

# Sandevices E681 RGB Pixel Controller Assembly Manual

Oct 22, 2011 Initial Release

Oct 30, 2011 Added component illustrations, silkscreen images, and misc text changes

**Prior electronic assembly experience is assumed. This is probably not a good 'first' soldering project. If you don't have prior PC board assembly experience, please seek the assistance of someone who has.**

Tools required:

**A good-quality temperature-controlled soldering station is important.** There are several large component leads/pins that will require quite a bit of heat to be soldered properly. Please use a good quality soldering tool.

**Good solder is critical. Radio Shack solder is crap.** Please use a good 63/37 tin/lead solder such as Kester 44. I recommend .031" diameter.

A good pair of **flush-cutting** diagonal pliers. This is an indispensable tool for PC assembly work as it allows you to trim component leads very close to the board after soldering.

**Note: Many components must be installed with the proper orientation, these are POLARIZED components and will be identified as such in the instructions. Please take the time to insure that all POLARIZED components are installed with the proper orientation, as these parts will most likely be destroyed if installed incorrectly. Examples of POLARIZED components include (most) connectors, ICs, diodes, LEDs, and some capacitors.**

The order of parts installation isn't critical. These instructions are the order that works best for me. If you're fairly new to this I would suggest sticking to the order specified, if you're experienced feel free to do it in whatever order you choose.

You will save yourself considerable construction time if you construct a small "jig" that allows you to turn the board over for soldering. I use a spare blank PC board with 4/40 bolts and nuts in the 4 corner mounting holes. I set the jig bolts up, then stack the board being built on top of it by sliding the bolts through the board's mounting holes from the solder side. The nuts raise the build board just enough that you can insert components such as connectors flush to the board without having to hand hold it. Then after loading parts, carefully lift the board off of the jig, then turn the jig over and slide the bolts through the build board from the component side, making a "sandwich". You can then turn the "sandwich" over and place it on your bench without losing any parts. You can do without this obviously, but I've found it to be a big help. A piece of wood or plastic or metal would work fine, just drill 4 properly spaced holes and install the 4-40 hardware. 1" long bolts suggested, longer if your jig material is thick. Parts loading sequence is intentionally from lowest to highest to allow use of this technique.

When soldering 2-lead components I recommend soldering one lead and letting it cool, rather than immediately soldering the 2<sup>nd</sup> lead. Otherwise the part may shift slightly when you touch the soldering iron to the 2<sup>nd</sup> lead, and if the 1<sup>st</sup> joint hasn't solidified completely you could get a 'cold' solder joint.

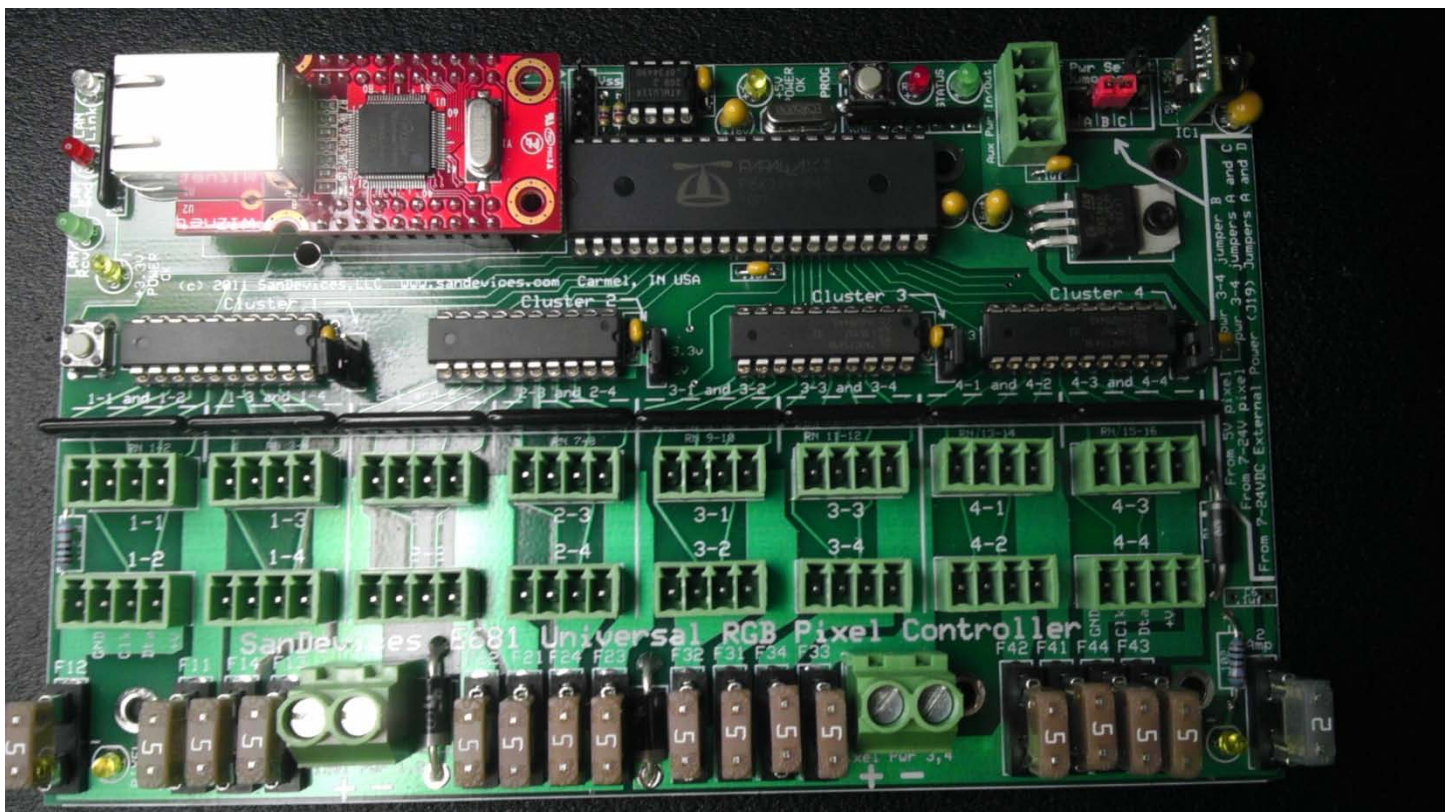
For example, if soldering a group of capacitors, I will solder one lead of every cap first, then go back and solder the 2<sup>nd</sup> lead of every cap.

Components are typically installed in groups, and then soldered, and where necessary the leads are then trimmed with the flush-cutting pliers. When installing components such as sockets and connectors, I recommend first soldering just one pin for connectors, or 2 diagonally opposite pins for IC sockets. Then double-check to make sure that the parts are fully seated against the PC board (and double-check orientation where applicable), before soldering the remaining pins. If you completely solder an IC socket and then discover it's not fully seated, or it's been installed facing the wrong way, it will be time-consuming and difficult to fix. When only 1 or 2 pins are soldered it's easy to 'seat' an out-of-position socket by applying finger pressure to the part while heating one soldered pin at a time, and it will just "pop" into place.

**Certain solder joints will require considerable additional time to solder. This is particularly true when component leads are large, such as the large diodes, or when the lead is being soldered to a large copper area. Make sure to allow sufficient time with these joints to allow solder to flow properly.**

Much as carpenter's use the rule of "measure twice and cut once", it's wise to remember that it's far better to take some extra time to insure proper location and orientation of parts before soldering. Removing an improperly installed part is difficult, time consuming, and risks damage to the part and the board.

## Assembled E681



## Parts Identification:

C1                    Quan 1                    10uf 35V Tantalum Capacitor:



Will be marked with "35" or "35V". POLARIZED. The longer lead is positive (+)

C2-C5                    Quan 4                    10uf 16V Tantalum Capacitors. Appearance is the same as above, but slightly smaller.  
Will be marked with "16" or "16V". POLARIZED. Longer lead is positive.

C6-C14 (or C6-C12) Quan 7 or 9 .1uf capacitor:



Appearance is similar to the tantalum capacitors but these will generally be smaller. There will be 7 or 9 identical capacitors depending on board date code. Not polarized. Lead lengths are the same.

R1,R2                    Quan 2                    4.7K ohm resistors, 1/8 watt:



These are very small parts, approx .2" long. Color code will be YELLOW-VIOLET-RED than 1 4<sup>th</sup> band typically gold.

R3,R4                    Quan 2                    1K ohm resistors, 1/2 watt:



(3 shown, 2 supplied) Similar appearance to R1 and R2, but much larger (about 1/2" long) and color code of BROWN BLACK RED plus a 4<sup>th</sup> band typically gold.

X1                    Quan 1                    5mhz crystal:



D1            Quan 1            1N5340BG Diode:



This is the smallest of the 3 diodes. POLARIZED. The end marked with the band is the cathode. It must be installed in the direction illustrated on the circuit board silkscreen, (banded end up).

D2,D3            Quan 2            SB5100 Diodes:



Similar in appearance to D1 but “fatter” and with thicker leads. POLARIZED. Must be installed with banded end down matching circuit board silkscreen.

LED1-LED9            Quan 9 total            T1 size LEDs:



There are 9 LEDs. 4 Yellow, 2 Red, 2 Green, and 1 usually clear. POLARIZED. The longer lead is the anode (+). The (+) lead must be facing as indicated on the silkscreen. On the E681, the (+) lead of ALL LEDs is toward the lower edge of the board. LED locations are identified on the board by a color letter, eg Rled, Gled, Bled, Yled for red green, blue, and yellow respectively. An alternate color LED may be supplied for the Blue LED. Whatever LED is NOT red, green, or yellow, should be installed at the Bled location.

RN1,RN2`      Quan 2      Resistor networks, 220 ohms:



These 2 resistor networks will be identified by the number “221” printed on the body. They are not polarized and may be installed in either direction.

RN1-2, RN3-4, RN5-6, RN7-8, RN9-10, RN11-12, RN13-14, and RN15-16

These 8 resistor networks are identical in appearance to RN1 and RN2 but will usually be a different value, typically 270 ohms, identified by the number “271”. They are not polarized.

SW1,SW2      Quan 2      Pushbutton switches:



(When mounting, please note that the lead arrangement is rectangular, not square.)

IC1      Quan 1      5V DC-DC Converter OKI-78SR-5/1.5-W36-C:



Must be installed so that the side shown in the photo (front) faces the right edge of the board.

IC2      Quan 1      3.3V regulator:



Bend the leads as required and mount flat to the circuit board and secure with a 4-40 machine screw and nut. Tighten bolt first, THEN solder!

IC3            Quan 1            Propeller CPU:



As with ALL ICs, it's POLARIZED. Insert into socket with the Pin 1 end (indicated by a notch on the short side, on the left as shown in this illustration) facing to the LEFT (this is the only IC that faces LEFT).

IC4            Quan 1            EEPROM:



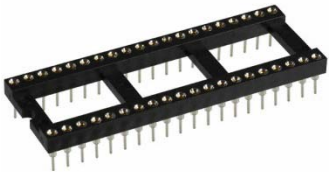
POLARIZED. The notched end, pin 1, faces to the right when installed in the socket.

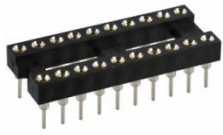
IC5-IC8            Quan 4            74HCT541:



POLARIZED. The notched end, pin 1, faces right when installed in the sockets.

IC Sockets: Quan 1 8-pin (IC4), Quan 1 40-pin (IC3), and Quan 4 20-pin (IC5-IC8):





All IC sockets are POLARIZED and all EXCEPT the 40-pin socket mount with pin 1 (notched end) facing right.

Fuseholders    Quan 17



These all mount along the lower edge of the board and accept Mini ATO fuses. Not polarized, but installing all in the same direction will look neater.

Fuse, 5 Amp    Quan 16

Fuse, 2 Amp    Quan 1



NOT POLARIZED. The 5 amp fuses are brown/tan in color and marked "5" on the top edge. The single 2-amp fuse is grey in color, marked with a "2" on the top edge, and installs in the right-most fuseholder.

J1-J16 and J19    Quan 17            4-pin Eurostyle Pluggable Connectors :



These POLARIZED SOCKETS must mount in the orientation that matches the image on the silkscreen. The upper edge as illustrated in the photo will be toward the top of the board for J1-J16 and towards the left for J19.



These PLUGS are the supplied mating connectors that will be wired to the pixel strings.

J18,J19

Quan 2

2-pin 6.35mm Screw Terminal Blocks:



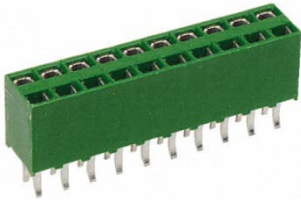
Note: 3 shown, only 2 supplied. MUST MOUNT WITH WIRE OPENINGS

FACING DOWN.

J21,J22

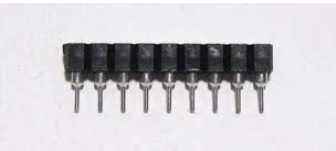
Quan 2

2x10 Sockets (.1") for the Ethernet Module:



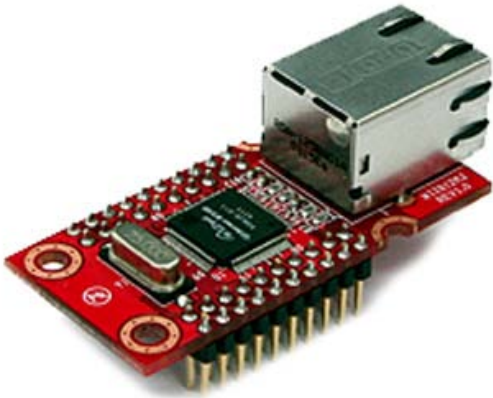
Supplied connectors are usually black in color Not polarized.

32-pin SIP sockets Quan 2:



Note: a 9-pin SIP socket is shown, 2 32-pin SIP sockets are supplied. Not polarized.

WIZ812MJ Ethernet Module    Quan 1



Polarized, must be plugged in with LAN connector facing left.

Sip Headers:



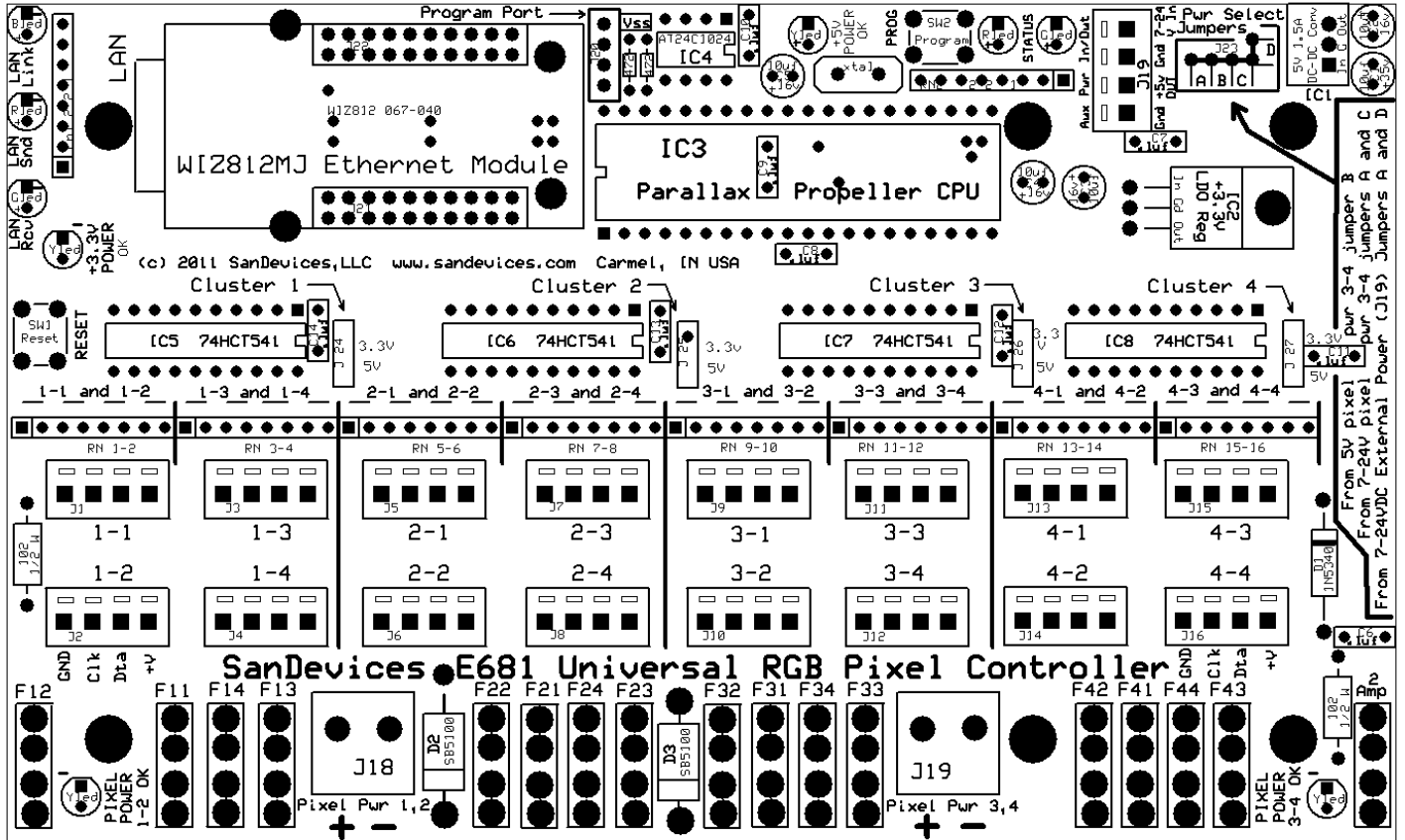
This may be supplied as a single long header that must be snapped to the needed lengths or cut with diagonal cutters, or may be supplied as 7 individual parts. What's needed are five 3-pin headers, one 4-pin header, and one 2-pin header. The short legs of the headers are inserted into the circuit board, the long legs are where the shunts (jumpers) are plugged. Not polarized.

Shunts (jumpers)    Quan 6

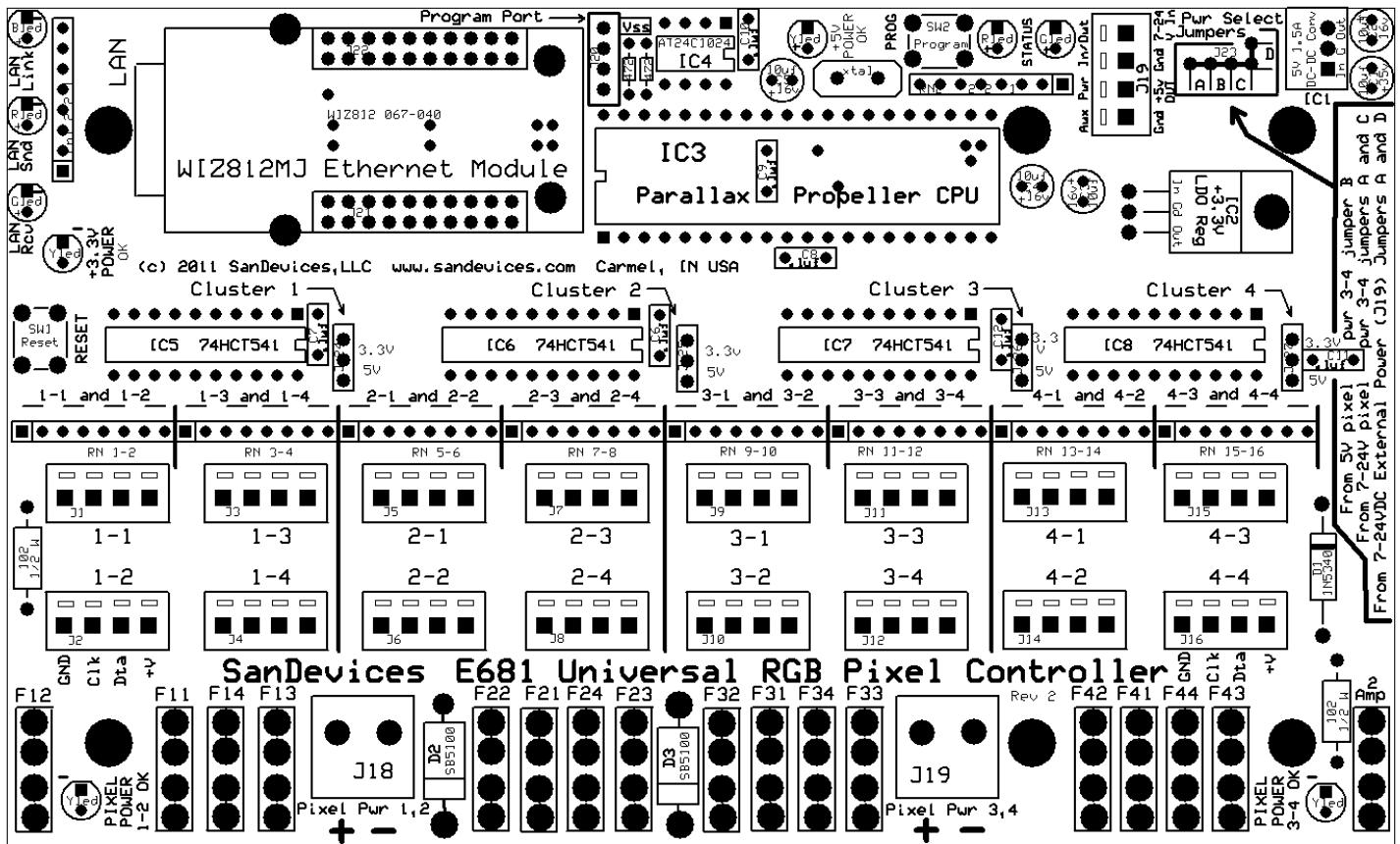


One each will be installed at J24 thru J27, and one or two at J23. Not polarized.

# Silkscreen Image for E681 PC Board with Date Code 2011-09-08:



## Silkscreen Image for E681 PC Board with Date Code 2011-10-14:



### Recommended Assembly sequence:

**Board orientation as referenced in the following instructions is assumed to be looking at the component side, with the fuseholders at the bottom, the same orientation in the above silkscreen images.**

- 1) Install the two 4.7K ohm 1/8 watt resistors R1 and R2, (very small parts, yellow violet red gold bands) just to the left of the 8-pin IC socket IC4.
- 2) Install the six POLARIZED IC sockets (4 20-pin, 1 40-pin, and 1 8-pin) at locations IC3 thru IC10, and the two 32-pin SIP sockets just below ICs 5 thru 8. All IC sockets face to the right, **with the exception of the 40-pin socket.** The end of the IC sockets with the notch is the pin 1 end. The 2 32-pin SIP sockets butt very close together. You may have to shave the edge of one slightly for them both to fit.
- 3) Install the two 20-pin (2x10) sockets for the Ethernet module at J21 and J22. First just solder 1 pin on each connector, then check to insure that the connectors are seated flush against the board and that they line up properly with the silkscreen outlines on the board. There is some 'play' to these connectors so it's a good idea to tweak the position slightly if necessary to line up with the silkscreen legends, to avoid excessive torque on the connectors when the Ethernet module is inserted. Solder the remaining pins.
- 4) Install the 17 fuseholders along the bottom edge of the board. Although these aren't polarized, it will look neater if you install them all the same way (crimped side of pins facing right or left). **These parts will take a considerable amount of solder and heat.** You want to use plenty of solder as there can be a lot of mechanical

force applied to the fuseholders when inserting or removing fuses. Take care to insure that the fuseholders are fully seated against the PC board before soldering all pins.

- 5) Install the 17 POLARIZED 4-pin euro pluggable sockets at J1 thru J16, and J19. Be 100% certain of correct orientation. The 'jagged' or 'keyed' side of the connector contact positions face **up** for the 16 string connectors, and **left** for the aux power connector. **When positioned correctly the part outline will match the silk-screened outline on the board, if reversed the part outline will be offset from the silkscreen outline.**
- 6) Install the SIP pin headers. The SIP headers may be supplied individually, or as a single long connector that must be cut to the sizes needed with small diagonal cutters. Four 3-pin headers mount at J24 thru J27 to the right of the four 20-pin IC sockets. A 4-pin header mounts at J20 just to the left of IC4. The last 3-pin header and the 2-pin header mount at J23, making an "L" shape with the 3-pin header at the area marked "AB" and the 2-pin header at "D". Note: (2011-09-08 boards only) In an attempt to make these parts easier to install, some of the mounting holes were intentionally made slightly small to provide sufficient friction to hold the parts in place for soldering. Unfortunately, with tolerance variations on the board holes and the header pins, you may find that the pins won't fit easily into the smaller holes. If this happens, seat the header as best you can, most likely you will then see that one pin will be "pushed up" higher than the others because it won't slide into the hole. If so, use a pair of long nose pliers to carefully apply downward pressure on the 'tall' pin and force it into the hole, until all pins are the same height.
- 7) Install the 3 POLARIZED diodes, D1-D3, matching the band on the diode with the band on the silkscreen. The 2 large diodes are the SB5100s (band towards bottom), the smaller diode is the 1N5340 (band towards top).
- 8) Install the two 1K ohm ½ watt resistors, R3 and R4, (brown black red gold bands) near the lower-left and lower-right corners. Not polarized.
- 9) Install the 5mhz crystal X1, just above the 40-pin IC socket. Not polarized.
- 10) Install the two 220 ohm resistor networks, RN1 and RN2, one at upper left, and one to the right of the crystal. These will be marked "221". They are not polarized.
- 11) Install the nine (or seven) .1uf capacitors. There are 2 versions of the PC board, one uses 7 .1 capacitors and one uses 9. The 9-capacitor boards can be identified by the location for a .1uf capacitor immediately above the 2 amp fuse. On these boards install: C6 toward the lower-right corner above the 2 amp fuse. C11-C14 to the right of each of the 20-pin IC sockets. C7 below the aux power connector. C8 below the 40-pin IC socket, C9 inside the 40-pin IC socket, and C10 to the right of the 8-pin IC socket. Note: If your particular style of 40-pin IC socket doesn't allow for mounting C9 normally, C9 may be mounted from the back side of the board. These are not polarized. On later boards the capacitor above the 2 amp fuse, and the capacitor below J19 are not used. Install the seven .1 capacitors in the 7 designated .1uf capacitor locations.
- 12) Install the five POLARIZED tantalum capacitors. There is one 35 volt capacitor, it will be slightly larger than the others and will be marked "35V" or "35". It mounts to the lower- right of the IC1 location, near the upper right corner of the board, at C1, + lead down (not the very upper-right capacitor location, but just below). The four 16-volt tantalums (marked "16" or "16V") install as follows: One immediately above the 35 volt cap (at C2), + lead up, 2 to the right of the 40-pin IC socket; the one nearest the 40-pin socket (C4) will have + to the left, the cap to its right (C3) will have + up, and the final cap installs above the 40-pin IC socket (at C5), with + to the left. **The LONGER of the two capacitor leads is +. DOUBLE-CHECK FOR PROPER POLARITY OF THE TANTALUM CAPACITORS as they can explode if operated with incorrect polarity.**
- 13) Install the 2 pushbutton switches at SW1 and SW2, and solder. They "snap" into the board, it may take a bit of force to seat them. Note that their pin pattern is rectangular, not square.
- 14) Install the 9 POLARIZED LEDs. LED locations are marked with the color of the LED, ie "Yled" designates a mount location for a Yellow LED. **As with the tantalum caps, the + lead on LEDs (anode) is the longer lead. ALL LEDs INSTALL WITH THE + LEAD TOWARD THE BOTTOM EDGE OF THE BOARD.** Another method for identifying LED polarity is that typically there will be a flat edge near the (-) lead. This can be very difficult to see, lead length is

generally the best indicator. The BLUE LED (may appear clear, or an alternate color may be supplied) installs upper-left at Bled. One each Red and Green and Yellow LEDs just below that. Another Yellow LED to the right of the 8-pin IC, and one each Red and Green LEDs to the right of the yellow one. Finally, the last two Yellow leds mount near the lower-left and lower-right corners.

- 15) Install the POLARIZED 3.3V regulator, IC2. Use a ¼" or 3/8" 4-40 bolt and nut to attach it to the PC board, after bending the leads to fit. Try to apply some hand pressure to the regulator body when tightening the nut to prevent the part from rotating as the nut is tightened. **Solder the 3 leads AFTER the regulator is bolted in place, not before.**
- 16) Install the POLARIZED 5 volt DC-DC converter IC1. **The side with the round protruding part with the sticker faces to the right, in other words that side faces the two tantalum caps. Be careful of solder bridges.**
- 17) Install the 2 large 2-pin pixel power terminal connectors at J18 and J19. **Make sure the wire openings face the bottom of the board.**

This completes the installation of all soldered parts. **At this time you should carefully inspect the solder side of the board. Check every solder joint to make sure that all joints are soldered and that there are no solder 'bridges' or 'cold' solder joints. Touch up any questionable joints. PLEASE DO NOT SKIP THIS STEP! The most likely locations for solder bridges are the DC-DC converter, the IC sockets, and the two 32-pin SIP sockets.**

Install the supplied fuses into the 17 fuse holders. The right-hand fuse holder will get a 2 amp fuse (grey), the other 16 will typically be 3 to 5 amp fuses. **Considerable pressure is needed to seat the fuses in the fuse holders.** Place your fingers on the back side of the board for support, and use your thumb to press the fuse in place.

Plug the eight 270 ohm or 330 ohm resistor networks into the 64 pin (2x32) SIP socket row. These parts will be labeled 271 or 331. They are not polarized. The eight 8-pin networks will completely fill the 64 socket holes.

Install four jumpers (shunts) between center and bottom pins of the four 3-pin headers to the right of the four 20-pin IC sockets (J24-J27).

Install the power select jumpers at J23 according to the voltage source you will be using to power the E681:

**If using 5 volt pixel power**, install a jumper in position B only (between the 2<sup>nd</sup> and 3<sup>rd</sup> pins of the row of 4). **If using 12 volt pixel power**, install **two** jumpers in positions A and C (jumper 1<sup>st</sup> and 2<sup>nd</sup> pins, and 3<sup>rd</sup> and 4<sup>th</sup> pins, in the row of 4).

Connect an appropriate **regulated** power source (matching the jumper selection above) to the "Pixel Power 3,4" connector, observing polarity. For the initial testing the power supply needs to be capable of providing about 300ma. Turn power on. 3 Yellow LEDs should be lit (all but the one in the lower-left corner). If you have a voltmeter, check for +5 volts DC on the top (input) pin of the 3.3 volt regulator, and +3.3 volts DC on the bottom (output) pin. **Be careful that the voltmeter lead doesn't slip and short circuit the regulator terminals.**

**If the above test is successful, Remove power** then install the six ICs, IC3 thru IC8. Make sure all ICs are installed facing in the proper direction, pin 1 to the right on all ICs **EXCEPT the CPU.** **Inserting ICs can be tricky.** First 'roll' each side of the IC against a hard flat surface to get the pin rows properly lined up at a 90-degree angle to the IC body. As shipped, the IC pins are slightly "splayed" out. **You must get the IC pins positioned exactly right before trying to install the IC in its socket or you will risk bending pins.** Make sure that every pin is started in its corresponding hole, and only then apply force on the IC to seat it fully. **Don't try to force the IC into the socket if you can't be sure that every pin is started in its hole,** remove the IC and re-check pins for straightness. Depending on the style of sockets used it may take

considerable force to seat the IC, particularly for the four 20-pin ICs. Make sure that every IC lead has seated properly and that there are no bent pins. If you have a bent pin you will need to CAREFULLY remove the IC, straighten all pins, and try again. TRY TO DO IT RIGHT THE FIRST TIME AND YOU WILL SAVE A LOT OF GRIEF.

Install the Wiznet Ethernet module in its sockets, with the LAN connector facing left. This completes the assembly of the E681.

Re-apply power to the board and observe the RED and GREEN status LEDs along the top edge of the board right of center. After a few seconds you should see 2 flashes of the green status LED then the RED status LED should come on and stay on, at least for several minutes. If an Ethernet cable is connected you should see the blue LINK led on as well, and possibly activity on the LAN SEND and RECEIVE LEDs.

If you don't see the indicated LED activity remove power and re-check for proper insertion of ICs (proper direction and all pins seated), also recheck the solder side of the board carefully, looking for missed solder joints or solder bridges.

If you have a way to measure the power supply current, you should see about 250 ma if using a 5 volt supply, somewhat less if using 12 volts.

At this time you should be able to access the E681 configuration/status page by pointing your web browser to 192.168.1.206. Please refer to the E681 Operating Manual for information on configuring and using the E681.