

You need the following components to assemble the Black'n'Wood Nixie Clock circuit board:

Quantity	Designator	Description
1	Battery	Battery, CR1220
1	Battery	Battery holder
3	Button 1, Button 2, Button 3	Switch
1	Buzzer	Buzzer
15	C1, C2, C3, C4, C5, C6, C7, C8, C11, C12, C13, C16, C17, C23, C25	Capacitor, 100nF
2	C9, C10	Tantalum Capacitor, 10 $\mu$ F/25V
2	C14, C22	Capacitor, 220 $\mu$ F/16V
2	C15, C18	Capacitor, 22pF
1	C19	Capacitor, 820pF
1	C20	Capacitor, 4.7 $\mu$ F/250V
1	C24	Capacitor, 470 $\mu$ F/25V
1	C26	Capacitor, 10 $\mu$ F/25V
1	C21	Capacitor, 220pF
1	D1	Diode, UF4003 or UF4004
1	D2	Diode, 1N4001...1N4007
1	D3	Diode, 1N5819
1	D4	Diode, 1N4148
1	DC 12V	Power connector
4	DOT1, DOT2, DOT3, DOT4	Glow lamp
4	DOT1, DOT2, DOT3, DOT4	Spacer for glow lamp
1	FUSE	Fuse, 1A
1	GROUNDING	pin header for grounding cable
1	L1	Inductor, 150 $\mu$ H
1	L2	Inductor, 68 $\mu$ H
12	LED1, LED2, LED3, LED4, LED5, LED6, LED7, LED8, LED9, LED10, LED11, LED12	LED, different colors, blue is standard
1	MCU	Microcontroller STC12C5628AD
1	MCU	DIP20 IC socket
1	PS/2 Port	PS/2 connector
62	Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23, Q24, Q25, Q26, Q27, Q28, Q29, Q30, Q31, Q32, Q33, Q34, Q35, Q36, Q37, Q38, Q39, Q40, Q41, Q42, Q43, Q44, Q45, Q46, Q47, Q48, Q49, Q50, Q51, Q52, Q53, Q54, Q55, Q56, Q57, Q58, Q59, Q60, Q63, Q67	Transistor, A42
2	Q61, Q62	Transistor, S8550
1	Q64	Transistor, IRF630
1	Q64	Screw, M3 $\times$ 6
1	Q64	Nut M3
1	Q65	Transistor, C9014C or KTC9014C
1	Q66	Transistor, C9015C or KTC9015C
3	Q68, Q69, Q70	Transistor S8050
78	Tube1, Tube2, Tube3, Tube4, Tube5, Tube6	Pin receptacle
6	Tube1, Tube2, Tube3, Tube4, Tube5, Tube6	Nixie tube, different types

6	R1, R2, R3, R4, R5, R6	<p>Resistor, Value depends on Nixie tube type.</p> <p>-----</p> <p>QS30-1, SZ3-1, SZ-8, Z5600M, Z560M: <b>24kOhm</b></p> <p>-----</p> <p>50347, 6844A, B-50347, B-6844A, BD-302, CV5278, CV9316, GN-3, GN-4, GN-4A, GR10M, JAN-6844A, JAN-CB-6844A, JAN-CZ-6844A, M2726-102500, NE-50347, NL-50347, NL-6844A, Z510M, Z520M, ZM1020, ZM1020/01, ZM1022, ZM1022p: <b>20kOhm</b></p> <p>-----</p> <p>122P224, 1970-0002, 5031, 5037, 5092, 5092A, 8037, 8037(B-5031), 8421, 8421(B-5092), B-5031, B-5092, B-5092-A, CD102, CD24, CD26, CK6844A, CK8037, CK8421, JAN-8037, JAN-8421, NL-8421: <b>15kOhm</b></p>
2	R7, R9	Resistor, 180kOhm
1	R8	Resistor, 4.7kOhm
12	R10, R75, R80, R81, R82, R90, R91, R92, R93, R94, R95, R96	Resistor, 62 Ohm
62	R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29, R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48, R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67, R68, R69, R70, R71, R72	Resistor, 18kOhm
1	R73	Resistor, 100kOhm
1	R74	Resistor, 270kOhm
2	R77, R86	Resistor, 10kOhm
1	R76	Resistor, 180 Ohm
1	R78	Resistor, 0.15 Ohm
1	R79	Resistor, 2.2kOhm
1	R83	Resistor, 13 Ohm
1	R84	Resistor, 1.2MOhm/1%
1	R85	Resistor, 8.2kOhm/1%
1	R87	Resistor, 0.33 Ohm
1	R88	Resistor, 1kOhm
1	R89	Resistor, 3kOhm
1	R97	Resistor, 1.5kOhm
1	R98	Resistor, 56kOhm
1	R99	Resistor, not assembled, user can assemble if he don't want an open collector AUX output but a pull up resistor.
8	U1, U2, U3, U4, U5, U6, U7, U8	IC, 74HC595
1	U11	IC, DS1302
2	U12, U13	IC, MC34063A
1	Y1	Crystal, 32.768 kHz
2	Y2	glass bead
1	Y2	Crystal, 22.1184 MHz
1	PCB	PCB board

### Soldering instructions for the Black'nWood Nixie Clock circuit board

Use solder wire with Ø0.5 mm for soldering. Use a thin solder tip.

Solder the low parts first. These are:

D4

R1, R2, R3, R4, R5, R6

R7, R9

R8

R10, R75, R80, R81, R82, R90, R91, R92, R93, R94, R95, R96

R11, R12, R13, R14, R15, R16, R17, R18, R19, R20, R21, R22, R23, R24, R25, R26, R27, R28, R29,

R30, R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R45, R46, R47, R48,

R49, R50, R51, R52, R53, R54, R55, R56, R57, R58, R59, R60, R61, R62, R63, R64, R65, R66, R67,

R68, R69, R70, R71, R72

R73

R74

R77, R86

R76

R79

R83

R84

R85

R88

R89

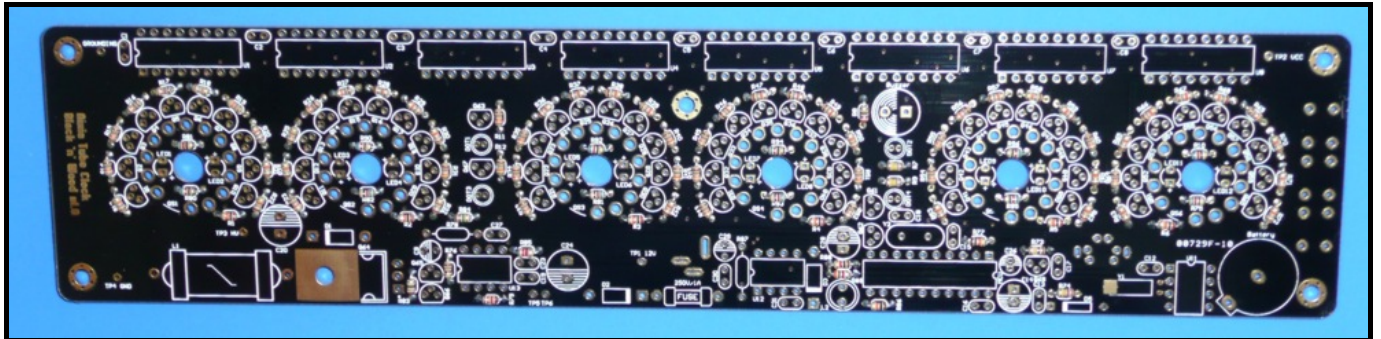
R97

R98

R99 (if needed)

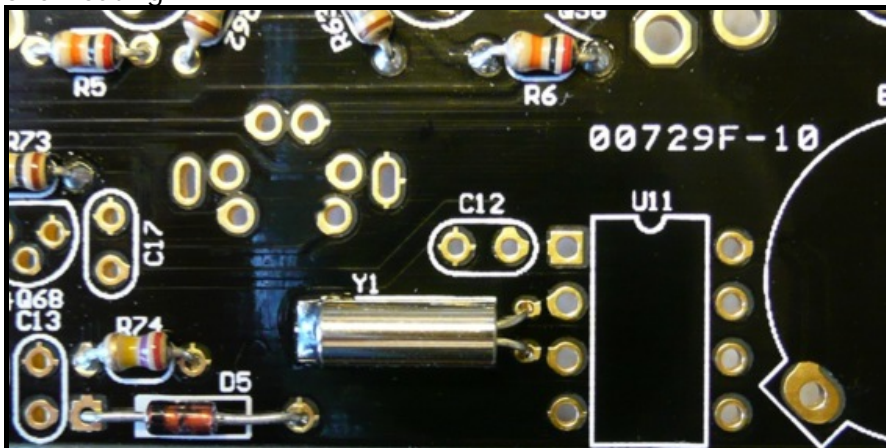
The polarity of D4 must be observed! (anode and cathode) The polarity of D4 must match the print on the board!

The result should now look like this:



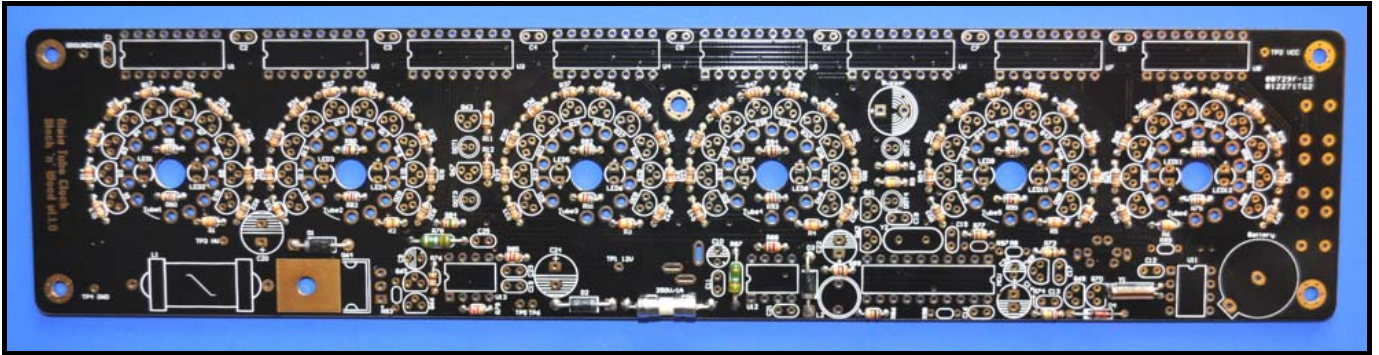
Then solder the higher flat parts: D1, D2, D3, FUSE, R78, R87, Y1

Note for Y1: Solder the top of the crystal to the board, but solder only very short to avoid overheating:



The polarity of the components D1, D2 and D3 must be observed! (anode and cathode) The polarity of the components must match the print on the board!

The result should now look like this:



Now solder the larger parts, starting with the lowest first.

These are:

Battery holder

Buzzer

C1, C2, C3, C4, C5, C6, C7, C8, C11, C12, C13, C16, C17, C23, C25

C9, C10

C14, C22

C15, C18

C19

C20

C24

C26

C21

GROUNDING (pin header for grounding cable)

L1

L2

MCU (IC socket only!)

Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q8, Q9, Q10, Q11, Q12, Q13, Q14, Q15, Q16, Q17, Q18, Q19, Q20, Q21, Q22, Q23, Q24, Q25, Q26, Q27, Q28, Q29, Q30, Q31, Q32, Q33, Q34, Q35, Q36, Q37, Q38, Q39, Q40, Q41, Q42, Q43, Q44, Q45, Q46, Q47, Q48, Q49, Q50, Q51, Q52, Q53, Q54, Q55, Q56, Q57, Q58, Q59, Q60, Q63, Q67

Q61, Q62

Q64 (use the screw and the nut for mounting Q64!)

Q65

Q66

Q68, Q69, Q70

U1, U2, U3, U4, U5, U6, U7, U8

U11

U12, U13

Y2

The polarity of the components Buzzer, C9, C10, C14, C22, C20, C24 and C26 must be observed! (plus and minus) The polarity of the components must match the print on the board!

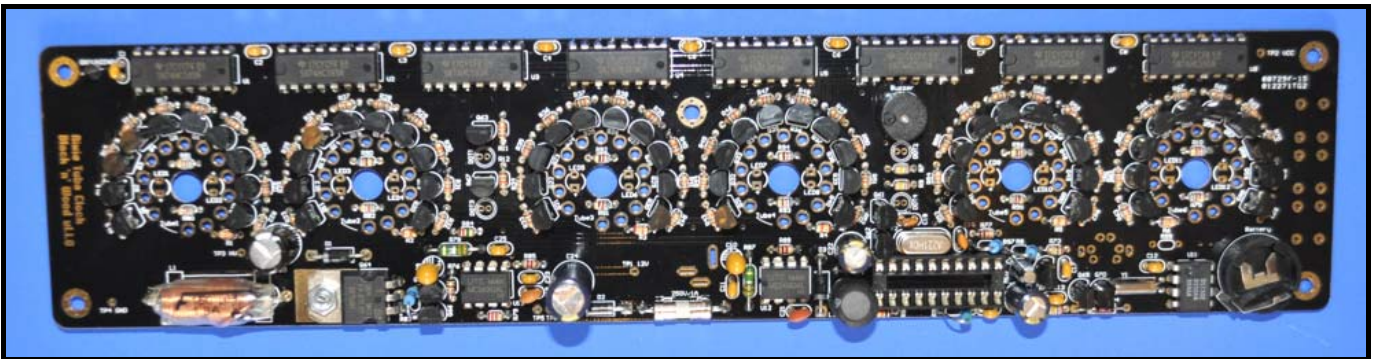
C9, C10: The longer wire is +.



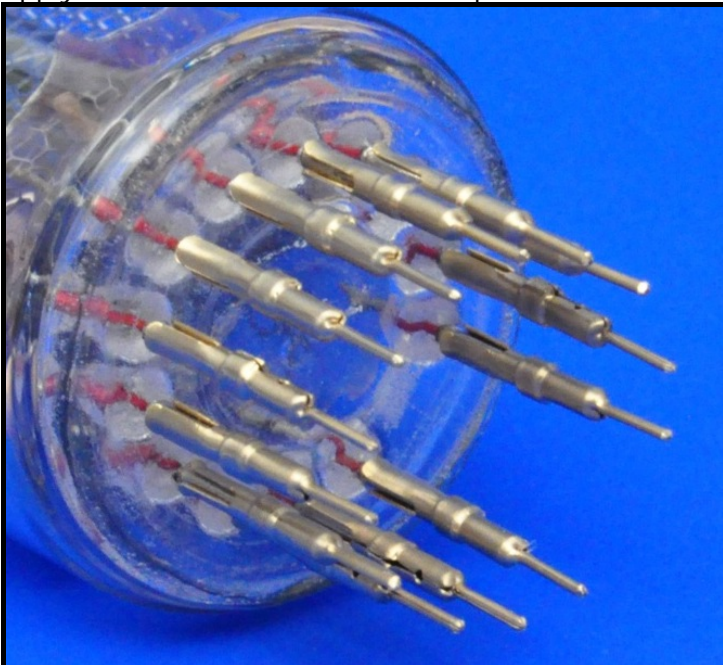
Note for Y2: put the glass beads over the leads of Y2 to avoid overheating and solder shorts:



The result should now look like this:



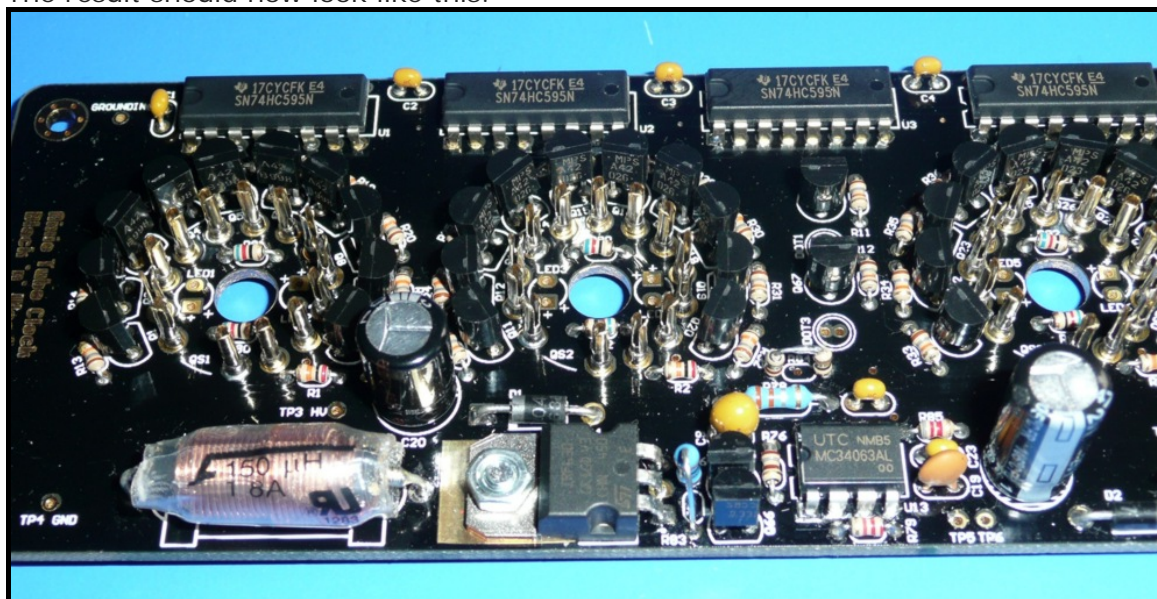
Apply all tube contacts to the tube pins:



Insert the tubes one after another with the contacts into the drills of the board and align the tubes right-angled to the board surface. Solder the contacts carefully **from the bottom side**. Don't use too much solder, otherwise the solder may flow into the inner side of the contacts. Cut **ONLY** the thin part of the contacts. Then pull the tubes out of the sockets again.

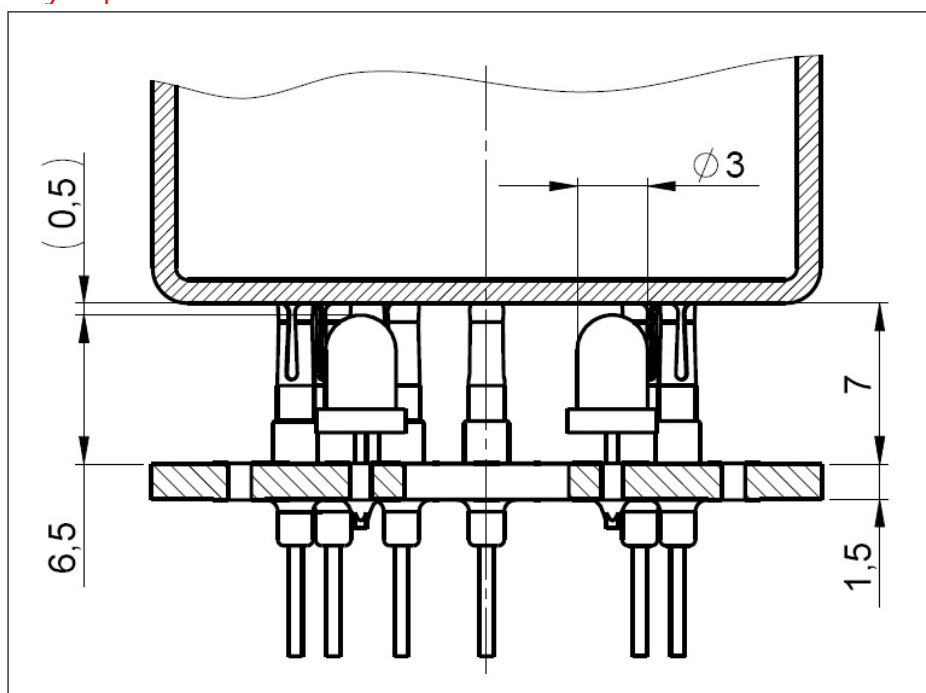


The result should now look like this:



Solder the LEDs to the board. The polarity of the LEDs must be observed! (anode and cathode). The long lead is the anode; the short lead is the cathode. The polarity of the LEDs must match the print on the board!

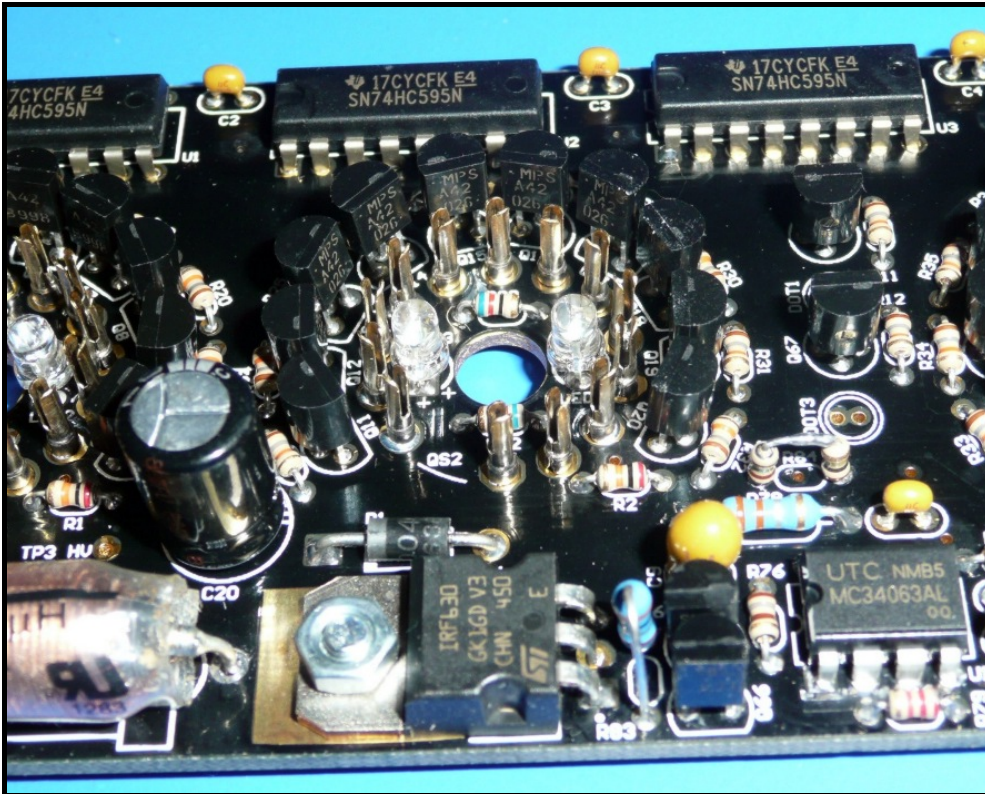
Very important: The distance between LEDs and tube bottom should be kept small as shown here:



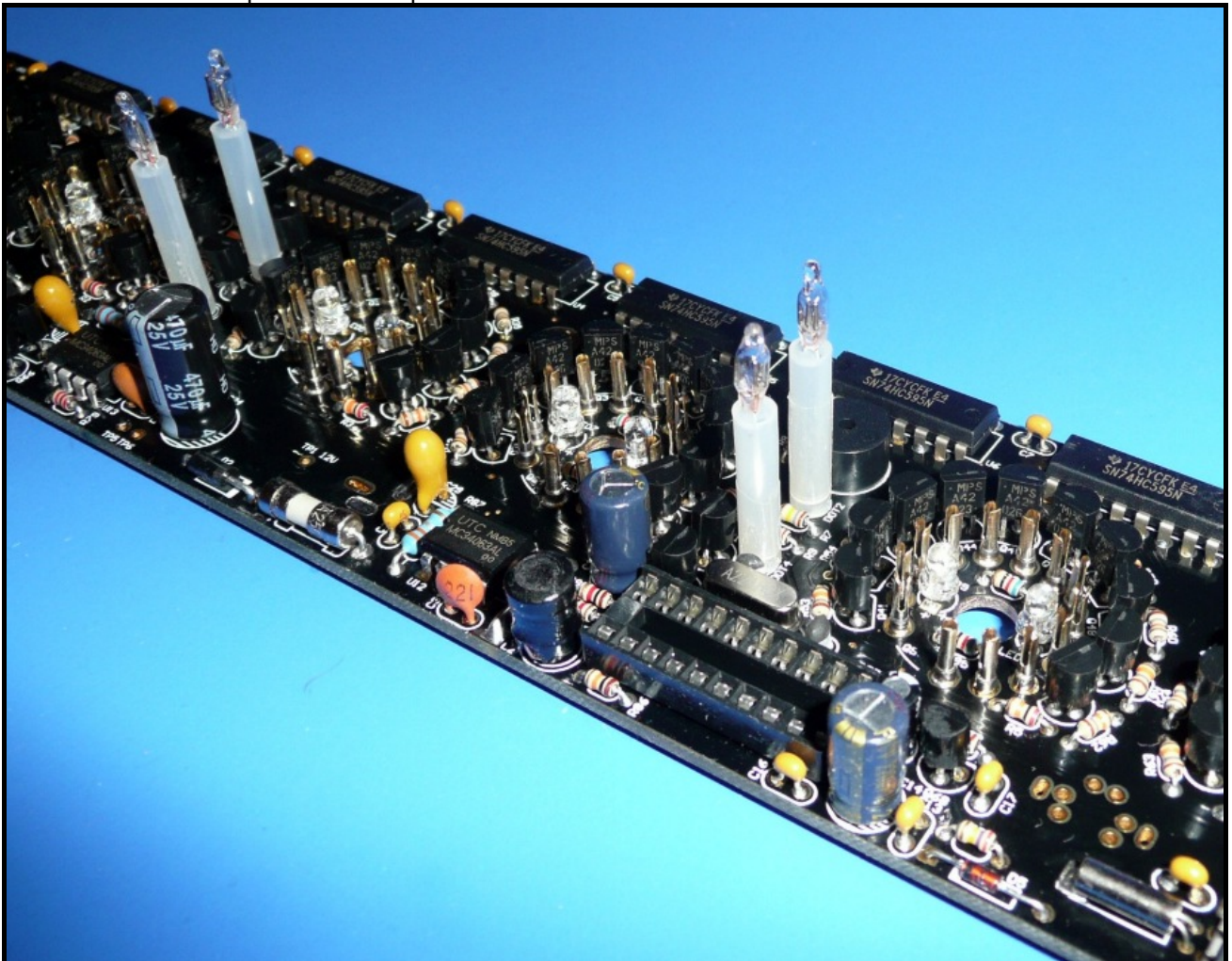
Please do not heat the LEDs too long. Heating the LEDs too long would damage them.



The result should now look like this:

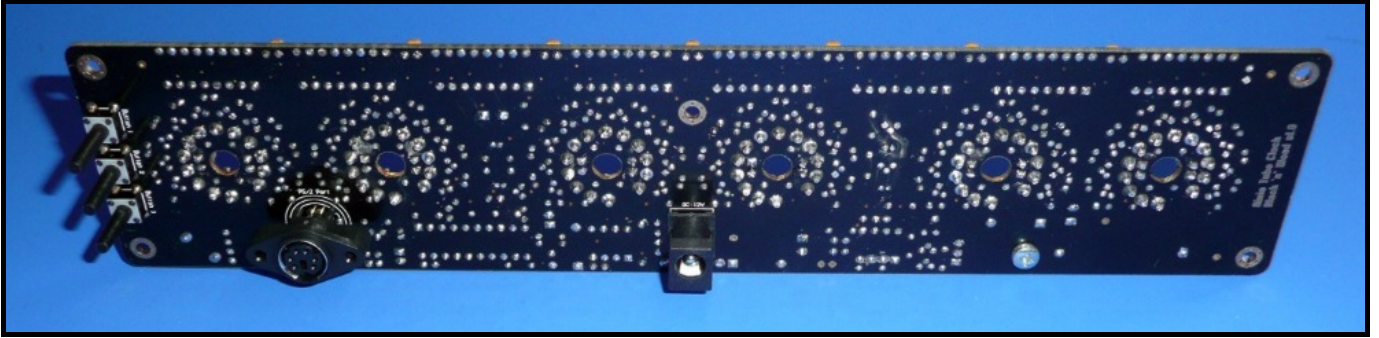


Now put the spacers for the glow lamps over the glow lamp leads and solder them to the PCB. The 2 small holes in the spacers must point to the front. The result should now look like this:





Now solder the 3 switches, the power connector and the PS/2 connector at the other side of the PCB. The result should now look like this:



Finally put the tubes and the controller into their sockets. Place the battery into the battery holder. The result should now look like this:



Your Black'n'Wood circuit board is now completed. Congratulations!

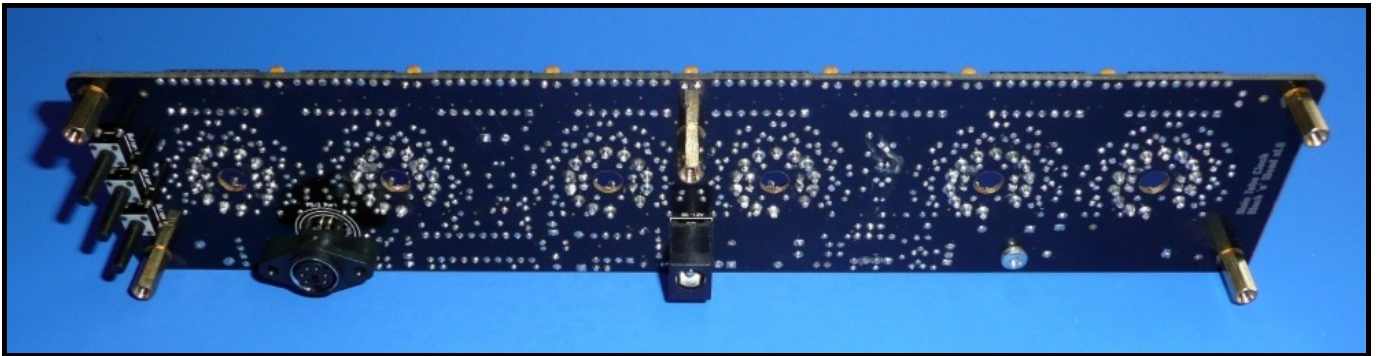


## Case Installation of the Black'n'Wood Nixie Clock

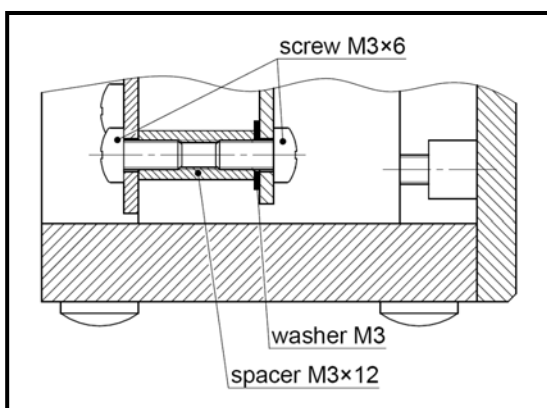
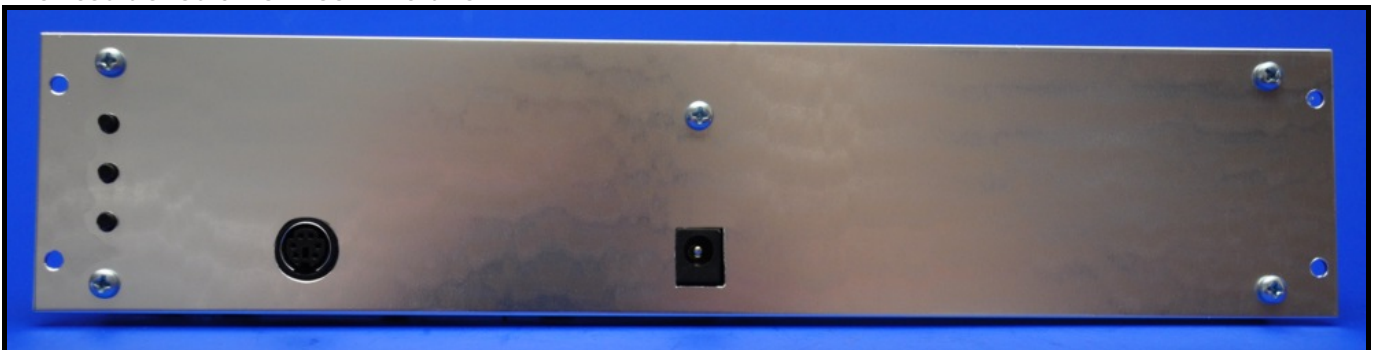
You need the following components to mount the Black'n'Wood PCB in the case:

Quantity	Description
1	Wooden frame
1	Front panel
1	Back plate
4	Polyamide screw M3×30
5	Spacer, M3×12
5	Washer M3
10	Screw, M3×6
1	Screw, M3×5
4	Self tapping pan head screw, 2.9×9.5 mm
4	Rubber bumpon
3	Foam rubber
1	Wire, with plug for GND connector
1	Cable lug
1	Heat shrinking tube

Mount the 5 spacers (M3×12) with 5 screws M3×6 and 5 washers between PCB and spacer on the PCB. The result should now look like this:

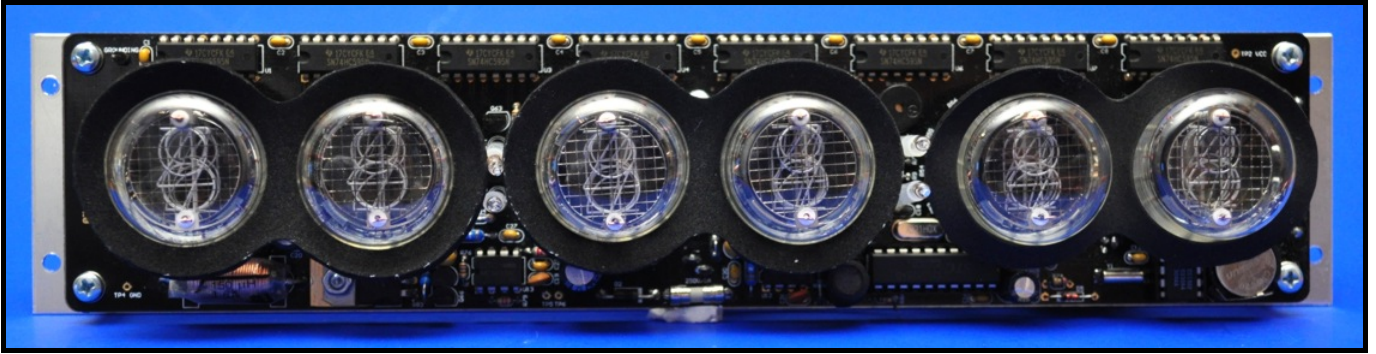


Mount this assembly to the back plate with 5 screws M3×6. The result should now look like this:



Check the fastening parts with the help of the left picture.

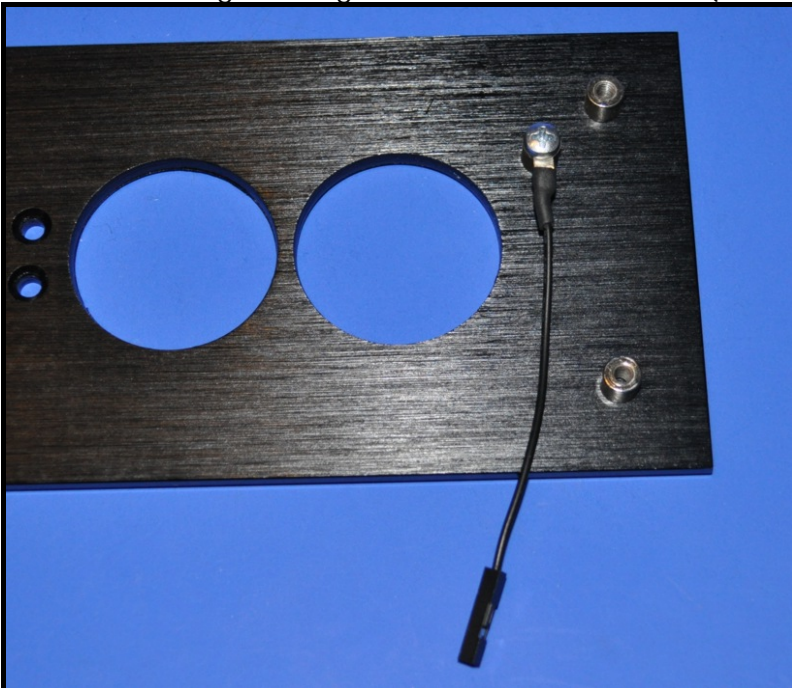
Put the foam rubber over the tubes, but put it as far as possible on the front of the tubes, so that the foam rubber will be moved in place automatically when inserting the assembly later in the case. The result should now look like this:



Now put the heat shrinking tube over the wire for the GND connector, solder the cable lug to the wire for the GND connector and heat shrink the heat shrinking tube over the solder tab. The result should look like this:

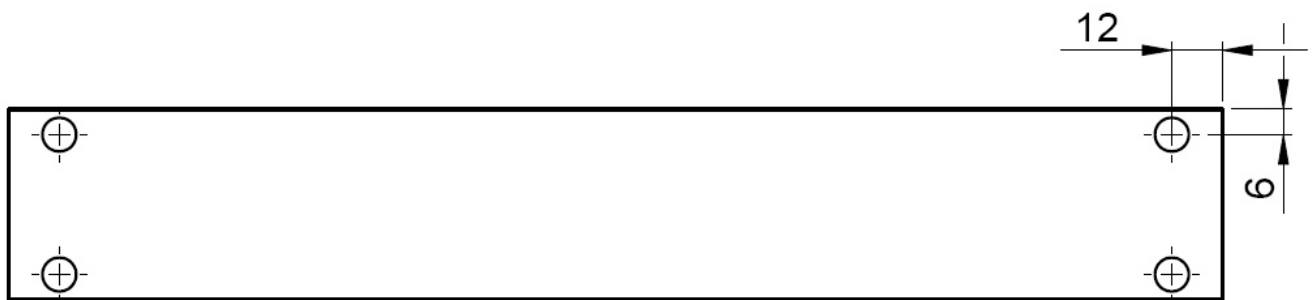


Now mount the grounding cable with a screw M3×5 (not M3×6!) on the front panel as shown:





Apply the rubber bumpers on the bottom of the wooden frame on the positions shown in the following sketch. Choose the side with the worse wood texture.



The result should look like this:



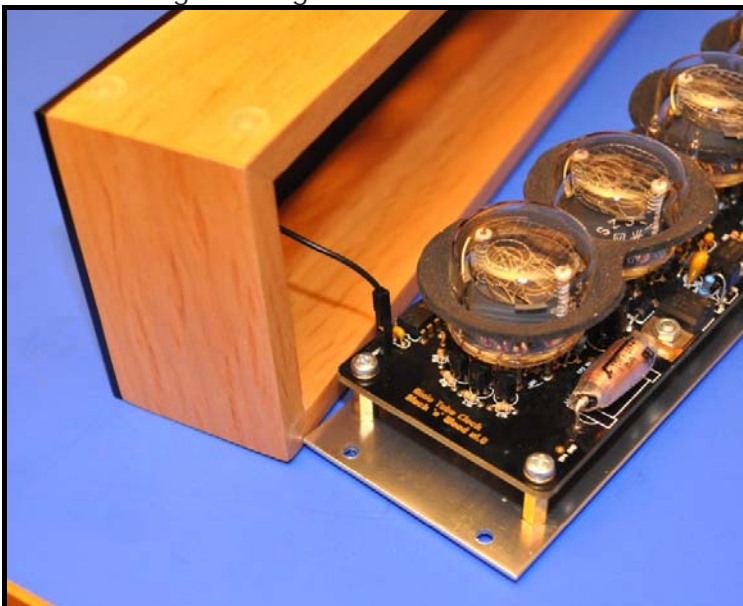
Now mount the front panel with the 4 polyamide screws M3×30 on the wooden frame.

Note: the GND connection must be on top (at the opposite of the rubber bumpers)

The result should look like this:



Connect the grounding wire to the PCB:



Mount the PCB assembly with the 4 self tapping pan head screw, 2.9×9.5 mm on the wooden frame:



Now it's time to test your beautiful new Black'n'Wood Nixie Clock!! Have fun!!



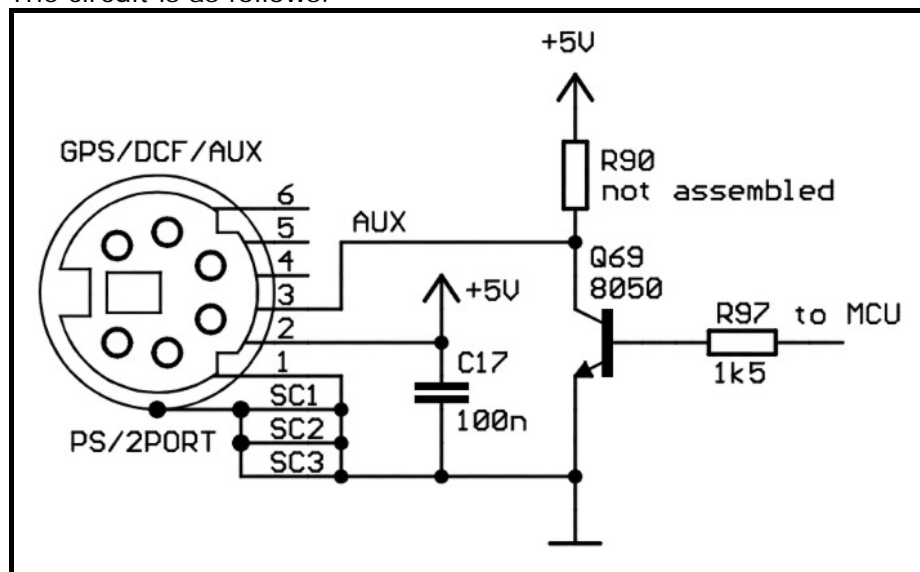
To clean the surface of the housing and the tubes use a smooth microfiber cloth.



### Notes on the AUX output:

The AUX output is an open collector output and is on pin 3 of the PS/2 (Mini DIN) connector.

The circuit is as follows:



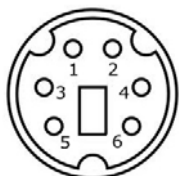
You can either use the open collector output, or install a pull up resistor for R90.

The maximum current to be drawn from the +5 V source, is 50 mA. The maximum load current of the transistor is 100 mA!

### Notes on the PS/2 (Mini DIN) Socket

Here is some information about the MINI DIN Socket that is mounted on the back of the clock.

Viewing direction is towards the socket



Pin	Connection
Shield	GND
1	GND
2	+5V DC (50 mA maximal)
3	AUX out (open collector)
4	Not used
5	TxT (DCF and GPS input)
6	Internal use, <b>do not connect!</b>

### Notes on cables switch or switched outlet

If you want the clock to run only occasionally, you may do so via a switched outlet or cord switch. Plug in the power supply into a switched outlet or simply build up a cord switch in the power supply cable.

The internal battery is not discharged faster than normal and it has absolutely no negative effects on the circuit or the tubes.