



**CT-1024  
TERMINAL  
SYSTEM**

## CT-1024 Terminal System Kit (TV Typewriter II)

The CT-1024 Terminal System kit is a low cost alphanumeric character generator designed to simultaneously display sixteen lines of 32 characters/line on a standard video monitor or slightly modified television set. Together with its low cost options it may be used to simply display messages and data on a TV screen, to communicate with either local or remote computer systems, such as the SWTPC 6800 Computer System or to store and recover data from an audio cassette tape recorder just to mention a few.

The terminal system is an upper case only, ASCII device. It is not compatible with IBM EBCDIC coded systems or the older 5 level Baudot coded Teletypes <sup>®</sup>. Although we may have a Baudot code converter for the terminal system in the near future, one is not available at the time of this writing. With the exception of the 2513 character generator, the UART chip on the serial interface option and the 2102 static, random access memories, the entire system is constructed using low cost, easy to get TTL integrated circuits.

The six 2102 memories give the system the capability of storing 1024 characters. 512 of these are being displayed on the screen while the other 512 are stored and may be accessed and displayed just by flipping a switch.

The CT-1024 terminal system does not have scrolling. When you get to the last character position of the bottom line it will return to the first character position of the first line (home-up position) on either the same page or opposite page, switch selectable.

The terminal system does have both hardware and software carriage return/line feed. If you are entering data thru either the keyboard or interface board and reach the end of a line, the terminal will do a self-generated carriage return/line feed (home-up if on the last line) to prevent the loss of data. In addition to this you may at any time generate a carriage return or line feed by entering a Control M or Control J respectively, from either the keyboard or from a computer thru an interface board.

Both erase to end-of-line (EOL) and erase to end-of-frame (EOF) features have been incorporated into the terminal system. Since these erase functions always start from the cursor location, a home-up function has been provided as well. Each is enabled thru a separate pushbutton switch unless the CT-CA computer controlled cursor option is used in which case either user selected control characters from the keyboard or pushbutton switches may be used.

The actual display device for the terminal system may be an unmodified video monitor or slightly modified television set. Although specific instructions are supplied for modifying a small screened Motorola set, almost any set may be used. Be sure to use one that does not have a "hot" chassis, otherwise you will need an isolation transformer. The suggested modification to the television set even includes a switch to allow one to select from terminal or normal television reception.

The circuitry on the terminal system requires a 60 Hz power line frequency and the U.S. standard 525 line television set. The terminal circuitry has been designed for sixteen lines of 32 characters/line and changing this figure for either more or less would entail complete redesign and is thus not recommended. The system is not adaptable to being feed from

external sync sources which eliminates its use in superimposed video titling applications.

The following is a list of each of the items available for the terminal system along with a brief description of each:

### CT-1024 Terminal System Kit

This kit includes the 9 1/2" x 12" doubled sided, plated-thru hole main board, the 3" x 7" doubled sided, plated-thru hole memory board, plus all of the components that go on the two. There are connector provisions for a positive logic, positive or negative keypress strobe, ASCII keyboard such as one of our KBD options or another compatible keyboard if you wish. There are connector positions for either the CT-M manual cursor board or CT-CA computer controlled cursor board. There is also a connector position for either the CT-S serial interface (UART) option or the CT-L parallel interface option. There is also one connector position where the CT-E screen read option may be inserted. Power requirements for the entire system, including interfaces are +5 VDC, +5% @2.25A, -5 VDC @20 Ma and -12 VDC @60 Ma. which are generated by the CT-P power supply option.

The main and memory boards do the storing and displaying of the alphanumeric data but to actually get data into the terminal's display you must use either a keyboard and/or in data communications applications one of the two interface options.

### KBD-2 Keyboard Option

The KBD-2 Keyboard kit is a 53 key upper case only ASCII keyboard including switch debouncing and encoder circuitry. The "keypress" strobe is a "low" true output while the seven parallel, TTL compatible data inputs are "high" true lines, fully compatible with the CT-1024 Terminal System. The keyboard is constructed on a 10 3/4" x 5 1/2" fiberglass circuit board and has 54 full typewriter travel, gold plated contact keyswitches with double shot molded keytops. The keys include the standard alphanumeric set plus ! " # \$ % & ' ( ) = - ; + : \* , . / ? , left arrow, right arrow, up arrow, spacebar, shift, control, escape, cancel, linefeed, carriage return and four user defined switches.

### KBD-3 Keyboard Option Kit

The KBD-3 Keyboard kit is similar to the KBD-2 kit except that it is jumper programmable for upper only or upper/lower case generation, has N key lockout and two key rollover, and its user defined keys are easily implemented for additional ASCII outputs. It has 53 keys which include two user defined keys and a REPEAT key. An ERASE key takes the place of the CANCEL key on the KBD-2. Both the ERASE and REPEAT keys generate no code and may be used as user defined switches if desired.

The KBD-3 Keyboard is recommended for CT-1024 Terminal System

applications involving computer use. Many computer systems require the use of specific ASCII codes not already on the keyboard and with the KBD-3, they can be easily implemented with the user defined keys and some PC board patching. Although the KBD-3 is jumper programmable for upper case only or upper/lower case operation the CT-1024 Terminal System is an upper case only display. In this case the KBD-3 would be jumpered for upper case only operation.

#### CT-M Manual Cursor Option Kit

The CT-M Manual Cursor Control option is a plug-on board used with the CT-1024 terminal system that provides complete control for manual cursor positioning. It is attached to the terminal system by simply plugging it onto connectors on the main terminal system board. Note that either the manual or computer controlled cursor boards may be plugged onto the cursor control connectors on the main board, but only one board may be plugged on at a time. The function of the manual cursor board is to allow the operator to incrementally position the cursor one position up, down, left or right. It also provides home-up, erase to end of line (EOL) and erase to end of frame (EOF). The functions are enabled by depressing the appropriate pushbutton switch (7 each which are not being supplied with the kit).

The circuitry provides the switch debouncing necessary to prevent multiple cursor counting thus insuring the cursor jumps only one position each time a directional button is depressed. The control switches themselves are SPST normally open pushbutton switches. The entire circuit is built up on a 3 1/6" x 4 1/2" fibreglass circuit board which is plugged onto the main board vertically just behind the memory board. Switch connections to the cursor board are provided thru a nine pin connector mounted on the board.

#### CT-CA Computer Controlled Cursor Option Kit

The CT-CA Computer Controlled Cursor option is a plug-on board used with the CT-1024 terminal system that provides complete computer as well as manual control over cursor positioning. The board is attached to the terminal system simply by plugging it onto connectors on the main terminal system board. Note that either the CT-M manual or CT-CA computer controlled cursor board may be plugged onto the cursor control board connectors on the main board, but only one board may be plugged on at a time. The function of the computer controlled cursor board is to allow the operator to incrementally position the cursor one position up, down, left or right, or do a home-up, erase to end of line or erase to end of frame using either manual switches or control characters generated by either the keyboard or a computer feeding data to the terminal system thru one of the interface options. By using control characters from the keyboard, the manual switches may be completely eliminated or you may retain the switches (7 each which are not supplied with the kit).

The circuitry on the 3 1/2" x 4 1/2" double sided, plated-thru hole circuit board provides the manual switch debouncing and control character decoding for the various cursor movements. The selection of the various control characters and their chosen functions is left to the user thru programming jumpers. The board is plugged onto the main board vertically just behind the memory board. Manual switch connections to the cursor board are made thru a nine pin

connector mounted on the board just like on the CT-M manual cursor board.

The CT-CA computer controlled cursor option has all of the features the manual option does plus it allows program (software) or keyboard control over cursor positioning. It's use is highly recommended in any CT-1024 Terminal System applications involving the use of a computer.

### CT-S Serial Interface Option Kit

In order for the CT-1024 Terminal System to communicate via a three wire system, a phone line or a magnetic tape data storage system, the parallel ASCII data must be broken down into sequential one bit at a time form both when being transmitted out of the keyboard and when being received by the display system. The CT-S serial interface or UART (Universal Asynchronous Receiver/Transmitter) provides this conversion from the parallel form into a series of properly timed one's and zero's including not only the serial data, but the start, stop and parity bits as well. The reverse is true during the receive mode. The baud rate or speed at which the serial data is transmitted or received, is 110 baud, or if the optional parts are installed, 110, 150, 300, 600 and 1200 baud. There is a provision for "echo" OFF (full duplex) where the data is transmitted to the receiver, but is not put up on the screen until it is "echoed" back by the receiver and displayed by the terminal; or "echo" ON (half duplex) where the data is transmitted and simultaneously put up on the screen and is not "echoed" back by the receiver.

The input/output connections to the interface are RS-232 compatible and will attach directly to most couplers and data sets. However, to record on, or playback from magnetic tape it will be necessary to have some kind of FSK encoder/decoder system to get the digital data on and off the tape. We will have such a system available in early 1976.

The RS-232 pin connections include transmitted data, received data, terminal "ready" and ground. There are no provisions for automatic transmit/receive switching. Data to be transmitted can either be provided by the terminal's memory using the screen read board or the keyboard.

The CT-S Serial Interface option is constructed on a 3/8" x 9 1/2" doubled sided plated-thru hole circuit board and includes all components to make the terminal system operational at 110 baud only. To operate at 110, 150, 300, 600 and 1200 baud you will need to add several other components including a crystal and two TTL IC's. We do not sell these components either with the kit or separately, however, there are positions for them on the circuit board.

The CT-S interface board is plugged onto the main board's interface connector vertically just behind the cursor and screen read boards. There is room for only one interface board; either the CT-S serial interface option or the CT-L parallel interface option. Only one may be plugged on at a time.

### CT-L Parallel Interface Option Kit

Although there are standards for the exchange of serial data such as the RS-232 format, there are no such standards for parallel data exchange. This

is unfortunate since it makes parallel interfacing difficult when interconnecting parallel devices supported by different manufacturers. Although we have tried to make the CT-L parallel interface option as universal as possible, we cannot guarantee that it will interface to any other parallel device, especially those supported by another manufacturer. We recommend that if at all possible you stay with serial interfacing unless you are sure there will be no problems or if your application requires maximum data transfer speed.

The CT-L parallel interface is compatible with the SWTPC 6800 Microprocessor's MP-L parallel interface, but it may not be used for the Computer's control terminal. The computer's mini-operating system will only work thru a serial interface. Some customers have reported problems interfacing to the Altair 8800's parallel interface so we recommend that you stay with the CT-S serial interface on this system.

The CT-L parallel interface option is constructed on a 4" x 9 1/2" double sided, plated-thru hole circuit board with two separate input/output (I/O) connectors along the top edge of the board.

For high noise immunity, the interface has been provided with Tri-State outputs, line rejection/noise discriminators on the strobe lines, and heavy duty diode clamping on all inputs from the data buss. For maximum flexibility all data and strobe lines from the I/O buss(es) can be selectively inverted by programming jumpers on the P.C. card. The keyboard may be directed to just print data on the screen, to print the data on the screen and load it on the output buss (half duplex), or just load it on the output buss (full duplex). This is especially nice when you want to have all typed information echoed back by a computer for verification. The interface's input and output buss lines can be used separately, or if selected, may be paralleled for applications where a bi-directional buss system is used. To make interfacing really simple, the data flow control lines can be either strobed or operated in a demand/response handshake mode, here again, selectable.

The CT-L parallel interface board is plugged onto the main board's interface connector vertically just behind the cursor and screen read boards. There is room for only one interface board, either the CT-L parallel interface option or the CT-S serial interface option. Only one may be plugged on at a time.

#### CT-E Screen Read Option Kit

If you ever need to use your CT-1024 terminal system in a situation where you need to get edited information that has been typed onto the screen transmitted out of the terminal and into another device, you will probably want to use the screen read board. The screen read when activated starts accessing information in the screen's cursor location and continues reading, transmitting the data out either the CT-S serial interface option or CT-L parallel interface option, advancing the cursor as it reads, until the READ ON/OFF switch is flipped off or an exclamation point is read from the screen. If when reading, the end of the page is reached it will continue after executing a home up on the same or opposite page depending upon the setting of the "page select" switch on the main terminal board.

The use of the CT-E screen read board in computer related terminal applications is more the exception than the rule. Almost all computer systems

operate in the interactive mode where each character is transmitted to the computer's instruction buffer as soon as it is keyed in. This includes those systems that do not process each line until a RETURN is keyed in thus eliminating the need for the screen read board. For those who insist on using the screen read in this type of application, there is a problem in that the terminal's memory does not store control characters which of course includes the RETURN key. Since most systems use the RETURN for line delimiters, not transmitting a RETURN at the end of each screen read line would thoroughly confuse most computers. While on the other hand screen reading one line at a time and manually entering the RETURN does not for make very efficient use of the terminal system.

The CT-E screen read option is constructed on a 4 1/2" x 3 1/16" double sided, plated-thru hole circuit board and is plugged onto the main terminal system board just behind the memory board adjacent the cursor control board. Either the CT-M manual or CT-CA computer controlled cursor board must be used along with the screen read board for proper screen read operation.

#### CT-P Power Supply Option Kit

The CT-P power supply is the +5 VDC, +5% @2.25A, -5 VDC @20 Ma and -12 VDC @60 Ma power supply designed to drive the CT-1024 terminal system including all of its option boards.

The circuit board itself is a 3 3/8" x 2 1/2" single sided circuit board containing a regulator transistor which must be heatsunk to a metal chassis or heatsink (not supplied with the kit). The power supply board itself is fed from a 117 VAC primary power transformer (included with the kit) mounted somewhere on the terminal system's chassis (not supplied with the kit).

#### Computer Application Customers

Since most individuals using the CT-1024 Terminal System for computer and/or modem applications will be using the same set of options, we have decided to offer the terminal system with the following options for a cost of \$275.00 postpaid in the U.S.:

1 EA.	CT-1024	Terminal System Kit
1 EA.	CT-P	Power Supply Option Kit
1 EA.	KBD-3	Keyboard Option Kit
1 EA.	CT-S	Serial Interface Option Kit
1 EA.	CT-CA	Computer Controlled Cursor Option Kit

This is the recommended package when using the Terminal System for most computer applications which include the SWTPC 6800 Computer System, the MITS ALTAIR 8800 and 680, as well as acoustic coupler/modem applications. This package does not include the video monitor or modified television display, chassis, cover, or 150, 300, 600 or 1200 baud CT-S serial interface option components. We do not sell these items.

#### General Comments

The unit is sold in kit form only and comes without a chassis or cover which we do not offer.

Our instructions have been written for the individual who has built up electronic projects before, knows how to recognize the various components, and is experienced at printed circuit board soldering. Although the instructions include step-by-step assembly details, schematics, wiring diagrams, and a theory of operation, they have not been written for the beginner. The various modules within the system simply plug together keeping the wiring to a minimum.

Assembly time will vary depending upon the number of options being assembled and the experience of the builder however most systems can be put together in less than twenty-four hours.

For those readers interested in finding out more about the circuitry in the unit, it was printed as a construction article series starting in the February 1975 issue of Radio-Electronics Magazine (TV Typewriter II page 27). If you do not have a copy of this magazine, you can probably find one in your local library. The CT-1024 (TV Typewriter II) is totally different from the TV Typewriter I printed in an earlier issue of Radio-Electronics Magazine. The two were designed by different individuals and their option boards are not interchangeable with one another. We are no longer supplying any of the parts for this older TV Typewriter I.

Since its introduction in February 1975 we have sold many of the CT-1024 terminal systems and have been very happy with its performance and reliability. However, for those customers that have difficulty getting the system working properly or have it fail after assembly, we do have repair service available at a reasonable cost.



Southwest Technical Products Corporation

CT-1024 Terminal System Price List

CT-1024	Terminal system kit including memory but less the keyboard and chassis.	\$175.00 ppd in U.S.
CT-P	Terminal Power Supply kit which powers the terminal system including a full complement of option boards.	\$ 15.50 ppd. in U.S.
KBD-3	Deluxe Keyboard kit with N key lockout, 2 key rollover with special character programmability.	\$ 49.95 ppd. in U.S.
CT-S	Serial Interface kit with bi-directional RS-232 capability for computers and modems.	\$ 39.95 ppd. in U.S.
CT-CA	Computer Controlled Cursor kit which gives both manual switch and program (software) control over cursor positioning.	\$ 15.50 ppd. in U.S.

NOTE: Cost of the preceeding five items when ordered simultaneously is \$275.00 ppd. in U.S..

KBD-2	Keyboard kit without N key lockout or 2 key rollover and without special character programmability.	\$ 39.95 ppd. in U.S.
CT-L	Parallel Interface kit to connect the terminal to a parallel data buss device.	\$ 29.95 ppd. in U.S.
CT-M	Manual Controlled Cursor kit which gives manual switch control over cursor positioning.	\$ 11.50 ppd. in U.S.

Circuit Boards

CT-1024b	Main Terminal System and Memory boards (G-10 fibreglass with plated thru holes).	\$ 47.50 ppd. in U.S.
CT-1024c	Connector Set for the above board set (sold only when purchased simultaneously with CT-1024b).	\$ 2.50 ppd. in U.S.

No other Terminal System boards are available.

# THINKING ABOUT A "6800" TYPE COMPUTER?

It seems that a great many people came to the same conclusion that we did here at SwTPC. The M6800 is an outstanding processor and makes a great computer — "BUT" — Not all computers using the M6800 processor are the same. May we suggest that you consider the following features when you make your choice.

## IT IS A COMPLETE 6800 SYSTEM?

You cannot get all of the advantages of the 6800 system with only the processor chip. Unless the whole 6800 family of chips is used you cannot possibly get all of the versatility and superior performance that the system is capable of providing. If for instance the design does not use the MC6820 parallel and the MC6850 serial integrated circuits for interfacing, you lose the programmable interface feature that makes it so easy to interconnect the computer system with outside devices such as terminals, printers, disks, etc.

## IS THE SOFTWARE COMPATABLE OR UNIQUE?

If the design does not use the "Motorola" Mikbug<sup>®</sup> ROM, then the software and programs that will run on the system are probably unique to

that particular brand of computer. SwTPC uses the standard Motorola MCM6830L7 ROM. This provides automatic loading and an operating system that is compatible with other systems using the standard widely sold Motorola evaluation set. As an owner of our 6800 computer system, you are eligible for membership in the Motorola Users Group. If you join you have access to a library of programs that will run on your system. Editor and assembler programs are available directly from SwTPC.

## CAN THE SYSTEM BE EXPANDED AT A REASONABLE COST?

Some of the limited systems being offered at lower prices can be expanded only with difficulty. Check the amount of memory that can be added and at what cost. How many additional interfaces can be added, if any. How much of the above can be run off of the power supply provided with the system? The SwTPC 6800 can be expanded up to 16K words of memory in the standard cabinet and with the power supply provided. It may also be expanded up to eight interface (I/O) boards for external devices by simply plugging in the cards. Memory is \$125.00 for each 4,096 words of expansion and inter-

face cards are only \$35.00 for serial or parallel types.

Memory expansion will be essential if you ever intend to use a resident assembler, or higher level languages such as APL or BASIC on your system. Assembler programs typically require a minimum of 4,096 words of memory and higher level languages require even more.

## HOW DO YOU ENTER AND READ DATA?

Let's hope it is by way of a TTY, or video terminal. No one with a serious computer application would consider attempting to enter data from a switch and status light console. These may be educational, but they sure aren't practical. Calculator keypads and digital readouts are not much better. There is no substitute for a full alphanumeric keyboard and terminal system display for serious work.

*Mikbug<sup>®</sup> is a registered trademark of Motorola Inc.*

**SWTPC 6800**  
Computer System  
with serial interface and 2,048 Words  
of memory ..... \$450.00



Enclosed is \$450 for my SwTPC Computer Kit     Send Data

or BAC \_\_\_\_\_ # \_\_\_\_\_

or MC \_\_\_\_\_ Ex Date \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_

STATE \_\_\_\_\_

ZIP \_\_\_\_\_

Southwest Technical Products Corp., Box 32040, San Antonio, Texas 78284

# BUILD THIS



*This new TV Typewriter is primarily designed around TTL logic and provides the builder with many plug-on option boards. The options include a manually operated cursor control, computer operated board and much more*

by ED COLLE

## TV TYPEWRITER II

AFTER SEEING THE OVERWHELMING response shown for the TV typewriter story featured in the September 1973 issue of **Radio-Electronics** magazine, it is obvious that there are many readers interested in these units. As described in the previous article, there are many uses for a display such as this with the possibilities limited only by the imagination of the user.

One of the biggest applications of these units, however, is for data communications with computers. Combined with a keyboard, we have one of the fastest and most efficient means for an individual to communicate with a machine. An excellent example is the Mark-8 minicomputer shown on the front cover of the July 1974 issue of **Radio-Electronics** magazine. You can

be sure that more powerful and more economical units will follow. Then of course, if you don't have or don't want your own machine, you can always tie into a full size time-shared system, assuming you have access to one.

If you tried to build the terminal in the September 1973 issue, you probably discovered as many did that although the printed circuit boards were commercially available, some of the semiconductor chips were rather difficult to get. For this reason, this terminal has been built using 74 series TTL IC's that are common, easy to get, and inexpensive. The only MOS chips used are 2102 RAM's (Random Access Memories) and a 2513 character generator. And just to make things really easy, the unit is available

as a complete kit including circuit boards, IC's, discrete components, interconnectors and optional power supply. A cabinet, however, is not being made available at this time. Since in most cases you will want to use the TV typewriter in combination with a keyboard of some kind to enter messages, the supplier of the TV typewriter is making available a low-cost compatible keyboard/encoder too.

To make the unit as flexible as possible, extra effort has gone into designing plug-on options including a manually operated cursor control board, a computer operated plug-on board, screen read board and a URT communications board.

## SPECIFICATIONS

<b>DATA FORMAT</b> .....	1024 characters arranged as 2 pages of sixteen lines of 32 characters each.
<b>OUTPUT</b> .....	2.25-volt video pulse — 1-volt sync pulse compatible with the video input of a standard television or video monitor. The display's response must be to 1.6 MHz for maximum character size and to 3 MHz for minimum character size and should be flat to 4.5 MHz for best appearance.
<b>INPUT</b>	7 bit parallel ASCII positive logic with a key-press strobe that may be either positive or negative going.
<b>CONTROLS</b>	<p>Page select</p> <p>Home up (moves cursor to upper left hand corner)</p> <p>Erase to end of line</p> <p>Erase to end of frame</p> <p>Cursor on off</p> <p>Line feed</p> <p>Carriage return</p> <p>Adjustable left hand margin positioning</p> <p>Adjustable character size</p>
<b>POWER REQUIREMENTS</b>	5 Vdc, 2A, 5% regulation; —5 Vdc, 15mA; —12 Vdc, 20mA.
<b>SIZE</b> .....	12" long × 9¾" wide × 3½" high.
<b>ACCESSORIES</b>	<p>Manual cursor control board.</p> <p>Computer cursor control board.</p> <p>Screen read board (allows transfer of accumulated data to an outside device — should be used with the cursor control and URT boards).</p> <p>URT board (receives and transmits data in RS 232 format using 7 bit ASCII code at 110, 220, 440, or 880 baud or if a different crystal is used 150, 300, 600, or 1200 baud).</p>

1. **Cursor control (manually operated)** allowing the operator to position the cursor anywhere on the screen by using a set of switches similar to the keyboard switches.
2. **Cursor control (computer operated)** allowing the operator to position the cursor on the screen by sending commands to the display through software.
3. **Screen read** allows the user to edit all of the information on the screen using the cursor control board and then to send all of the accumulated data out to some external device using URT board, or as parallel data directly to a computer.
4. **URT board** receives and transmits data in RS 232 format using a seven-bit ASCII code. Baud rates can be multiples of either 110 or 150 depending upon a choice of crystals, up to 1200 baud.

The basic character organization is very similar to the original TV Typewriter, in that there are sixteen lines of 32 characters, however, this unit has a second page of memory as part of the basic unit rather than as optional accessory, providing a total character memory of 1024 characters.

Since the FCC is very rigid in their requirements for transmitters in the television frequencies, the unit has been designed to be connected directly to

the input to the video amplifier of a standard television set.

Although any set may be used, the small-screen black and white portables give the best picture. The connections are simple and a jack can be provided to allow switching between terminal and normal television operation.

Automatic carriage return is provided after the last character of each line, returning the cursor to the beginning of the next line. Unless switched off, a blinking cursor always shows where the next character is to go and you have the option of writing on either one of two pages of memory which are independently selected and displayed on the screen, through the PAGE SELECT switch. This same switch also provides automatic carry-over of the cursor from one page to the other when the end of frame is reached; or when selected, automatically performs a "home up" (return to line 1—column 1) of the same page. Erase to end of line (EOL) and erase to end of frame (EOF) functions are also provided. When enabled, they perform the erase function from the cursor location on the page selected. Line feed and carriage return are provided as well; with a line feed being a binary 0001010 or a control J, and a carriage return as a binary 0001101 or a control M.

## PARTS LIST TV TYPEWRITER

### PARTS LIST — MAIN BOARD

IC1, IC8 — NE555 timer  
 IC2, IC4, IC9, IC16, IC27, IC36, IC37, IC38, IC39 — 7474 dual "D" flip flop  
 IC3, IC5, IC26, IC29 — 7408 quad AND gate  
 IC6 — 7490 decade counter  
 IC7, IC14, IC21 — 7493 4 bit binary counter  
 IC10, IC15, IC19, IC32 — 7400 quad NAND gate  
 IC11 — 7451 dual AND-OR-INVERT gate  
 IC12, IC33 — 7404 hex inverter  
 IC13, IC26 — 7420 dual NAND gate  
 IC17 — 7409 quad AND gate (open collector)  
 IC18 — 74123 dual one shot  
 IC20 — 7405 hex inverter (open collector)  
 IC22 — 2513 ASCII character generator  
 IC23, IC24 — 7495 4 bit shift register  
 IC25, IC31 — 7430 8 input NAND gate  
 IC30 — 7422 dual NAND gate (open collector)  
 IC34, IC35 — 74193 4 bit up/down counter  
 IC40 — 7403 quad NAND gate (open collector)  
 IC41, IC42 — 7485  
 R1, R2, R3, R8, R9, R10, R13 to R23, R26, R29, R42 to R49 — 1000 ohms, ¼-watt carbon  
 R4 — 20,000 ohms, trimmer  
 R5 — 5600 ohms, ¼-watt  
 R6 — 5000 ohm trimmer resistor  
 R7 — 5100 ohms, ¼-watt, 5%  
 R11 — 47 ohms, ½-watt  
 R12 — 100 ohms, ½-watt  
 R24, R25, R28, R30, R31 — 4700 ohms, ¼-watt  
 R27, R32 to R35, R37 — 10,000 ohms, ¼-watt  
 R36, R50 — 2.2 meg ohms, ¼-watt  
 R38 — 50,000 ohm trimmer  
 R39 — 47,000 ohms, ¼-watt  
 R40 — 220,000 ohms, ¼-watt  
 R41 — 33,000 ohms, ¼-watt  
 C1, C6 — 500 pF  
 C2, C7, C14 — 0.01 μF  
 C3 — 0.002 μF  
 C4 — 50 pF  
 C5 — 0.0015 μF  
 C8, C9, C10, C11, C15, C16 to C33 — 0.1 μF  
 C12 — 0.047 μF  
 C13 — 0.22 μF Mylar  
 C16 — 0.001 μF  
 C17 — 33 μF, 10V, tantalum  
 C34, C35 — 100 μF, 16V, electrolytic  
 Q1, Q2 — 2N5129 silicon  
 Q3 — 2N5139 silicon  
 Q4, Q5 — T1S58 field effect transistor  
 D1, D2 — 1N914 silicon

### PARTS LIST — MEMORY BOARD

IC1 to IC6 — 2102 1024 bit static RAM  
 C1, C2 — 0.1 μF, 10V

The following items are available from Southwest Technical Products Corp., 219 W. Rhapsody, San Antonio, TX.

- CT-1024 Terminal System Kit with 1024 Memory Card — less cabinet or power supply. \$175.00 postpaid.
- CT-E Screen Read Plug-in Card kit. \$17.50 postpaid.
- CT-M Manual Cursor Control Plug-in Card kit. \$11.50 postpaid.
- CT-P Power Supply for CT-1024 — 115-230 Volt Primaries. \$15.50 postpaid.
- KPD-2 Keyboard Kit — 53 Keys. \$39.95 postpaid.