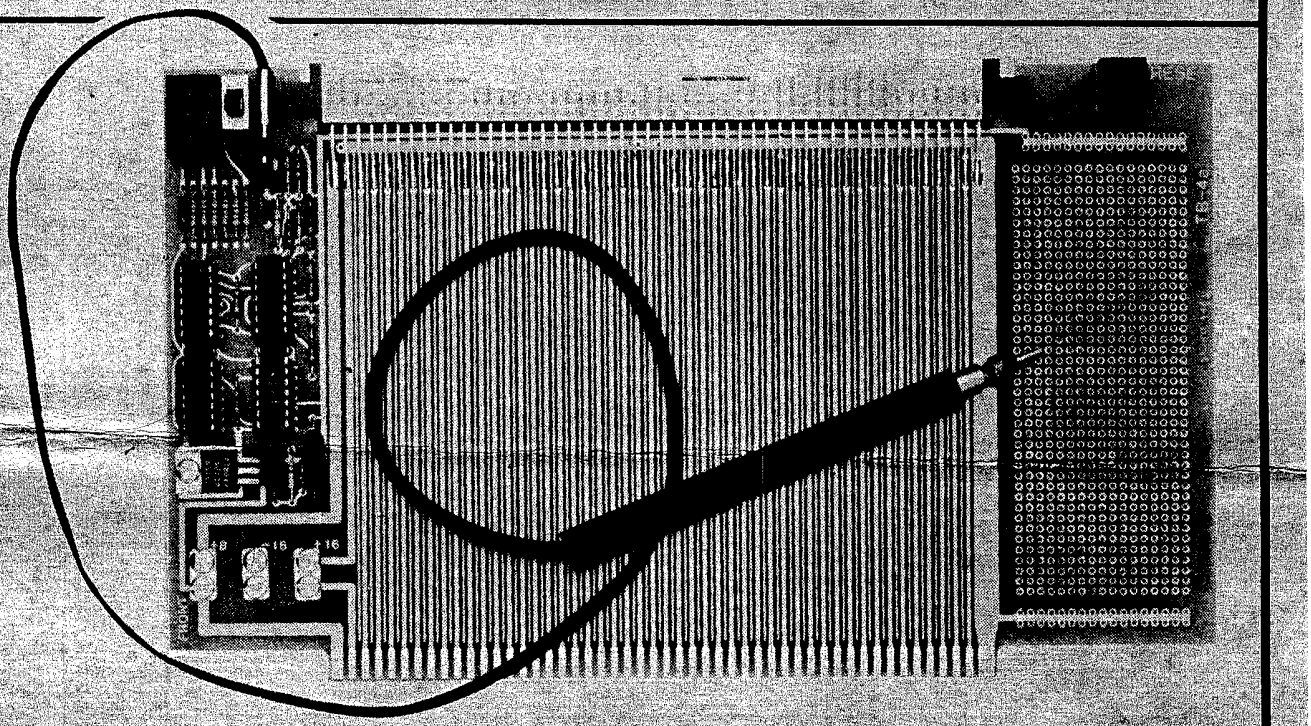
# TB4a
# USER GUIDE



IEEE 696 / S-100

## S-100 EXTENDER BOARD with LOGIC PROBE

MCPI MULLEN COMPUTER PRODUCTS INC.

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Design and Layout by Graphics•2. Printed and Assembled in U.S.A.

**USER'S GUIDE & ASSEMBLY INSTRUCTIONS**
**FOR THE S-100 EXTENDER BOARD W/LOGIC PROBE**

If this is an Assembled & Tested model of our Extender Board, skip this portion of the manual. This section is a good reference to keep handy in case you should run into a problem at some future date and need to change some parts.

It should take you less than 2 hours to assemble this kit. We recommend that you start at a time when you will be able to complete it without interruption. Mark the boxes (X) as you do each step. This kit could be assembled many ways, but if you follow these step by step instuctions your assembly problems should be fewer.

1. Make sure you have the tools needed. You will need: A soldering iron (60 watt max.), rosin core solder, a screw driver and a damp sponge. Other useful aides are: needle nose pliers, wire cutters, a small magnifying glass and a lead former.

2. Check the parts received against the **PARTS LIST.** Take special care to correctly identify each part.

3. Before you start assembly read our "Construction and Soldering Tips".

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**CAUTION** - USE EYE PROTECTION WHILE SOLDERING OR CUTTING WIRE

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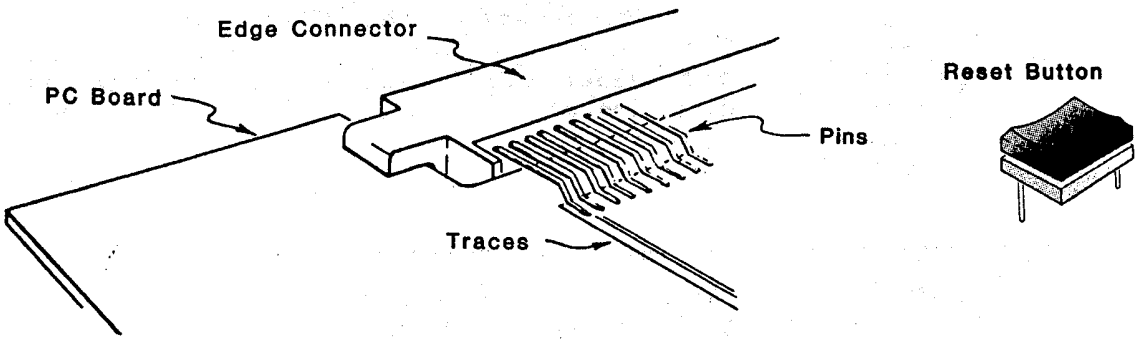
4. Begin the assembly by sliding the 100-pin edge connector onto the PC board. Align the connector pins with the signal (wider) traces on the board, solder the four (4) end pins only. Check the pin alignment on the front and back, if each pin is aligned with a trace, solder the remaining 96 pins. If the pins and traces aren't aligned, unsolder and try again. The board is solder-masked to prevent "solder splash" and make kit assembly easier. Insert the Reset Button and solder it into place just to the right of the card edge connector. Polarization isn't applicable on this component.




Put the "Parts Placement Diagram" where you can refer to it easily. Begin parts assembly by bending the leads of the diodes, resistors and bullet-shaped capacitors. Use a lead former (if you have one) or a pair of needle nose pliers to gently bend the leads.

5. Select and bend:

| | |
|---|---|
| Diodes .4" | 22 µF CAP .6" |
| Resistors .5" | 39 µF CAP .8" |

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6. Insert and solder the following components:

(✓) a. Diodes. (D1-D3). Diodes are polarized and must be inserted correctly. The end with the color band or bands correspond to the diode symbol (▶|) on the board. Double check the polarity of all diodes.

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(✓) b. Resistors (R1-R16). Check the color codes as you insert. Resistors are not polarized and can be oriented either way. **NOTE:** The pulse sensitivity can be adjusted by changing R15.

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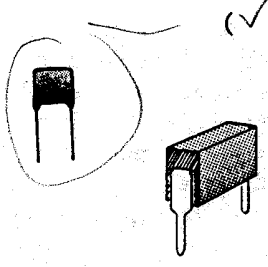
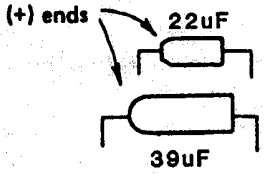
(✓) c. Capacitors. The small red decoupling cap (C1) isn't polarized and should be the last component installed on the board.



Insert and solder the rectangular decoupling caps (C2-C3); these aren't polarized either.

The bullet-shaped capacitors (C4 C5) are polarized, the rounded end is the positive lead and corresponds to the '+' sign on the board. The 22uF cap is smaller than the 39uF. Insert and solder these caps and notice that the direction of polarity is different for each of them.

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**CAUTION** - DO NOT INSERT ANY OF THE IC'S UNTIL ALL SOLDERING HAS BEEN COMPLETED.

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Sockets are provided for all IC's and we recommend their use. If at some future time an IC malfunctions its easier to take an IC out of a socket than it is to unsolder. All other components solder directly onto the board.

Each socket has a notch in one side, if properly oriented, as indicated on the Component Layout on the board, this notch will indicate the pin-1 position of it's component.

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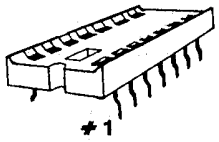


( ✓ ) d. IC Sockets (4 - 14 pin). Orient each socket to match the Component Layout on the board and solder into place.

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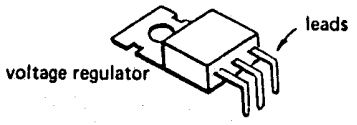


( ✓ ) e. Voltage Regulator. Insert the leads gently into the holes on the board. Now, gently bend the body over to align the holes. Insert the screw from the front and tighten it and solder the leads.

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( ✓ ) f. Probe Jack. Insert the leads, make sure the hole in the board lines up with the hole in the Jack, then solder it into place. (**NOTE:** The hole in the board allows the probe to be connected through the board if desired. No orientation needed.)

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( ✓ ) g. Seven Segment Display. This component fits only one way and no orientation is needed. Insert and solder it into place.

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( ✓ ) h. Pulse Catcher Switch. The switch is symmetrical and requires no orientation. Insert and solder it into place.

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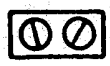

( ✓ ) i. Jumpers. Install the three (3) metal links using a 4-40 machine screw in each end to connect adjacent traces in the +8, -16 and +16 volt lines.

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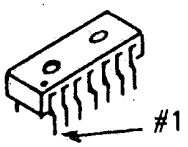
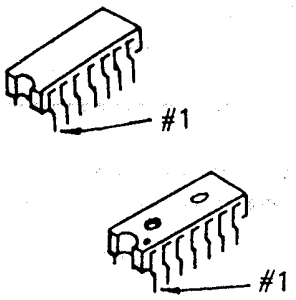
7. Carefully insert the IC's:




( ✓ ) j. There are several ways of "messing-up" this operation. We recommend checking the Component Layout Diagram in the manual for the correct location of each IC. Check for correct orientation (pin-1) of the IC with the notch in the socket. Now, with the IC inserted only half way, check all the pins to make sure they are going into the socket and not bending under the




IC. Everything OK? Push the IC in firmly; check again.

Remember, pin #1 of each IC must be in the proper orientation or it can be destroyed the first time you put power to it. With the board in an up-right position and the bare edge down the #1 position will be in the upper left-hand corner.

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(✓) k. Edge Connector Labels. Select a pair of labels and trim to size. Peel off the backing, align and stick to connector. The pins on the front are 1 thru 50 (from left to right). Pins 51 thru 100 are on the back, also from left to right. Please take note that there are two (2) <u>different</u> labels for the back of the edge connector. Which label you chose to apply is determined by the way you will be viewing the board most often.

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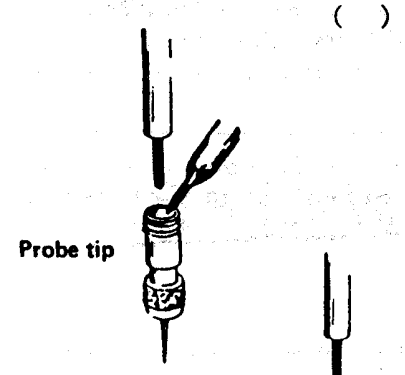
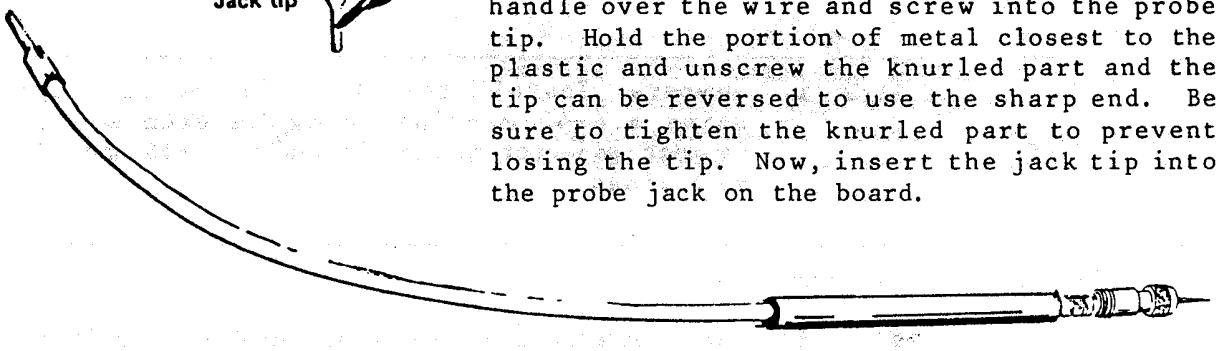
8. Assemble the test probe:




( ) 1. Begin by stripping about 1/2 inch of insulation from both ends of the wire. Twist the strands together and tin lightly with solder.

Unscrew the plastic handle from the probe tip. Clamp the tip, a nail hole in a piece of metal or wood will work. Heat the probe tip until solder flows into it and while the solder is liquid, insert one end of the stripped wire. Allow the probe tip to cool, quench it on a damp sponge before touching it. Repeat this process for the probe jack tip.

Try to wiggle the wire at each end. When you have two solid connections, thread the plastic handle over the wire and screw into the probe tip. Hold the portion of metal closest to the plastic and unscrew the knurled part and the tip can be reversed to use the sharp end. Be sure to tighten the knurled part to prevent losing the tip. Now, insert the jack tip into the probe jack on the board.



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Your kit should now be ready to use. First however, inspect your work. If you have soldered the capacitors in backwards, they'll go bang when the power is turned on, so check the orientation of all the polarized parts. Use the Parts Placement Diagram to check for parts in the wrong place. Look at the IC's and check for bent pins, orientation in sockets and correct location on the board. Check for unsoldered connections and solder bridges.

## CONSTRUCTION AND SOLDERING TIPS

Choose a well-lit work space with enough room to lay out tools, parts and instructions. Two light sources help to eliminate shadows.

Soldering has the potential of causing several different kinds of problems in kit building. Excessive heat can damage the PC board and components; or solder bridges can form causing unwanted electrical connections. Using the right soldering iron (60 watts maximum) and the right solder (rosin core) and a little practice to develop an efficient technique will eliminate most problems.

Parts are inserted on the component side (front) of the board and all soldering is done on the back side.

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**ALWAYS USE EYE PROTECTION WHEN SOLDERING OR CUTTING WIRE**

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If you plan to build many kits and have the extra dollars, a quality (temperature controlled tip) soldering iron is a good investment.

Use only **ROSIN CORE SOLDER** when constructing our kits. 63/37 (tin/lead) is excellent; 60/40 can be used also.

Solder with a well tinned tip. Tinning is a thin film of solder coating the surface of the irons tip. Eliminate the oxide which forms on the tip by wiping on a damp sponge as you work.

Heat both the component wire and the solder pad with the tip of the iron until the pad looks wet (liquid). Next, touch the solder to the junction where the iron, pad and component lead meet. When the solder melts and flows onto the connection remove the iron's tip right away to avoid over heating. Allow the connection to cool while taking care not to move the component. A good joint will be smooth and bright.

Avoid using too much solder. If small drops of solder appear on the component side of the board too much solder was used or too much heat applied. Solder adjacent pads carefully as the heat may cause the solder to flow between them forming a solder bridge. A small solder bridge can be removed by touching it with a clean, hot tip until it wets and adheres to the tip.

Excess wire can be cut off with diagonal cutters after the joint has cooled. **Beware of flying pieces of wire!**

Sockets are provided for the most sensitive components. Always solder the sockets onto the board before inserting the IC's.

## TESTING THE EXTENDER BOARD

1. Turn off the power to your machine. Insert the TB-4a with the probe attached and the Pulse Catcher Switch down; then turn on the power.

2. Without the probe touching anything the display should show an 'O' for OPEN.

3. Touch the tip of the probe to pin #50 and an 'L' should be displayed to indicate a LOW.

4. Touch the tip to pin #14 of IC4; a 'P' for PULSE should be displayed for about 1/5 of a second followed by an 'H' for HIGH and the decimal point should be lit.

5. Touch the tip to pin #49 (Clock) and a constant 'P' should be displayed to indicate a stream of pulses.

6. Move the Pulse Catcher Switch to the up position (indicated by a 'P' on the board) and while touching pin #14 of IC4 a 'P' should be displayed. The 'P' will remain "latched" until the switch is reset (turned off) by returning it to the down position.

Now, after all of that, if it won't work and it isn't something obvious, like smoke coming from the board, send it back and we'll see if we can get it to work. Please read the warranty information on the back page then send it to:

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**MULLEN COMPUTER PRODUCTS, INC**
**REPAIR SERVICE**
**2306 AMERICAN AVE #6**
**HAYWARD, CA 94545**

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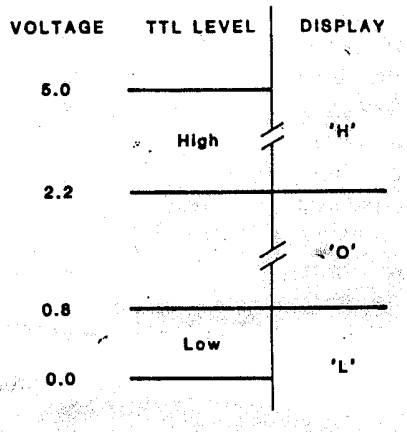
## PROBE DISPLAY INFORMATION

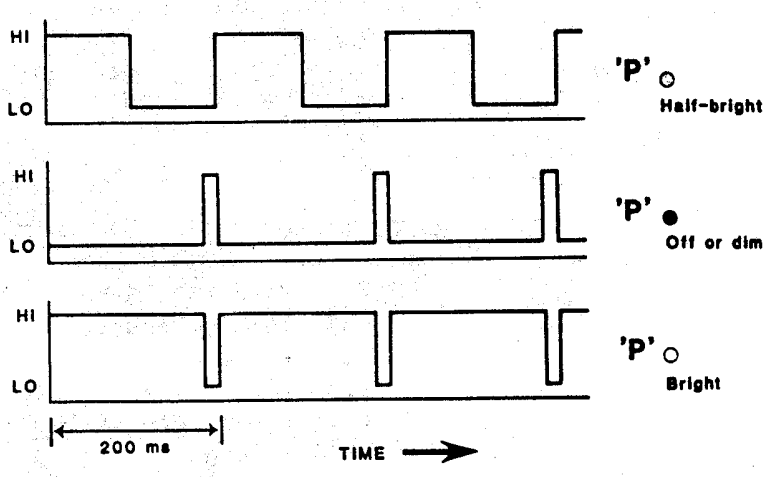
When the probe is at a voltage above 2.2 volts an 'H', for high, will be displayed. When the probe is at a voltage below 0.8 volts an 'L', for low, will be displayed. These voltage levels are the TTL high and low logic levels. When the probe is not making contact or it is at a voltage between 0.8 and 2.2 volts an 'O', for open, will be displayed. An 'O' is also displayed for the high impedance of a 3-state output.

The decimal point on the display is lit (ON) during the time the probe is at a voltage above 2.2 volts.




When a low-to-high transition occurs a 'P', for pulse, is displayed for about 200 milliseconds. Pulses occurring more often than 200 ms will cause the 'P' to be displayed continuously. A low going short pulse in a high level signal will cause the 'P' to be displayed and the decimal point to be on. A high going short pulse in a low level signal will also cause the 'P' to be displayed, but the decimal point will be off or very dim. A pulse stream which is half high and half low will cause the 'P' to be displayed and the decimal point will be half bright.

If the "pulse catcher" switch, just to the right of the display, is in the up (ON) position and a low-to-high voltage transition occurs, at the probe, a 'P' will be latched and displayed until the switch is turned off. This feature aids in looking for a single or rarely occurring pulse.




The RESET button in the upper right-hand corner of the board grounds line number 75 when it is pushed. Line 75 is the S-100 RESET.

## TB-4a S100 EXTENDER BOARD PARTS LIST

(1) Printed Circuit Board
(1) Edge Connector (50-pin dual)
(1) Set Edge Connector Labels *
(1) Probe w/wire & Jack Tip

### LOGIC CIRCUIT PARTS

**DIODES**
(3) IN4148 (D1-D3)

**RESISTORS** (All are 1/4 watt)
(1) 100 ohm (R1) Brown/Black/Brown
(6) 200 ohm (R2-R7) Red/Black/Brown
or 220 ohm (R2-R7) Red/Red/Brown
(1) 30K ohm (R8) Orange/Black/Orange
(1) 1M ohm (R9) Brown/Black/Green
(1) 2.2M ohm (R10) Red/Red/Green
(1) 5.1K ohm (R11) Green/Brown/Red
(1) 2.7K ohm (R12) Red/Violet/Red
(1) 1.5K ohm (R13) Brown/Green/Red
(2) 470 ohm (R14 R15) Yellow/Violet/Brown
(1) 20K ohm (R16) Red/Black/Orange

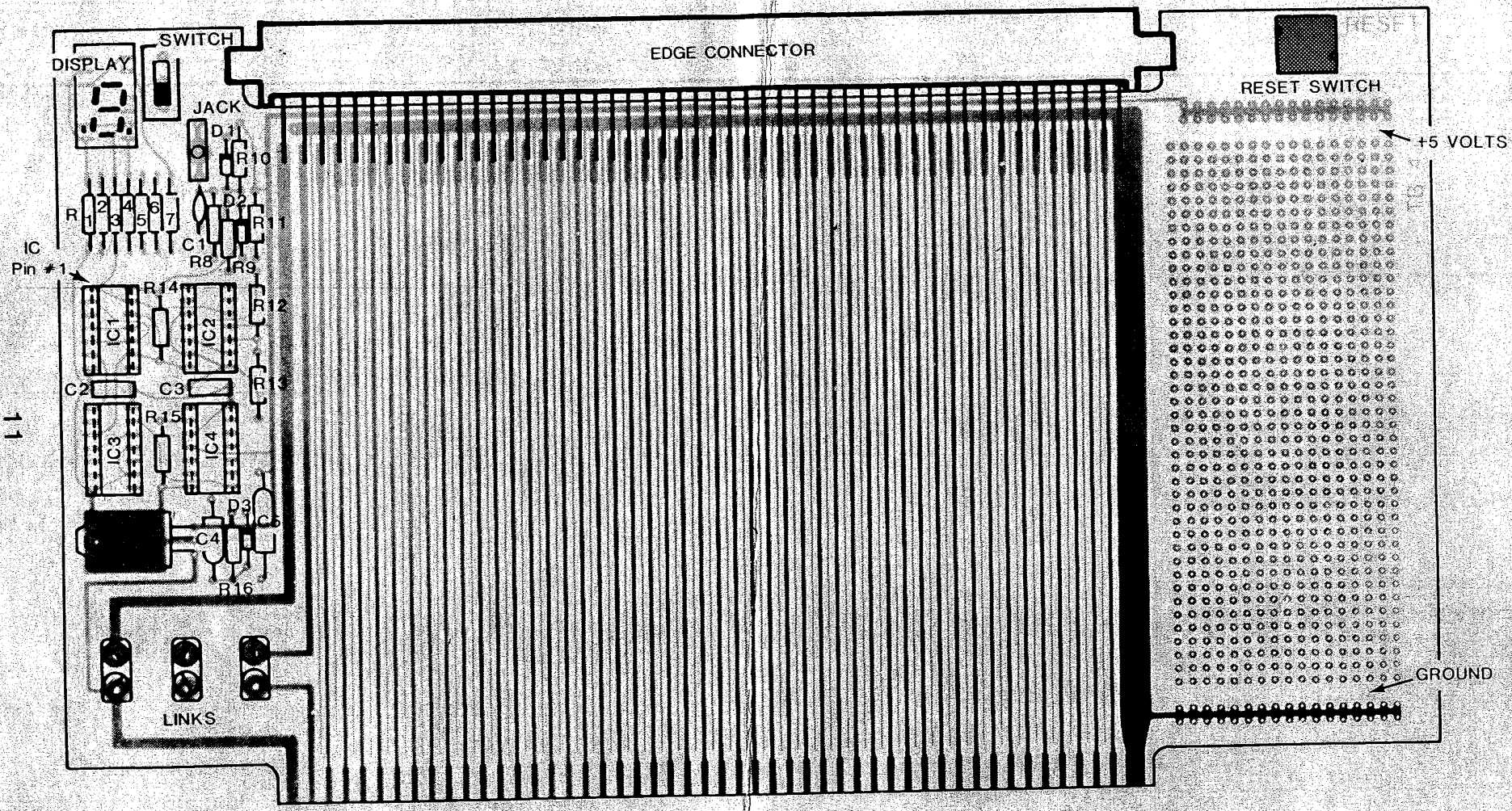
**CAPACITORS**
(1) 220pF (C1)
(2) .1uF (C2 C3)
(1) 22uF (C4)
(1) 39uF (C5)

**CHIPS**
(1) 74LS00 or 7400 (IC1)
(1) LM319 (IC2)
(1) 74LS05, 74LS06, 7405 or 7406 (IC3)
(1) 74LS122 or 9601 (IC4)

### MISCELLANEOUS

(1) Momentary Reset Button
(4) 14-pin Sockets
(1) Probe Jack
(1) 7805 or 340T5 Voltage Regulator
(1) Seven-Segment Display
(1) Switch
(3) Jumpers (Links)
(7) 4-40 Machine Screws

*** ADDITIONAL LABELS ARE AVAILABLE. SEND SELF-ADDRESSED, STAMPED ENVELOPE.**




COMPONENT LAYOUT

## CUSTOMER SERVICE INFORMATION

We want our customers to be satisfied. If this product fails to operate properly, return it to us for service (see Warranty Information below). If you need further service or information write to:

**MULLEN COMPUTER PRODUCTS, INC**
**P.O. BOX 6214**
**HAYWARD, CA 94545**

When writing please be specific concerning the nature of the problem; please include your telephone number. If you have any questions you can call us at (415) 783-2866. A technician will take or return your call. Orders can also be placed through this number.

## LIMITED WARRANTY INFORMATION

We will repair or replace, at our option, any parts found to be defective in either materials or workmanship for a period of 1 year from the date of invoice. Defective products must be returned for repair or replacement.

If a defective part causes an MCPI product to operate improperly during the 1 year warranty period, we will service it free, for the original owner, if shipped postage paid; we'll pay the return postage. If improper operation is due to an error or errors on the part of the purchaser there may be a repair charge. Purchaser will be notified if this charge exceeds $50.00.

We are not responsible for damage caused by the use of solder intended for purposes other than electronic equipment construction, failure to follow instructions, misuse or abuse, unauthorized modifications, use of our products in applications other than those intended by MCPI, theft, fire or accidents.

Return to purchaser of a fully functioning unit, meeting all advertised specifications in effect as of the date of purchase, is considered to be complete fulfillment of all warranty obligations assumed by MCPI. This warranty covers only products marketed by MCPI and does not cover other equipment used in conjunction with our products. We are not responsible for incidental or consequential damages.

Prices and specifications subject to change without notice.