Assembly Instructions CD81-6-3 Nixie Clock Revision 3

IMPORTANT
Unless you are very experienced with kit-building, it is highly recommended to follow the steps below. First read the entire document twice, before starting.

First step is to solder all the resistors. The resistors have numbers printed on them, and you should not mix them up.

The value of the resistor is printed as a small number, for instance 472. This should be read as 47 plus 2 zero's, so the value would be 4700 ohms, which is the same as 4K7. It can also be printed as 4701, meaning 470 plus 1 zero, again 4700 ohms or 4K7. A printed value of 3300 means 330 plus 0 zero's (!) so that is indeed 330 ohm. When you are in doubt, use a multimeter and simply measure the value.

The resistors are numbered in increasing order, using designators like R1, R2, R2 etc. Their values can be found in the schematic and/or component list.

For soldering you need:

a) very thin solder, diameter 0.5 mm. (0.020 inch).
b) insanely good eyesight, or a jewelers loupe, magnifying glass, or cheap +3 reading glasses.
c) long sharp pointed soldering tip. 25-30 watt iron.
d) steady hand.
e) metal tweezers. Make sure the tweezers align properly, adjust them by either bending, grinding and sanding.

LAST WARNING
Believe it or not, but SMD components are like flees. They can jump hundred times their own size. Your tweezer has to be absolutely perfect, has to close 'parallel'. Even the best brand new tweezers need some bending, sanding, filing, etc. Make sure your table is clean. Make sure you have enough light. If an SMD components is upside down, don't try to turn it, it will jump away. Better is to lift it a couple of centimeters, using the tweezer, and let it drop again. With some luck, it is now facing up. Also, count all the components in the kit, so you will know how many have actually jumped away before you could solder them. No kidding!!!

Find a resistor and locate on the PCB where it has to go. First put a tiny bit of solder on one pad, about 2 mm. of solderwire is enough. Just make a nice little blob of solder on one of the pads. Now use the tweezer to place the resistor on the right pads, and reflow the solder on the pad you have just presoldered. Move away your soldering iron. Now the resistor won't move anymore, so you can let go of the tweezer. Solder the other pad, applying a few mm. of solder. Finally solder the first pad, adding some solder too. If the component has disappeared mysteriously, it probably hangs on the tip of your soldering iron.

Take your time, and don't panic. If you don't get the hang of it after 5 resistors or so, better stop and ask a friend to help you.

After you have done all the resistors, you can do the transistors. These have three legs. Again, find the place on the board where it has to go, and pre-solder the middle pad. Place the transistor and touch it with the soldering tip, so that the transistor is fixed in position. Solder the other 2 remaining

pads, and finally add a tiny bit of solder to the first pad. Don't overheat the transistors, you should not spend more than a couple of second on each pad.

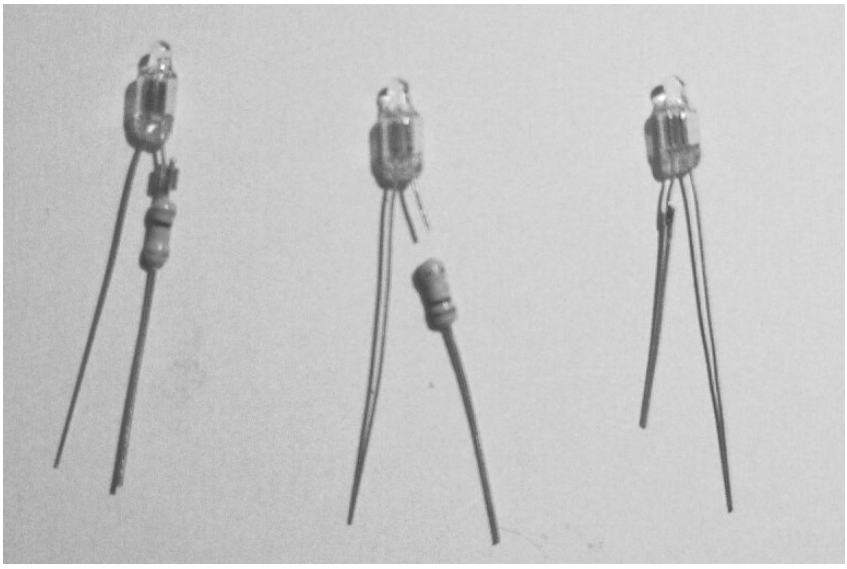
The highvoltage FET (T26) is fitted already.

Mount the electrolytic capacitors, the square hole indicates the (+) connection. Take care to mount these correctly. A reversed capacitor will certainly fail; your clock won't work.
Some capacitors are mounted on the bottom of the PCB!!! Take a good look at the photos.

Mount the inductor, potentiometer, these go on the bottom as well.

Mount IC1 and D3.

Locate the 2 neonlamps. The neonlamps need a bit of preparation.



Cut away the resistor, don't throw it away yet. Try to cut away the copper, leaving as much wire as possible. Use the wire from the resistor and solder this to the neonlamp, making the solderblob as small as possible. Locate the 2 plastic black standoffs. As you will notice, the wire with the solderblob won't fit through the standoff's holes. No problem, drill out one (1) hole of the standoff, using a 1.5mm drill (0.060 inch). Now you can fit the wires through the standoff, and mount it on the PCB.

Do not mount the nixie tubes yet.

Mount all other parts on the PCB. Do not insert the PIC processor yet! The socket for the PIC may come as two 14pin sockets, because 28pin sockets are sometimes hard to get.

Connect a 12VDC/100mA (or better) adapter to the board. Test and measure if you have 5V on the 7805 regulator. If you don't have 5V, check the polarity of your DC-adapter, you may need to reverse the +/- and check things again. Proceed if you have a clear +5V.

The next step is to insert the PIC processor. Be careful to align the pins, not to bend them as you insert the IC in its socket. All pins first should go in about one millimeter, without any brute force needed… and **then** you may press a bit harder so that it firmly sits in the socket. Please don't insert

the PIC in the wrong way, there is a little notch on one end, that should match the notch on the PCB/Socket itself. Inserting it wrong will damage the PIC for 100% sure, your clock will never work, and you have to contact me for a replacement.

Mount the two PCB's together, still without the nixietubes. Put the screw of the potentiometer in the middle. Connect the DC adapter, but be careful not to touch any parts, after all there is a high voltage converter on the nixieboard !!!. Although it won't kill you immediately, it can be very uncomfortable. With a bit of luck, you have the two neon lights blinking now. Job well done!

If you don't have the neonlights blinking, disconnect the adapter, and check the board for shorts. Closely examine the entire board. Check if all parts have all their pins soldered. Check the high voltage generator, adjust it for 142V.

If the neonlamps blink, you can adjust the high voltage for the nixie tubes. Use a voltmeter to check the voltage. Set it at 142V, adjusting the potentiometer.

The last step is mounting the nixies. This is a very accurate job. Start with U6, the tube for the display of the seconds. The little arrow on the PCB indicates the front. Insert the wires one by one, using your tweezers. This is not an easy job, so be patient. After all wires are inserted, move the tube a bit backward and forward, from left to right, to work it down to the height you want. While doing this, keep looking at it from all directions, and try to keep the tube 'in the middle' with all of it's legs having equal length. Turn the board upside down, and **only** solder the wire that is closest to the back. Do not solder the other wires yet.

Turn the board over, and move the tube a bit, so that it sits perfectly straight. Check if the height is really what you want it to be. The exact height depends on the casing you have in mind, reasonable values are 5-10 mm between PCB and bottom of the tube. Solder the wire opposite of the first wire. Check again the tubes position. Now solder one wire on the left, and one on the right. Again check if the tube is sitting straight. If it is, solder all other wires and cut away the remaining ends. It really pays off to put a lot of care in mounting the tubes, take your time!

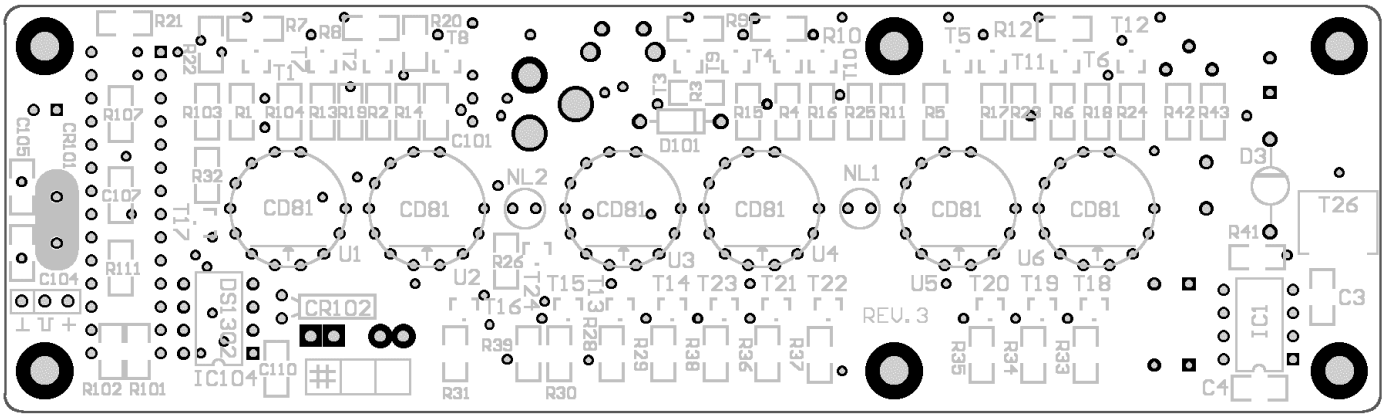
Impatient as we are, we can now connect the DC adapter. The tube should display the seconds from 0-9. If you see some 'ghosting' turn the potentiometer a little bit until the display improves.

Mount the other five tubes, be careful to put them all at the same height. If you miss one or more digits, check the board again, maybe you forgot to solder one or more legs of some transistor.

Now your clock is ready!

Refer to the 'User Manual' for details how to adjust/calibrate your clock.

This is the layout for the TOP of the PCB.



This is the layout for the BOTTOM of the PCB.