

Congratulation of the purchase of the FDU nixie clock V3.

This manual wil help you to make the kit into a working clock.

**ATTENTION !!!!!**  
**Before beginning read this.....**

**The power of Some parts on this nixie clock can excede above 200 Volts**  
**Be very carfuly with this !!!!!**

**This kit is not for beginners, you need some knowledge of electronics and must have some soldering skills**

**If you don't have the knowledge ask someone who hase and build the kit under supervision.**

**It is not my (fd�) responsable you don't have any or less knowledge so mount the nixie clock wrong and complaining it's not working**

**I made this manual in steps, if you follow these than it should be relatively easy to make this kit into a working nixie clock.**

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1. Tools you need
2. Parts
3. Building the clock
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## 1. Tools you need

You need some tools to build the nixie clock.

- Soldering iron or station about 30 to 60 watts with a small soldering point.
- Soldering tin
- A good electronics cutting plier.
- An electronics flat wide jaw plier.
- A small flat srewdriver
- A multi meter (volts/amp/ohm)
- These are the main tools you need for building the nixie clock.

## 2. The parts

Check if the following parts are in the bags. Parts are in separte bags, do not empty all bags into one pile of parts. It will be hard to reconize some parts especialy the transisors. Bag number is at front of list.

	Identifier	Number	Value	Ends with gold
1	R1,R3,R28	3	1k	brown-black-red
1	R2,R19,R20,R29,R30,R31,R32,R33,R34,R35,R36,R37,R38,R39, R40,R43,R53	17	10k	brown-black-orange
1	R4	1	56k	green-blue-orange
1	R5	1	220k	red-red-yellow
1	R6,R7,R8,R9,R10,R11	6	100k	brown-black-yellow
1	R12	1	2k2	red-red-red
1	R13,R14,R15,R16,R17,R18	6	470k	yellow-purple-yellow
1	R21	1	470R	yellow-purple-brown
1	R22,R23,R24,R25,R26,R27,R44,R46,R47,R48,R49,R50,R52,R54, R55,R56,R57,R58	18	33k	orange-orange-orange
1	R42,R45	2	4k7	Yellow-purple-red
1	R51	1	100R	brown-black-brown

1	P1	1	1k	Multiturn
3	C7,C9,C12,C14,C15,C16	6	100n	104
3	C8,C10	2	22p	
3	C6	1	2n2	222
3	C5	1	100p	101 / >250volt
3	C1,C2,C3	3	100μ	16v or higher
3	C4	1	4μ7	Or higher / >250volt
3	C11	1	470n	
3	C17	1	1μ	105
3	C13	1	22p	Trimmer (green)
	Cap.	1	1 Farad	5volt
1	T1,T2,T3,T4,T5,T6	6	MPSA92	
	T7	1	IRF740	
3	T8,T9,T10,T11,T12,T13,T16,T17,T18,T19,T20,T21,T22,T23,T24,T25,T26,T27	18	MPSA42	
2	T14,T15	2	BC550c	
2	D1,D12,D13,D14,D15,D16,D17,D18,D19,D20,D21,D22,D23,D25	14	1N400X	X stands for 4,5,6,7
2	D2	1	BYV95c	
2	D3,D4,D5,D6,D7,D8,D9,D10,D11	9	1N4148	
1	D24	1	75V zener	500mW or >
1	D26	1	200V zener	1.3 Watt
4	TMP36	1	TMP36	Temp. sensor
4	IC1	1	NE555	timer
4	IC2	1	CD4028	Bcd to dec. decoder
4	IC3	1	PCF8563	RTC (real time clock)
4	IC4	1	pic18F2550	Programmed
4	Socket	2	8 dil	
4	Socket	1	16 dil	
4	Socket	1	28 dil	
2	Vr1	1	7809	
2	Vr2	1	7805	
2	L1	1	100 μH	1Amp
4	Cr1	1	20Mhz	
4	Cr2	1	32.768khz	
2	S1,S2,S3,S4,S5,S6,S7	7	Switch	Mini buttons
	Nixie tube	6	IN-14	
4	Connector	1	12x1	Male
4	Connector	1	12x1	Female
4	Connector	1	7x1	Male
4	Connector	1	7x1	Female
0	Power inlet	1	12V input	
0	Chassis 3.5 mm	1	For TMP36	Mini jack
0	Plug 3.5 mm	1	For TMP36	Mini jack
0	Wire	1	1.50 Mtr	
0	Pcb	1	Main	
0	Pcb	1	Tube	
0	Pcb	1	Switch	

0	Pcb	1	Temp	
	Power suply 100-240Vac > 12Vdc / 2Amp.	1		
	Power cable euro to “8 shape”	1		* Note below

\* note: for outside EU, you have to buy powercable that is suitable for your country. Or cut cable and mount suitable connector.

### 3. Building the nixie clock

Al the parts checked ? Than now you can start building the Nixie Clock.

If you follow the steps than it should be an easy job, but only if you are following the steps, if you do it a different way than you could come in some troubles to make the clock working right.

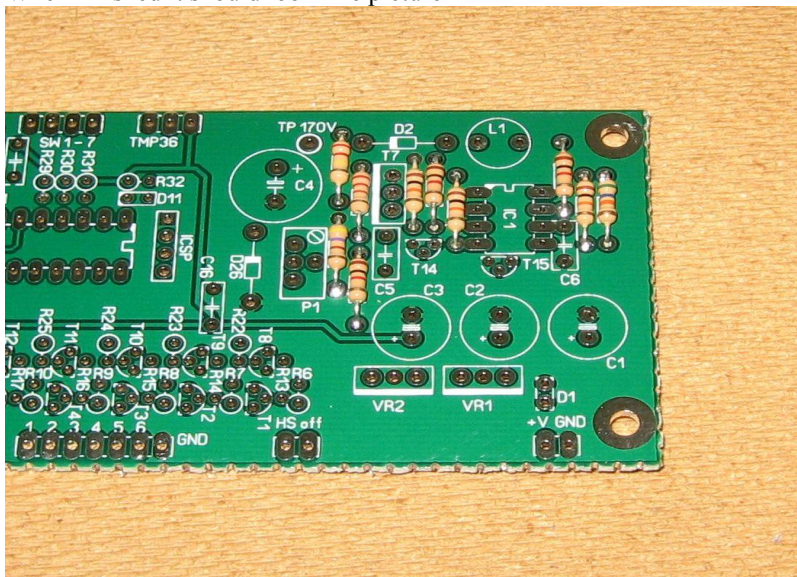
Always check 2 or more times you mounth the right part and also your soldering.

Lets go building.....

#### Step 1.

Start mounting and soldering the following parts: R4, R19, R1, R2, R3, R20, R12, R28, R5, R21

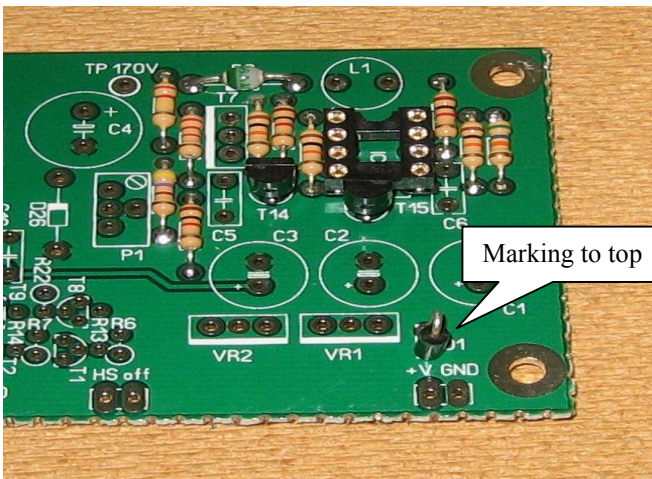
When finished it should look like picture



#### step 2.

Mount and soldering the following parts: IC1 (socket), T15, T14, D1, D2

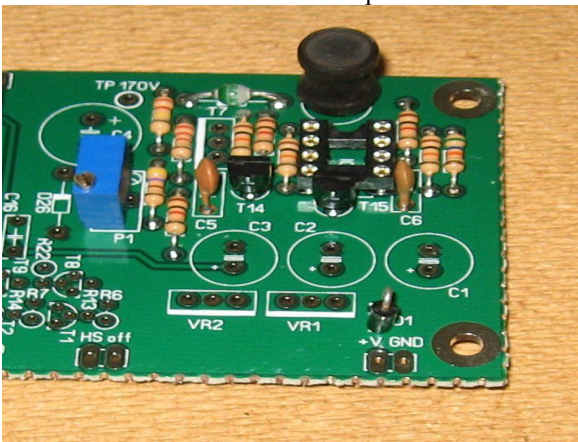
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### Step 3.

Mount and soldering the following parts: C5, C6, P1, L1

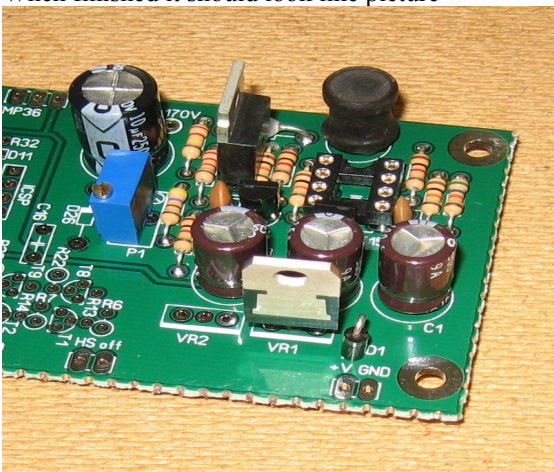
When finished it should look like picture



### Step 4.

Mount and soldering the following parts: C1, C2, C3, C4, VR1, T7

When finished it should look like picture

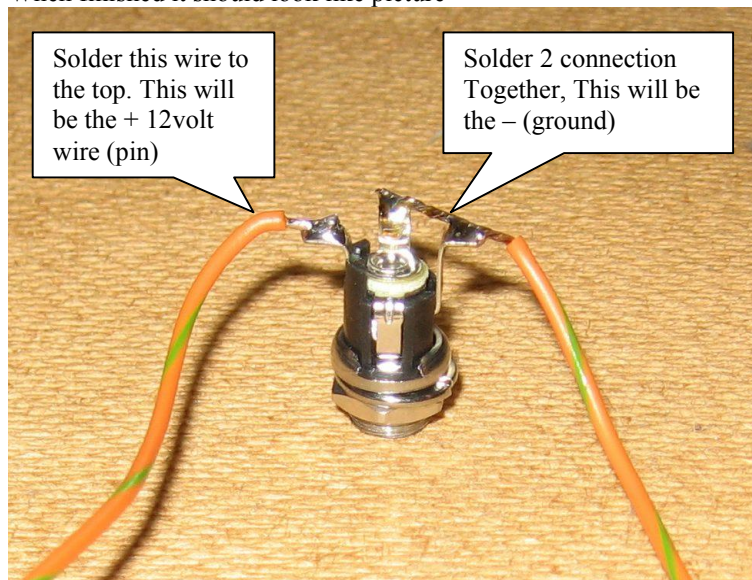


### Step 5.

In the kit is 1.5meter of wire included. Make 2 wires of 15 cm (or choose lengt you need, but beware that it possible you have to short of wire if you make wires to long !)

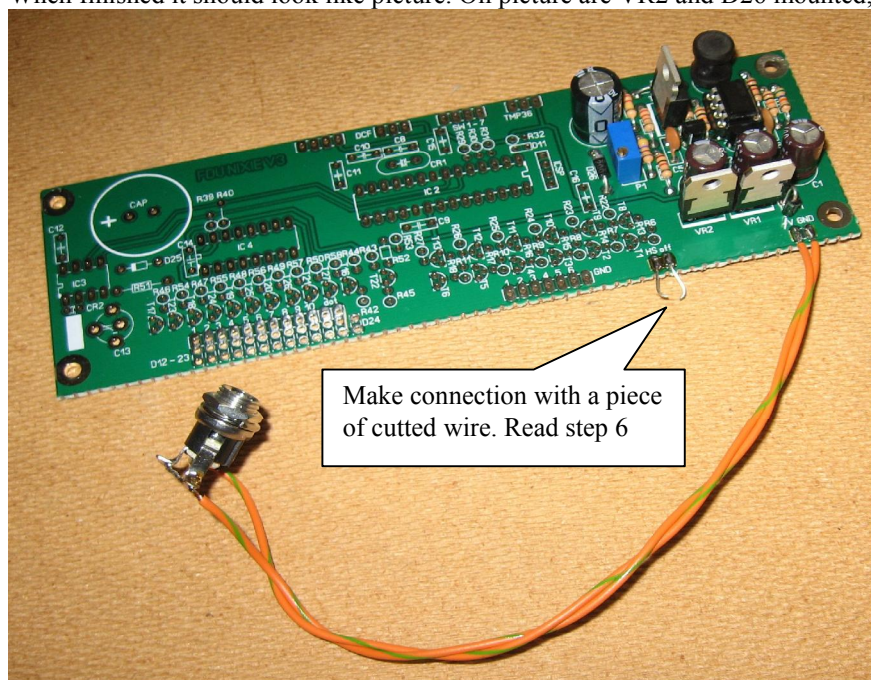


When finished it should look like picture



Connect wire to pcb, watch out you mount the + and - the good way (Wrong way connection is protected by D1, if it does not work connect the 2 wires around)

When finished it should look like picture. On picture are VR2 and D26 mounted, DO NOT MOUNT THEM YET !!



## Step 6.

### Testing high power circuit:

Solder a piece of cutted wire from resistor or other part on the HSoFF.  
Put the ne555 into the socket.

### Read following carefully before you connect the power!

Connect the 12 volt adaptor (but do not hook it to the main 100-240volt)

Take your multimeter and connect the black wire to the - (can of VR1 or 1 of the 4 mounting holes)  
Connect the red wire to +V. If you do not have clamps use some cutted wire around the measure cable and solder it on +V.

Connect power supply to the main, check if you have 12volts, if not disconnect main and check parts and your soldering. Also check for short circuit (maybe drop of tin)

If you have 12 volts check the volts on TP170 this is around 8,5 volts.

Now cut the wire of Hsoff and it should read > 50 volts.

Via P1 you can set the voltage to 170 volts.

If you can not regulate voltage, disconnect main and check parts, soldering etc.

If the high power circuit is working properly make the Hsoff connection closed for later testing.

## Step 7.

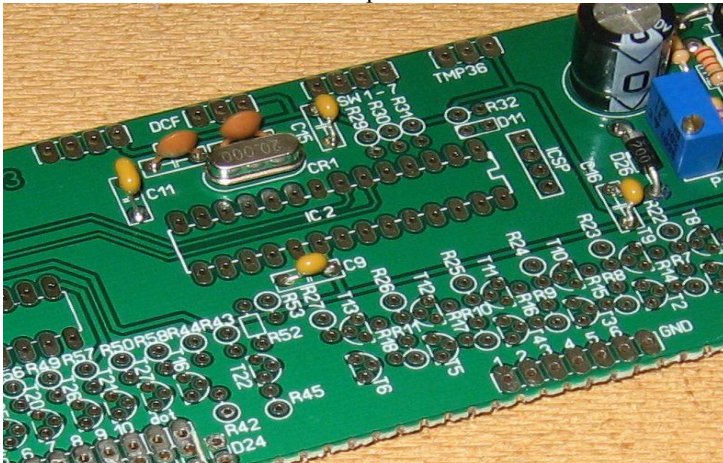
Mount VR2 (7805) and D26 (200volt zener)

## Step 8.

Mount and soldering the following parts:

C11, C10, C8, C9, C15, C16, CR1 (leave some space between pcb and x-tal. So you don't get short circuit)

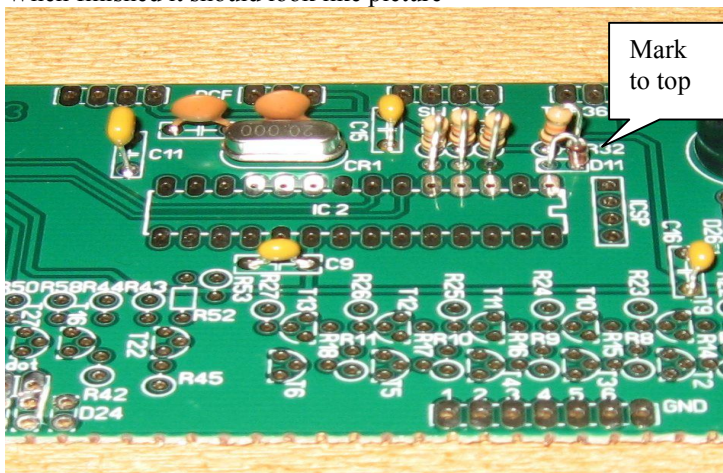
When finished it should look like picture



## Step 9.

Mount following parts: D11, R32, R31, R30, R29

When finished it should look like picture

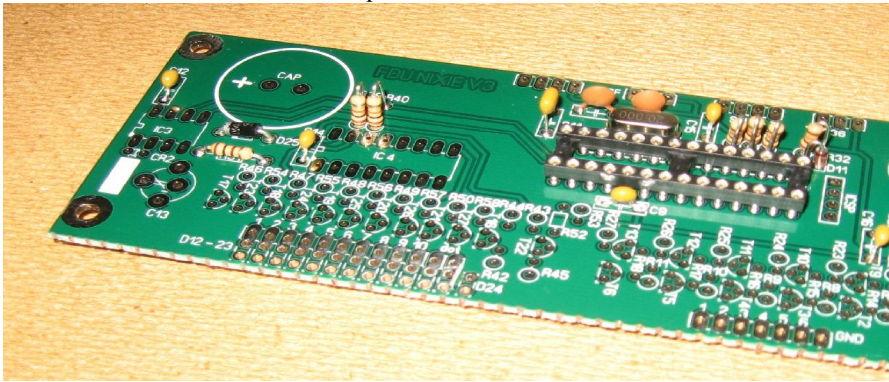


## Step 10.

Mount following parts: IC2 socket, R40, R39, C14, D25, R51, C12



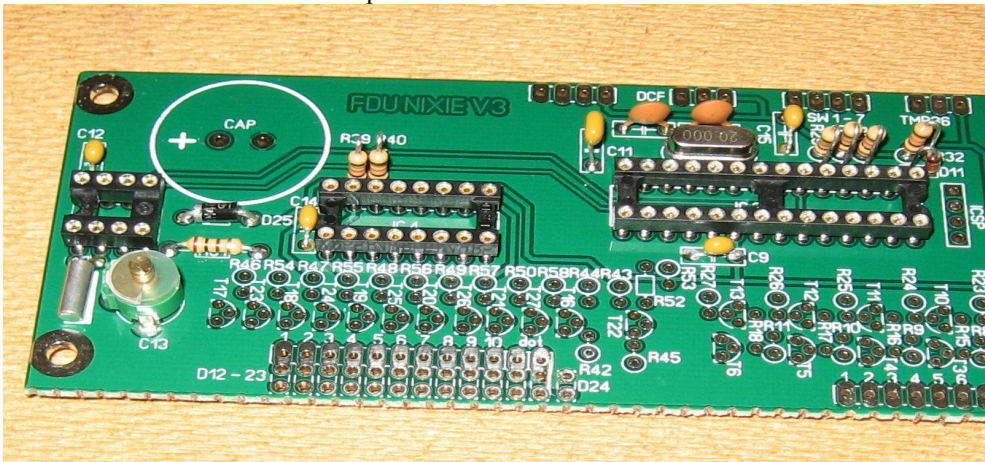
When finished it should look like picture



## Step 11.

Mount following parts: IC4 socket, IC3 socket, CR2, C10

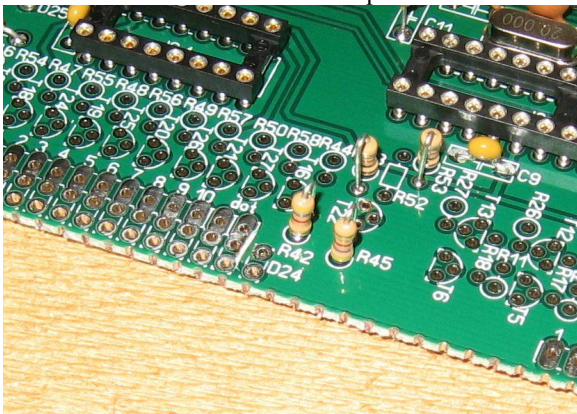
When finished it should look like picture



## Step 12.

Mount following parts: R53, R43, R42, R45

When finished it should look like picture

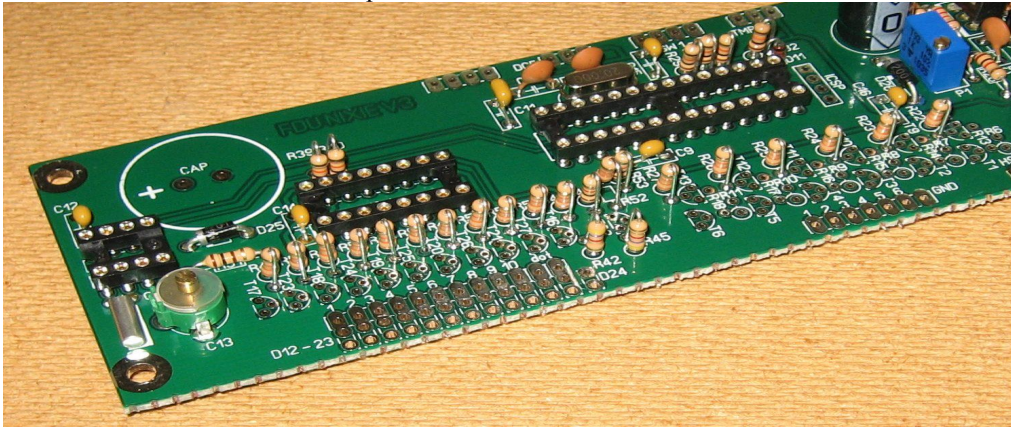




### Step 13.

Mount following parts: R46, R54, R47, R55, R48, R56, R49, R57, R50, R58, R44, R43  
R27, R26, R25, R24, R23, R22 (18x 33k)

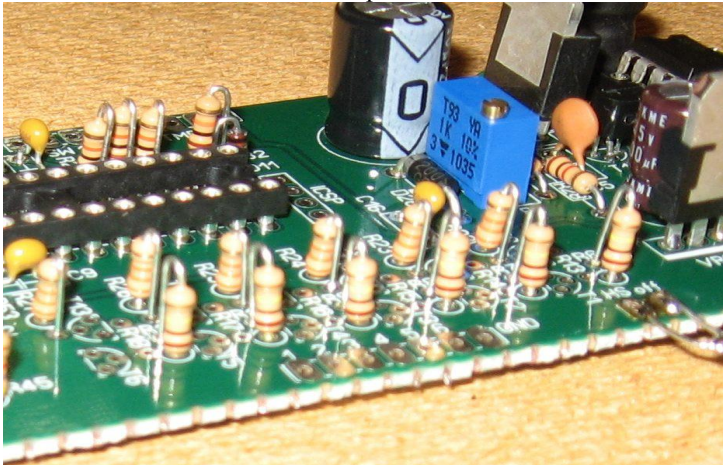
When finished it should look like picture



### Step 14.

Mount following parts: R6, R7, R8, R9, R10, R11

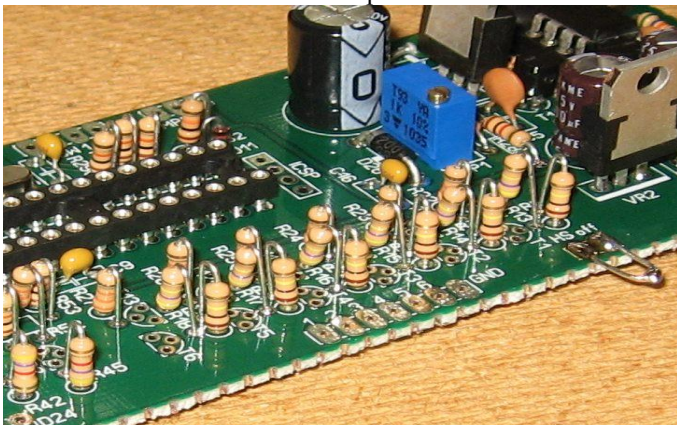
When finished it should look like picture



### Step 15.

Mount following parts: R13, R14, R15, R16, R17, R18

When finished it should look like picture

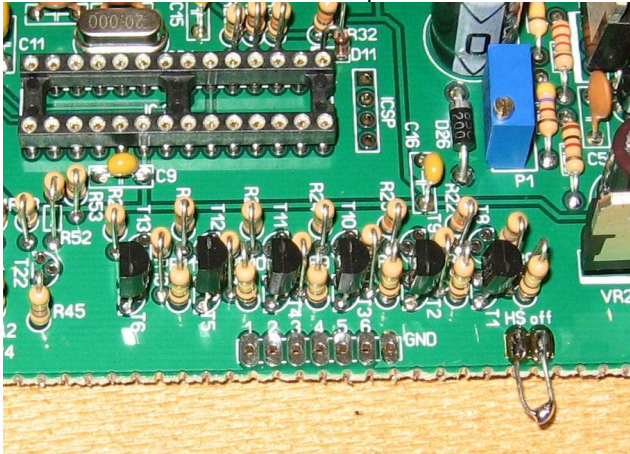




## Step 16.

Mount following parts: T1, T2, T3, T4, T5, T6

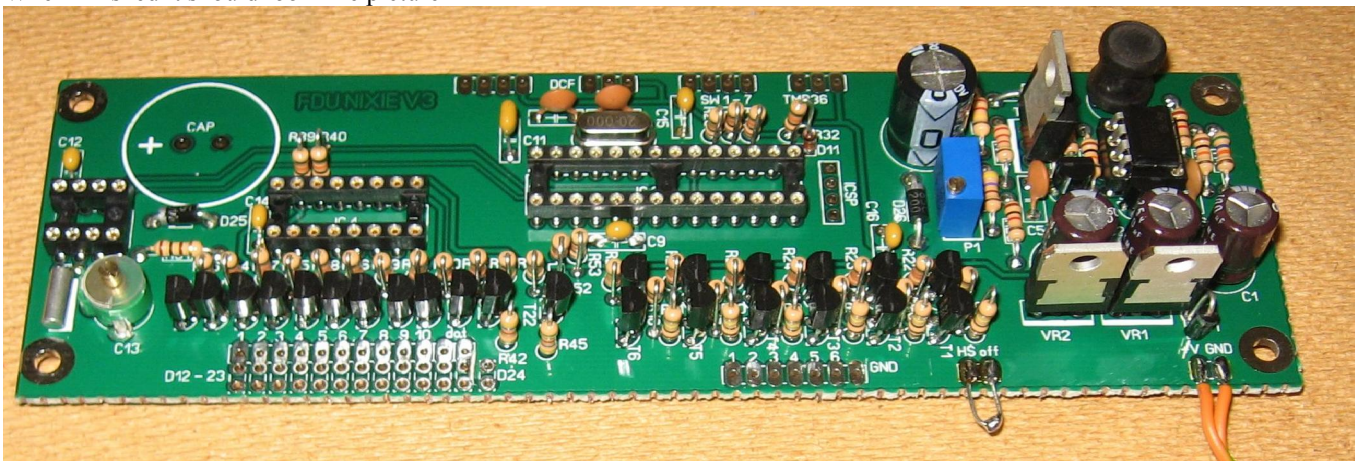
When finished it should look like picture



## Step 17.

Mount following parts: T17, T23, T18, T24, T19, T25, T20, T26, T21, T27, T16, T22  
T13, T12, T11, T10, T9, T8 (18x mpsa42)

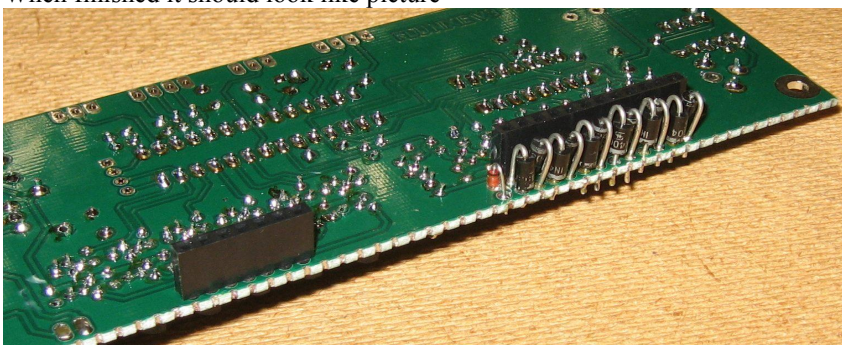
When finished it should look like picture



## Step 18.

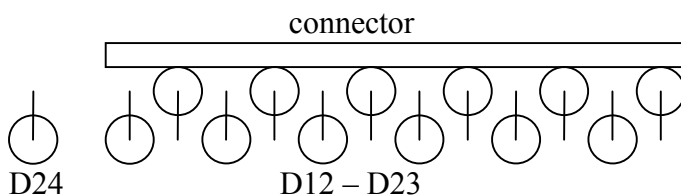
Mount following parts ON OTHER SIDE OF PCB ! : female connector 7 pin and 12 pin, D12 till D23, D24

When finished it should look like picture



note: it could happen that the used diode (400x) will not fit if you mounth them all the same way, if so mount them in turns to solve this small problem. (see picture below)





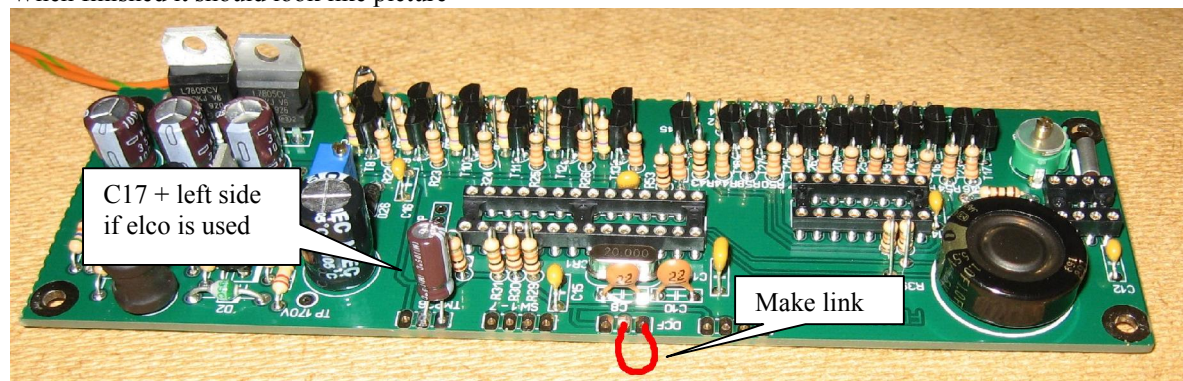
## Step 19.

Mount following parts: Cap. (1 farad) The pins are bit thick for the holes, use flat plier to squeeze the pins a little bit smaller so they will fit better in holes.

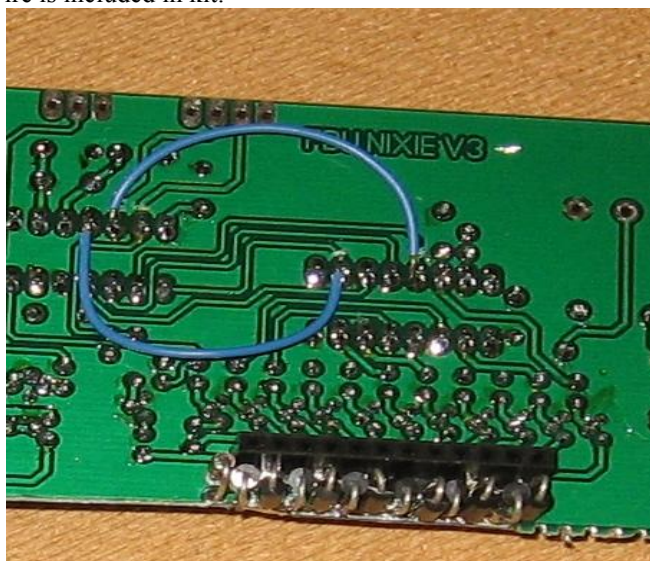
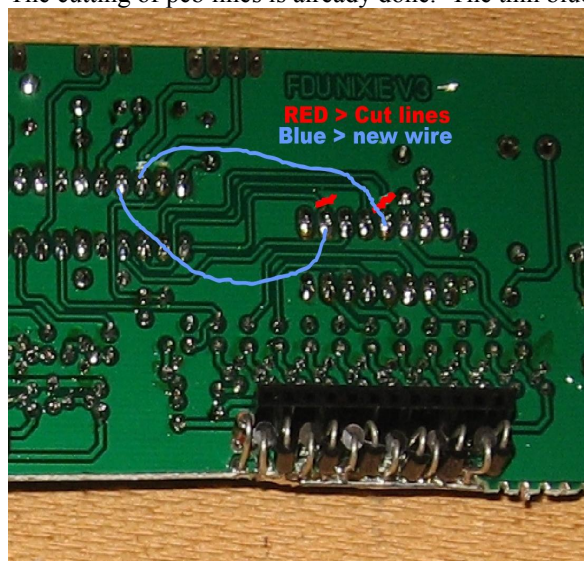
Mount C17, that's either a 1u elco (polarised so watch out for + and -) or Capacitor (105)

Also make a link like red line, this is for in future receiving dcf signal

When finished it should look like picture



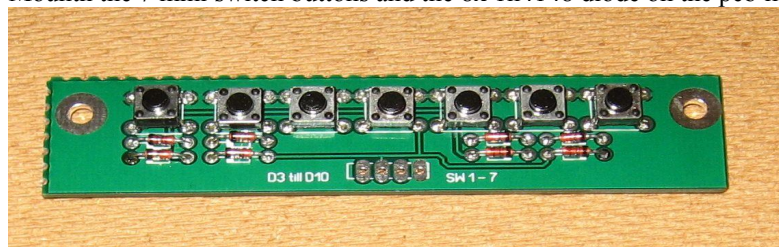
Thru small designer mistake you have to make a modification with two wire connections on the pcb. The cutting of pcb lines is already done. The thin blue wire is included in kit.



The main pcb is now finished.

## Step 20. Switch pcb.

Mounth the 7 mini switch buttons and the 8x 1n4148 diode on the pcb like picture.





## Step 21. Nixie tube pcb.

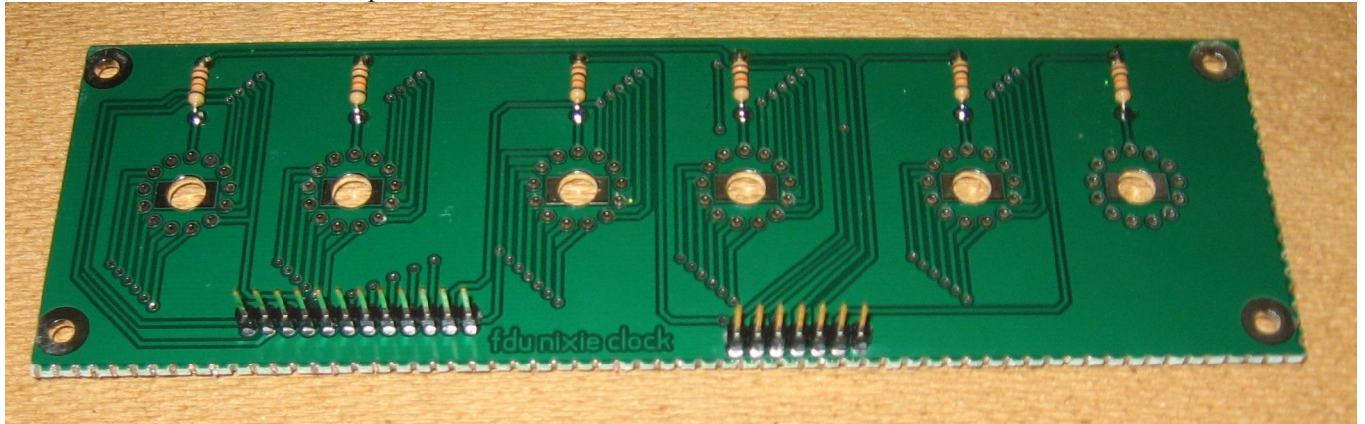
The pcb has 5mm hole under each nixie tube for mounting a led. If you going to use this option leave away the plastic socket under nixie. The pcb is fitted with solder pads for the leds.

You can take power from 12 volt connection, DO NOT take power from +5 or +9 volt !

If you do, than make sure the 7805 and/or 7809 are cooled with some (aluminium) cooler.

Mount male connectors (sil 12 and sil 7 ) and the 6 resistors 10Kohm like picture

When finished it should look like picture



## Step 22.

Mount Nixie Tubes on the site where stands “mount nixie’s this site”

On the back of tube, inside there’s one wire with a “white” sort of coating, this is the wire that should be connected to the resistor. Start mounting from this wire.



When finished mounting Nixie tubes it should look like picture.

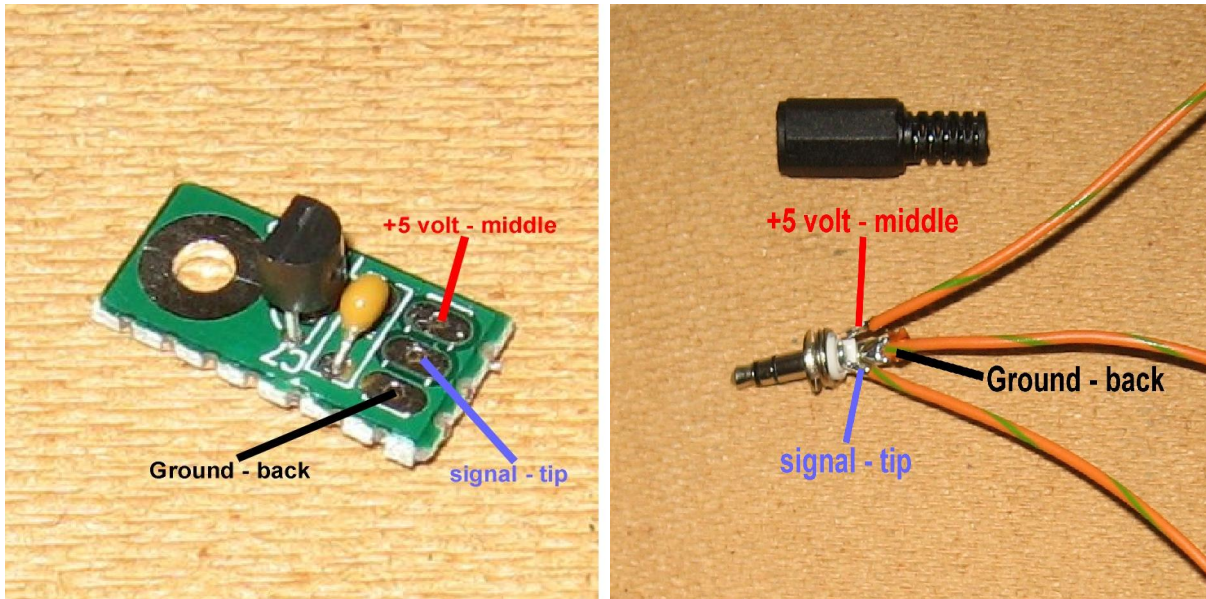


The Nixie tube pcb is now finished.



## Step 23. Temperature pcb:

Mount C7 and the TMP36 > Watch out ! The symbol on pcb is wrong, mount it 180 degrees like picture.



Make 3 wires of 15cm, or use own cable to make any length. You also can decide to use no wire and mount pcb straight on the 3.5mm plug. (you can buy 3.5mm jack-jack cable of any length, cut of one plug and connect pcb.)

Do not forget to put the plastic house over the cable before you connect the wires to pcb.

With 15cm cable result look like this:



## 4. Connecting the boards.

When it's ok all PCB's are finished and ready to hook to eachother.

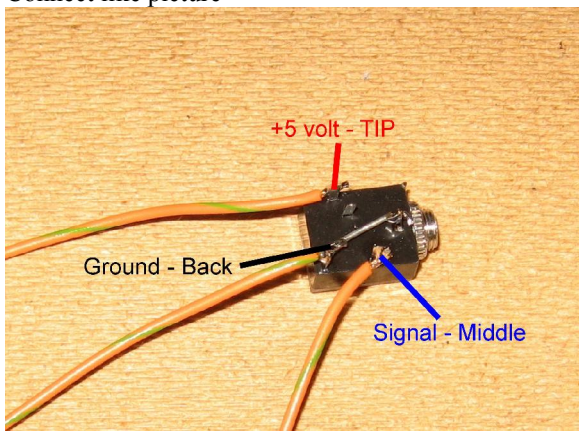
Make 7 wires of 10cm. from the last piece of wire.

### Temperature connector:

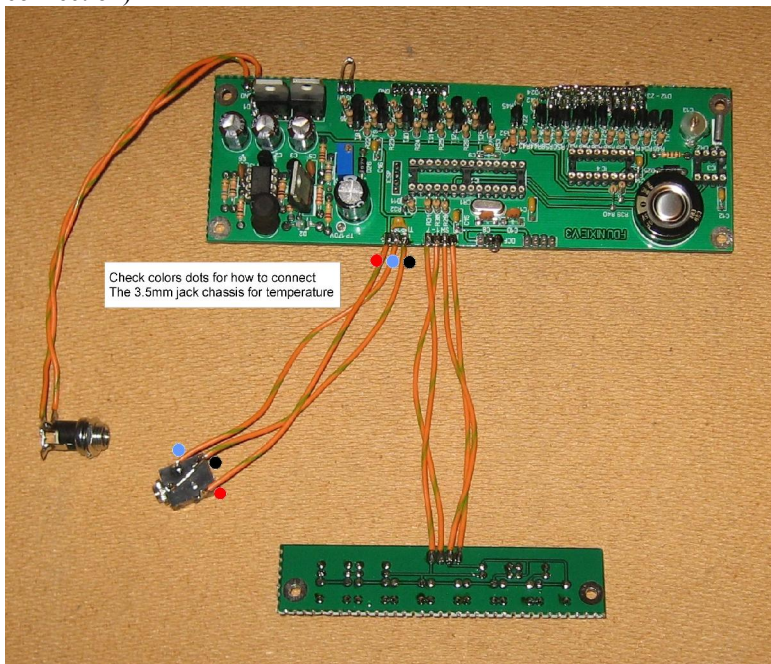
Connect the 3.5mm chassis socket like picture, use 3 wires of 10cm. (use piece of cutted wire between pins)



Connect like picture



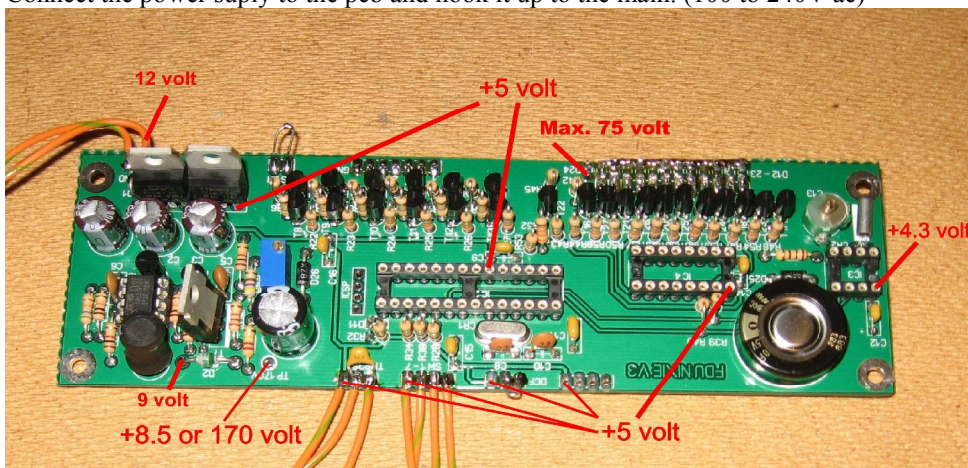
Solder the temp. Chassis and the switch pcb to the main pcb like picture. (see colored dots for 3.5mm jack for easier connection)



## 5. Final Testing.

Hook the ground (black) of your multi-meter to the ground of pcb (use one of the metal cans of VR1 or VR2 or mounting holes)

Connect the power supply to the pcb and hook it up to the main. (100 to 240V ac)



Measure the voltage on +V this should be around 12Volts dc

Measure the voltage on VR2 this should be around 5Volts dc also do this at pin20 IC2, pin16 IC4, pin8 IC3

When all powers are good, disconnect mainpower and Mount IC4(cd4028), IC2 (pic18f2550) and IC3 (pcf8563)

Connect again main and check if you have 5 volt. If not immediately disconnect and check you mount the ic in good place.

Disconnect main power.

Connect the nixie-tube pcb to the main pcb

Connect mainpower and check the +V, if this is still around 12 volts dc then cut the wire of "HS off"

When all parts are mounted good, the nixie's will glow up. If nixie's will not glow up disconnect mainpower and check parts mounted good and soldering.

Check the voltage over D20 this should be 75volts max. or lower, if not check parts mounted good and soldering.

Check again TP 170, and adjust via R1 the voltage to around 180Volts

Disconnect main power.

Connect the temperature pcb with jack plug into the jack chassis.

Connect power, if tubes do not go on, immediately disconnect power and check if you mount pcb, jack plug the right way.

If you press switch 4 (see time settings), you should be seeing temperature, if it display 51(celcius) or 17 (fahrenheit) and does not change you have short circuit to massa or connect something wrong way.

### Adjust timing of RTC

C13 (22pf green trimmer) is for adjusting the speed of time, start out by putting this in the middle.

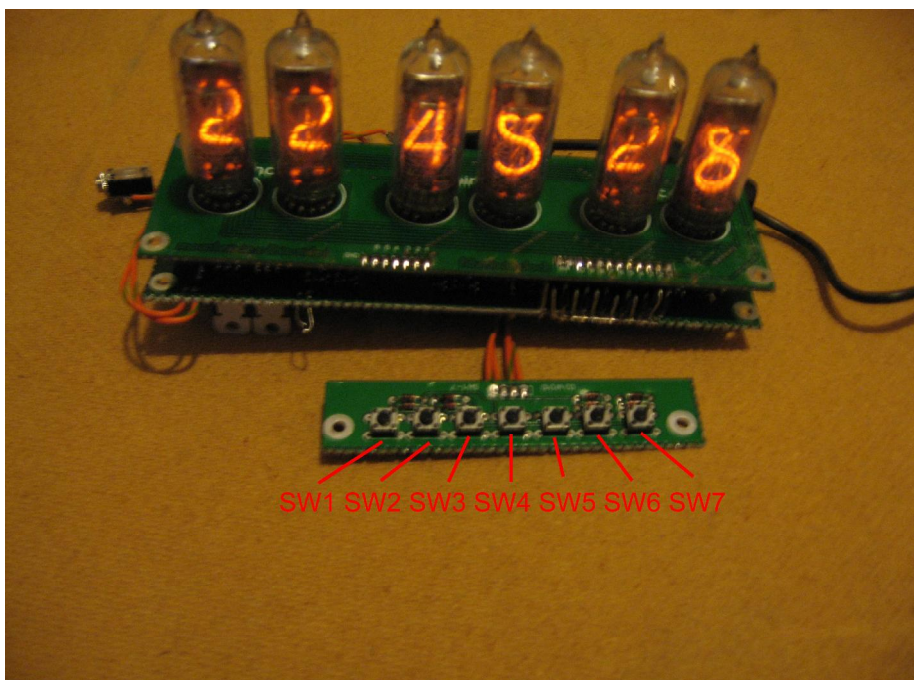
If time is going to fast, turn plates in.

If time is going to slow, turn plates out.

Can be taken a lot of time(few days) to get this right. Normal it will be 1 or 2 seconds different a month because of 10ppm fault correction. 100% good time is almost impossible because of temperature difference of parts etc.

Congratulations you now have made your own working Nixie Clock.

Put the electronics into a nice housing and watch the time flies by.....





## 6. Clock settings:

### Setting time:

Push sw1 and you will come into the time setting menu.

- 24 or 12 hour mode (12:xx:x0 or 24:xx:xx) There's a dot (right) in the tube sec. for am/pm. Pm is dot on - (24H default)
- press sw6 to change.
- press sw1 for next setting.
- NO zero, choose "x0" for no 0 at front or choose "01" for 0 at front (x1:xx:xx or 01:xx:xx) - (NO 0 default)
- press sw6 to change.
- press sw1 for next setting.
- Hour setting. (In 12H mode you have am/pm setting) – (HH:xx:x0 12Hmode) : (HH:xx:xx 24H mode)
- press sw6 to increase hour
- press sw5 to decrease hour
- press sw1 for next setting.
- Minutes setting. (xx:MM:xx)
- press sw6 to increase minutes
- press sw5 to decrease minutes
- press sw1 for going out of menu and return to clock mode. (seconds will set to zero)

### Setting date:

Push sw2 and you will come into the date setting menu.

- day/month or month/day setting (EU or US style) DD:MM:00 or MM:DD:01 – (day/month/year default)
- press sw6 to change
- press sw2 for next setting.
- Day or Month setting depends on setting EU or US style.
- press sw6 to increase day or month.
- press sw5 to decrease day or month.
- press sw2 for next setting.
- Month or Day setting depends on setting EU or US style.
- press sw6 to increase month or day.
- press sw5 to decrease month or day.
- press sw2 for next setting.
- Year setting. Only last 2 digits of year will be showed. 00 to 99 xx:xx:YY
- press sw6 to increase year.
- press sw5 to decrease year.
- press sw2 for going out of menu and return to clock mode.

Note: clock is equipped with leap year counter so every 4 years february will have 1 day extra.

### Setting switch mode menu:

In this menu you can set the timing for auto switching. (default is OFF mode)

All default settings are set to 5 seconds. If you put the autoswitch to ON and don't change the timing it will be as following:

5 seconds time

5 seconds date

5 seconds time

5 seconds temperature

and starts all over

- Press sw3 to enter the switch mode menu
- 1x:xx:00 is autoswitch OFF.
- 1x:xx:01 is autoswitch ON.
- Press sw6 to change between OFF or ON.
- If autoswitch is OFF, Press sw3 to go back to clock mode.
- If autoswitch is ON, press sw3 to go to the following settings.
- It shows 2x:xx:05 , here you can set the first “show time” . Can be 1 to 59 seconds.
- press sw6 to increase.
- press sw5 to decrease.
- Press sw3 to enter the seconde swichtime setting.
- It shows 3x:xx:05 , here you can set the “show date”. Can be 0 to 59 seconds.
- press sw6 to increase.
- press sw5 to decrease.

When set to 0, in clock mode it will NOT show the date in auto switch mode.

- Press sw3 to enter the thirth swichtime setting.
- It shows 4x:xx:05 , here you can set the second “show time” . Can be 0 to 59 seconds.
- press sw6 to increase.
- press sw5 to decrease.
- note: if you set the “show date” to 0 and this setting to higher than 0 seconds it will will add this time to the first “show time”.
- Press sw3 to enter the fourth swichtime setting.
- It shows 5x:xx:05 , here you can set the “show temperature” . Can be 0 to 59 seconds.
- press sw6 to increase.
- press sw5 to decrease.

When set to 0, in clock mode it will NOT show the temperature in auto switch mode.

- press sw3 for going out of autoswitch menu and return to clock mode.

### **Setting Temperature mode.**

- Press on sw4 to enter the temperature mode. – (Celcius default)

You can choose between degrees Celcius or Farhenheit.

- press sw6 to change.
- press on sw4 to go back to clock mode.

Note: Temp. Sensor can read in degrees celcius from -50 to +150 in a 0.5 read out. In Fahrenheit is goes from 17 to 302.  
Also in Celcius mode you will see a (left) dot appear if temperature goes below 0 degrees.

### **Show Temperature:**

In normal clock mode press on sw5 and it will show the temperature for about 3 seconds and than goes back to clock mode.  
Note: if autoswitch mode is set to “on”, this function will be dissabled.

### **Show Date:**

In normal clock mode press on sw6 and it will show the date for about 3 seconds and than goes back to clock mode.  
Note: if autoswitch mode is set to “on”, this function will be dissabled.

## **Nixie Tubes OFF / ON**

In normal clock mode press on sw7 and the nixie tubes will go out.

By pressing ( hold longer than 1 sec) on one of the buttons (sw1 till sw7), the nixie tubes will go on.

Note: when clock is in any kind of menu setting and you leave it, it will go back into clock mode after about 15 seconds.  
It will NOT store the settings if this happens.

All Settings will be stored in used microcontroller. So with power lost or disconnection it will remember the settings if powered back on.

The clock will be running for about 2 weeks without power (uses a 1 farad goldcap for back-up)

## **Info:**

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Website: [http://members.home.nl/fdu/html/nixie\\_clock.html](http://members.home.nl/fdu/html/nixie_clock.html) << link to nixie page

Mainpage: <http://members.home.nl/fdu/index.html>