A 24-Line Display for the Heath H9

By Stephen L. Sama

The Heath H9 video terminal is a very versatile instrument with an abundance of operating modes and interface features. However, many H9 owners have probably shared my frustration with the rather limited 12-line display format. Only relatively small portions of a program can be displayed for editing, and graphical outputs can only be inspected with 12 point resolution. This article is intended to be a reference for present and future owners of an H9, describing my conversion scheme for doubling the display capacity of this terminal.

At the outset I was briefly encouraged by the fact that there were provisions on the RAM and counter circuit board of the terminal to exactly double the display memory size. I was hopeful that Heath had planned a future expansion to 24-line format. However, on communication with the factory I learned that these extra RAM locations were only remnants of an abandoned idea for a two-page feature.

As it turns out, though, the convenience of these extra RAM locations combined with the fact that the H9 display is in reality a 24-line type with 12 lines purposely blanked, made conversion of the terminal to 24-line output a practical venture.

THE CONVERSION

The conversion circuitry I present here turns the H9 terminal into a 24 line by 80 character format display device. All original features are retained, including proper scrolling, erasing, homing, plot mode with the first line displayed 8 times, and short form display in four columns of 24 lines each. Only the appearance of the cursor was significantly modified. The new cursor is an enhanced square the size of one character location. When the cursor is placed over a displayed character, the character is still visible at about twice the intensity of the cursor. All original cursor motions and modes are preserved.

For about $40 invested in parts, of which $30 is used to buy two 2114 memory chips, a complete conversion can be implemented. Six standard TTL chips must also

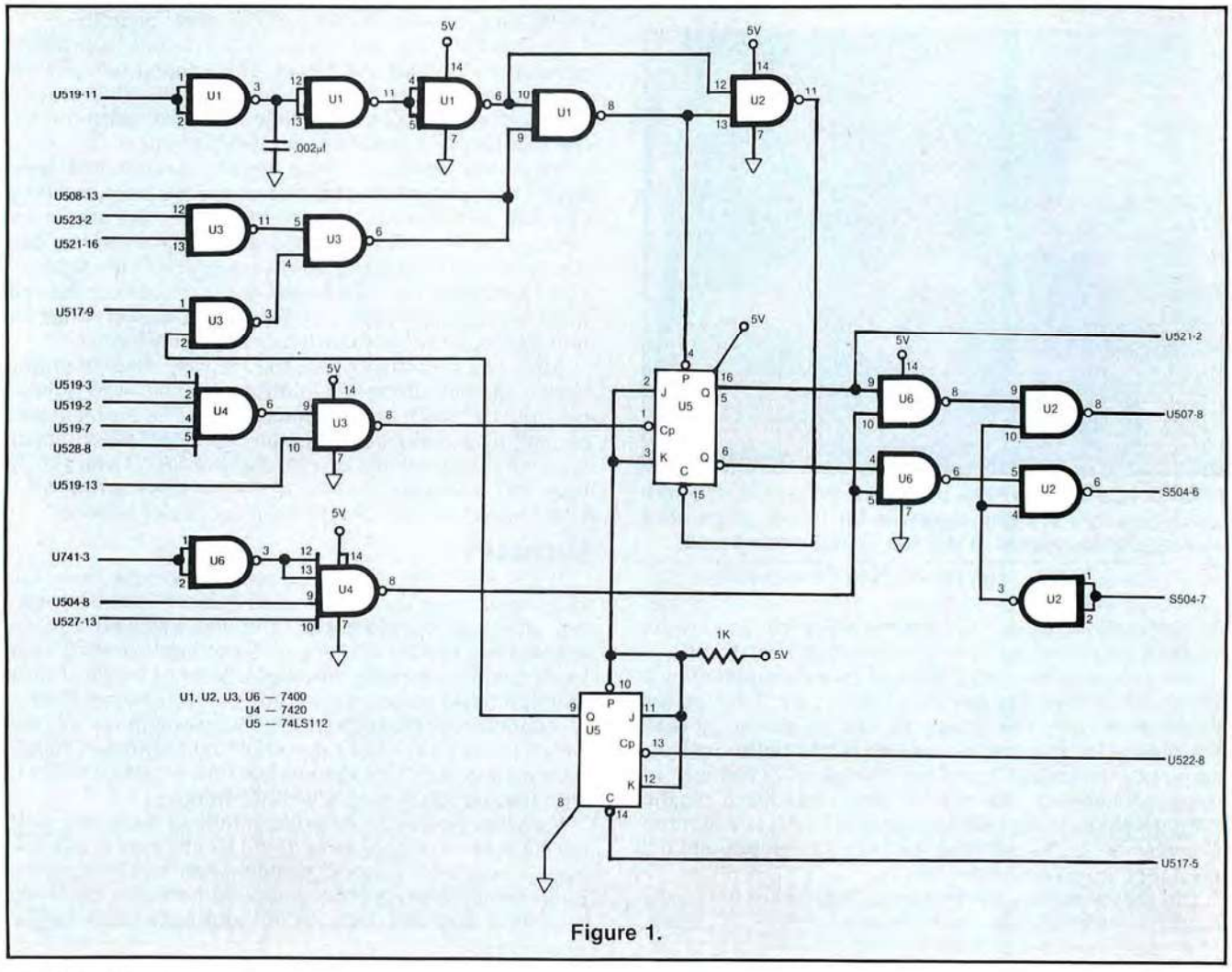

Figure 1.

be added on a separate breadboard with most interconnections made to the RAM and counter circuit board. I recommend mounting this board on the keyboard support brackets alongside the RAM and counter board. Layout and lead length are not critical and almost any breadboarding technique should work.

The following is a listing of changes which must be made to the H9 PC boards themselves. The terms "cut" and "jump" are obvious in definition. "Isolate" means that a given point or section of a chip must be disconnected from the circuit by land-cutting, but the original continuity of all connections must not otherwise be disturbed. Designations are of the form XYYY-Z where X is U for an IC package and X is S for a PC board connector. YYY is the package or connector number and Z is the corresponding pin number. The most significant digit of YYY identifies the proper PC board in accordance with the conventions of the Heath schematics (i.e. 7 for the TPU board, 5 for the RAM and counter board and 2 for the character generator board):

CHARACTER GENERATOR BOARD MODIFICATIONS

1. Cut S202-3 to U213-7
   Jump S202-3 to U213-6

2. Isolate U222-9, U222-11
   Jump U222-9 to U212-6
   Jump U222-11 to U212-4

3. Cut U219-4 to U218-5
   Isolate U221-4, U221-5, U221-6
   Jump U218-10 to U219-10
   Jump U221-2 to U219-11
   Jump U221-4 to U218-5
   Jump U221-5 to U219-4
   Jump U221-6 to U210-3

RAM AND COUNTER BOARD MODIFICATIONS

1. Jump U508-11 to U520-3
   Jump U521-2 to U508-12
   Isolate S504-7

2. Jump S504-8 to U504-9,10
   Jump S501-5 to U527-11,12

Figure 1 shows the schematic of the required external breadboard. I recommend that a standard speed TTL device be used for U1. The circuit should work with any speed version for the remaining chips. The type and tolerance of the .002μf capacitor is not critical. With one exception, all connections are made to the RAM and counter circuit board. I suggest tapping power from the RAM and counter circuit board as well.

The major undertaking in this project is that of the 22 interconnection wires. Pay careful attention here to avoid errors by using color coded wires, preferably from ribbon cable. I also advise preparation of your own wire-run list for both checkout and your own future reference. Do not forget to add the two additional 2114 memory chips and their sockets into the vacant locations on the RAM and counter PC board.

I feel that anyone who was successful in assembling a project of the magnitude of the H9 terminal kit should have no trouble incorporating this 24 line conversion. But I must emphasize the need for careful assembly, neatness (to make errors more apparent) and plenty of circuit doublechecking before turning the power on. The H9 terminal is a complex system. Trusting your trouble-shooting skills instead of completely checking out your wiring can result in tremendous amounts of wasted time.

Try the conversion; the added power and convenience of the expanded display is well worth the effort. □