



A SURPLUS KEYBOARD is used in this version of the TV typewriter. Unit on cover has a home-made keyboard based on the article in the February issue.

TABLE I

COMPLETE SPECIFICATIONS—TV TYPEWRITER

STORAGE:	1024 Characters arranged as 2 pages of 16 lines of 32 characters each.
OUTPUTS:	Rf Output tuneable from channel 2 through 5; clips directly to the antenna terminals of one or more unmodified television sets. Optional positive-white video output.
INPUTS:	Parallel, TTL compatible, ASCII character code (Table II) is input with positive logic on six lines; a seventh <i>keypressed</i> line is suddenly brought to ground to input character, Internal debouncing. The full 8-bit ASCII code may also be used as an input. If done, any CTRL input will be interpreted as a combined CARRIAGE RETURN and LINE FEED, CTRL output available for code extension.
FORMAT:	Begins in upper left HOME position and proceeds as in normal typing. Carriage return and linefeed automatic at end of line. At bottom of screen, jumps to upper left HOME position and rewrites over old text.
EDITING:	Winking cursor indicates next character position. Cursor may be blanked and may be independently moved in any direction with or without changing text. One or more letters may be easily changed at any time.
TIMEBASE:	Internal, crystal controlled TTL divider. Basic video clocking rate = 4.562 MHz. 15,840 kHz noninterlaced horizontal scan rate; 60-Hz vertical scan rate. Easily converted to full interlace for Video Recorder titling applications.
MEMORY:	512 word by 6 bit MOS dynamic storage, bus oriented for easy page conversion, optional memory output, and optional extension to calculator, computer, and other functions.
CONTROLS:	Internal: Rf frequency (trimmer capacitor) Position—(Jumpers—4 horiz; 3 vert for 12 possible locations.) EXTERNAL: ON-OFF PAGE OR LINE SCAN KEEP-CHANGE memory protect A or B page select REPEAT or SINGLE character HOME or RUN cursor location CURSOR ON-OFF ADD-SUBTRACT cursor direction
CONSTRUCTION:	Modular mother-daughter boards. Mother board contains power supply, rf modulator, and control switches. Timing board, cursor board and one or two memory boards snap on as a stack. Add-ons such as calculator and MODEM FSK unit snap onto same stack; not included in basic unit. 33 integrated circuits, of which 8 are MOS LS1.
SIZE:	7"x8½"x3", not including keyboard or case.

adjustments can further help the appearance, although they are not needed.

The characters are added one at a time and normally go on the screen just like you were typing. This is done by providing the proper ASCII character code on seven input lines and tripping an eighth "key pressed" line to enter the character. A winking cursor tells you where the next character is to go, but you can turn this off if you want to. Should the screen get filled, the machine starts over again on the top, rewriting over the old message.

Besides the normal operation, you have a complete editing capability. You can move the cursor either direction anywhere you want and then change only the characters or words you wish to, thus editing something you already have on the screen. This nicely handles mistakes without having to start over again. A REPEAT key is available for putting down a group of identical characters or getting to a given position in a hurry. There's a KEEP-CHANGE switch to protect what you have written while you are moving around, and you can home the cursor to the upper left either by itself or erasing the whole picture on the way. Other switches control the direction the cursor goes, which page is being displayed, and optionally whether the mode will be a full screen one for typewriter use or a line scan one for calculator use.

Computer people would call this a parallel input system with off-line editing. A single machine command is available; this is the LINE FEED. Thus, any CTRL key moves you down a line. Other remote commands are easily added, but were left off to hold the cost down. The contents of the memory can be retransmitted with simple circuit modifications, and the whole system is bus-oriented to allow all sorts of add-ons without major circuit rework.

Character input rate is asynchronous and up to 30 characters per second, thus making the beast three times faster and compatible with the industry standard ASR-33 teletype. Hard copy is via cassette recorder or Poloroid® photos.

Organization of the instrument

To keep things as simple as possible, the circuit is arranged like a set of snap-together blocks. This way, the only interconnect wiring consists of the line cord and the 300-ohm twinlead output. Since the interconnect wiring is locked into the board and 60-pin connector system, the biggest single headache and potential error source is eliminated.

Fig. 1 shows the basic blocks. The MAINFRAME contains a power supply of +12, +5, -5, and -12 volts; the control switches; the rf modulator; the internal test system; and connectors for both the keyboard and the other boards in the stack.

There are three other essential boards. The MEMORY board is the most important and the most complex. It contains a dynamic MOS (Metal Oxide Semiconductor) shift register that stores 512 words of 6 bits each. It also holds a single-line memory; a character generator; and an output video register. We'll see later that the single-line memory is needed to get each character back eight times in sequence for eight successive TV scans.

For a page-A memory, you need all of