

IN-12 NIXIE CLOCK (SMD) ^{v1.0}

Jakub Dorda © 2016-2017

ASSEMBLY GUIDE

What You will need:

- Soldering iron with standard and precise tip
- Side cutters
- SMD tweezers
- Solder
- Solder pump or solder wick (for correcting mistakes)

Optional:

- Hot air gun
- Pliers / small tongs
- Crocodile clip
- Multimeter

Estimated assembly time: 7-9h



Great soldering tutorials:

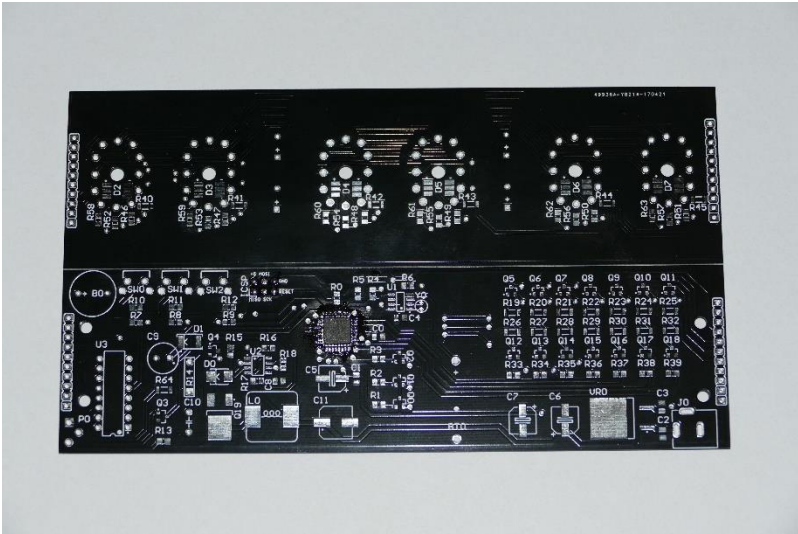
<https://www.youtube.com/playlist?list=PL2862BF3631A5C1AA>

Table of elements

Designator	Value	Package	Quantity
Y0	32.768kHz	THT	1
X6-X9	IN-3	Nixie	4
X0-X5	IN-12	Nixie	6
VR0	(78M05)L7805ACD2T	D2PAK	1
U3	SN74141N / K155ID1	THT	1
U2	NE555P	S08	1

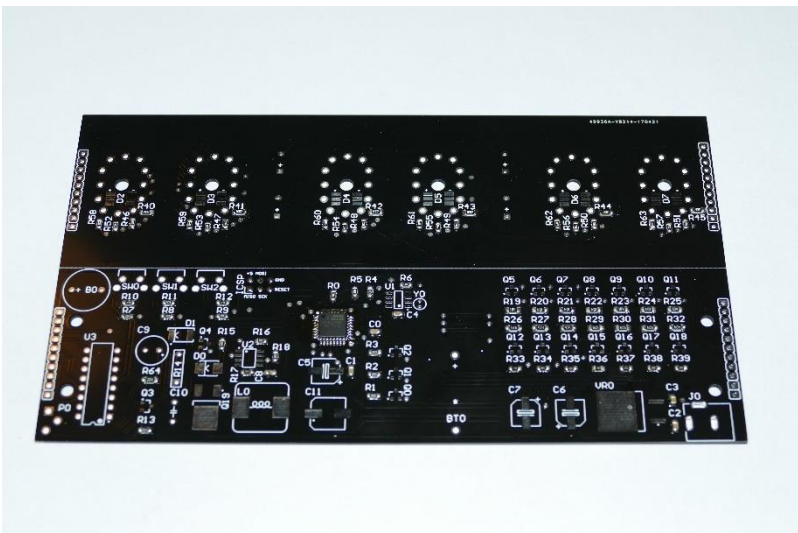
U1	DS1307Z+	S08	1
U0	ATmega8A-AU	TQFP32	1
SW0-SW2	6mm switch	THT	3
R7-R9, R15, R16	1k	0805	5
R64	220k	1206	1
R46-R63	220	0805	18
R40-R45	12k	1206	6
R26-R32, R65-R68	470k	1206	11
R19-R25	100k	1206	7
R17, R33-R39	33k	0805	8
R14	1k	THT	1
R10-R13	470	0805	4
R0-R6, R18	10k	0805	8
Q5-Q11	MMBTA92	SOT23	7
Q4	MMBT2907	SOT23	1
Q19	IRFR310TRPBF	DPAK	1
Q12-Q18	MMBTA42	SOT23	7
Q0-Q3	MMBT2222A	SOT23	4
P0	1k potentiometer	THT	1
L0	100uH	SMD	1
J0	2.1/5.5mm 9v DC	THT	1
D2-D7	LED RGB comm. cathode	5050	6
D1	SUF4007	DO214AC	1
D0	M7	DO214AC	1
C9	2.2uF 400V	THT	1
C8	2.2nF 50V	0805	1
C5-C7	100uF 16V	type D	3
C11	470uF 16V	type E	1
C10	47pF	THT	1
C0-C4	100nF 50V 0805	0805	5
BT0	coincell CR2032 holder	THT	1
B0	Buzzer piezo 5v	THT	1
Connector	M20 female	THT	21
Connector	M20 male	THT	21

1. Programmed IC



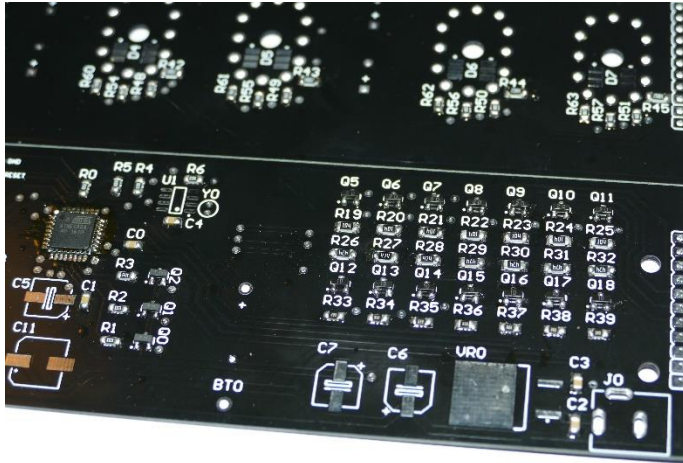
Microcontroller is already soldered to the pcb. You can separate pcb boards before starting the assembly, or during later steps.

2. SMD resistors and ceramic capacitors



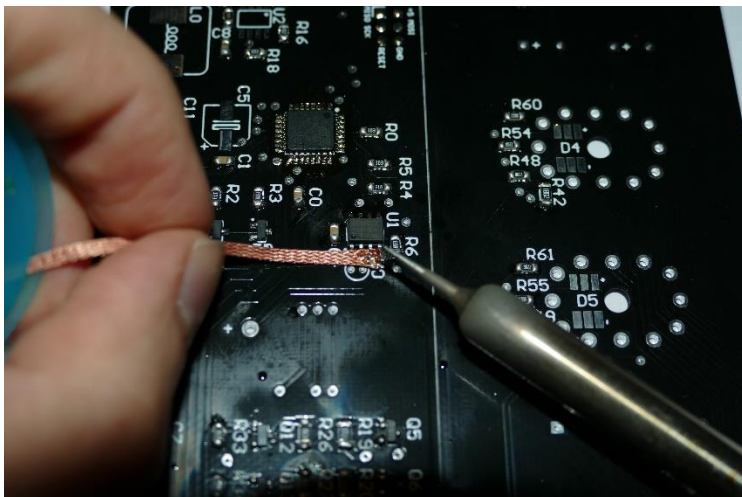
Start soldering with the smallest SMD elements such as resistors and ceramic capacitors.

3. Transistors

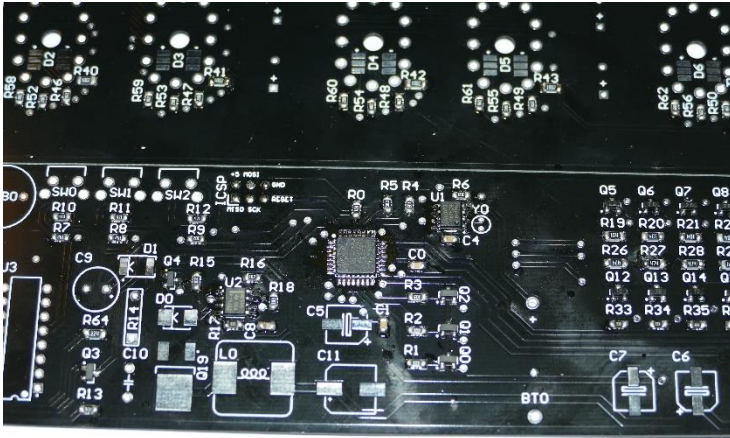


Mount SMD transistors in the next step.

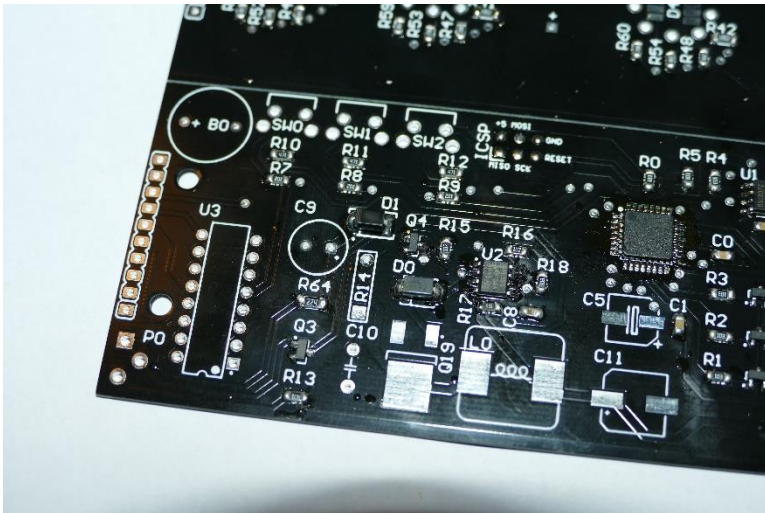
4. Other ICs



Solder two 8-pins ICs. I recommend soldering ICs with excessive amount of solder first, and then clearing bridges between pins with solder wick.

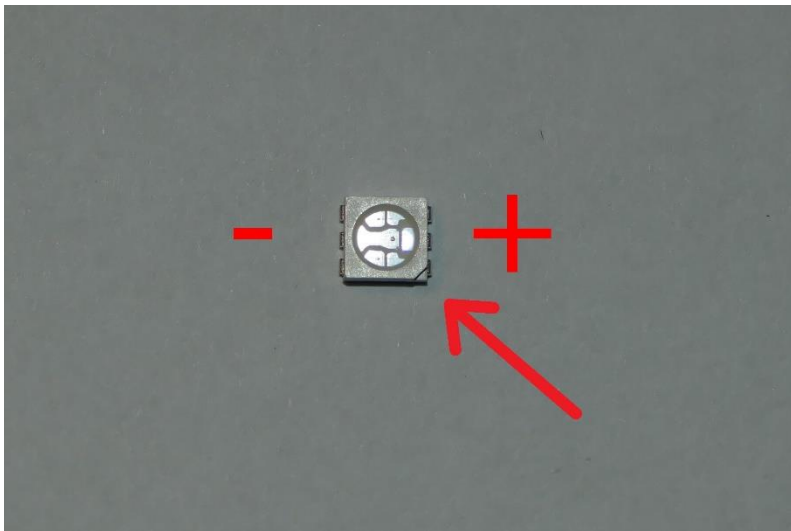


5. SMD rectifier diodes

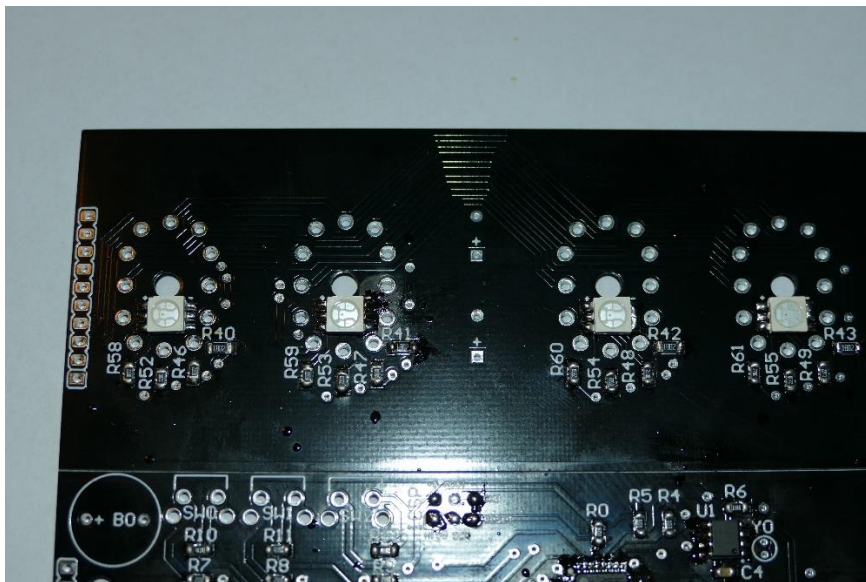


Solder two rectifier diodes.

6. LEDs



Solder backlight LEDs with correct polarity, as shown on this picture.

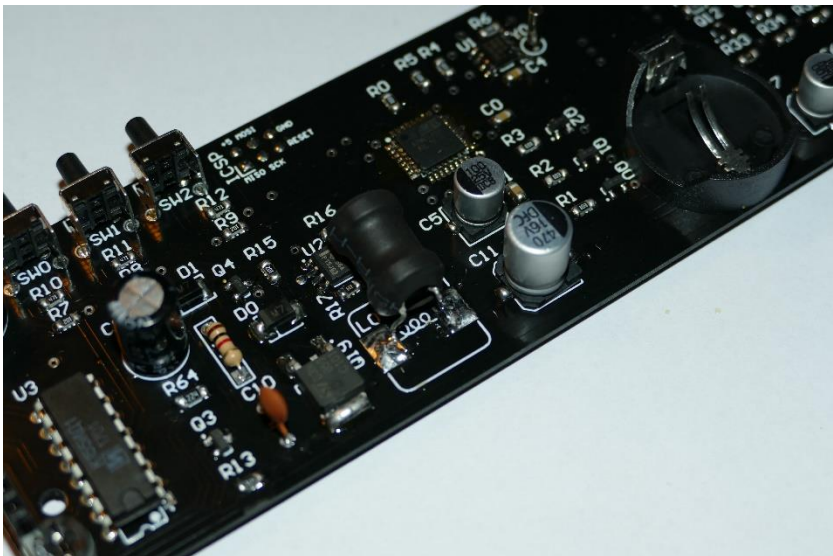


LEDs soldered to the display board.

7. Large SMD components



Notice that it's possible to use THT equivalents instead of SMD.



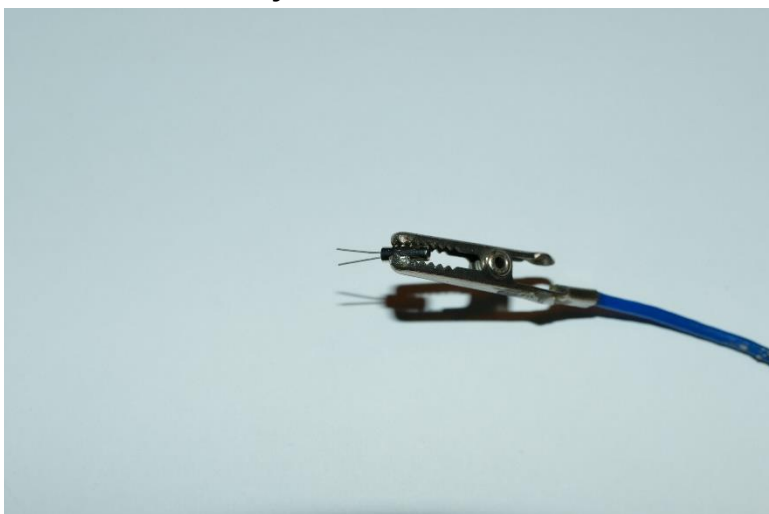
If you decide to do that, you will have to ensure that part will fit in-between the boards, by for instance bending it to the side.

8. THT parts on main board



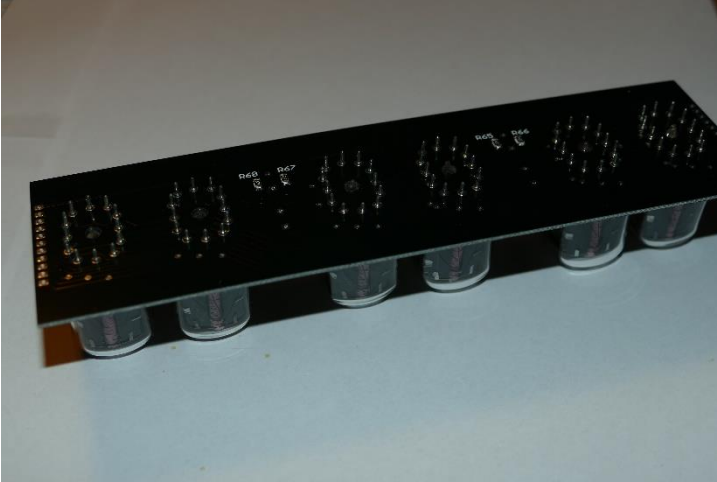
Mount THT components to the main board, you will have to separate the PCBs before this step if you haven't done it before.

9. Mount clock crystal

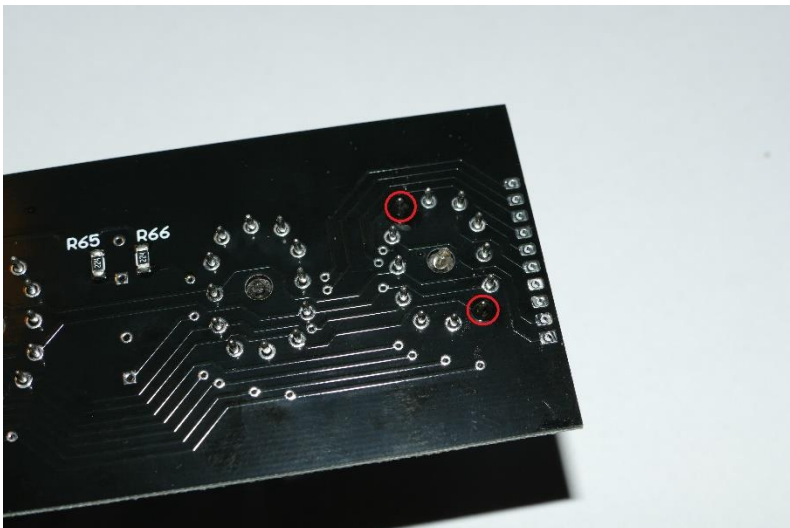


While soldering small crystal, it is advisable to use crocodile clip in order to protect it from overheat. (it may have impact on clock accuracy over time)

10. Position nixie tube



Place and adjust nixie tubes in the display board's sockets. Handle nixies with care, small cracks in glass near pins can cause “vacuum to escape”, and tube won't light up!



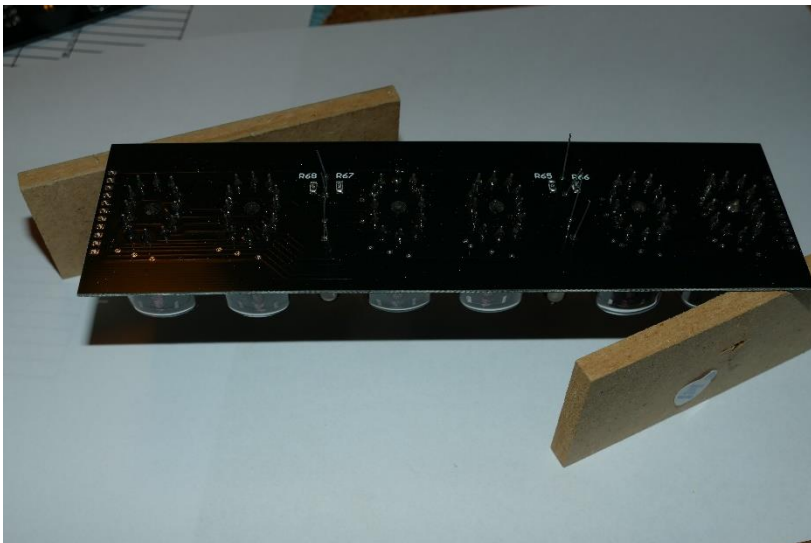
Solder two diagonal pins first from each tube and check on the alignment. With this method, it's very easy to correct mistakes.

11. Solder nixies

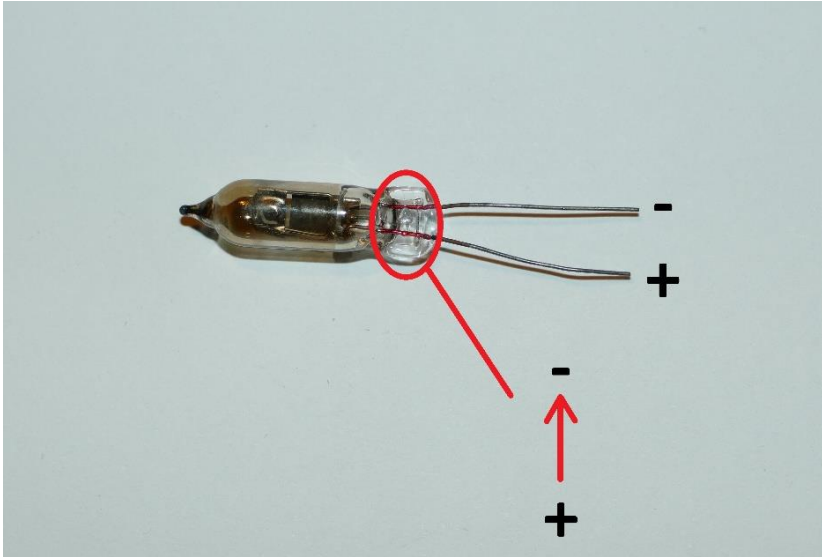


Once you are satisfied with the tubes alignment solder rest of the pins.

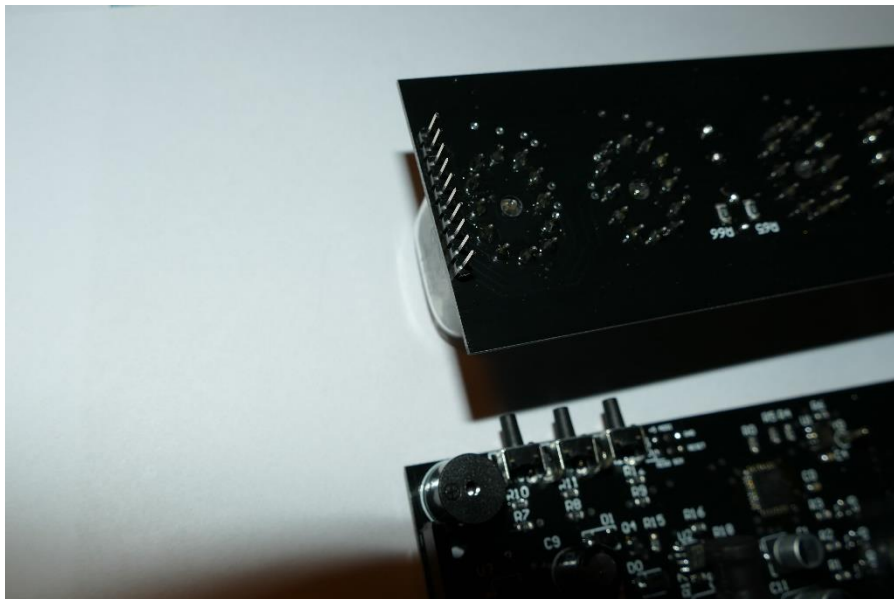
12. Separators



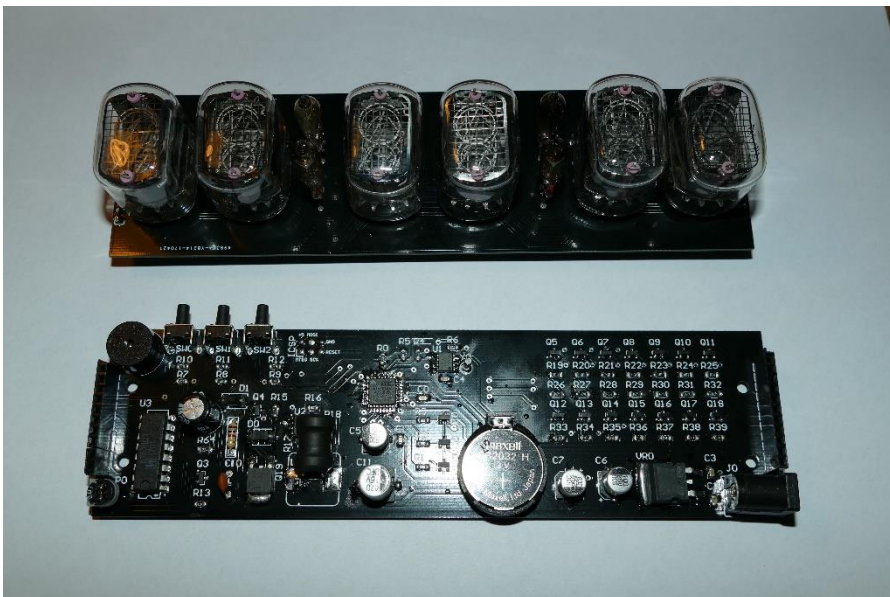
Solder separators at desirable pins height, be careful pins might be fragile!
You can use support to make this step easier. The arrow on tube indicates polarity. (As shown below)



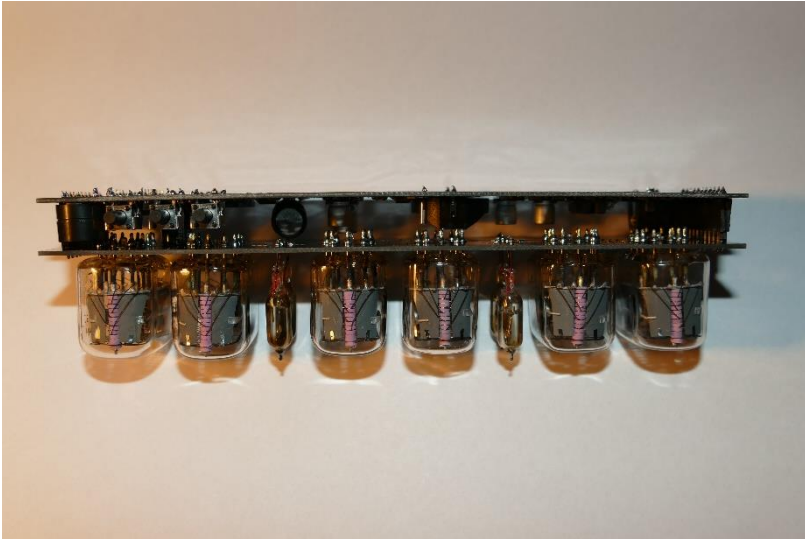
13. Mount boards connectors



14. Double check all solder joints!



15. Elements clearance



Ensure that none of the parts on the main board touches nixie pins on the display board.

16. Turn on

After last step, the clock should be completed. Just insert battery (clock will not boot up without it!), stack boards on top of each other and then plug the power supply and you are ready to go!

Don't forget to set up time first and adjust brightness. I recommend setting brightness to half of the range on first turn on. You will find instruction how to do that in the User Manual

I hope everything went as planned, and your nixie clock is working flawlessly and it will serve you for many years to come!

Sincerely, Jakub Dorda