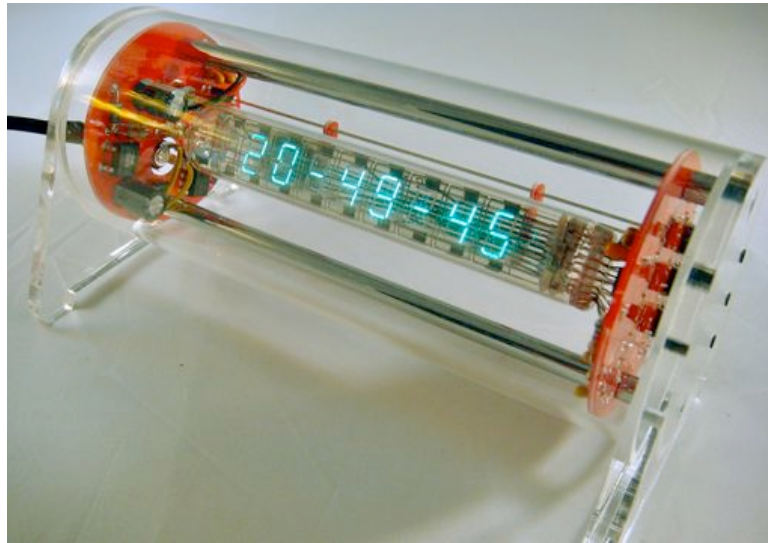


## User Manual IV-18 „Harp“ clock



This clock is a real beauty. The IV-18 tube floats inside the acrylic housing. The 2 pcbs are connected using 7 silver wires. From the back of the clock it looks like a harp.

The pcbs have been made professionally and the smd parts have already been soldered to the pcb, to make it as easy as possible for the clock builder.

The time is shown with 8 digits of the VFD tube 12-00-00. On the left hand side of the tube there is a dot that blinks in 2 Hz if a DCF77 antenna is connected. A DCF-77 antenna can be purchased in the shop.

If in DCF77 mode the clock switches between time and date. The date is shown in the middle part of the tube so it is easy to tell whether time or date is shown. The clock sits inside an acrylic cylinder and is sheltered against dust.

The kit is easy to build. We even produced a template to mount the tube easily. All the parts are high quality - the connectors a chrome plated. All acrylic parts are laser-cut and CNC-milled.

This documentation will help you to build your own vfd clock without any problems. Take your time and you will have a wonderful product after a few hours. Please read this document before you start building the clock.

You need a soldring iron, solder, a side cutter, a plier, a drop of super glue and a multimeter. After having finished your clock you have brought life back into the old tubes.. Visit our shop [www.shop.nixieuhren.de](http://www.shop.nixieuhren.de) to get other additional items for the clock.

### Technical Details:

- Operating voltage: 9-12 Volt AC 50 Hz or 60 Hz
- Tubes: VFD IV-18
- Power usage: 120 mA / 12 Volt
- Optional DCF77 Module
- Clock shows time in 8 digits HH-MM-SS and date if DCF 77 module is connected

### What you get:

- kit with all parts needed (SMD parts already solder on the pcb)
- IV-18 VFD tube
- Power supply 9-12 Volt AC
- housing: Acrylic cylinder, 2 Acrylic side plates - CNC milled and laser cut
- chrome plated connectors, silver wire, wires for power supply socket and DCF77 socket
- templates for mounting the tube correctly
- 2 spacers for the silver wires (pcb material - milled)
- 2 sockets (power supply and DCF 77)

High resolution pictures have been made to help you build the clock and get special hints. [Please see here.](#)

## 1. Safety and legal warnings

**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 break easily. 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 purposes 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 must 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](http://www.nixieclocks.de) takes no responsibility for any possible personal or property damage.

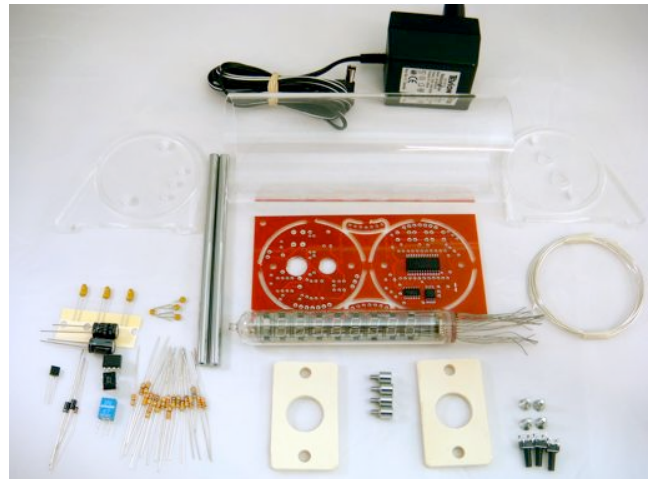
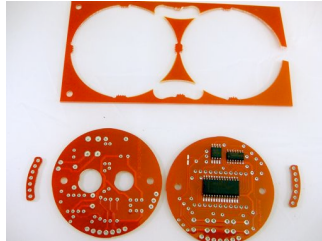
No responsibility is accepted for any damage, injury (however serious) or death. In no event shall [www.nixieclocks.de](http://www.nixieclocks.de) be held liable to you or any third parties for any special, punitive, incidental, indirect, consequential, or any other damages resulting from the assembly 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. Preparing the pcbs and mounting of the components

With your kit you get a big red pcb that consists of 4 parts that are milled (The clock pcbs and 2 spacers for the silver wires). The 3 smd circuits have already been mounted to save you a lot of soldering work. Now cut or break out the 4 parts from the big pcb and sand them on the outside using sandpaper.

The pcbs should look like the ones on the right.

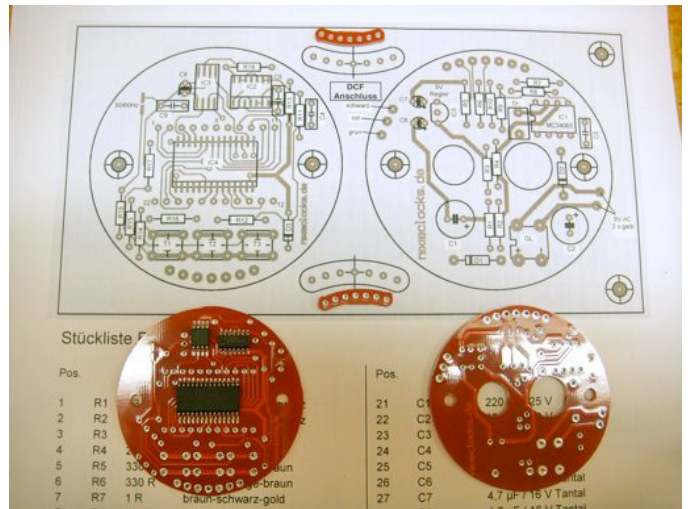


Let's start mounting the flat components.

Be very careful when mounting the components as all the parts will be visible through the acrylic cylinder later. So please take your time. Please do not overheat the components, especially IC1.

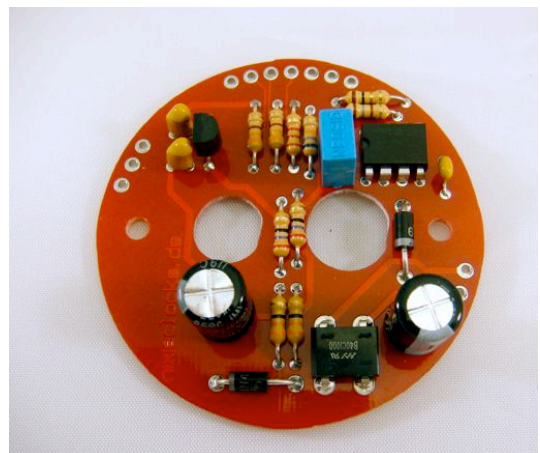
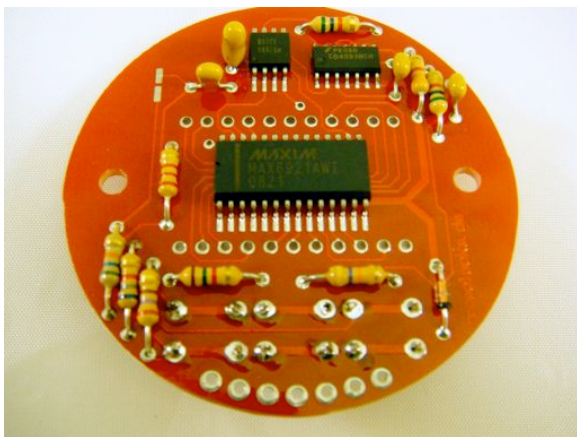
**Always follow the assembly documents to see where which part goes on the pcbs.**

The SMD parts IC2, IC3 and IC4 have already been mounted. Start with soldering IC1, rectifier, resistor, diodes and the rest of the flat components. The diodes have a white marking which must correspond with the marking on the component drawing. Then solder the capacitors, the regulator and the coil. The 10nF capacitors have "103" printed on them. Use the color code from the component list to find the correct resistor. Or use a multimeter. Cut the wires on the back side of the pcb with a side cutter.

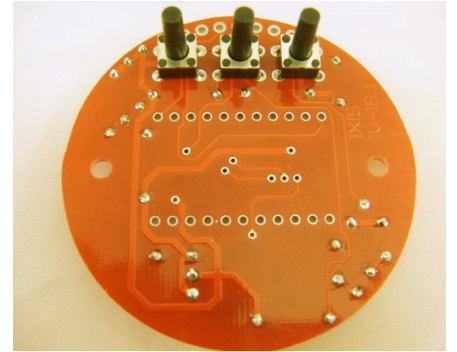


Watch out for the **polarity of the capacitors** and the rectifier. The rectifier is located with „+“ and „-“, to the bottom side of the pcb. The electrolyt capacitor have the“-“ printed on the outside of the plastic cover. The “+“ wire is longer than the “-“ wire. This is the same with the tantal. They are orange in color. When you look on the tantal capacitor and you can read the text, the “+“ wire is always on the right. The “+“ is marked in the pcb layout. So be careful to solder them in correct!

### Parts mounted on the pcbs



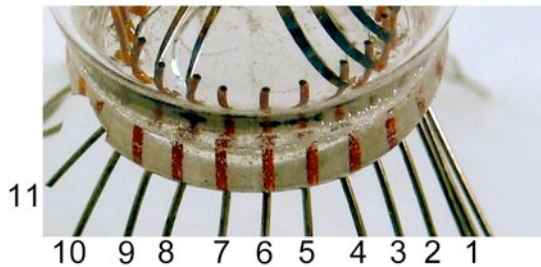
Now solder the 3 push buttons from the solder side of the pcb as shown in the picture on the right. Be sure to solder them firmly to the pcb.  
Now that all parts have been mounted to the 2 pcsb please check your work carefully. Check the polarity of the capacitors, the rectifier, the diodes and IC1.



### 3. Mounting the IV-18 tube

The IV-18 tube has 22 wires. It is very important to find a reference wire so that you know how to connect the wires to the pcb. Have a look at the tube. You will find **3 wires** that have **no internal connection** inside the tube.

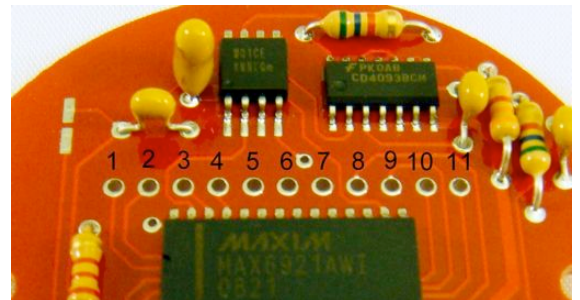
Belegung der IV-18 Röhre - layout tube



Draht Nr. 6 kommt in Loch Nr. 6 auf der Platine  
Pin 6 of the tube goes into hole no 6 on the pcb

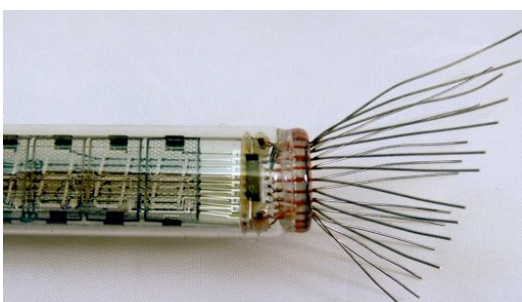
See the picture above – the 3 wires are easy to locate. The middle one of the 3 unconnected wires is our reference – we call it “pin no 6”. This pin no 6 will go into hole no 6 the tube pcb later. Now take 5 wires to the left and five wires to the right of pin no 6 and bend them away from the middle. Do the same with the opposite side of the wires.

Your tube looks like the left picture above from the bottom. You should have 2 rows of wires 1-11 and 12-22.  
The right picture shows the tube pcb with the holes from 1 to 11. You now know where the wires go into the pcb.



Cut the wires of the tubes to **different lengths** so that is easier to fit the wires into the holes of the pcb as shown in the picture below.

The next step is to place all 22 wires through the holes in the pcb. **Please do not solder them yet!!**  
See how to cut the wires on the picture below and see how the wires go through the holes in the pcb.



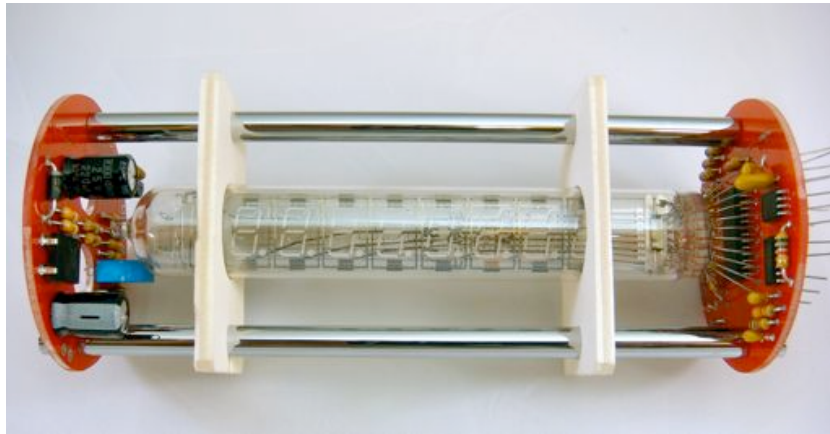
To make mounting of the tube alignment as easy as possible for you we made 2 special templates to help you mount the tube in angle.

Mount the 2 chrome-plated pcb connectors to the tube pcb using the chrome plated screws. It should look like the picture on the right.

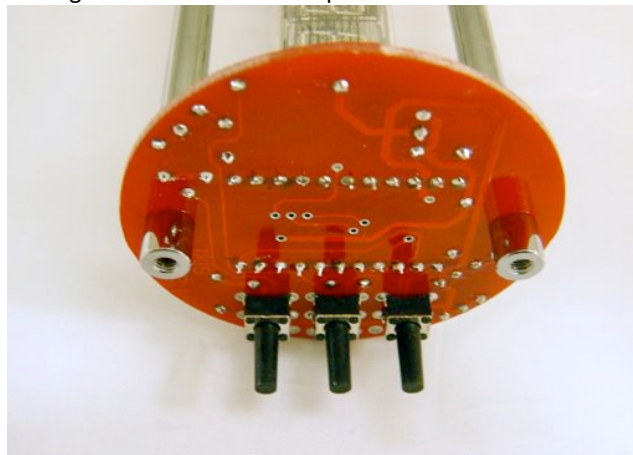


Now slide the 2 wooden templates over the tube and over the 2 chrome-plated connectors.

Mount the opposite pcb to the connectors using the 2 chrome plated screws. Your construction should look like the picture below. Make sure that the tube wires are in all the holes and none of them is crossed! The tube must not touch the left pcb or any components there!



Now as the tube is aligned, you can solder the 22 wires on the tube pcb. Be careful when soldering. After having soldered all the wires please cut them with a side cutter.



The result should look like the picture above.

You can now take away the left pcb and the 2 wooden template. The result is shown in the next picture.



Tube aligned and soldered to the tube pcb.

The most difficult part of building the clock is done. ☺

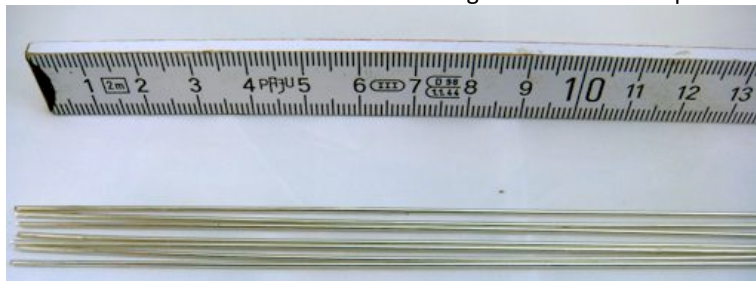
#### 4. Connecting the 2 pcs and making the 'harp'

A roll of silver wire came with the kit. This wire is about 110 cm long. You will have to stretch the wire to make 7 connectors.

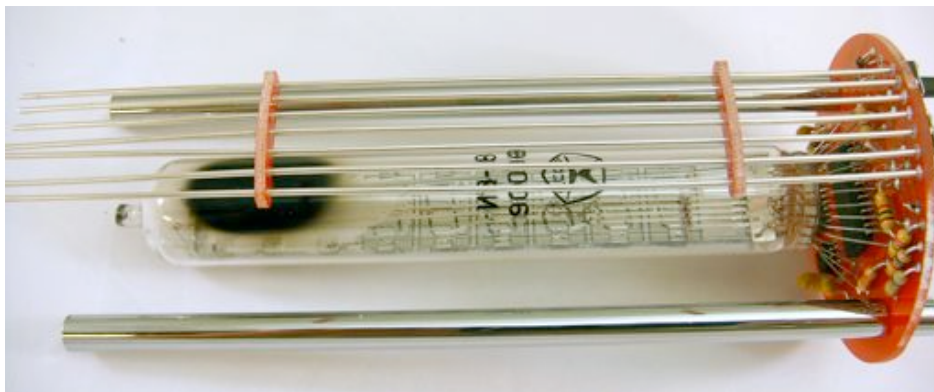


The wire must be stretched by about 10 %. You do that by using a clamp and pliers. Fix one end of the silver wire in the clamp and stretch the wire with the help of your pliers. Be sure not to stretch it too much. 10% is enough. Do not rip apart the wire. Now the wire is straight and you can take it out of the clamp carefully.

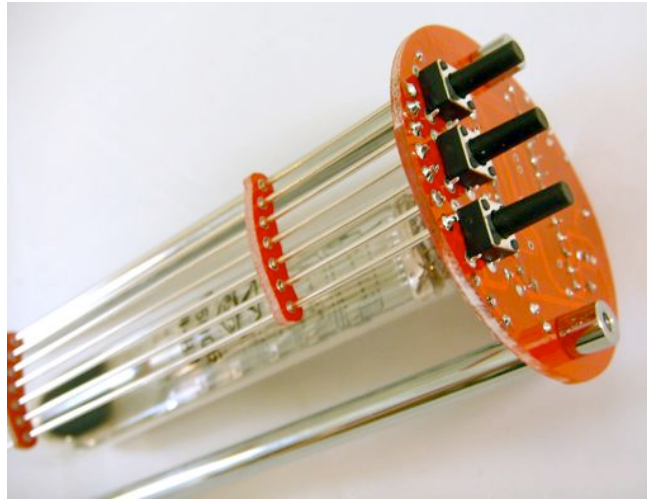
Put it on the table and cut 7 wires of 135 mm length as shown in the picture below.



The big red pcb consists of 2 spacers. You will need them now. They are responsible for keeping the 7 wires parallel and apart from each other.

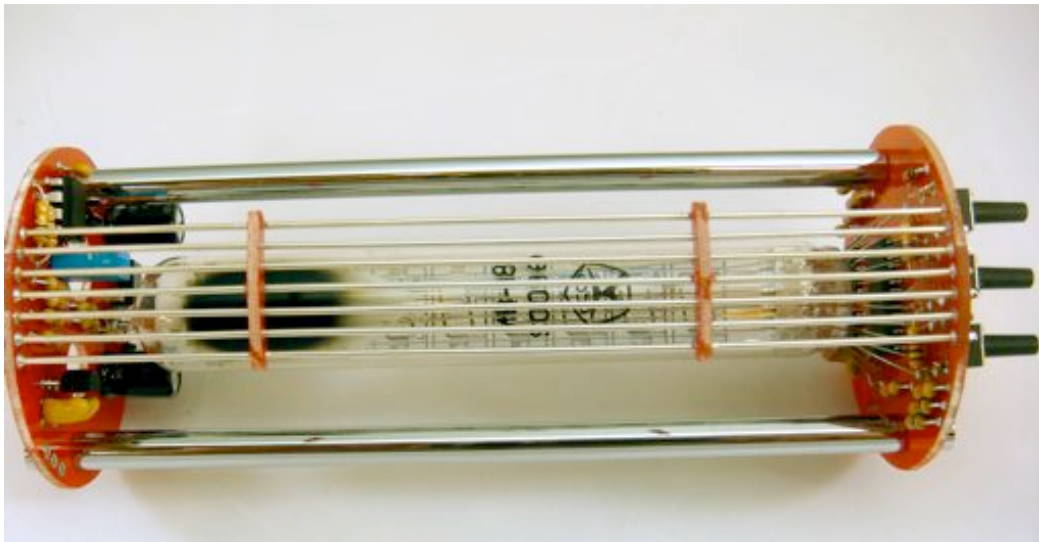


Take the 2 spacers and put the 7 wires through the 7 holes of the spacers. Now stick the wires through the 7 holes in the tube pcb – **but do not solder them yet! The wires should stick 3-4 mm out of the tube pcb.** Take your pliers and press the ends a bit so that they do not fall out of the pcb. Now solder them carefully and cut the rest that is too long. See the picture below.



Now you mount the opposite pcb by sticking the 7 wires through the 7 holes and soldering them. Cut the wires with your side cutter. **The spacers must not be soldered! If you solder them, the wires will bend.** Place the spacers 35 mm away from the pcb and fix them with a drop of glue. It is ok if you only place a drop of glue to the 2 outside wires and to the middle one.

Your clock should now look like this:

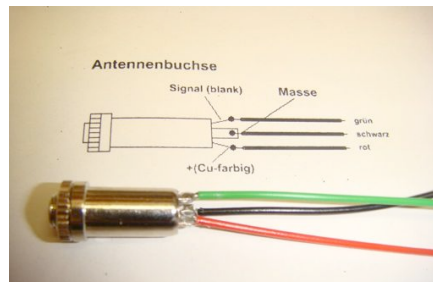


Your "harp" is ready ☺.

##### 5. Preparing the sockets for the power supply and DCF-77

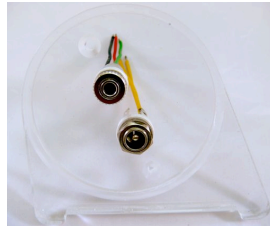
Take the 2 sockets and solder the wires. The power supply socket uses the 2 yellow cables and the DCF-77 socket uses green, black and red. Even if you do not use DCF-77 signal input, please mount the socket into the side plate because otherwise there will be an empty hole and that does not look good.

Solder the cables as shown in the picture below:



DCF-77 – green = Signal, red = Plus, black = GND

After having soldered the cables stick the cables through the holes in the side plate and mount the sockets by using the nuts.

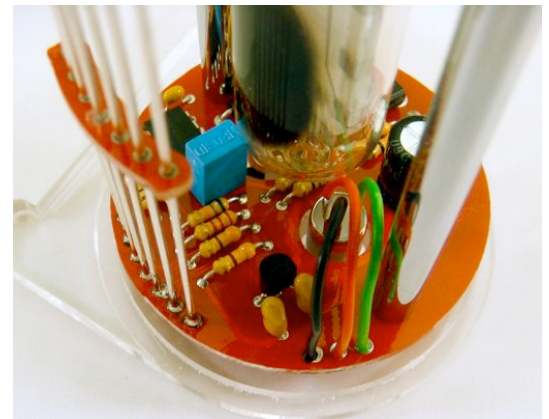


Solder the yellow wires to the power supply input in the pcb. It does not matter how the wires are soldered, because we use AC. So there is no Plus or Minus.

Solder the 3 wires for the DCF77 input into the 3 holes in the pcb as shown in the picture on the right.

You have now completed the assembly of the electronic components.

We will now finish the housing.



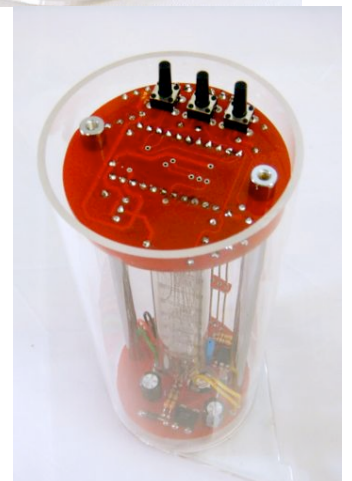
## 6. Finishing the housing

Take the acrylic cylinder and unwrap it from the protective foil. Be careful not to make any fingerprints from the inside and try to prevent dust. As this material can be static, try to work as careful as possible.

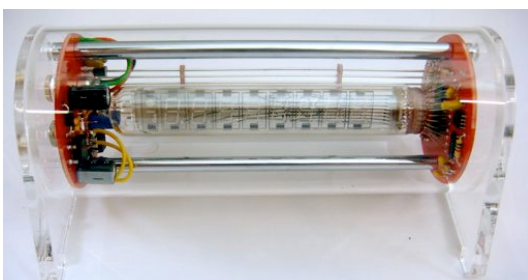
Both acrylic side plates have notch that was CNC milled. The cylinder fits perfectly into that notch.

Slide the cylinder over the pcb and mount the side plates using the M3 screws. Be careful that the 3 push buttons fit exactly through the holes in the side plate.

Do not tighten the screws too much.



**You have finished your clock – congratulations!**



**7. Power up your clock – setting the time**

Plug in your power supply into the clock and connect the power supply to mains. The clock will show 12-00-00. It should start to run immediately.

To set the time you will need the push buttons T1-T3. Press the middle button and the clock will stop running and the spacer between the hours and the minutes will start to blink. Press T1 (upper button) to increment the hours and T2 to decrement them. Press T2 again and set the minutes in the same way the hours were set. Check a reference clock and press T2 to set the clock to the correct time. The seconds will start at 00. If a DCF-77 module is connected, you cannot set the clock!

**8. Connect a DCF-77 module**

We sell DCF-77 module in our shop. If you use our DCF-77 kit with the black housing, it is very easy to get the correct time. Unplug the clock and plug the DCF-77 plug into the DCF-77 socket. Power up the clock and wait.



The LED of the DCF module will start to blink red if a correct DCF-77 signal is received. The clock will set the at next minute change. It can take up to 20 minutes until the antenna receives a correct signal. So please be patient. Be sure to point the antenna towards Frankfurt/Main. **We cannot guarantee a correct DCF-77 signal outside Europe.**

The range of the signal is 1500 km. Signal strength depends on weather conditions and time of day.

After the clock has set to the correct time, you will see a gig dot blinking on the left side of the tube with 2 Hz. This indicates that the DCF signal is being received correctly. The clock will now show time and date alternating. The date will be shown for 8 seconds and the time for 12 seconds. When date is shown the digits move to the inside of the tube to indicate date. The separator changes from a dash to a dot.



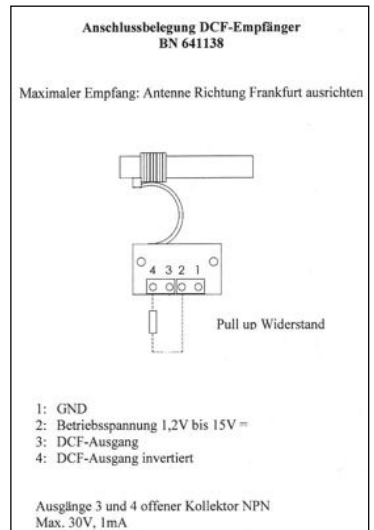
Date and time shown in the IV-18 display

**9. Connect the DCF 77 Module by Conrad electronics**

You can also use the DCF77 Module by Conrad Electronic. Connect the module according the description below. Use a 3 wire shielded cable of 1-1.5 meter. The Conrad Module has 4 contacts. You need no pull up resistors. Use a 3,5mm stereo plug and solder the wires according to the schematics.

Connect as follows

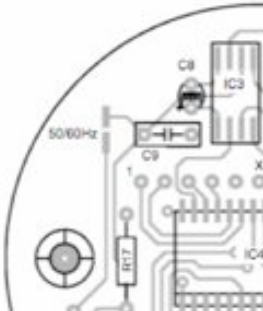
- |                               |                   |
|-------------------------------|-------------------|
| <b>Conrad Module</b>          | <b>clock pcb</b>  |
| 1- GND                        | GND on clock pcb  |
| 2- 1,2 V – 15 V               | PLUS on clock pcb |
| 4- DCF output inverted Signal | Signal on pcb     |



After about 3 minutes you should have the correct time displayed in your clock.

### 10. 50/60 Hz Option and 12 hour mode AM / PM

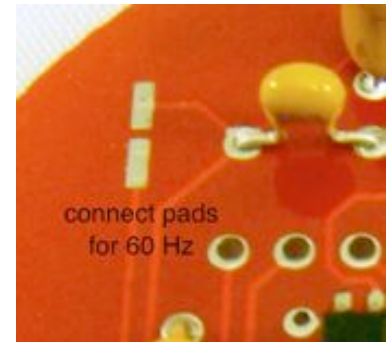
If you live in a country with other than 50 Hz, you can change the clock to 60Hz.



Just connect the 2 pads (50/60 Hz) on the pcb.

The clock now only runs in 12 hour AM/PM mode. The big dot in the left of tube indicates PM.

To change to back to 50 Hz /24 hr mode, desolder the connection.



We hope you managed to get your clock up and running and we hope the clock will find a descent place in your house.  
If you have any problems with your clock, please contact us via E-Mail.

