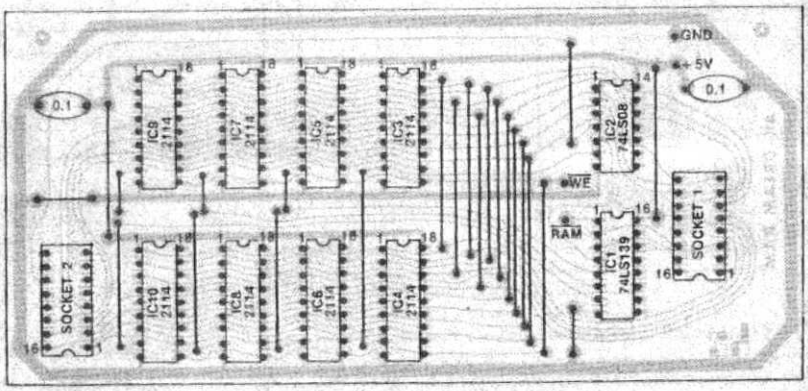
The extra board has been designed to mount above the main board over the expansion sockets by using spacers and longer screws. Prior to fitting the board, thoroughly check it again. It's better to be safe than sorry. If everything checks



Above is the full-size artwork for the PC board while below is the component layout diagram.

out OK, it's time for the big test.

Remove the RAMs from the main board. Don't forget they are MOS devices, so chain yourself to your earthed metal workbench before handling them. You don't want to blow their brains out, now, do you? Plug in the bus extenders (the address lines plug into the socket nearest the corner on the main board) and the other connections and insert the ICs on the RAM board. The next



step is obvious. Take a deep breath to steady yourself and switch on. If all is well you should be confronted with a totally awe uninspiring picture, very similar or identical to the one displayed prior to brain surgery. Think of that — a Dream 6800 that to all intents and purposes appears to be stock-standard, but is in reality waiting for you to fill it's vast memory with useful things to do.