

Assembly Instructions IN16-4-V1 Nixie Clock

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. At the end of the document there are two pictures to help you check which parts should go on the top or bottom of the pcb.

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 a 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.

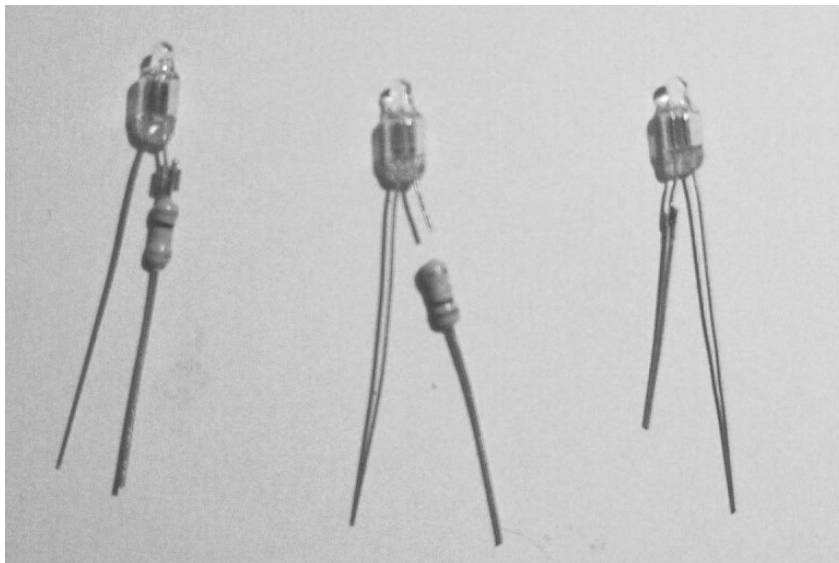
The high voltage FET (T26) is fitted already.

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. The little pushbutton come with an extender. If you have ordered the stainless steel plates, and you want the switch to stick out a little, you may want to mount the switch a little bit above the PCB. Decide for yourself what you like best.

Mount IC1 and D3.

Locate the neon lamp. The neon lamp need a bit of preparation.



Cut away the resistor. Try to cut away the copper, leaving as much wire as possible. I often manage to bend the crimp open. Find a piece stiff wire, and make the short leg longer. Now you can feed the wires through the plastic standoff, and mount it on the PCB. Do not solder for too long, or the wire may run too hot and unsolder itself from the neon lamp. Pull the lamp gently to check if it actually is still connected inside the plastic standoff.

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 nixie tubes. 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 circuit board !!! Although it won't kill you immediately, it can be very uncomfortable. With a bit of luck, you should see the two neon lights blinking now. Job well done!

If you don't see the neon lamps 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.

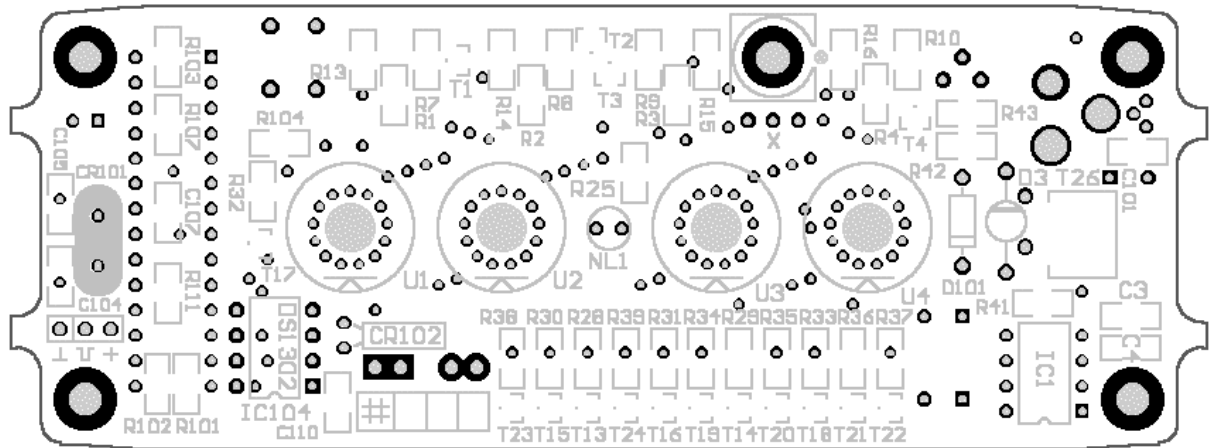
If the neon lamps blink, you can adjust the high voltage for the nixie tubes. Use a voltmeter to check the voltage. Set it at 142V, adjusting the potentiometer.

The last step is mounting the nixies. Start with U4, the tube for the display of the seconds. The anode is on the back of the tube, you can see the metal lug inside the tube. This should point to the back. The tubes come with a plastic spacer. If you want to mount leds underneath the nixie tubes, you should drill 5mm holes in these plastic spacers. The leds are not included in your kit. At the time I designed the board I thought it was perhaps a nice gimmick to mount leds. I made some provisions to mount leds, such as 5mm holes in the PCB. Anyway, it might be a good idea to drill holes in these plastic spacers, so that you can always mount leds at a later stage. Insert the wires one by one. After all wires are inserted, move the tube a bit backward and forward, from left to right, to work it down until it sits tight on the plastic spacer. Turn the board upside down, and solder two or three wires, and check again if it is firmly down. Also check if the position is not at an angle. Do not rely blindly on the flatness of the spacer, but check and double check. If all is okay, solder the other wires. Do not mount the other tubes yet.

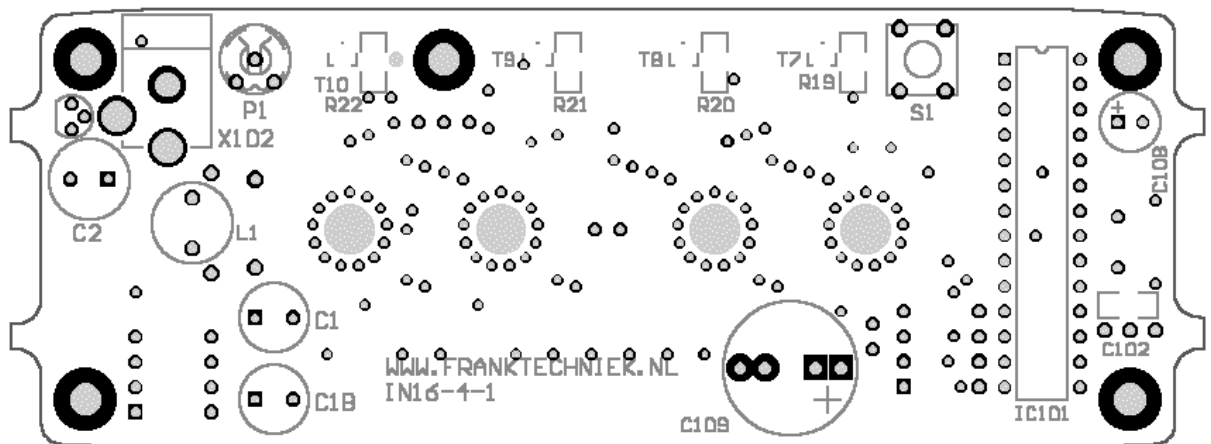
Impatient as we are, we can now connect the DC adapter. The U4 tube should display the seconds from 0-9. If you see some 'ghosting' turn the potentiometer a little bit until the display improves. If you miss one or more digits, check the board again, maybe you forgot to solder one or more legs of some transistor. It is important to check this with only one tube mounted, because it makes it easier to find a fault, if any.

Mount the other five tubes, but do this one by one. Check the operation every time you add a tube. If a tube does not work, check the anode driver for that tube and fix the problem first.

Now your clock is ready! Congratulations! If it doesn't work and you can't find what is wrong, just send me an email.



This picture shows which parts should be fitted on the top.



Some parts go at the bottom. Note the orientation of the 5V regulator near the DC input connector. Also take care mounting the capacitors, placing them in the right direction (polarity). The square hole indicates the positive lead of the capacitor. It may be wise to mount S1 a few millimeters above the pcb, so that the plastic extender sticks a little bit through the bottom plate.