Fluke 8050A Multimeter - Add Continuity Tone and TM1637 LED Display
Description

This describes the software and required hardware changes to add a continuity tone and a 6 digit TM1637 LED display to the classic Fluke 8050A multimeter. These 6 digit displays with the incorporated TM1637 chip are widely available on Amazon and eBay. The software runs on an ATmega328P (Arduino Uno). The software requires the TM1637TinyDisplay6 library (https://github.com/jasonacox/TM1637TinyDisplay).

There are two versions of the continuity tone software. The first version is named LED_8050A_TM1637_Display_Cont. This code enables use of the TM1637 LED Display driver. It also adds a continuity test with a tone using the output to the LED display to determine if there is continuity. Continuity is checked each time the display is updated (2 times per second) when the 8050A is set to the ohm function in the 200 range.

The second version is named LED_8050A_TM1637_RT_Cont. This version is the same as the first version but instead of using the output to the LED display to determine if there is continuity, the software samples the voltage on the rear lead of R8 (the 220k ohm 2 watt resistor) of the 8050A. This provides for a real time continuity check without any display update delays. Voltage for the continuity check is read at the rear lead of R8 through an added LF347 op amp configured as a voltage follower buffer having high input impedance. This is followed by another LF347 op amp configured as an inverting 10x amplifier. This produces a voltage in the correct range for the ATmega328P to read through its analog input at A5.

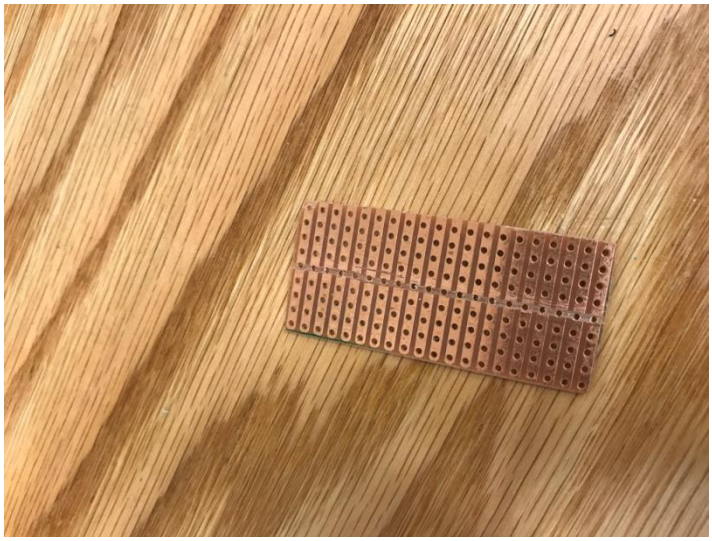
Both of these versions could be used without changing the original display if one just wanted to add a continuity tone.

This project is based on the original software named LED_8050A written by Michael Damkier. The original project used a MAX7219 LED display driver instead of the TM1637 display driver. Michael also created software named Strobe 8050A to emulate the 8050A display driver outputs to test modifications to the LED_8050A software.

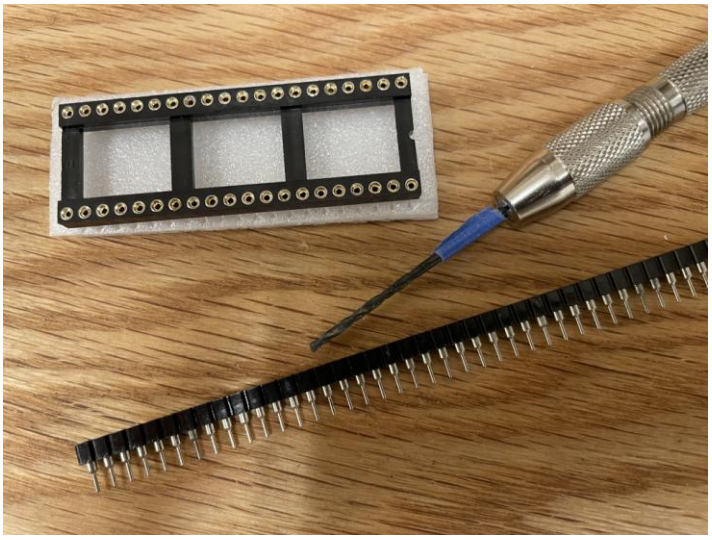
The finished product.

The yellow LED display works well with the yellowing cases. The displays also come in red, green, blue and white.

First step - create 40 pin IC carrier with headers.

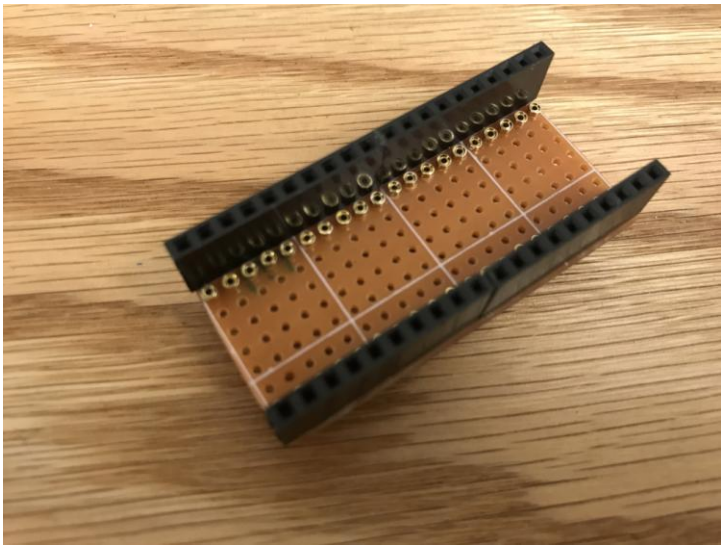


Cut a strip board to size. Separate the conductors down the center with a hacksaw blade.



Remove 40 round pins from an old header or an IC socket using needle nose pliers. Drill out 40 holes in the board to 0.059 inch with a pin vise (drill bit #53). Press the loose round pins into the holes. Insert the four 10 pin headers on each side.

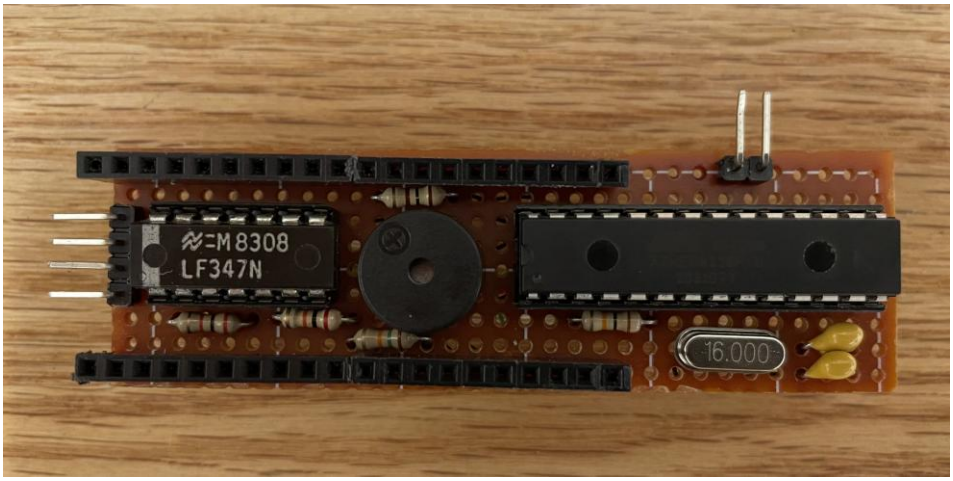
Solder the 40 pins on each side and then solder the headers. Buzz the connections to ensure no open or shorted connections.



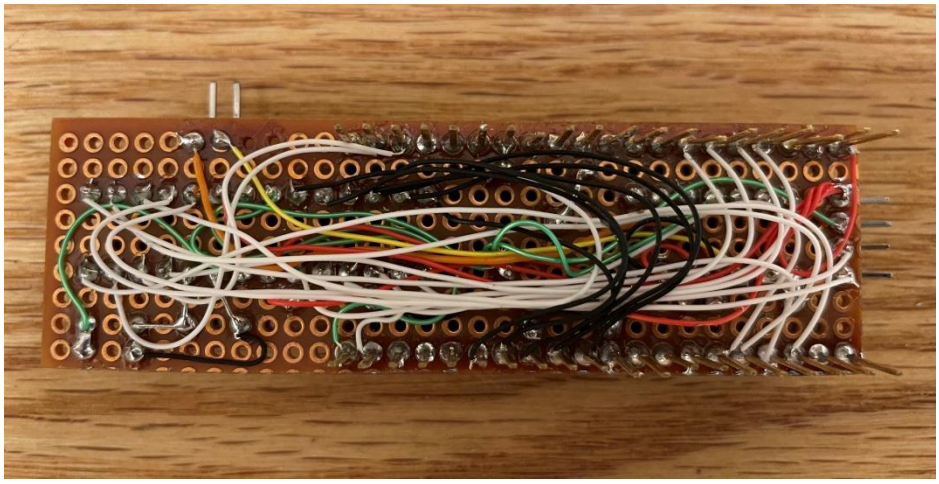
Top view of completed IC carrier.

IC Carrier installed with the 8050A chip.

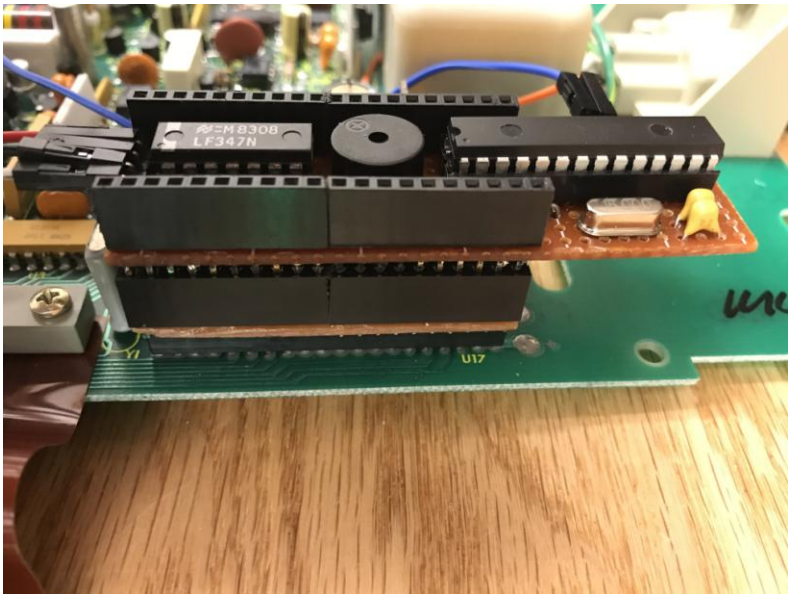
Second step - build add-on top board.



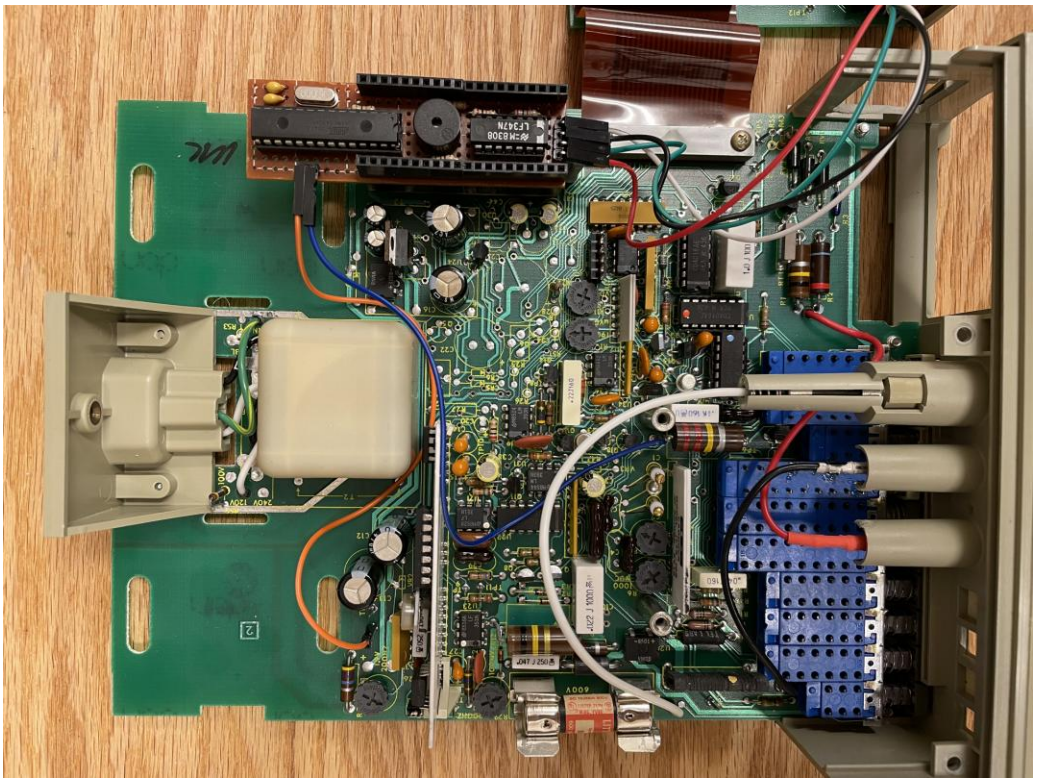
The top board plugs into the headers on the IC carrier. The LED display connects to four pin header. The sense connection to the rear lead of R8 (220K ohm 2 watt resistor) and TP3 connect from the 8050A to the two pin header on the top. Connections are described in the software and associated project documentation.



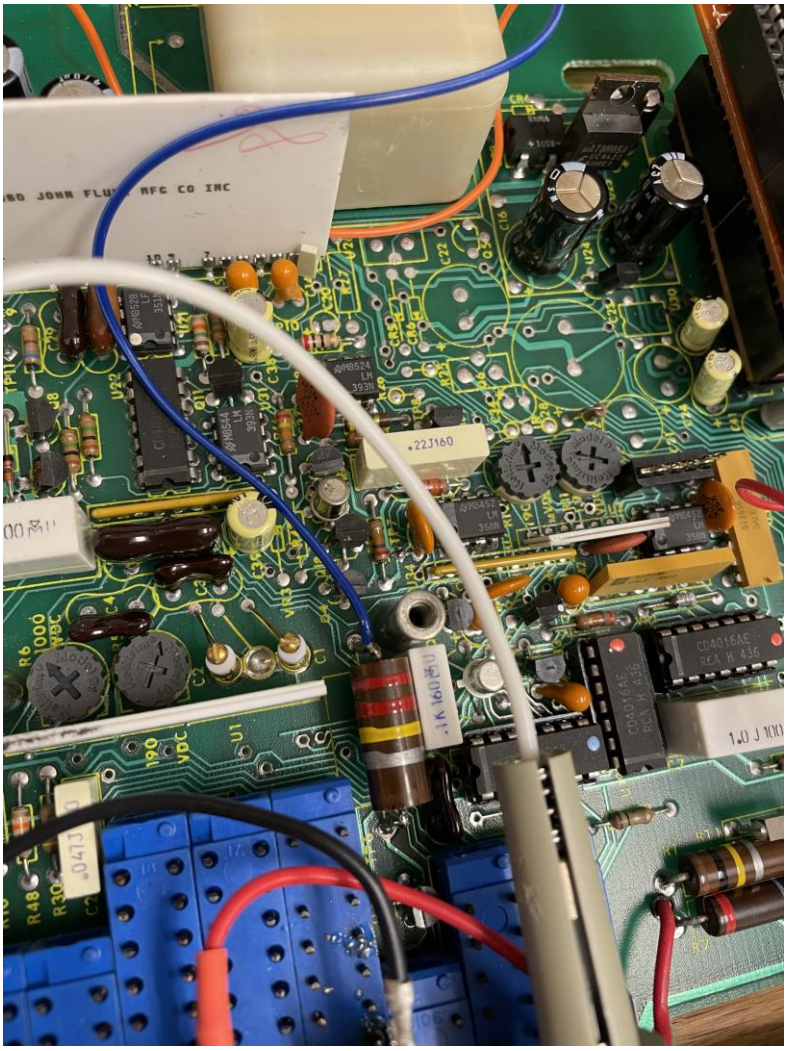
Point to point soldering using Kynar AWG 30 silver plated wire wrap wire (from Jameco). This wire holds its shape and works great for a project like this.



IC carrier and top board installed. This might work with the battery version of the 8050A as well if the second battery could be removed or if the top board was not pushed all of the way down into the headers.

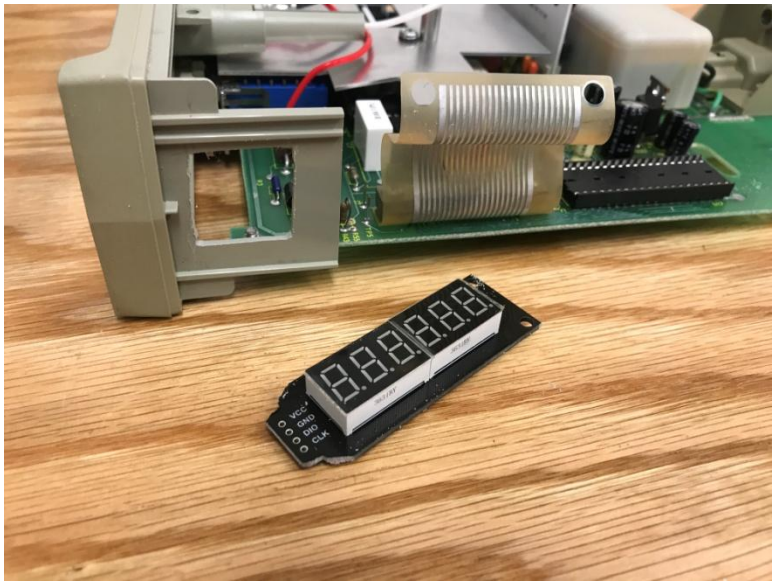


Top view showing the board installed, the TP3 connection (orange wire), the sense connection to the rear lead of R8 (220K ohm 2 watt resistor) (blue wire) and the LED connections. I just cut off the end of jumper wires to make the LED and sense connections. I soldered the wires to the LED display board and the rear lead of R8. TP3 has a pin.

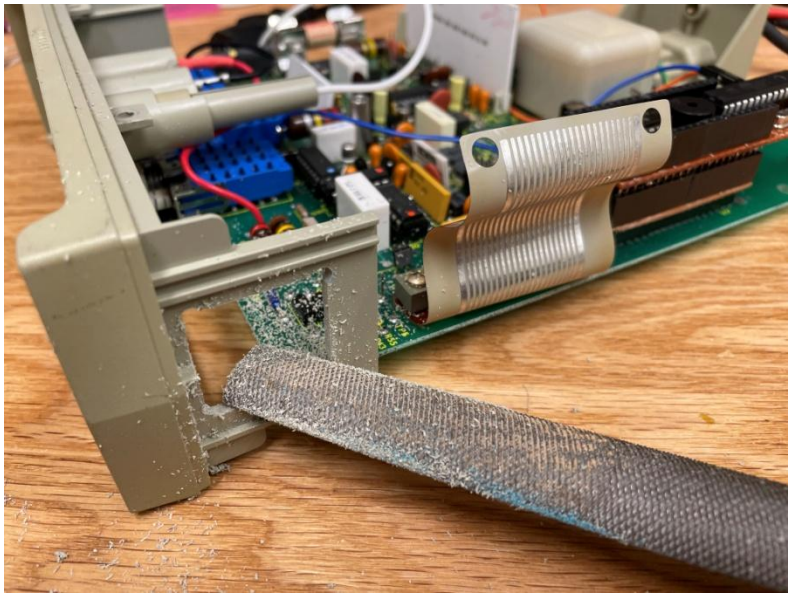


Blue wire connects to the rear lead of R8 to sense the 8050A voltage.

Third step - mount the new LED display.

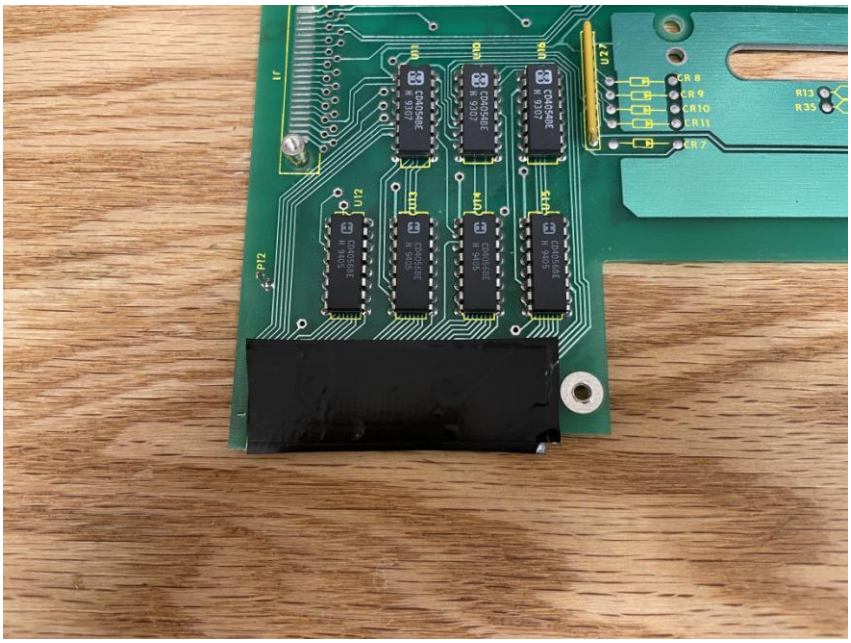


Modify the LED display and the side of the slide in case. This allows the left hand side of the LED display to fit in the bezel area. I used a round file to file off the corners of the display. I covered the back of the LED display with tape.



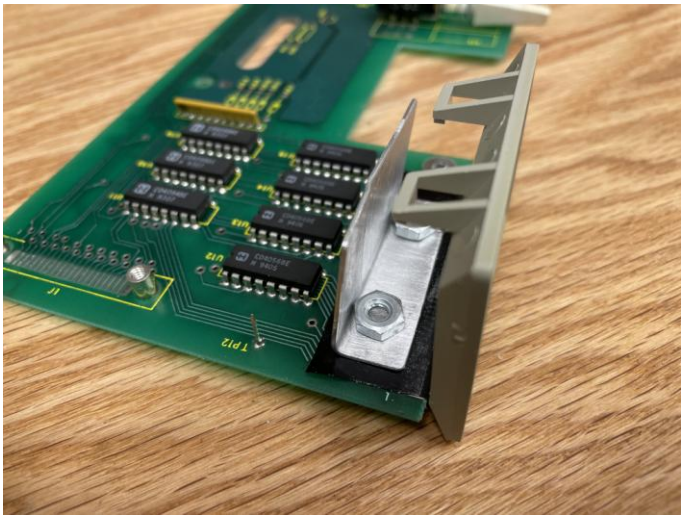
For the case, I drilled four holes and used a hand scroll saw to cut the sides. I then cleaned up the sides with a rough flat file. It is a messy job. To make things easier in this and the following steps, first remove 2 screws to disconnect the flex cable.

Remove the bezel by removing the two retaining screws and gently lifting the tabs over the bushings and then rotating forward and over.

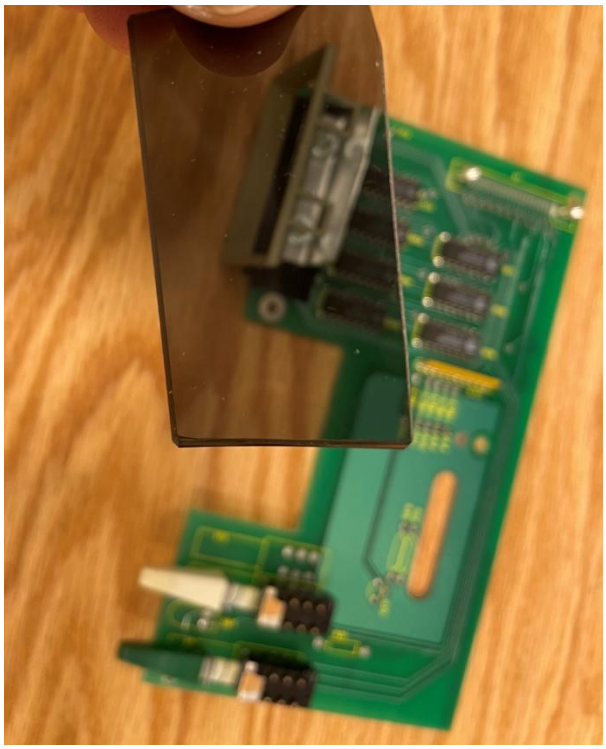


Tape over the LCD contacts. Cut holes with an exacto knife for the new bolts.

Cut replacement bolts to fit. I found 10-32 worked well. I cut them to the length of two nuts with a hack saw.

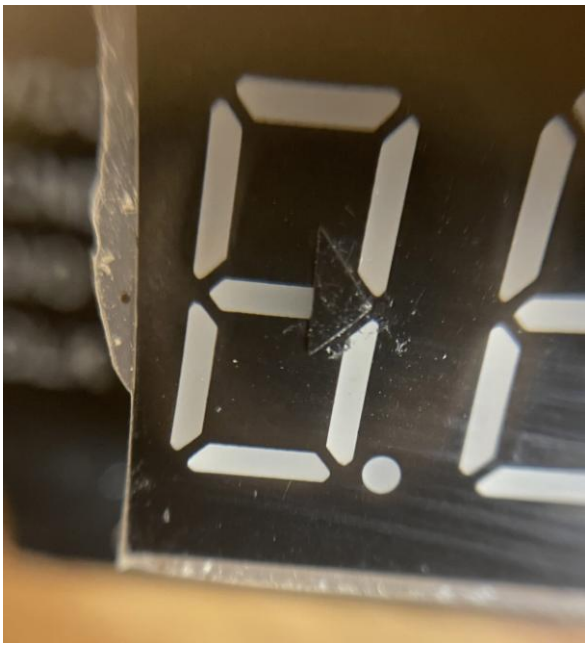


Bend 1 3/4 wide by 1 1/2 inch tall aluminum backing plate so it extends up 1 inch. Dill holes in backing plate and mount with the two cut bolts.

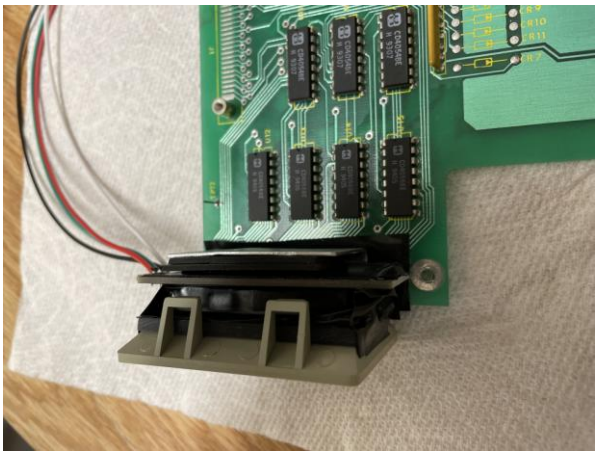


Cut acrylic grey transparant sheet to fit. I tried a darker one as well, but it looked no different and just reduced the light transmission. I bought the acrylic sheet on Amazon. You probably could also use the glass from the old display.

Mask the backside of the acrylic sheet with electrical tape.



Add a tiny triangle-shaped piece of electrical tape on the minus sign as a mask to provide separation from the first digit.



Use electrical tape to tape the sides of the masked acrylic sheet to the back of the bezel. Place the LED display in the aluminum holder. Add a spacer between the back of the LED display and the aluminum holder to keep the LED display snug (I used rubber sheet material) and then tape the LED display to the acrylic sheet and bezel to further help hold the LED display in place. The bottom of the LED display board can be sanded as needed to fine tune the height of the LED display which sits on the nuts.

The first 8050A upgrade I made three months ago only used tape to hold the display without the aluminum backing plate and there have been no issues so far.

Reconnect the flex cable to the display board, reinsert the aluminum cover plate over the switches and carefully work the display board back into place.

Under mounted displays. These cases were damaged on top with impossible to remove black markers, so I drilled four holes through the top side and used screws from below - two in the back where the feet pads were and two in the front at an angle through the front opening. I used washers as spacers on top of the case to make removal of the units from the cases easier.

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