

Nixie Clock Universal Kit V1.08

Assembly and Operation

Software Version 6.3

Revision 11. 11. 2012

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1 Introduction

The **Nixie Clock Kit v1.08** can be used with only the clock PCB, or different tube PCBs. At the moment we offer tube PCBs V1.08a, V1.08d, V1.08e and V1.08f.

The universal **clock PCB v1.08** contains all the clock circuitry. It is a multiplexed design which minimizes the parts count and PCB size, allowing the kit to be mounted in a wide variety of enclosures.

- **Tube PCB V1.08a** holds different front view nixie tubes like IN-14, IN-8-2, CD 66 etc.
- **Tube PCB V1.08d** is used for 6 IN-8 tubes and LED lighting (**Blue Dream**)
- **Tube PCB 1.08e** is used for 6 B5853 nixie tubes and 12 LEDs (**Little Blue Something**)
- **Tube PCB V1.08f** is used for 6 IN-8-2 tubes and LED lighting (**Blue Dream IN-8-2**)
- **Tube PCB 1.08g** is used for 6 IN-12 nixie tubes and 4 neon bulbs

The tube sets can be bought at www.nocrotec.com

The documentation of the tube pcbs is described in a separate documentation and is available for download.

This manual documents how to:

- Assemble and adjust the Clock PCB
- Connect different types of Nixie tubes to the Tube PCB
- Connect the Clock PCB and Tube PCB together
- Implement the following options:
 - DCF77 time receiver module / GPS converter
 - Neon AM/PM indicator and flashing colons
- Operate the completed clock

This manual does not cover mounting the completed kit in a specific enclosure. That is left up to you, and is part of the fun of building your own Nixie clock.

**Please take your time while building the clock – it will be worth it.
Have fun with your new Nixie clock!**

1.1 Safety and Legal Warnings

DANGER: This circuit design includes a switching-mode voltage converter which generates 180 VDC. Therefore, assembly should be attempted only by competent qualified personnel experienced in electronics assembly and high voltage safety. Safe assembly and operation of this kit is completely the reader's responsibility.

Read instructions: All the safety and operating instructions should be read carefully and completely before the clock is operated. **Heed warnings:** All warnings on the appliance and in the operating instructions should be adhered to.

Retain Instructions: The safety and operating instructions should be retained for future reference.

- If one of the tubes is broken or damaged, immediately pull the power plug out of the clock and contact the customer support.
- The tubes are made of glass and are consequently very easy to break. Because of their fragility, it is important that you keep the clock in a safe place free from the possibility of being struck inadvertently.
- No part of the clock may be swallowed or inserted into body openings.
- The power supply may not be swallowed or inserted into body openings.
- No part of the clock or the power supply may be used for other purpose other than described in this user manual.
- **Water and moisture:** The clock should be kept in a dry room free from humidity and dust. The clock should not be used near water – for example, near a bath tub, washbowl, kitchen sink, laundry tub, in a wet basement, near a swimming pool, in a sauna, etc. In addition the clock should be kept out of direct sunlight and high temperatures.
- **Object and liquid entry:** Care should be taken so that the clock does not fall into liquids or have them spilled over the clock.
- Do not use this appliance for anything other than the intended use as described in the manual.
- Immediately pull the power plug out of the clock and contact the customer support if the appliance does not appear to operate normally or exhibits a marked change in performance. In this case do not run the clock again!
- This clock is not a toy! Keep this clock out of the reach of children.
- Pay attention that this clock shall only be touched by people who have completely read and understood the user manual.

IMPORTANT: Please follow the assembly steps with extreme care. Please operate the clock only in an enclosed housing which prevents contact with the dangerous voltages present on both printed circuit boards (PCB).

DISCLAIMER: The information in this document is provided strictly 'as is'. It is hereby stated that this kit is to be assembled only by experienced electronics engineers. No troubleshooting information is provided. Readers should not attempt to build this kit and/or design unless they are competent at electronics assembly and understand the dangers of mains voltages. Further, www.nixieclocks.de takes no responsibility for any possible personal or property damage. No responsibility is accepted for any damage, injury (however serious) or death. In no event shall www.nixieclocks.de be held liable to you or any third parties for any special, punitive, incidental, indirect, consequential, or any other damages resulting from the assembly or use of this kit and/or design. The assembled unit should be properly encased to prevent contact with high voltages.

All applicable UL, CCE, VDE and local regulations must be considered. Commercial use of the kit, circuit designs, software or any parts thereof requires express written permission.

2 What You Need

2.1 Tools

- Soldering iron
- Tin-solder
- Wire cutter
- Multimeter

2.2 Parts

See Section 7.1.3 (Appendix) on page 20 for suggested suppliers.

Required:

- **Nixie tubes**
- **Wall wart power supply**, 9V AC or DC, 300-500 mA
If you want to derive the clock timing from the 50Hz/60Hz mains frequency, you must use an AC wall wart. If you use a DCF77 module or any 1pps input for clock timing, you can use an AC or DC wall wart.

Optional:

- **DCF77 module.**
- **LDR** See Section 7.1 (Appendix) on page 20 for details.
- **GPS to DCF Decoder**

Any tools and parts needed for mounting the kit in a specific enclosure are not listed here.

3.1 Clock PCB V1.08

Part	Part Number	Installed
Capacitors		
Capacitor 1000uF/16-25V	C3	<input type="checkbox"/>
Capacitor 4,7 uF /250V LoESR	C4	<input type="checkbox"/>
Tantal Capacitor 1uF-10uF /16-63V	C10	<input type="checkbox"/>
Capacitor 2,2 nF (222)	C14	<input type="checkbox"/>
Capacitor 47 pF	C13	<input type="checkbox"/>
Capacitor 22 nF (223)	C5, C7, C9, C12	<input type="checkbox"/>
Capacitor 22pF	C30, C31	<input type="checkbox"/>
Resistors		
Resistor 100 KΩ	R1, R3, R5	<input type="checkbox"/>
Resistor 470 Ω	R23, R30, R31, R32	<input type="checkbox"/>
Resistor 1 KΩ	R16, R17, R19 , R27	<input type="checkbox"/>
Resistor 470 KΩ	R2, R4, R6	<input type="checkbox"/>
Resistor 220 KΩ	R7	<input type="checkbox"/>
Resistor 10 KΩ * please see 3.2	R18, R26 - please see 3.2	<input type="checkbox"/>
Resistor 33 KΩ	R14, R20, R21, R22, R25 , R33	<input type="checkbox"/>
Trimmer 1 KΩ	R24	<input type="checkbox"/>
Sockets		
16 pin socket for 74141 driver	Socket for IC3 and IC4	<input type="checkbox"/>
28 pin socket for PIC	Socket for IC1	<input type="checkbox"/>
Diodes		
Diode 1N 4001	D1, D2, D3, D4	<input type="checkbox"/>
Diode BYV95C or UF4004	D5	<input type="checkbox"/>
LED dual color	D30	<input type="checkbox"/>
LED red	D31	<input type="checkbox"/>
Diode Zener ZF 5,6	D9	<input type="checkbox"/>
Transistors		
Transistor MPSA 92	Q1, Q2, Q3	<input type="checkbox"/>
Transistor MPSA 42	Q4, Q5, Q6, Q8	<input type="checkbox"/>
Transistor FET IRF 730	Q7	<input type="checkbox"/>
Integrated circuits		
Voltage regulator μA 7805 or cool nixie converter (see description)	IC2	<input type="checkbox"/>
PIC processor 16F876	IC1	<input type="checkbox"/>
Driver IC 74141 (KM 15588..)	IC3, IC4	<input type="checkbox"/>
Timing circuit NE 555 DIP	IC5	<input type="checkbox"/>
Other parts		
Xtal 4 MHz - small version	X1	<input type="checkbox"/>
Coil 100μH	L1	<input type="checkbox"/>
Switch to set the clock (see description)	S1, S2	<input type="checkbox"/>
HEBW - 21 Pin diameter 2,1mm (see description)	Power Supply socket	<input type="checkbox"/>
Shrinking tube for C3		<input type="checkbox"/>
Adhesive pads for IRF730 and Cool nixie converter		<input type="checkbox"/>
Pin connector 3 pins	J3	<input type="checkbox"/>
Pin connector 20 pins	J4	<input type="checkbox"/>
Screws M3x5	H1 - H3	<input type="checkbox"/>
Distance holders 12 mm	H1 - H3	<input type="checkbox"/>
Distance holders 5 mm	H1 - H3	<input type="checkbox"/>
Micro solder socket for pin connector 3 pins	J3	<input type="checkbox"/>
Micro solder socket for pin connector 20 pins	J4, J5	<input type="checkbox"/>
PCB version 1.08	Clock Circuit board	<input type="checkbox"/>

3.2 Tube PCB V1.08a, V1.08d, V1.08e and V1.08f – resistor values

The value of the anode resistors on the tube PCB depends on the type of tubes used. 10k resistors work fine with almost all tubes. This is why they are always included in the every kit. The tube PCBs will be delivered with the correct resistors values. So it can be that you have 6 resistors (10K) that you will not use.

4 Assembling the Clock PCB

4.1 Solder the Components

IMPORTANT: Solder all the parts according to the partlist and the print on the PCB - **but do not solder the following parts now:** C3, C4, C10, C11 (is not used), C13, C14, IC2, J3, J4, Q7, R19, R25, R26, X1, D30, D31. **The parts R19, R25, R26 and C13 are mounted from the solder side of the PCB!!** All parts are **bold printed** in the partlist!

4.1.1 Diodes and Coil

Solder the diodes D1, D2, D3, D4, D5 und D9 and the Coil L1. All diodes are directional, and have a band marking on one end. Match the band on each diode with the band on the PCB. The coil can be soldered in either direction.



4.1.2 IC Sockets and IC5

Solder the 3 sockets for the ICs. Be very careful to mount the sockets in the correct orientation. There is a notch on one end of each socket, and the PCB is printed with matching notches. No socket is provided for IC5 (555). It is more effective without a socket, and should be soldered directly to the PCB. It has a notch on one end, or a dot which marks pin 1. The end with the pin 1 dot goes on the same side as the notch printed on the PCB, near the coil.

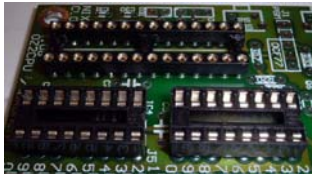


Figure 1 - The IC Sockets

4.1.3 Transistors

Solder the transistors Q1, Q2, Q3, Q4, Q5, Q6 and Q8. Watch out for the orientation on the PCB, and match the flat side of each transistor with the flat side printed on the PCB.



Figure 2 - Proper transistor mounting

4.1.4 Resistors

See Section 7.1.1 (Appendix) for help identifying each resistor. The resistors should be mounted standing up.

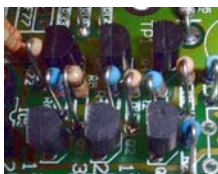


Figure 3 – Detail view of some resistors

4.1.5 Trimmer Resistor R24

Solder the trimmer resistor and adjust it to mid position. The trimmer will be used later on to adjust the tube voltage to 170V-180V DC.

Attention: Make sure that the metal part of the IRF 730 does not touch the trimmer.

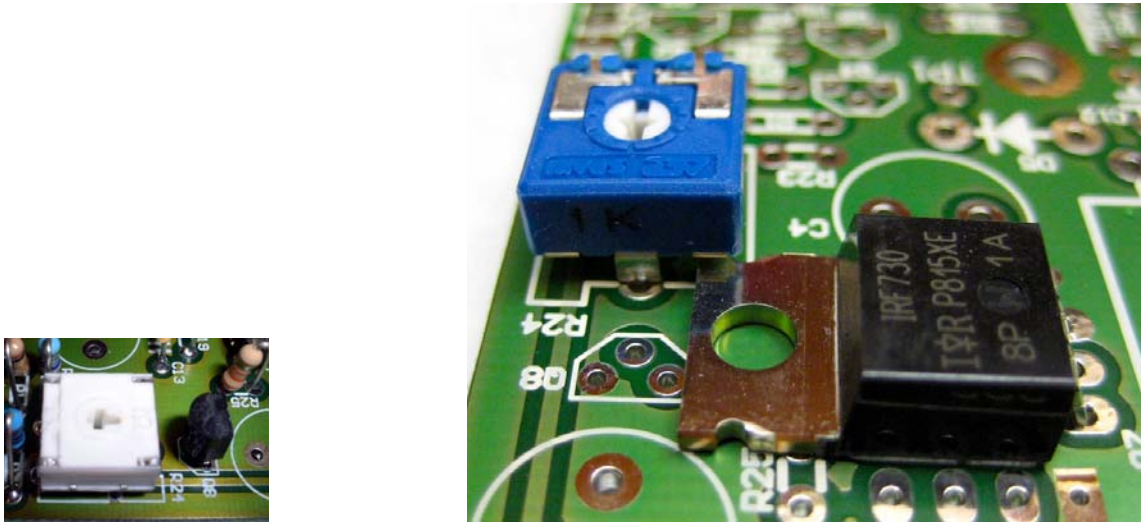


Figure 4 - Trimmer Resistor R24 and blue trimmer

4.1.6 Small Capacitors

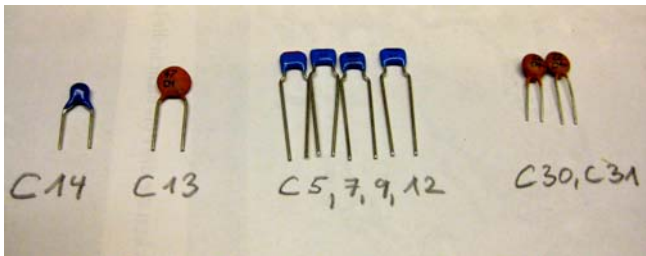


Figure 5 - capacitors

TIP: These capacitors are not polarized and can be mounted either way, but for easier identification after the kit is completed, mount them with the markings visible whenever possible.

4.1.7 Switches

Solder the switches firmly against the PCB. If you plan to mount these (or other) switches elsewhere in your housing, you can connect them to the PCB with wires soldered into the holes meant for the switches.

If you use our black brilliance case, do not solder the switches now!



Figure 6 - Switches for setting the time, dimming and other functions

4.1.8 LEDs

If you use the 'black brilliance' case do not solder the LEDs to the board. You will not be able to see them. If you want to use them, wire them, drill 2 holes to the back of the case, where the LEDs can be fixed.

When the clock is in DCF77 mode (See Section 6), the LED's indicate DCF77 signal quality and status. Otherwise, they function as AM/PM indicator and blinking colons. **If you will not use a DCF77 module (i.e. you are outside Europe) and you also do not want colons or an AM/PM indicator on your clock, they you do not need to install the LEDs at all.**

The LEDs are polarized and must be mounted in the correct orientation. This is especially important with the dual-color LED D30. If it is mounted backwards, the DCF77 signal indicator will show the wrong color, confusing the user. See Figure 7 and Figure 8 for correct mounting.



Figure 7 - LED D31
DCF77 status
or AM/PM

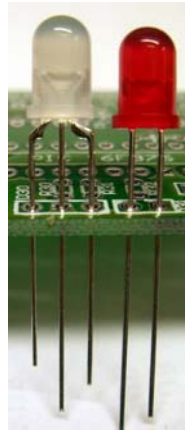
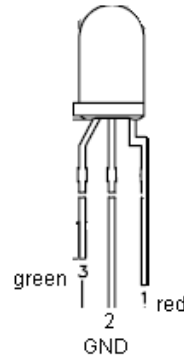


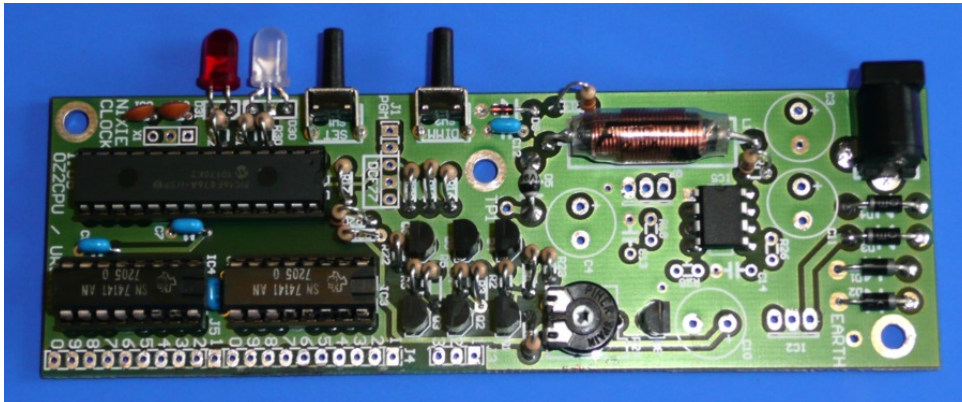
Figure 8 - Dual Color LED D30
DCF77 signal quality
or blinking colons and status LED



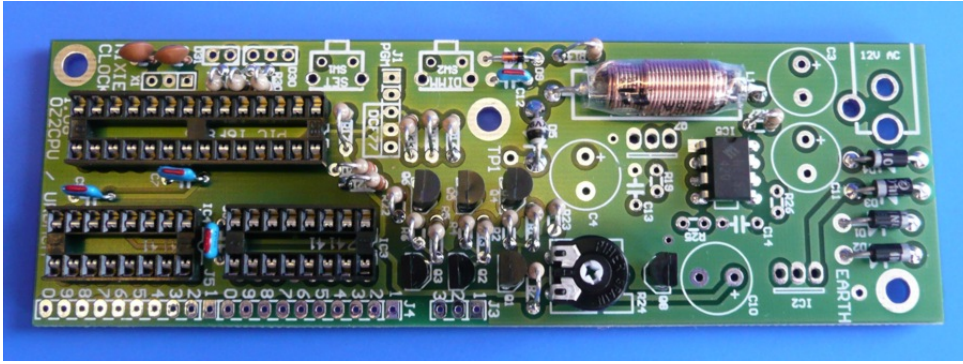
For DCF77 mode, be careful to mount the LEDs at the correct height from the PCB to be visible in the enclosure you plan to use.

For an AM/PM indicator and blinking colons, use wires to attach your enclosure-mounted LEDs to the PCB holes for D30 and D31. For the colons, use regular 2-wire LEDs (not the dual color LED supplied) and wire them to two of the three D30 PCB holes – connect to one side for a 1Hz blink rate, or the other side for a .5Hz blink rate. If you would like to use Neon bulbs instead of LEDs.

Having soldered all the parts (but not C3, C4, C10, C11, C13, C14, IC2, J1, J3, J4, Q7, R19, R25, R26, X1, D30, D31) Your PCB should look like this:



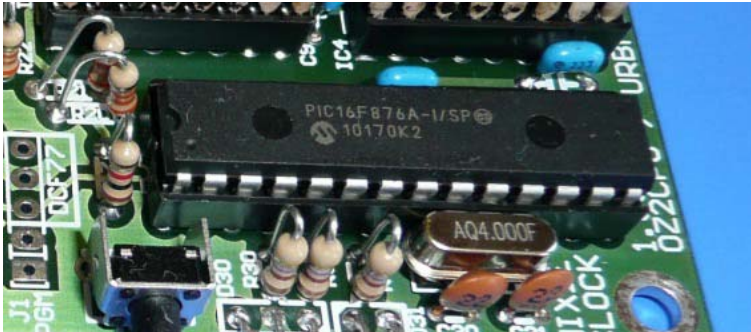
If you use the **Black Brilliance Case**, do not solder SW1, SW2 and the power supply socket your PCB should look like this:



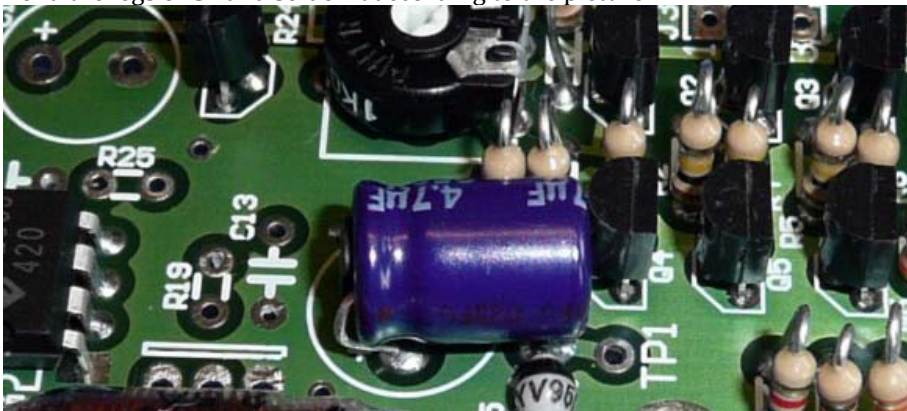
If you use the 'Black Brilliance Case' solder S1 and S2. The switches come together with the case kit.



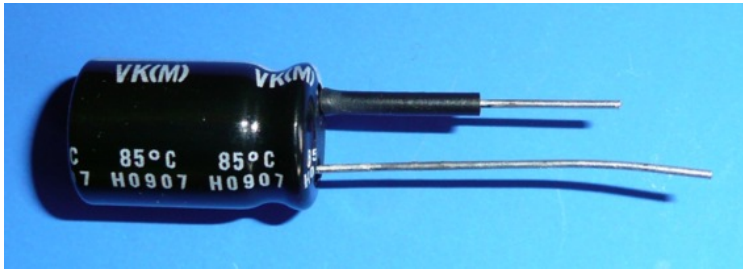
Solder the Xtal and make sure that it does not touch the PCB. It should be away 1mm from the PCB!



Bend the legs of C4 and solder it according to the picture.



Shrink the 11 mm shrinking tube over the minus leg of C3:



Bend the legs of C3 and solder it as shown in the following pictures. Even if no power supply socket is soldered in, C3 must be soldered like this:

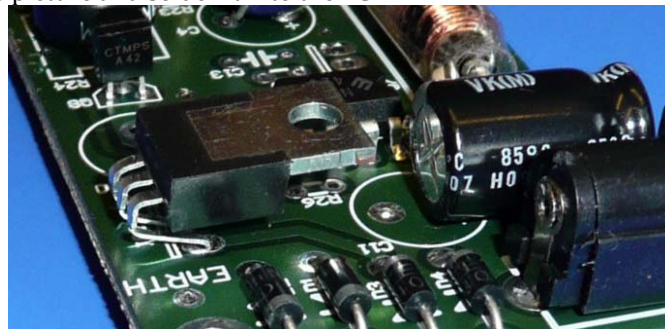
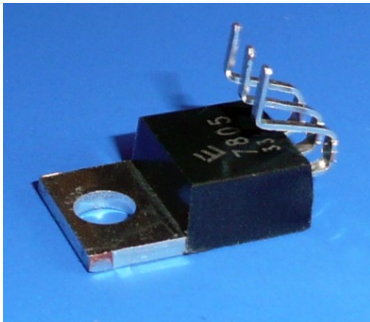


4.1.9 Solder the regulator 7805

If you use the Cool nixie converter module, skip this passage.

We highly recommend the cool nixie converter whenever you use LEDs, GPS or DCF with your clock kit or if you use a housing such as the 'black brilliance' case!!

Bend the regulator as shown in the picture and solder it into the PCB:



4.1.10 Cool Nixie Converter-Module

Carefully bend the legs of the Cool Nixie Converter-Module straight:



Before:

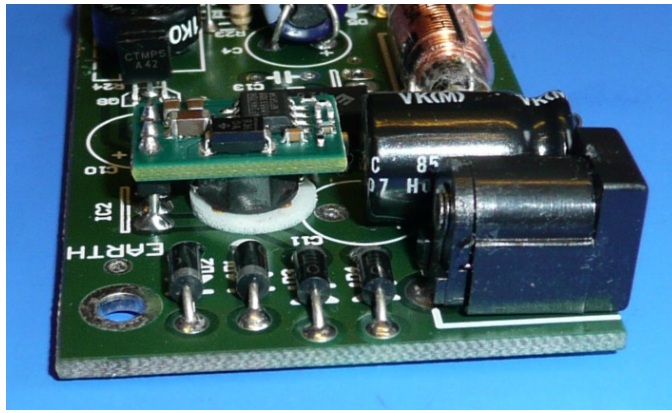
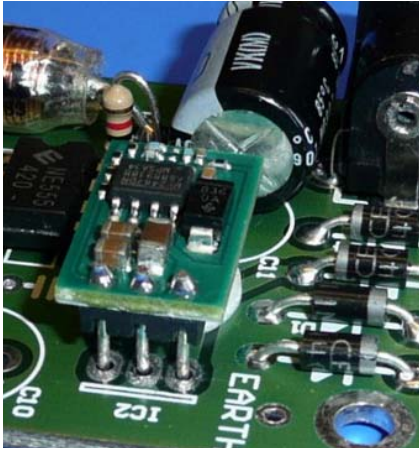


After:

Stick the round adhesive pad to the Cool Nixie Converter-Module:



Stick the Cool Nixie Converter-Module to the PCB as shown here and solder it **from the top**:

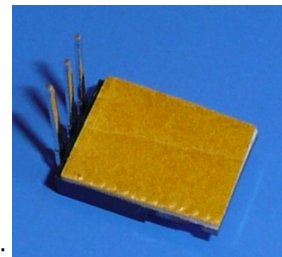
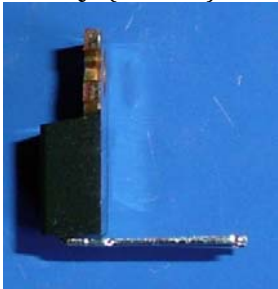


4.1.11 Solder the rest of the parts

Solder C14 („222“) as shown:

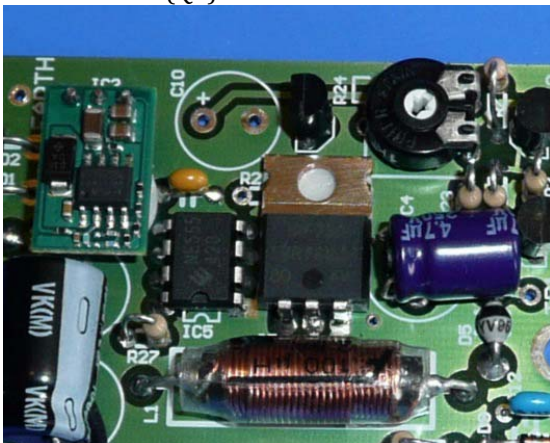


Bend Q7 (IRF 730) as shown:

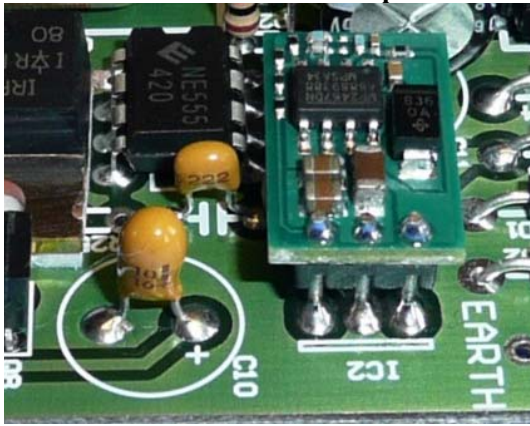


Stick the adhesive pad 10x15 mm to Q7:

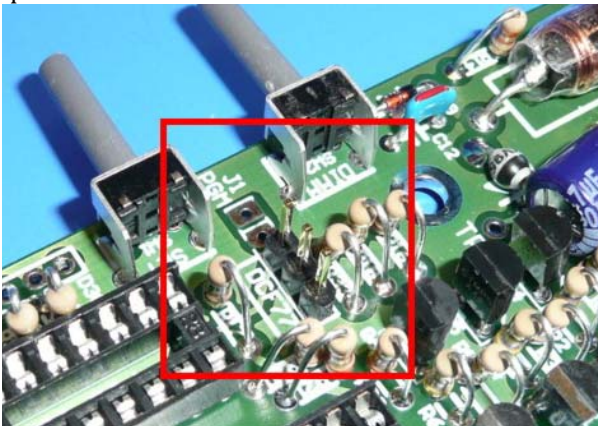
Place IRF 730 (Q7) to the PCB as shown and solder it:



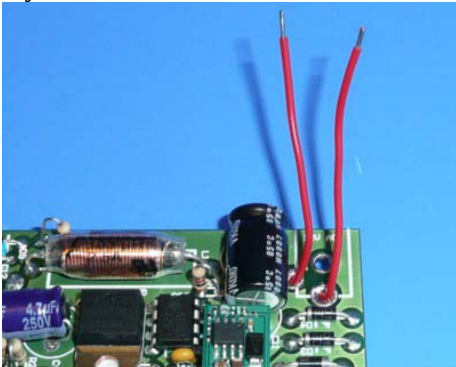
Solder C10: Make sure that the plus connector points to the right as shown in the picture!



If you use a DCF receiver or the GPS to DCF converter solder a 3 pin connector (not included) as shown in the picture:



If you use the “Black Brilliance” Case solder 2 red wires (50mm) to the power supply pins on the PCB:

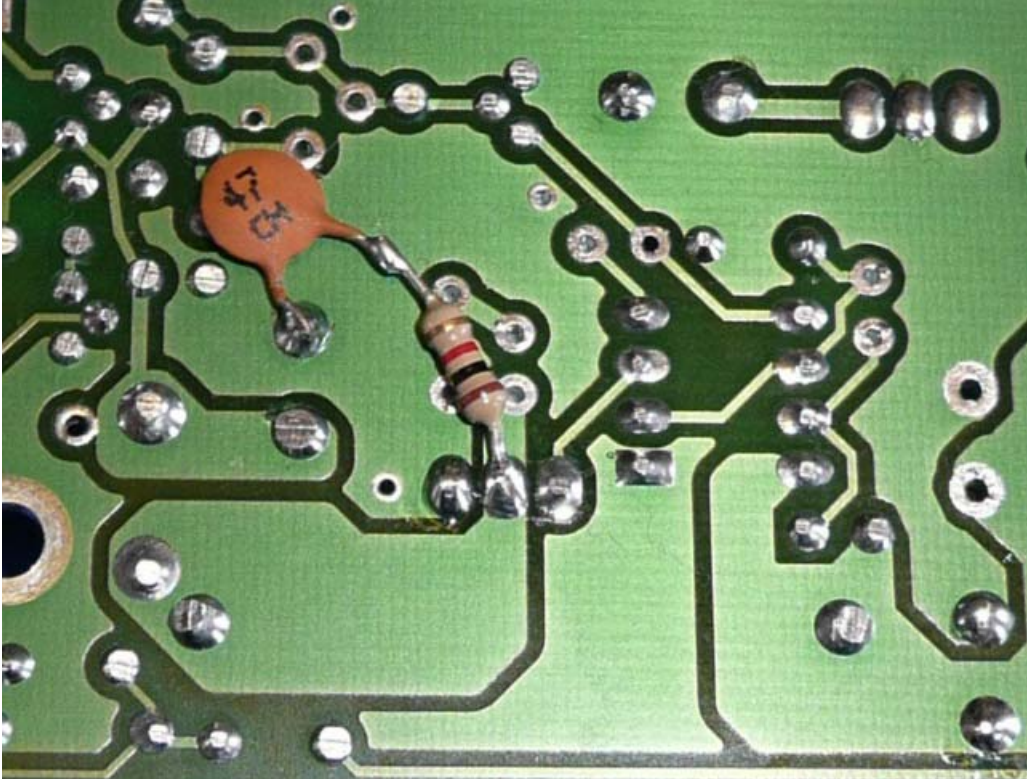


Cut all wires on the PCB short to about 0,8mm – 1mm. Use a good quality pliers for this!

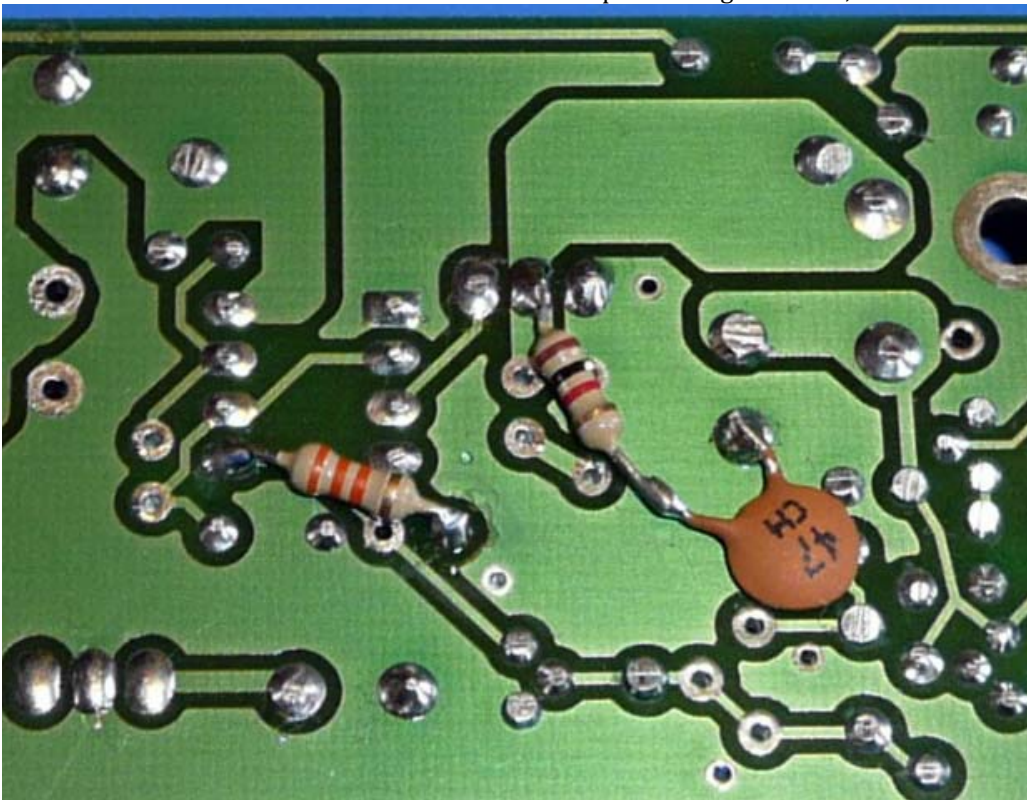


The following parts are mounted from the solder side of the PCB!! Be very careful when soldering them.

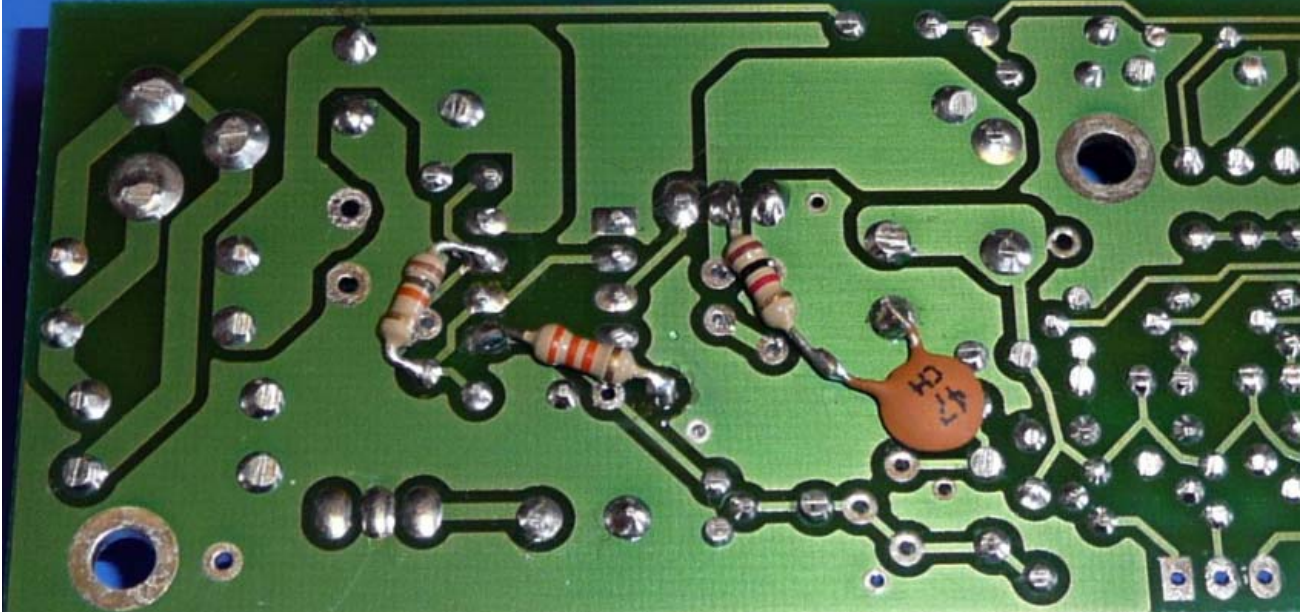
Solder R19 and C13 flat to the PCB as shown. R19 and C13 are connected. **Do not stick the wires through the holes**, but flat to the solder pads as shown:



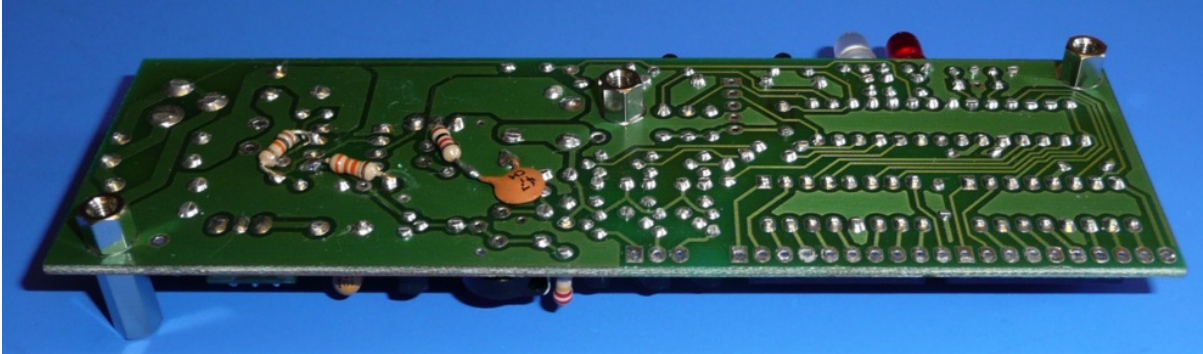
Solder R25 flat to the PCB as shown. Do not stick the pins through the hole, but solder them flat to the solder pads:



Solder R26 flat to the PCB as shown. Do not stick the pins through the hole, but solder them flat to the solder pads:

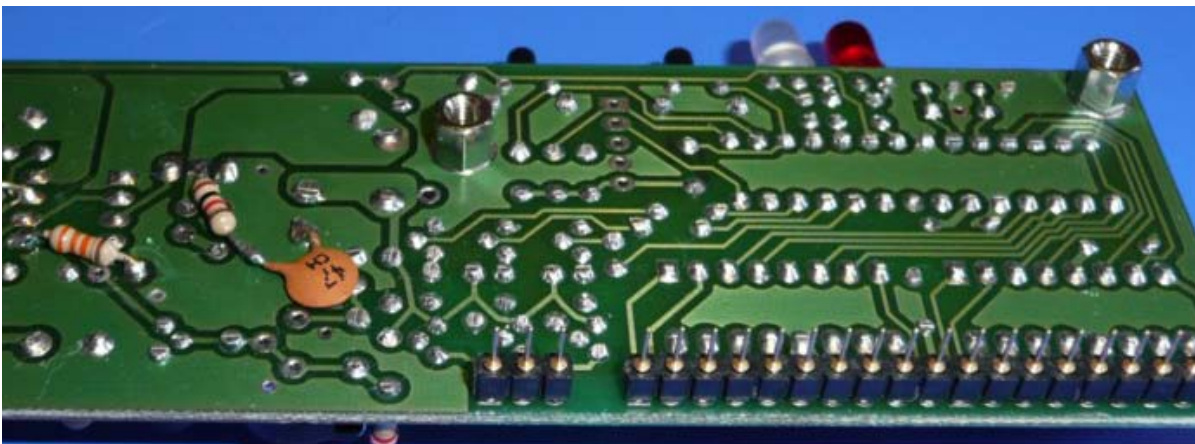


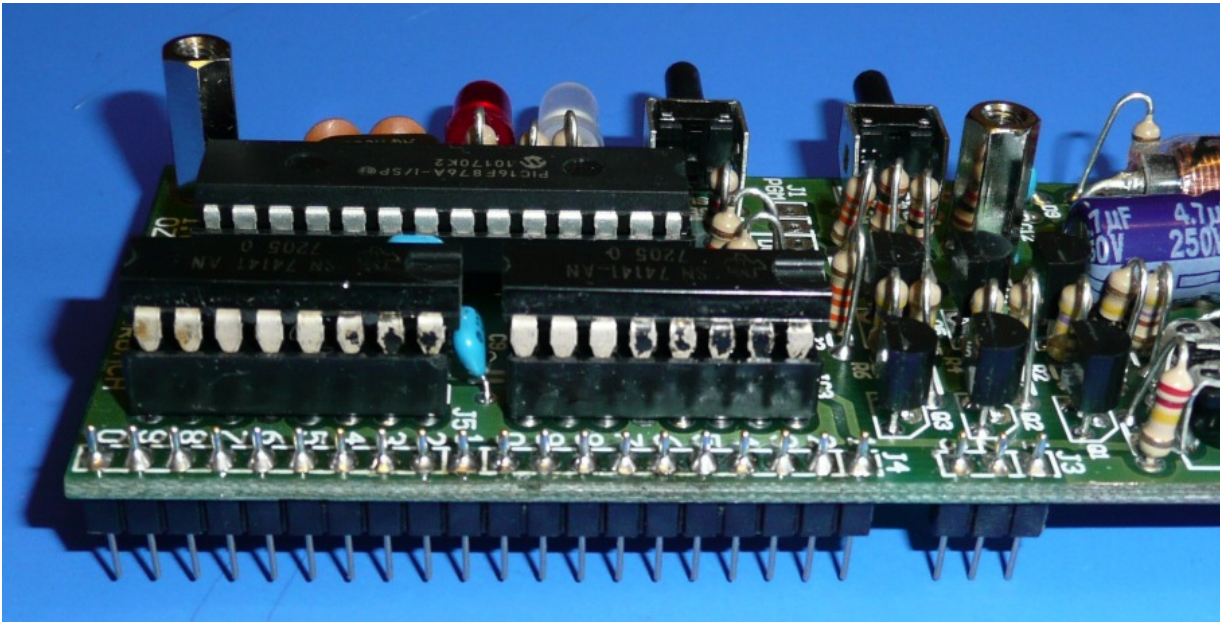
Screw the 5mm distance holders through the top of the PCB and connect them with the 12 mm distance holders:



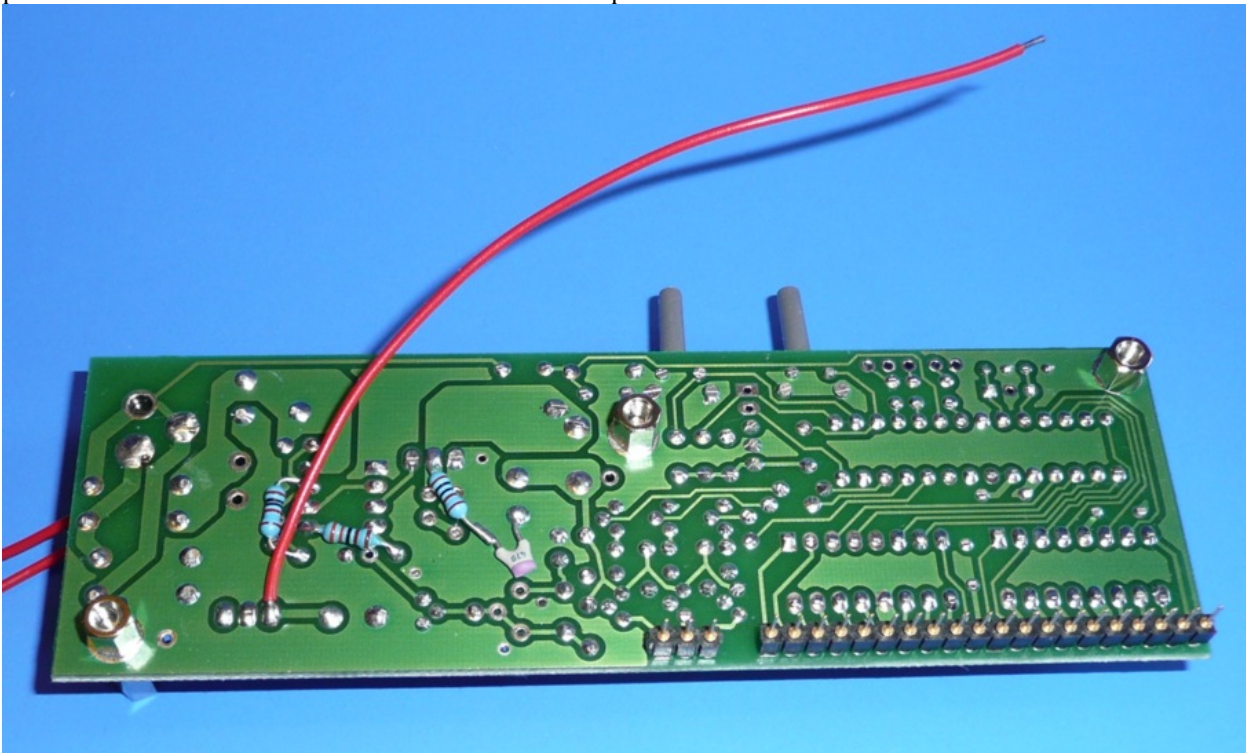
Insert the pin rows to the PCB from the top, angle them correctly and solder them from the bottom

Attention: The thin ends face upwards!!





If you use the LED Switch Option in the “Black Brilliance” Case, solder a 150 mm long red wire as shown in the picture below. You can switch off the LEDs with this option



Please check your work carefully!!

4.2 Assembling the tube PCBs

4.2.1 Tube PCB V1.08a

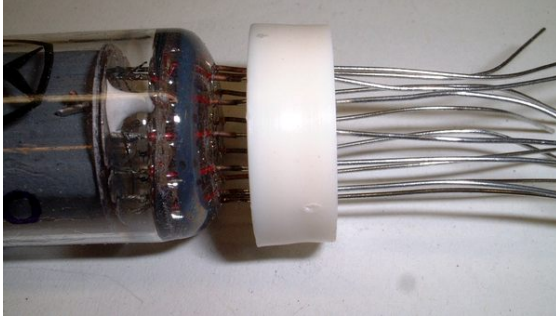


Figure 9 - IN-14 tubes come with long wires

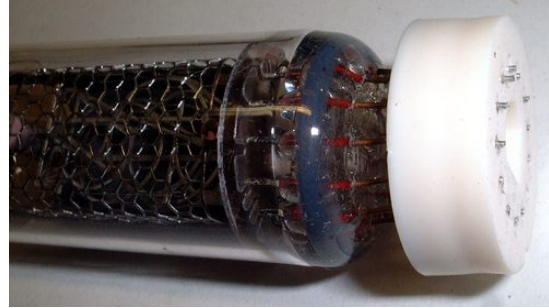


Figure 10 - Cut the wires short to facilitate placement on the PCB

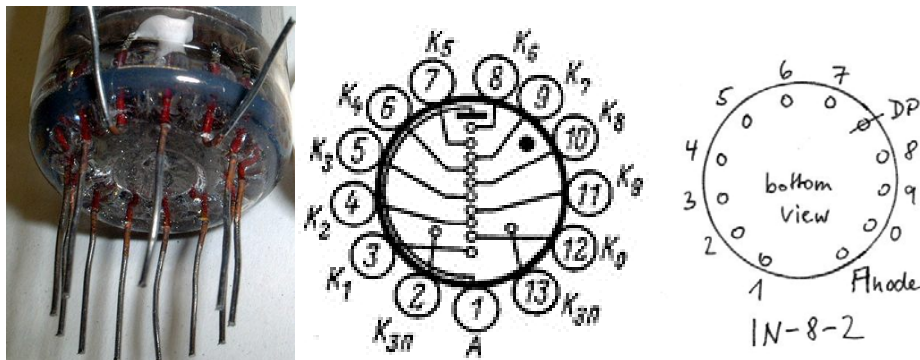


Figure 11 - Bottom view of IN-14 and IN-8-2

Bend the wires of the IN-14 left and right to the anode and cut them. Cut DP on IN-8-2 tube.

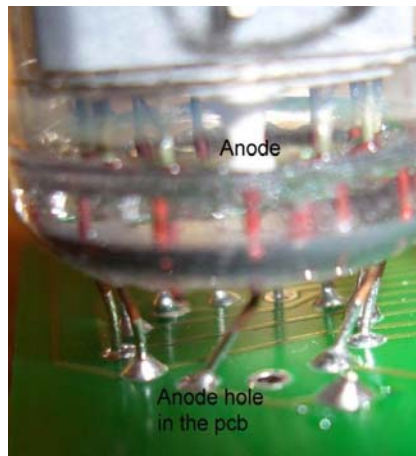


Figure 12 - Place the anode in the anode hole in the PCB.



Figure 13 - Bottom view of the tube PCB

Do not solder the tubes too close to the PCB. Be careful to leave enough lead length to permit bending the leads, if it's necessary to straighten the tubes, and to allow the tubes to protrude enough to be fully visible in whatever enclosure you choose.

If you use other tubes via a cable connection, connect the cathodes according to the tube's pin layout. In this manner, it is possible to mount virtually all Nixie tubes to this clock board.

The description of the DCF module will be found in a separate documentation.

6 Software Operation

6.1 Clock Features - version 6.3

NEW: Slot machine effect for cathode poisoning prevention.

We have implemented a **12/24 hr mode, a date format setting from EU date format to US date format, a tube saving routine, a “tubes off level”** in the clock’s software.

The DCF77 mode is showing DATE and MONTH and YEAR, if in 6 digit mode. If in 4 digit mode the DATE and MONTH are shown, not the year. Every minute when the seconds go from 50 to 55, the date is shown. If no valid DCF77 string has been received after a 23:59 to 00:00 change, the date will not be shown, until new valid string has been received.

In the two digits modes, no date will be shown no matter what, sorry. But DCF77 mode is still useful /possible to set the clock.

If you don’t want the date to be shown in DCF77 mode, please connect a short circuit in the DCF/programming connector J1 from pin 2 and 4 - that is RB7 from PIC - to ground.

6.2 Power Up Sequence

❶ At power up the software version “63 -- --” flashes on the HOURS tubes 20 times. The other tubes remain blank. During this time, the clock is looking for a DCF77 signal pulse. This delay has been implemented because DCF77 modules typically take 8-10 seconds to wake up. If there is no DCF77 module attached, this delay can be skipped by pressing the SET button.

❷ The clock performs a display test by flashing a sequence of digits on all the tubes for about one second.

DCF77 Module not detected:

❸ The clock measures the mains frequency for 1 second, then displays it on the MINUTES tubes, along with the software version on the HOURS tubes (such as “63 50 --”). The mains frequency changes slightly throughout the day (slower during the day, faster at night), but always averages exactly 50 or 60 Hz long-term. Therefore the measured frequency is typically 49/50/51 Hz or 59/60/61 Hz. However, as long as the frequency is within +/- 5 Hz of 50 or 60 Hz, the clock will go into either 50 or 60 Hz mode and it will be very accurate over a long period of time. If the clock detects a 1 Hz signal instead, such as from a GPS module, it will go into 1 Hz mode.

❹ The clock enters normal mode and begins counting the time, starting at “12 34 56”

DCF77 Module detected:

❺ The blinking ‘63’ in the start up shows the version. It will take up to 20 blinks while searching for a DCF77 input. If a DCF input signal is found, the blink sequence is dropped and DCF77 mode is entered directly without further delays! If no DCF module is found, the 20 pulses are shown, so that even slow DCF77 receiver units can be used also.

If still no DCF module found after all 20 pulses, the input frequency counter is started and the result is shown in the minutes’ field. The clock enters normal mode and displays the received time. This might look like 00:00:00. It continues receiving the DCF77 signal and updating the display.

-- or --

❻ If the DCF77 signal is of poor quality, all the tubes are turned off after 3 minutes and the clock continues looking for a good DCF77 signal. As soon as it receives a good signal, the tubes are turned on and the received time is displayed. If the tubes remain off for a long time, you can manually set the time as described in section 7.3 below. The clock will continue looking for a good DCF77 signal and as soon as it receives one it will replace the manually set time with the exact time as received from DCF77. See Section 6.6 for information on the DCF77 status LED

indicators.

6.3 Manual Time Setting

From normal mode:

❶ **Press the SET button to enter HOURS set mode.**

While in set mode, the SECONDS are reset to 00 and are blanked. The HOURS light up bright, since they are being set, and the MINUTES are dimmed.

❷ **Press the UP/DIM button repeatedly until the correct HOURS are shown.**

TIP: To switch between 12 hour and 24 hour mode while setting the HOURS, press and hold the UP/DIM button for 3 seconds until all the digits blink momentarily.

❸ **Press the SET button again to switch to MINUTES set mode.**

Now the HOURS are dimmed, and the MINUTES are bright.

❹ **Press the UP/DIM button repeatedly until the correct MINUTES are shown.**

❺ **Press the SET button again to exit set mode.**

The SECONDS re-appear and begin incrementing from 00.

6.4 Manual Brightness Control

While in normal mode, press the UP/DIM button repeatedly to rotate through the 4 brightness levels. The OFF Level switches the tubes off but the clock still works. Maximum brightness is the default level at power-up. Note that the eye-catching fade effect during digit transitions is only on the highest brightness level. In the 3 lower brightness levels, the digits change instantly. Remember that manual brightness setting is deactivated if the LDR feature has been installed (see Section 7.1).

6.5 12/24 Hour Mode Selection / date format setting

To switch between 12 hour and 24 hour mode, while in regular mode, press and hold the UP/DIM button for 2-3 seconds until all the digits blink twice quickly. If there is no 12/14 hour indicator LED installed, there may not be any immediate change in the displayed time. The clock will remember the 12/24 hour mode setting even if the clock is turned off.

To select the date format you can choose between EU standard **DD:MM:YY** and US standard **MM:DD:YY**. Press the DIMM button for 6 seconds and the date format has been changed to US standard (MM:DD:YY) or vice versa. The tubes will blink twice slowly if the change has been made. To go back to the previous date setting just repeat the procedure above. The clock will remember the date format setting even if the clock is turned off.

6.6 DCF77 Indicator LEDs

During normal operation:

- If the dual color LED is blinking green, your clock is receiving a good DCF77 signal and is super accurate. Due to the DUO LED, it has never been so easy and fun to receive correct DCF77 signals.
- The dual color LED is a signal quality meter, indicating how close the DCF77 pulses are to the correct pulse width. It is very fast reacting and updates every second. A correct pulse width is 100ms or 200ms. The LED blinks green if the pulses are within +/-10ms of the correct pulse, orange if the pulses are within +/-20ms, and red if the pulses are within +/- 30ms. If the pulses are more than 40ms away from correct time, the signal will be marked as bad. That means it is actually possible (in theory) to set the clock to the correct time if only red blinks.

6.7 Tube saving mode – switch off the tubes to increase their lifetime

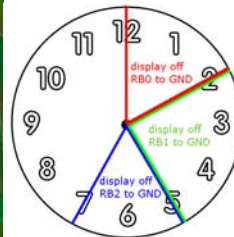
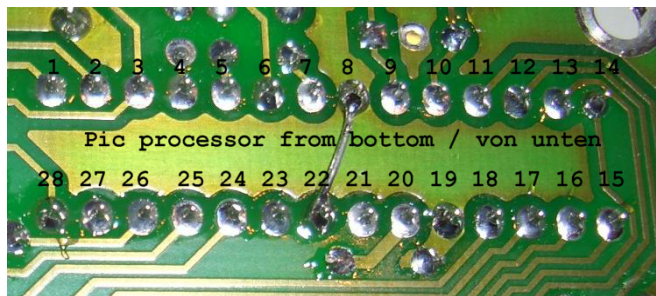
The current software version can switch off the tubes at a selected time to increase their lifetime and save power. You can decide what time you want to switch the tubes off by connecting different pins from the pic processor to GND.

Here is an overview of the possible switch-off times:

- | | |
|----------------------------------|--|
| 1. no pins connected | - default mode – tubes on all time |
| 2. tubes off from 00:00 to 01:59 | - Pin 21 (RB0) of pic processor to GND (Pin 8) |
| 3. tubes off from 02:00 to 04:59 | - Pin 22 (RB1) of pic processor to GND (Pin 8) |
| 4. tubes off from 05:00 to 06:59 | - Pin 23 (RB2) of pic processor to GND (Pin 8) |

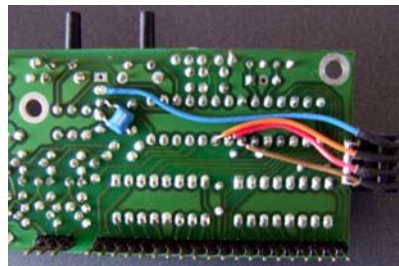
Example 1: If you want to switch off the tubes from 00:00 to 06:59 then connect pin 21 and pin 22 and pin 23 to GND (pin 8 of the pic processor). **Example 2:** If you want to switch off the tubes from 02:00 to 06:59 then connect Pin 22 and Pin 23 to GND and you are done. In the following picture the tubes are switched off from 02:00 to 04:59 (see wire from Pin 8 (GND) to Pin 22 (RB1)). You can also use switches so it can be changed if you wish. The maximum switch off time goes from 00:00 to 06:59.

The tube save mode works in all display modes (2 tubes / 4 tubes / 6 tubes), in DCF77 mode and in 12 / 24 hr mode! The picture shows the PCB from the bottom with the pic processor in the centre.



This is the off-times only at night.

Here is an easy way to make the setting variable. Just use a DIP switch. Solder 4 pins to the PCB to give the total construction more strength. Of course you have to remove some green paint to get to the copper, otherwise the solder will not hold.



6.8 Setting the Number of Installed Tubes

The clock software can drive 2, 4 or 6 digit clocks. **To change tube operating mode:** Press and hold the SET button, then power up the clock. Continue pressing the SET button, and press the UP/DIM button repeatedly to cycle through the 5 display modes. When you have selected the correct mode, release the SET button and this mode will be saved until you choose a different one. The 5 different tubes modes are as follows:

- Mode 1: is six tubes 2x3 multiplexed mode normal Nixie tubes (default mode)
- Mode 2: is four tubes 2x2 multiplexed mode using normal Nixie tubes
- Mode 3: is four tubes using dual anode tubes 1x4 multiplexed mode
- Mode 4: is two tube non multiplexed mode using normal Nixie tubes

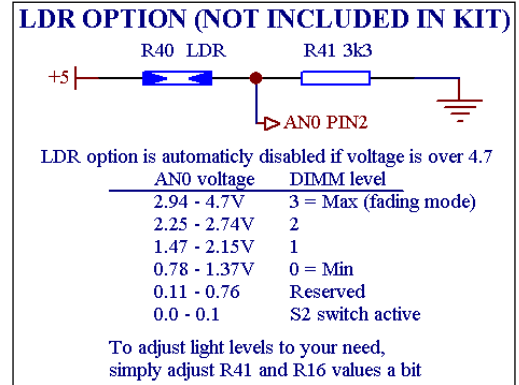
- Mode 5: for two B7971 or ZM1350 special alphanumeric tubes multiplex 1x32

When the correct mode is chosen, the tubes will show “12” or “12 34” or “12 34 56” depending on how many tubes you have used in your clock.

7 Appendix

7.1 Auto-Dimming LDR Option

The clock can auto-dim the tubes in relation to the light in the room, using an LDR and a resistor. This is an optional feature, and the necessary parts are not included in the kit. The life time of a Nixie tube is determined by its light output multiplied by the hours it is lit. Since this kit uses a multiplexed design, Nixie tube brightness is in general lower compared to non-multiplexed Nixie clocks, therefore the lifetime is in general 2-3 times longer in this kit. By adding the auto-dimming feature, this can be made 10-15 times longer. If the LDR feature is in use, the push button dim function is disabled.



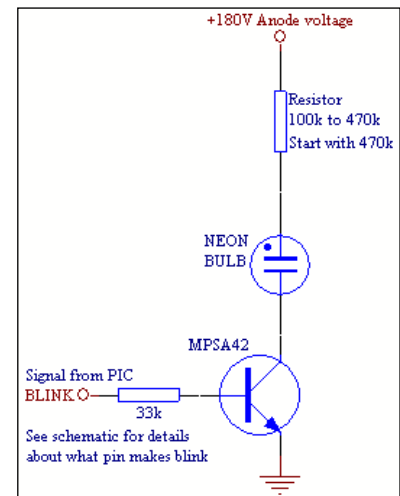
7.1.1 Neon indicator bulbs

As explained in Section 4.1.8, the two LEDs can be used as an AM/PM indicator and blinking colons. If you would rather use neon bulbs to match the appearance of the Nixie tubes, the following circuit can be used to drive neon bulbs from the LED outputs. These parts are not supplied with the kit.

7.1.2 Parts Identification

Some of the supplied parts may have alternate markings, as shown here:

Diode	BYV 95 =	FR205 DC
Transistor	MPSA 92 =	KSP 92-044
	MPSA 42 =	CMPS A42
Driver ICs	74141 =	KM155
Capacitors	22 nF =	223
	2.2 nF =	222



7.1.3 Suppliers

Nixie Tubes – www.nocrotec.com Dieter Wächter is a reputable supplier of Nixies.

neon bulbs, DCF77 at - www.nixiekitworld.com

Wall Wart power supply – A variety of wall warts from various vendors will work, Radio Shack catalogue number 273-1631 is ideal for the Nixie clock. It is available in their USA retail stores and at www.radioshack.com. You must use an AC wall wart if you use normal clock mode and no DCF77 input.

If you are not sure what power supply you should buy, please ask us. We will be happy to help you.