

# TentLabs DIY Hybrid amplifier

Assembly manual - V1.0



# Disclaimer

## Electrical safety

Within the equipment, during building and surely when finished, AC mains voltages and high DC voltages exist. Care should be taken as long as the cabinet is not closed and the equipment is been connected to the mains. The user remains responsible for his own and others' safety and damage of the equipment. Following the instructions however will avoid hazard and electrical shock.

## Mechanically

Assembling the kit you will be handling metal parts that may cause injuries if not handled carefully. Moreover you will use tools. Be aware of this.

## Warrantee

The content of this kit has been assembled with great care. All modules and parts have been tested prior to shipping. If assembled according these instructions, the equipment will work.

The warrantee on the modules is as following

Tentlabs modules: 5 year assumed built in according instruction

Mechanical parts: 5 years assumed built in according instructions

Exceptions: Tubes, these carry 6 months warrantee.  
Moving parts, these carry 1 year warrantee.

## Liability

Tentlabs accepts no liability at all from any potential damage or injury that may occur when assembling, connecting or using the Hybrid amplifier or any of its sub parts and assemblies.

## **1. Preparation**

You bought you a kit that will give you a great satisfaction because of the excellent performance, when finished. Assembling the DIY-kit is great fun if you are prepared to the job. Therefore some words in advance:

Assure that the place to work will be large enough and sufficiently lightened. The table you will be working on should be covered with a soft cloth to avoid scratches on the case parts of the equipment.

To avoid parts scattering around during assemblage, it is a good habit to use some fist-sized (plastic) boxes to temporarily store the components from each bag of the kit. (Make sure not to mix the parts)

To keep a good overview, assure another place to display all the kit parts and tools to be used. Make sure you will not be disturbed by others who have no idea of what you are doing. Keep them away for their and your safety, especially children!

Finally, first read the total instructions in this manual, until the last page. This will give you a good idea of the expected building phases.

### **Missing parts**

In case you miss some parts, please do not hesitate to contact me. The kit has been prepared with great care, but errors are only human, and we are willing to supply missing parts in order to keep the building process going..

### **Maintenance**

The kit requires little maintenance. The metal parts can be cleaned with a soft cloth. The wooden side panels can be oiled using "any" regular furniture maintenance oil. We used to ship this with the kit, but international regulations have changed and since the oil is flammable..

The tube stage bias can be checked every year, using the procedure described at page ??.

We do not include a mains power cord as:

- Plugs differ from country to country
- You usually have a few lying around
- Most customers prefer some special audio cable of their own preference

### 1.1. Required tools

Depending on your experience and your tool-kit, you will be able to assemble this DIY kit within four to eight hours. The following tools are needed:

1. A crosshead screwdriver PH1 and/or PZ1
2. A crosshead screwdriver PH2 and/or PZ1
3. A flathead screwdriver size 2
4. Set of metric wrenches (8, 10, 11, 12 and 13)
5. A soldering iron (50 watt, small tip)
6. Solder (0,5 to 1 mm, with flux)
7. A pair of tweezers
8. A small wire cutter
9. Some wire stripper
10. Straight nose pliers
11. Socket spanners (metric 5 and 5,5 mm)
12. A cheap multi meter for AC and DC voltages
13. Contact adhesive, based on synthetic rubber.
14. A small hacksaw



## 1.2. How a nearly assembled player will look like

It is convenient to know where to end, before one begins. For this purpose, below picture is inserted.



## 1.3. General instructions

Never use excessive force to get things in place or when tightening nuts or bolts. If things do not fit easily, something must be wrong. Check connections when made and double check them prior to the first operation. Ask someone else to check all wiring using the photographs and pictures in this depiction as a reference.

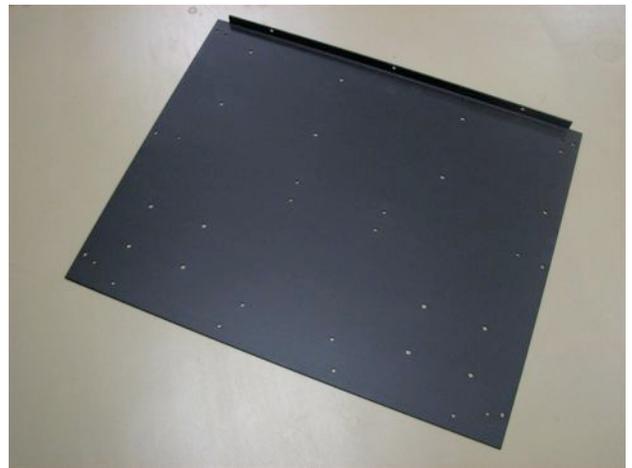
In doubt, contact us using [info@tentlabs.com](mailto:info@tentlabs.com) or +31-40 2130 186

**Have fun!**

Juli 2009, Guido Tent.

## 2 Preparing the base

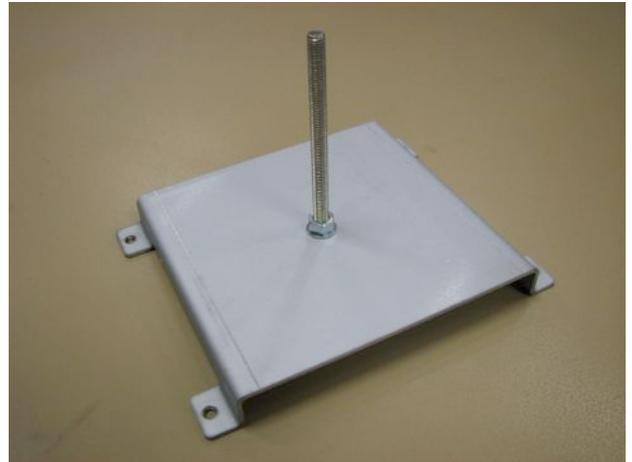
Take the base and put it on the table



Mount the 4 rubber feet, using 4 pieces M4\*8 bolts, all from bag #1. The base plate has threaded holes, hence no nuts are needed.

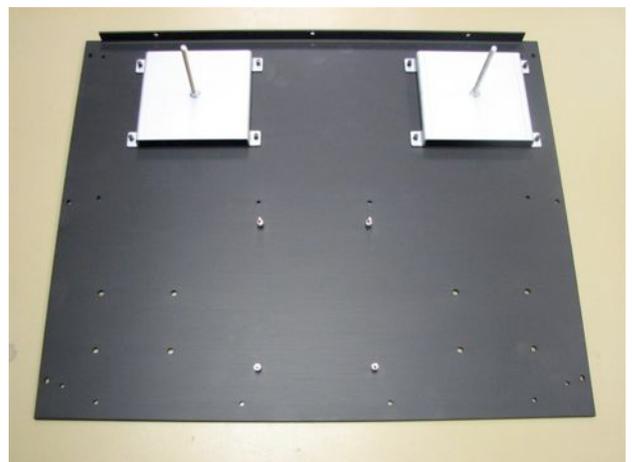


Take both power transformer supports from bag #2 and mount the M6 bolts, nuts and washers from bag #1. Do not forget to put the spring washer between the mount and the nut. Tighten very well, using wrench size ??



Take 8 pieces M4\*8 bolts, and mount the supports, from bottom to top. The supports have threaded holes, no nuts required. Tighten well.

Take the base, and mount 4 studs (M3\*8) using 4 bolts M3\*6, all from bag #1, see also next picture. These studs will support the valve driver board.



### 3 Preparing the bridge

This bridge carries the UCD modules, their power supplies and the mains distribution PCB. In addition, the bridge supports the base, once mounted.

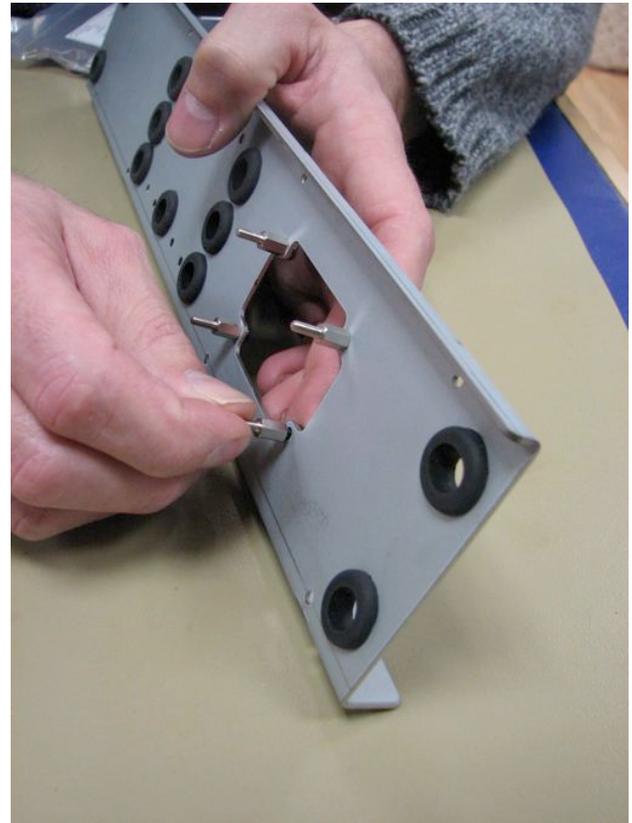
Take 12 grommets from bag #1 and mount them as shown right. These will support the wiring.



Mount 4 studs (M3\*6) using 4 bolts M\*6, all from bag #1.

**Please note that the bridge is not symmetrical; take care of correct orientation.**

The folded edge with the 4 threaded holes should be facing down.

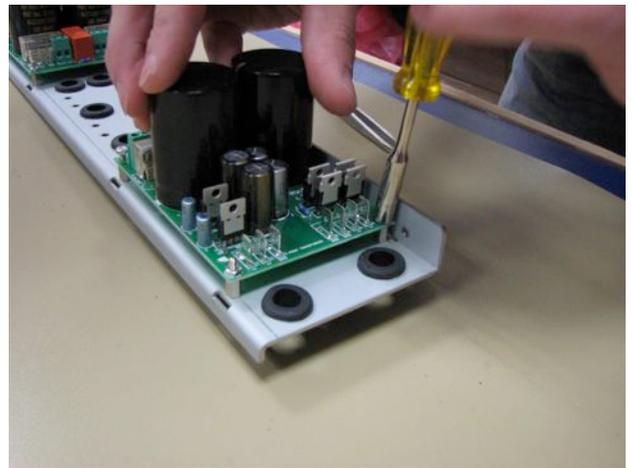


Take another 8 studs and M3 bolts and mount them at the opposite side.



### 3 Mounting the UCD power supply and amplifier modules

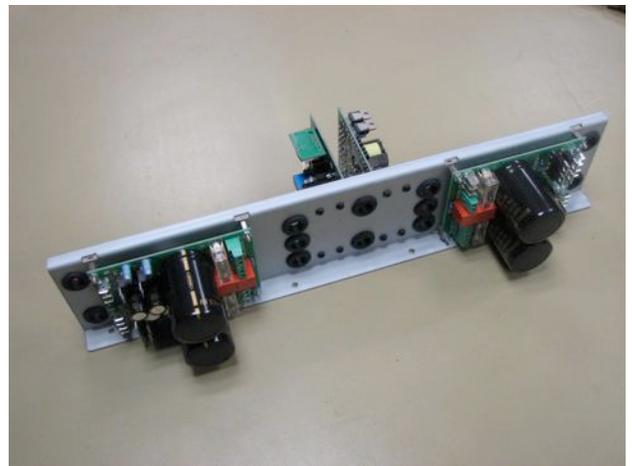
Place both modules on top of the studs. The red relays should point inwards. Fix them using 8 pieces M3 nuts.



The result should look like this.



Mount both UCD modules to the bridge, mirror matched. The result should look like shown right. Use 8 pieces M3\*6 bolts. Tighten these well.



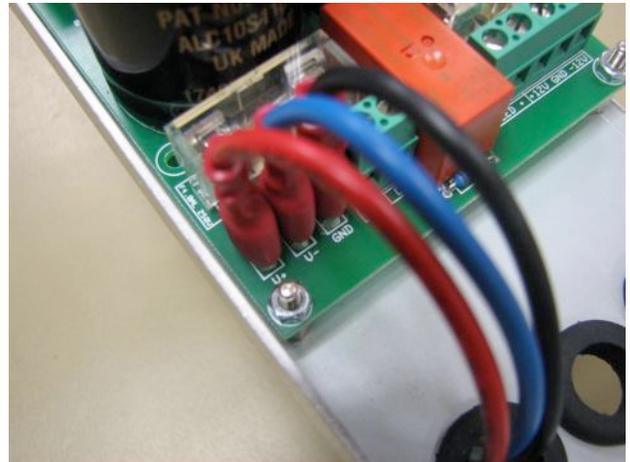
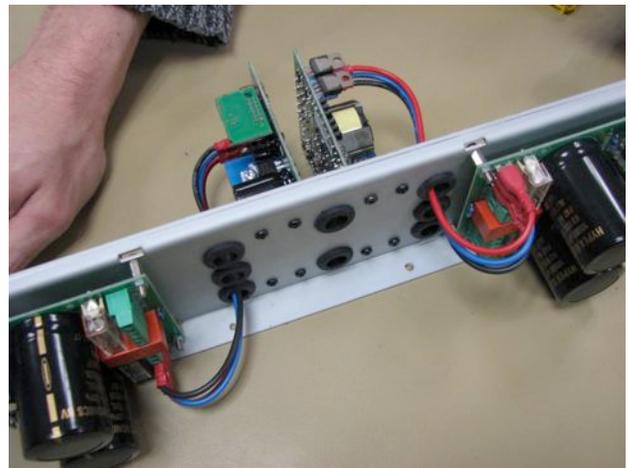
## 4 Wiring the UCD and power supply modules.

Take the power and speaker wiring from bag #3. This wiring is all 1.5mm, and is terminated with fast-on connectors. The result of the work on this page looks as shown right.

First wire the power leads, fit them through the tubes ?? The next photos show the wiring and colors in detail. Use the following colors:

“ - “            **BLUE**  
“ + “            **RED**  
“ gnd “        **BLACK**

Place the wiring on the power supply modules, as shown.



The other side of this wiring becomes connected to the UCD modules. Use the same color-coding:

“ - “            **BLUE**  
“ + “            **RED**  
“ gnd “        **BLACK**

Repeat for other channel.

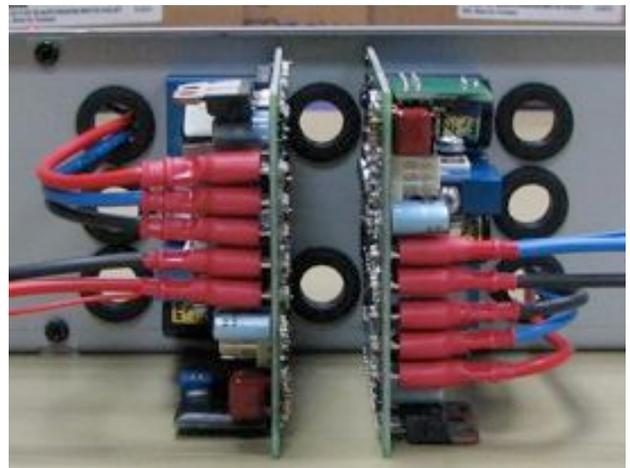
**This wiring is the most critical part of building this Hybrid amplifier. Double check, and have some-one else check the third time.....**



Once that is done, fix the speaker wiring, at the same side of the UCD modules. Use:

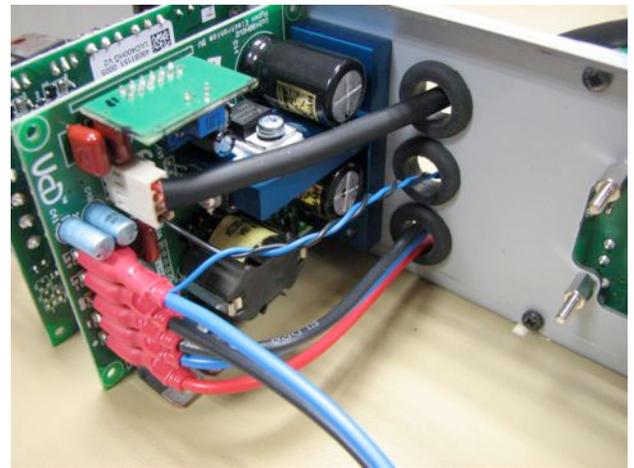
“ + “            **BLUE - left channel**  
“ + “            **RED - right channel**  
“ gnd “        **BLACK - ground**

The result should look like shown right



## 5 Connecting UCD signal wiring

Bag #4 contains signal wiring, 2 pieces are assembled with a white connector, one has a blue shrinking sleeve at the other end, one a red sleeve. Make sure these colors coincide with the colors of the speaker wiring, and connect them to the white receptables on the UCD module. Lead the signal wire through the accompanying tulle ??



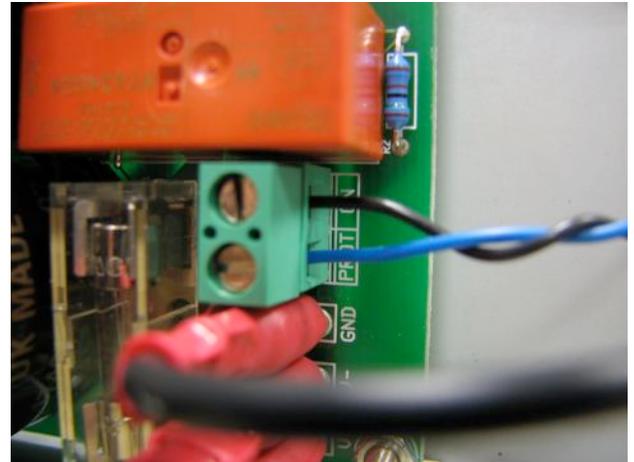
Loosely twist the black and blue wire, and stick them through the remaining tulle ??

Repeat this on the other channel, as shown right. Twist the black and red wire.



Reverse the bridge. Strip the blue / black wire for about 2mm and connect them as shown right. Use the following connections:

“ prot “ = **blue**  
“ on “ = **black**



Repeat for other channel. Strip the red / black wire for about 2mm and connect them as shown right. Use the following connections:

“ prot “ = **red**  
“ on “ = **black**



## 6 Connecting the valve PCB signal wiring

Take the base, and carefully lay the bridge down, on top of the mounts. This creates some extra space, and facilitates the soldering process.

Take the valve driver board from box #8, and put it on the studs. Fix it with 4 pieces M3 nut from bag #1.

Take the remaining signal wiring from bag #4. This wiring has a grounded wire (black) at one end. These sides go to the valve driver board. Stick the wiring through the upper middle tulle ??, make sure the colors end up at the correct side, as shown on the picture upper right. These wires go to the inputs of the board.

Pre-tin the wiring, and connect to " INL " according:

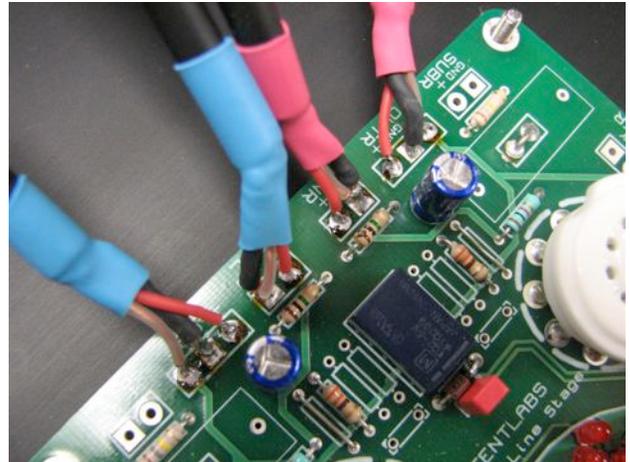
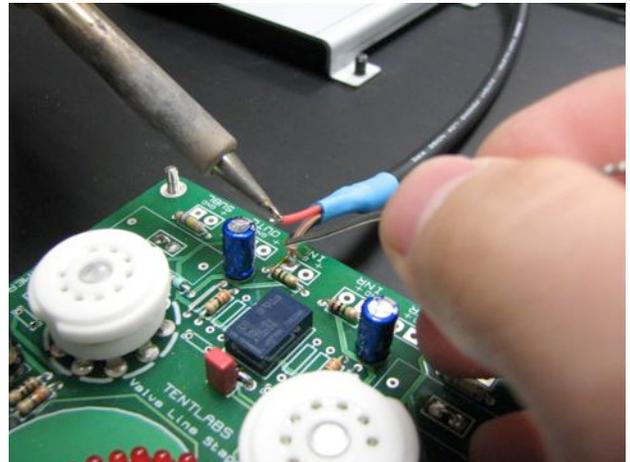
" + "            **red**  
" gnd "        **black & transparent**

Repeat for other channel " INR " .

The output wiring, going to the UCD modules, shall be connected to " OUTL " respectively " OUTR " as following:

" + "            **red**  
" gnd "        **black**  
" - "            **transparent**

The result should look like shown right



## 7 Mounting the bridge & interstage transformers

Take 4 pieces M4\*8 bolts, and place the base on its side. You may need the help of a third hand here. Tighten all 4 bolts.



Take both interstage transformers from box #9 and #10

### WARNING

These transformers are wound with 65um wiring, hence very sensitive. Although the wiring is internal, please handle these transformers with care.

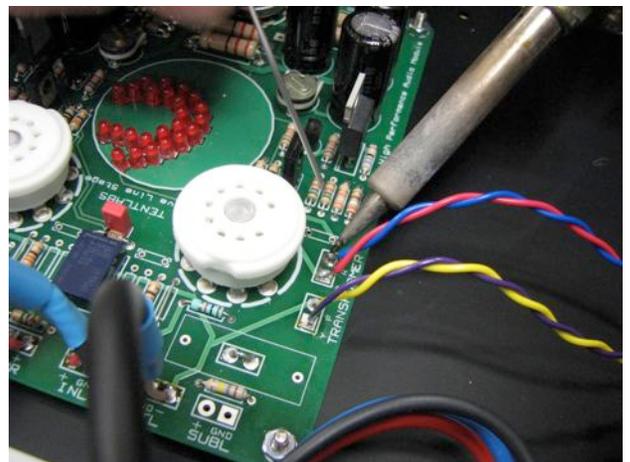
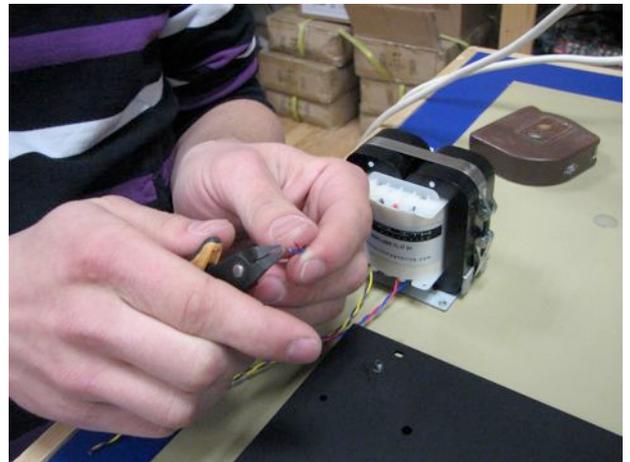
Cut the wires to 15 cm and twist respectively

Purple & yellow

Red & blue

Solder these wires to the board, following the indications (P, Y, R, B)

Repeat for other channel



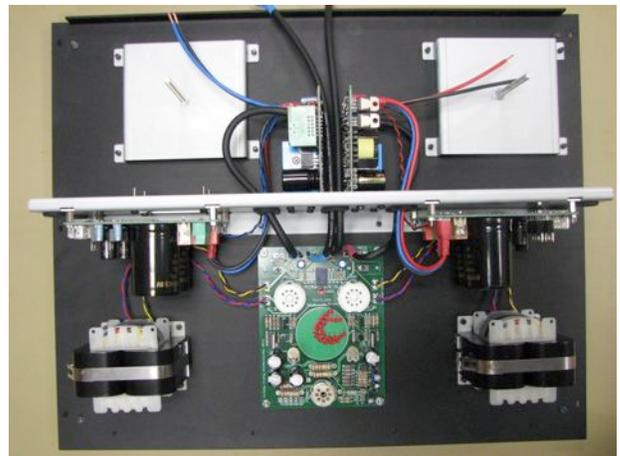
## 8 Mounting interstage transformers

Take 8 pieces M4\*8 bolts from bag #1, and place the base as shown right. Position the transformers with the wiring pointing towards the bridge.

Tighten the 4 bolts and repeat for the other channel

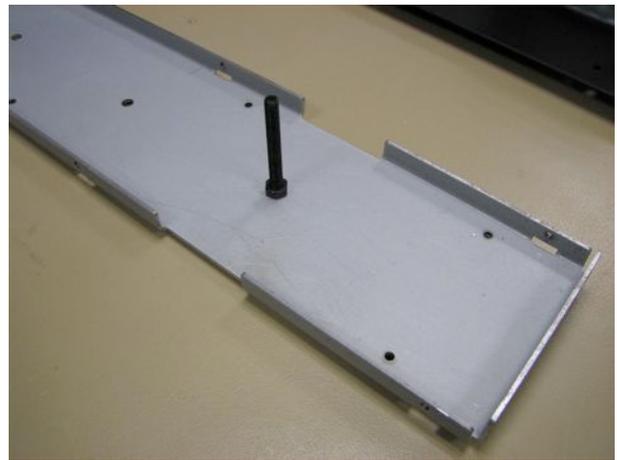


Now, most modules have been mounted at the base, and all should look like the picture on the right.



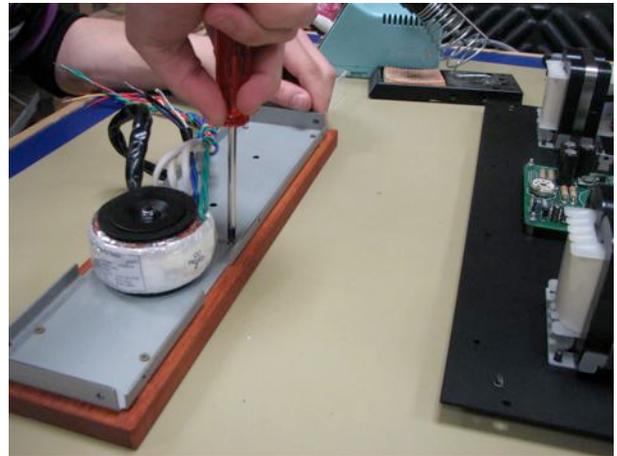
## 9 Preparing sides

Take the sides (left & right are equal, #10 & 11) and take the high voltage transformer from box 14. Take the bolt and nut, and mount them as shown right, to one of the sides. Tighten very well, using wrench size M5



Place a neoprene disc, the transformer, another neoprene disc and the metal disc. Take an M5 securing nut from bag #1 and loosely tighten this transformer

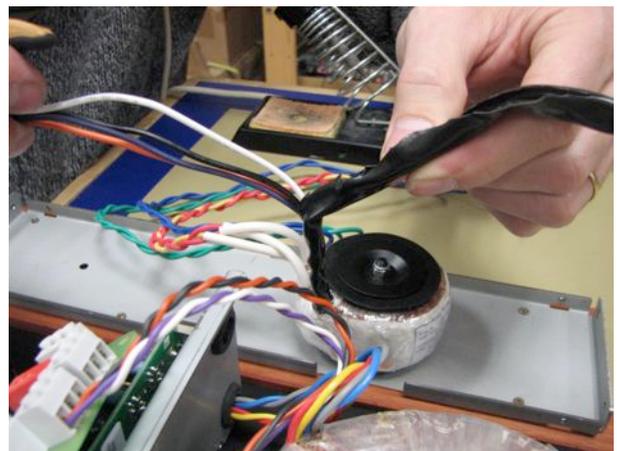
Take both wooden sides, place the metal sides on top of them (one orientation possible) and secure them using 6 screws from bag #1. Repeat this for the other side.



Carefully cut the black isolation sleeve away, until about 5cm remains.

Cut the primary wiring (black, orange, purple, white) to a length of ??cm.

Strip all wiring to a length of about 3mm.

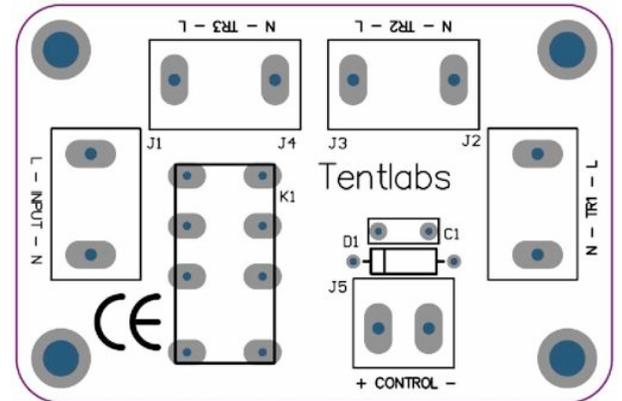


## 10 Preparing the mains PCB

Take the mains PCB from bag #5



Place the components as shown right.  
Diode D1 is sensitive to polarity; make sure the black ring coincides with the mark on the board.



Solder all components as shown right, cut the wires from C1 and D1.



The result should look like .....

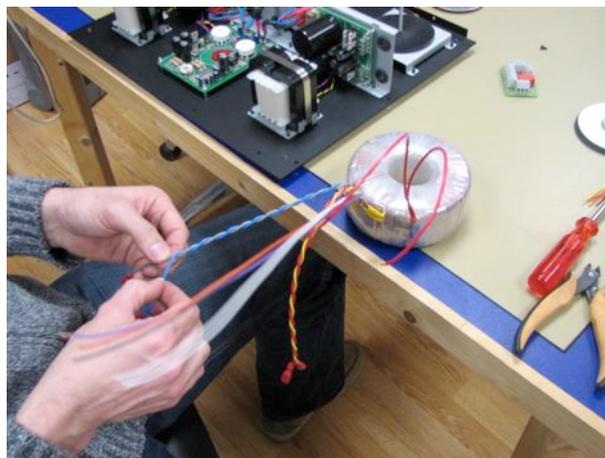
Put it aside, you'll need it in 10 minutes from now.



## 11 Preparing the power transformers

Take the (heavy) transformers from boxes #13 & #14. The secondary wiring contains fast-on connectors. Twist respectively:

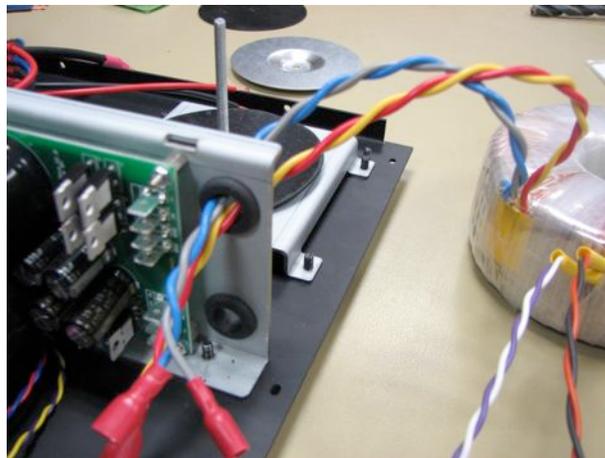
Red & yellow  
Blue & grey



Place the transformer beside the base and lead this wiring through the upper grommet

Twist the primary wiring as well:

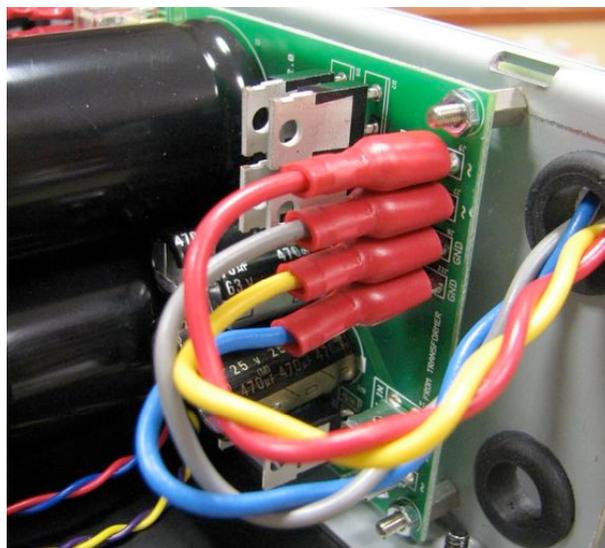
Black & red  
Purple & white??



Repeat this for the other channel. Note to put the secondary wiring through the lower grommet.

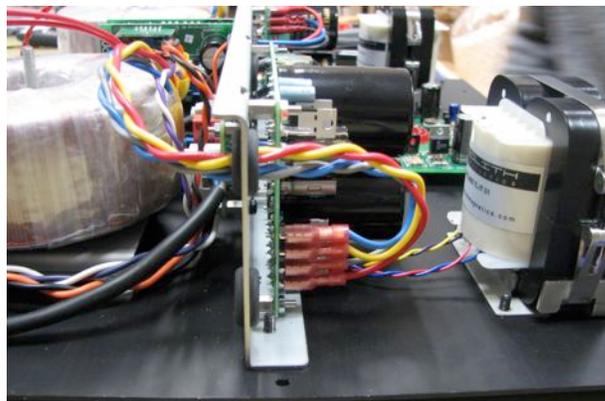
Connect the secondary winding to the power supply modules. Respect the order as shown right

“ ~ “            red  
“ ~ “            grey  
“ gnd “        yellow  
“ gnd “        blue



Repeat for the other channel. Note that the modules are mounted mirror-matched; hence the order of colors **reverses** (from top to bottom):

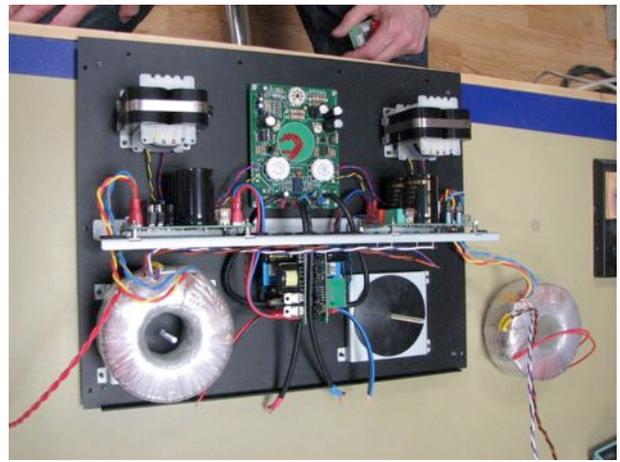
“ gnd “        blue  
“ gnd “        yellow  
“ ~ “            grey  
“ ~ “            red



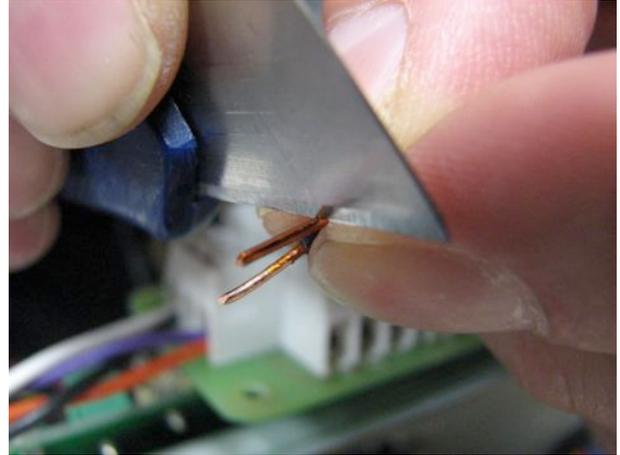
## 12.1 Mounting power transformers and mains PCB

### 115V version

Place neoprene discs for the power supply transformers TR1 & TR2, one on each mount. Place the left transformer TR1 on the mount, the right transformer TR2 should stay right from the base plate to keep some space to mount the mains PCB later



Take a sharp knife and scratch the lacquer from TR1 / TR2 primary winding.



The final result of connecting all mains transformers to the mains PCB is shown right.

**The inner connections of the 3-pole PCB connectors are not used.**

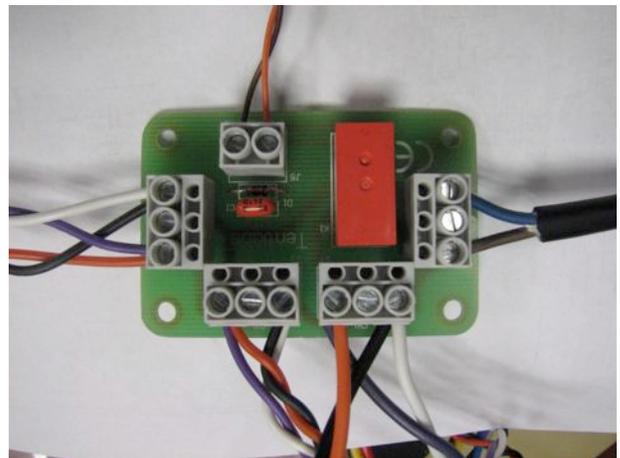
For all transformers, wire together:  
- **black** and **white**  
- **orange** and **purple**

Connect both power transformers to TR1 & TR2 connections of the main PCB.

Connect the left transformer to connection TR1 on the mains PCB, the other one goes to TR2. Take the right side with TR3 already mounted and place it aside TR2; wire this high voltage transformer TR3 to connector TR3.

Connect the twisted orange / brown wire to the control connector. Connect:  
**brown** to “-”, **orange** to “+”

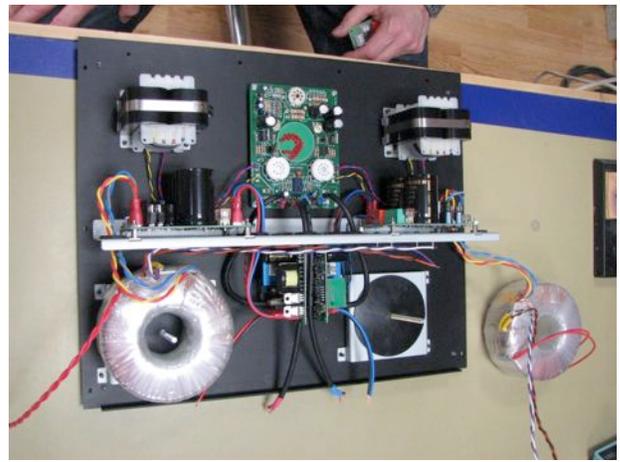
Finally connect the rubber mains cable (with mains entry) to input L / N.



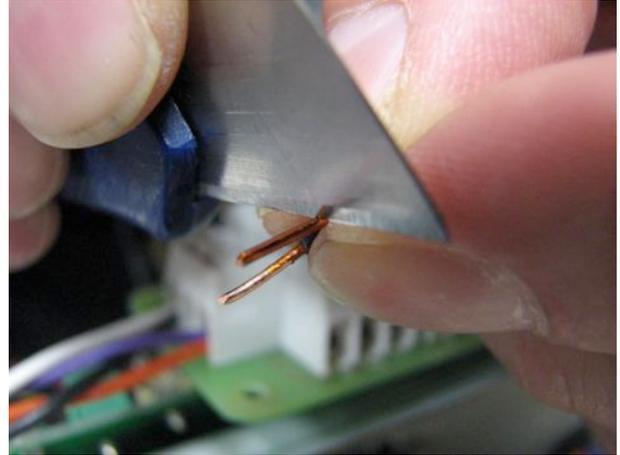
## 12.2 Mounting power transformers and mains PCB

### 230V version

Place neoprene discs for the power supply transformers TR1 & TR2, one on each mount. Place the left transformer TR1 on the mount, the right transformer TR2 should stay right from the base plate to keep some space to mount the mains PCB later



Take a sharp knife and scratch the lacquer from TR1 / TR2 primary winding.



The final result of connecting all mains transformers to the mains PCB is shown right.

For all transformers, wire together to the middle connection of the PCB connectors:

orange and white

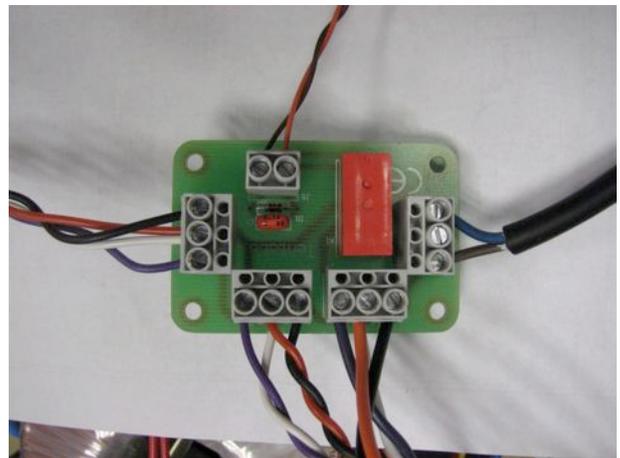
Black and purple go to the remaining outer connections

Connect the power transformers to TR1 & TR2 connections of the main PCB, the left transformer to connection TR1 on the mains PCB, the other one goes to TR2.

Take the right side (with TR3 already mounted) and place it besides the chassis. Connect TR3 to connector TR3.

Connect the twisted orange / brown wire to the control connector. Connect: brown to “-”, orange to “+”

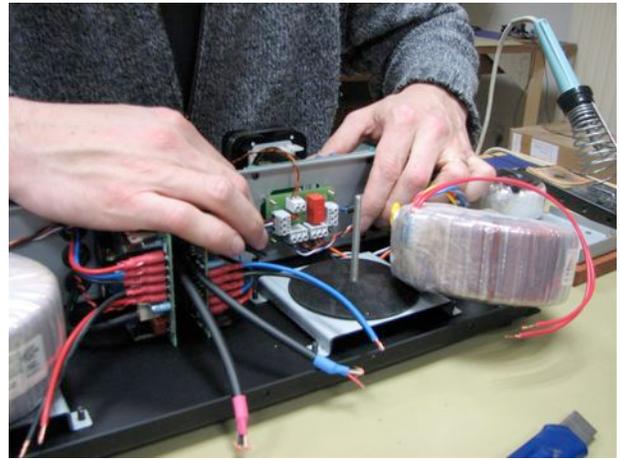
Finally connect the rubber mains cable (with mains entry) to input L / N



### 12.3 Mounting the mains PCB

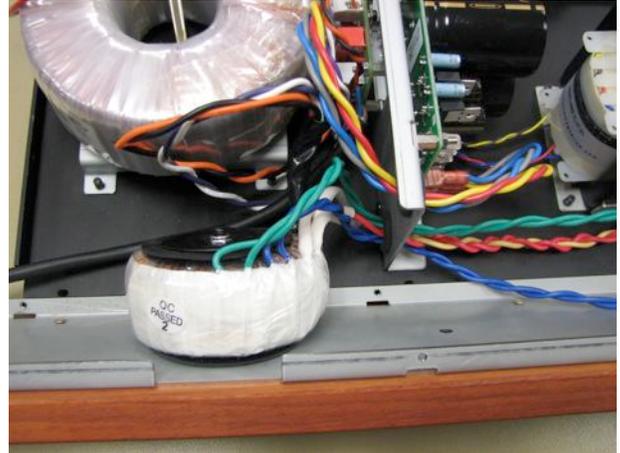
Place the mains PCB to the 4 remaining studs. Make sure no wiring gets in-between. Fix the board using 4 pieces M3 nut.

Now the remaining power transformer TR2 can be placed upon its' mount, but do not tighten yet.



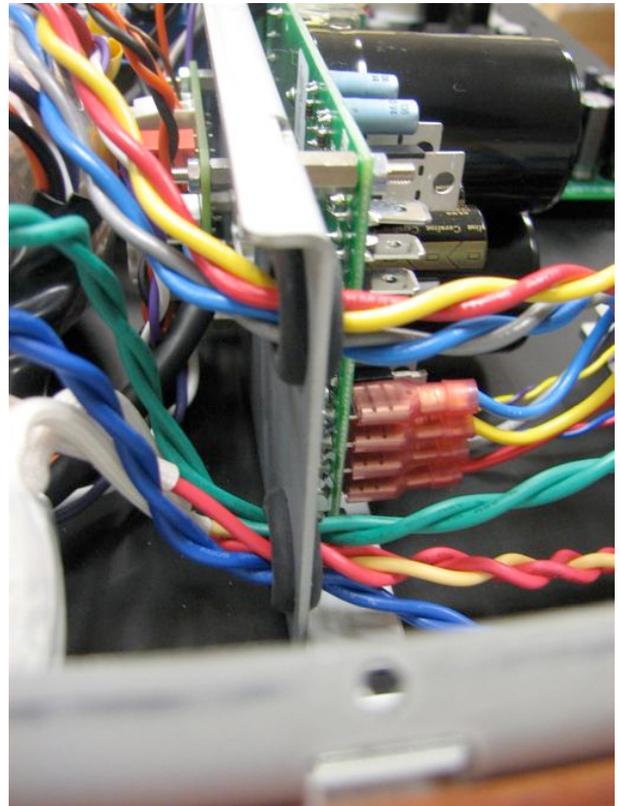
Twist the secondary wiring from TR3, twist together:

- blue & blue
- green & green
- red, yellow & red



Lead these wires through the lower grommet as shown right

In the next chapter we'll connect these secondary wires to the valve board, but first secure the power transformer on its' mount



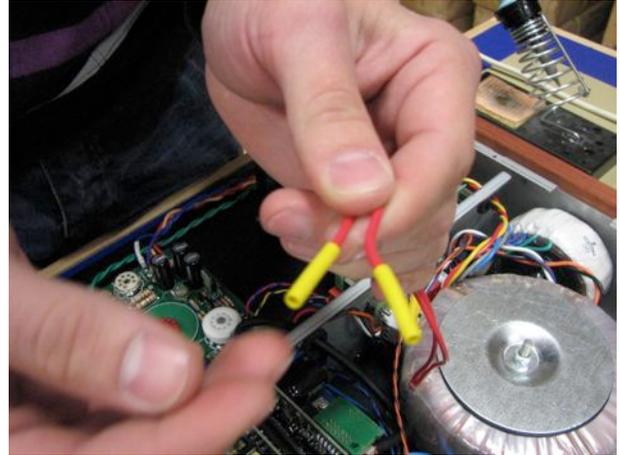
### 13 Connecting the valve board

Place the side with TR3 mounted on it; that transformer should come at the back of the cabinet. Use 3 screws M3 to secure the side to the bottom. Do not tighten yet.

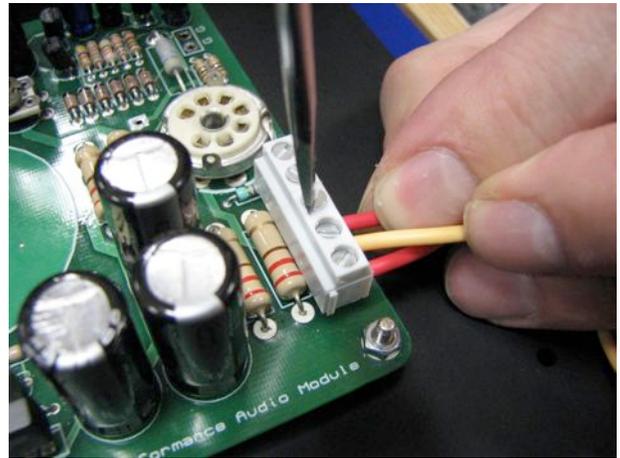
Place a rubber disc and the metal disc, and secure them with an M5 securing nut.



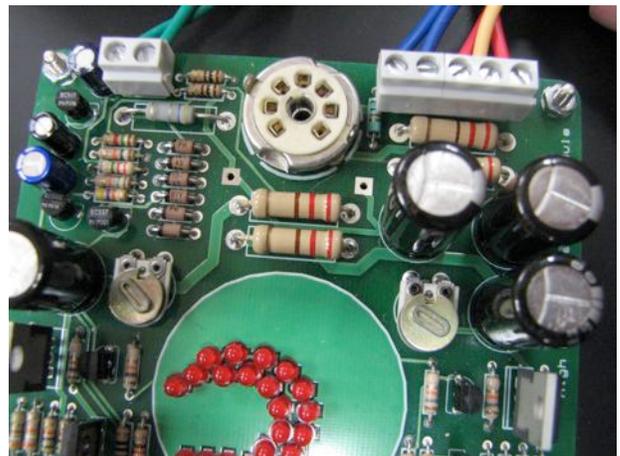
Take the remaining (unused) red wiring, cut the stripped ends and place 2 isolating sleeves on the ends. Take the tie rap and fit the wires as shown



Connect the wiring to the valve board, as shown on both pictures right. All wiring colors are indicated on the board, and shown on the next picture.



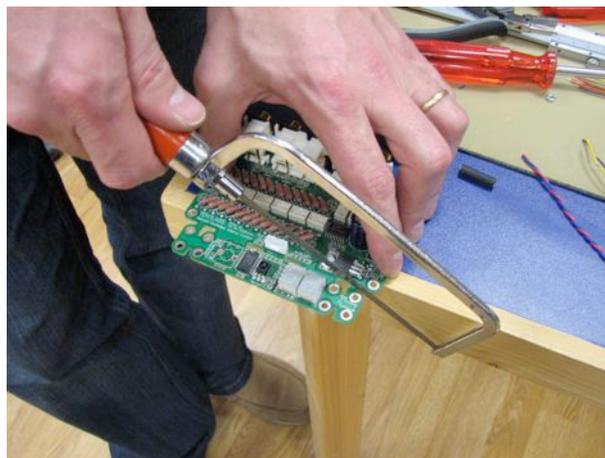
Do not put the valves on the board yet



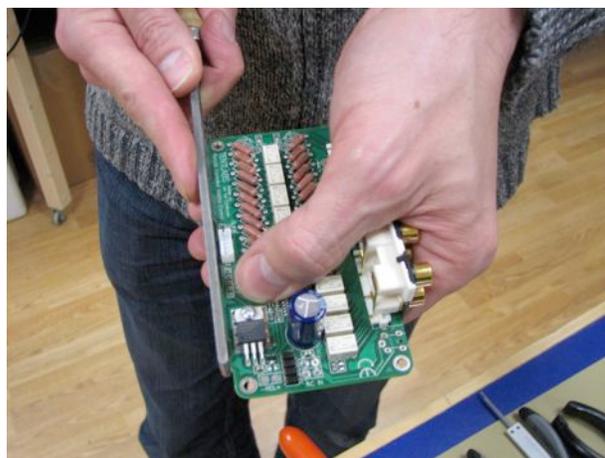
## 14 Preparing the volume control module

Take box # 6 and a small hacksaw.  
Separate the volume control board into 2 modules, the front and the main PCB.

Carefully separate the 2 boards, do not use excessive force.

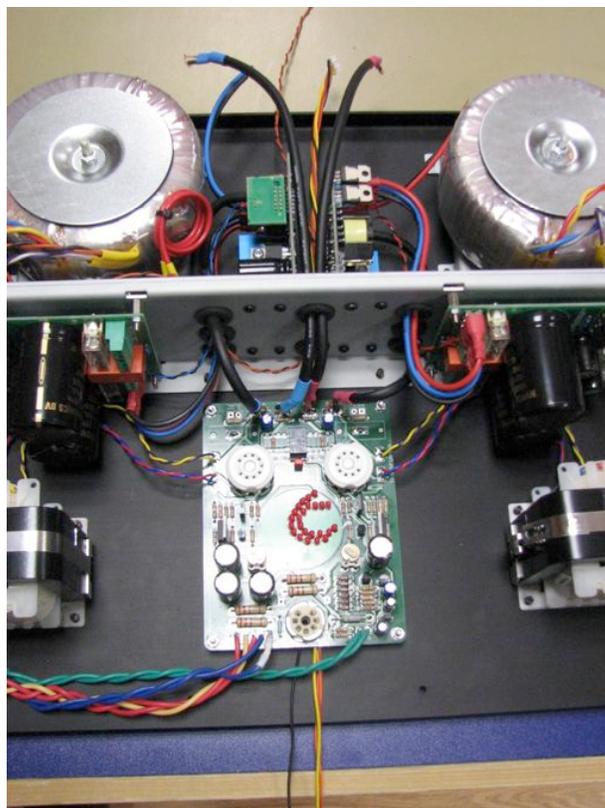


Flatten the cut boards, using an appropriate file.



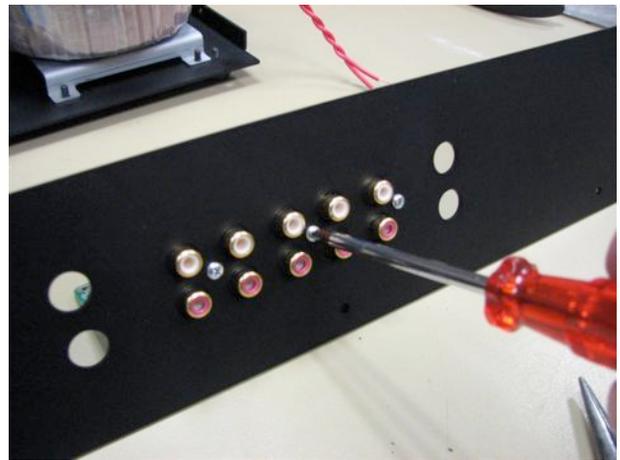
Take the 5 pole colored wire (black to yellow) and put it through the middle grommet (the lowest). The connector should be at the back of the amplifier, the loose ends go below the valve driver board to the front.

Take the **brown / orange** wiring from the bag #5, lead it through the closest lower grommet towards the valve board, and back towards the back through the middle lower grommet, the same carrying the 5 pole wiring. Lead it to the back in-between both UCD modules.

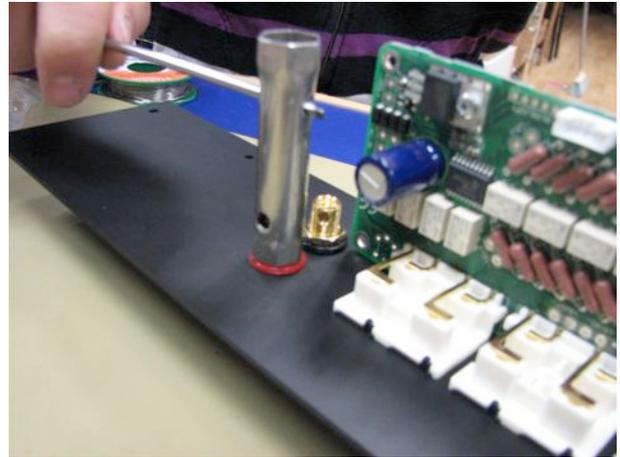


## 15 Assembling the back

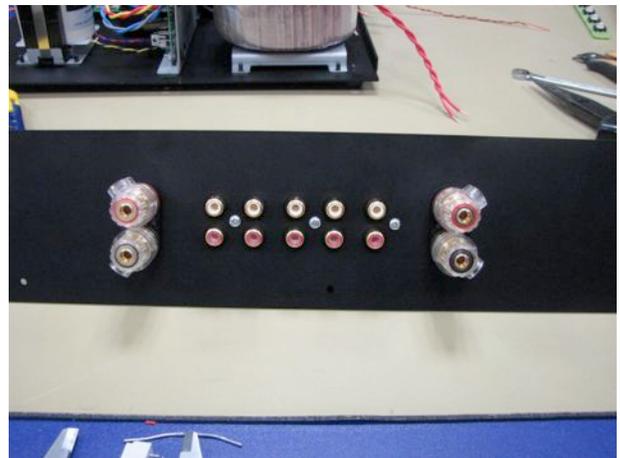
Take 3 screws from bag #1 and mount the volume control input board to the back of the amplifier.



Take the speaker terminals, take them apart and mount them at the back.

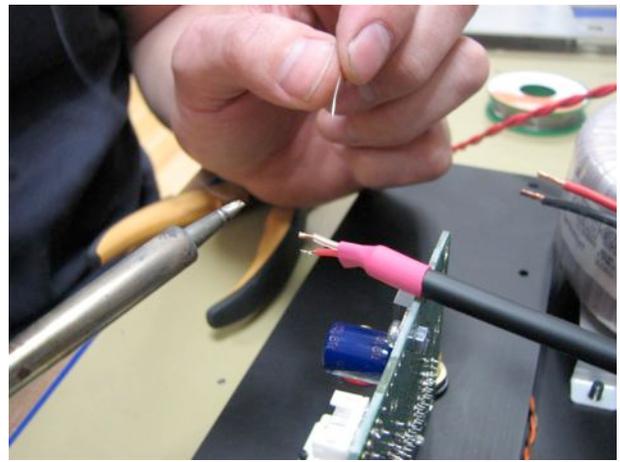


Look how the side entries are located, this should be done as shown right, to facilitate wiring entering the connectors.



## 16 Connecting volume control

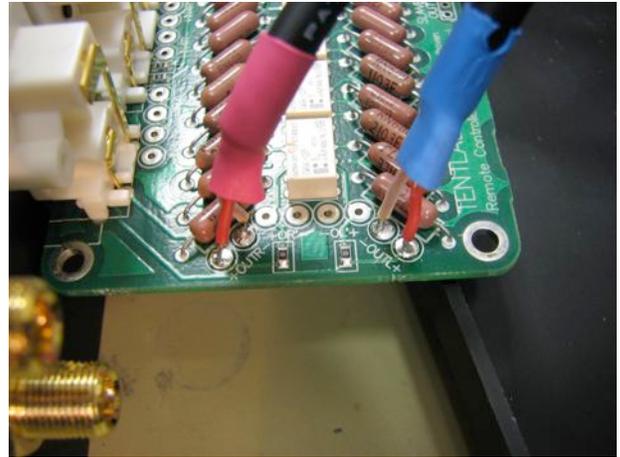
Pre tin the signal wiring that is going to be soldered to the vlume control main board.



This detail shows how to connect this signal wiring;

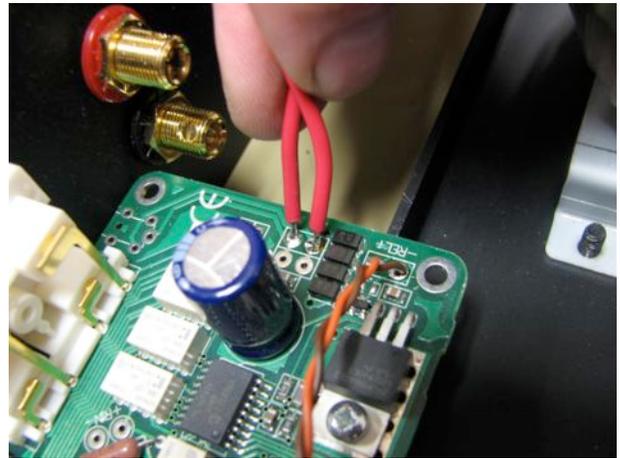
Red = +

White = -

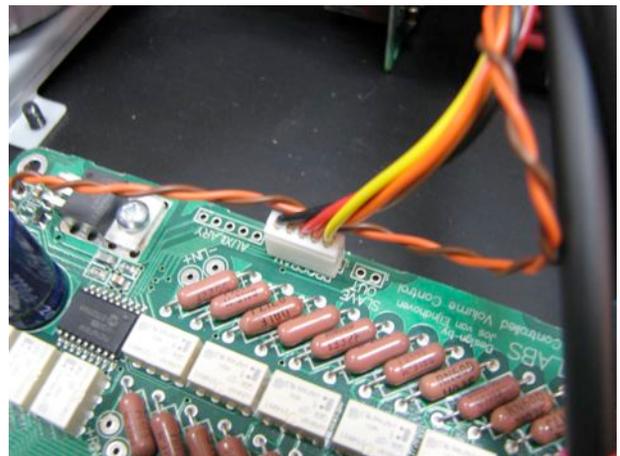


Connect both red wires from the mains transformer to the volume control board as shown.

Repeat the same for the orange / brown wiring, from the mains PCB, to "rel".  
Connect **brown** to "-", **orange** to "+".

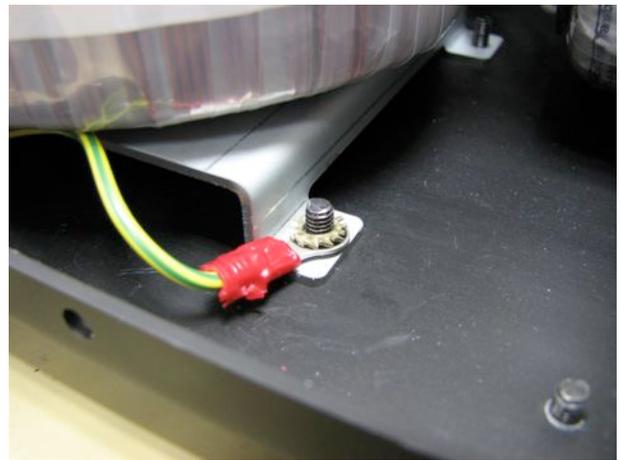


Stick colred wiring with its' connector to the socket on the volume control board.

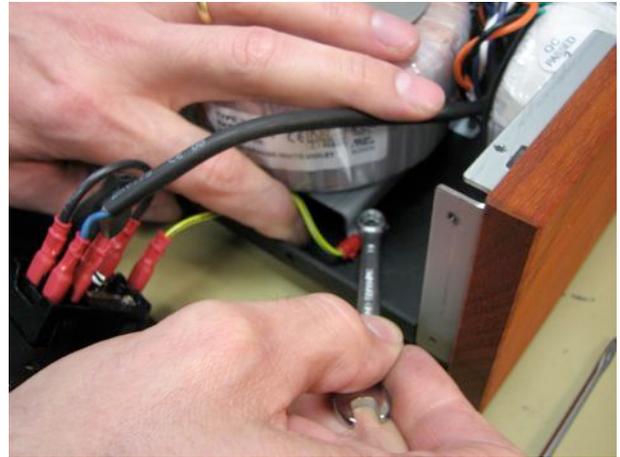


## 17 Connecting earth tag

Take the mains entry, and click it into the back panel (switch up). Take the safety earth wire and put it on the M4 screw from the transformer-mounting bracket.

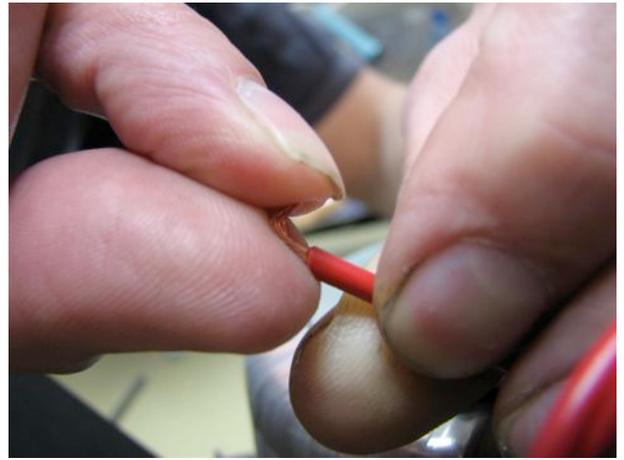


Take an M4 securing washer, and an M4 nut, and fix the tag. Tighten firmly.



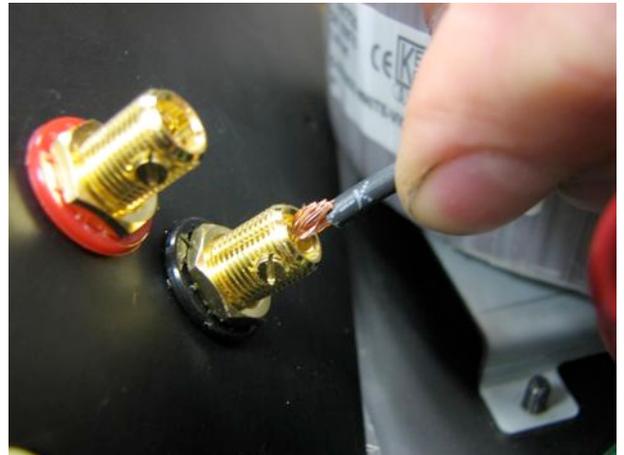
## 18 Connecting speaker wires

Strip the ends of the loudspeaker terminal wiring, 10mm will do. Twist the copper wiring, and double fold it.

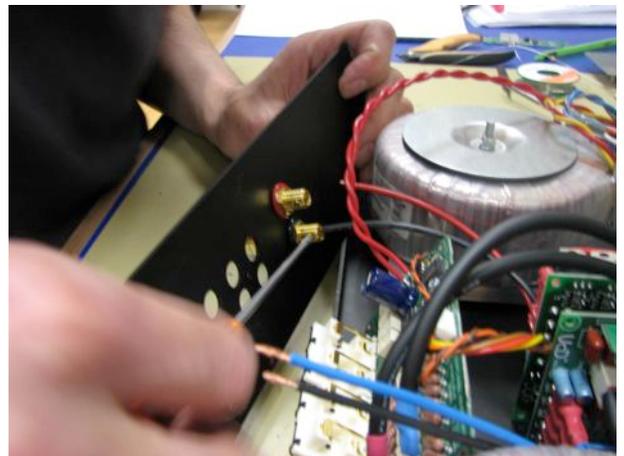


Fit each wire in the loudspeaker terminal, tighten firmly.

Black goes to black

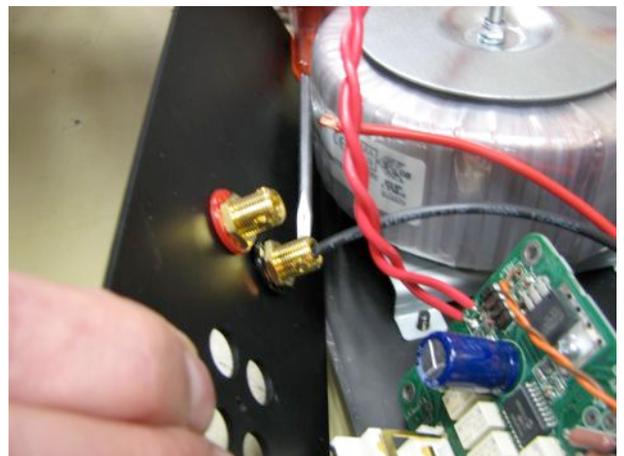


The red and blue wires go the red terminals, depending on the channel.



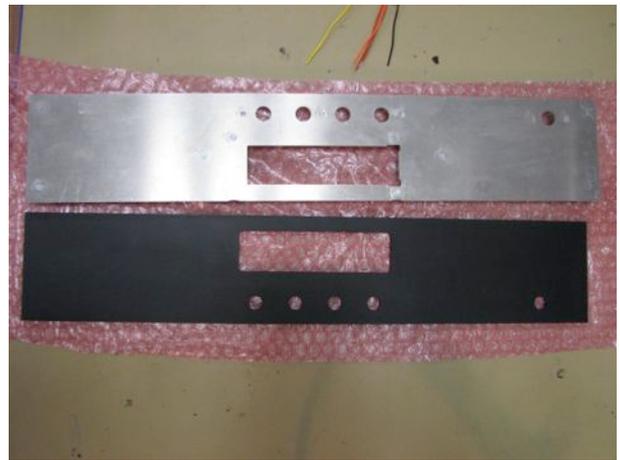
It may help to release the volume control board from the back, temporarily.

Once these 4 connections are OK, the back panel can be secured to the amplifier; use 7 pieces M3\*6 screw (securing process not shown on photo).

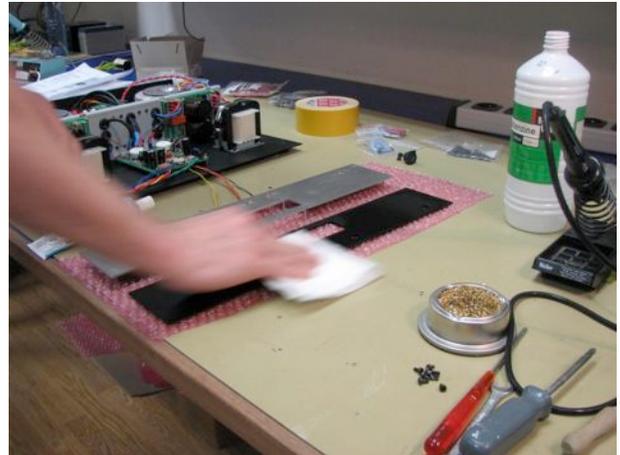


## 19 Assembling the front

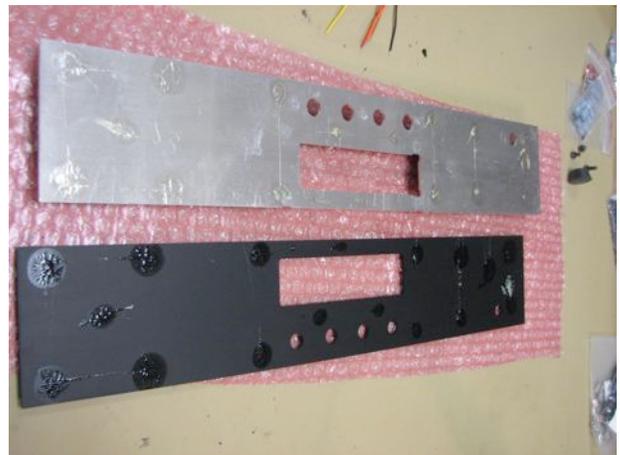
Place the front panel and front sub panel as shown.



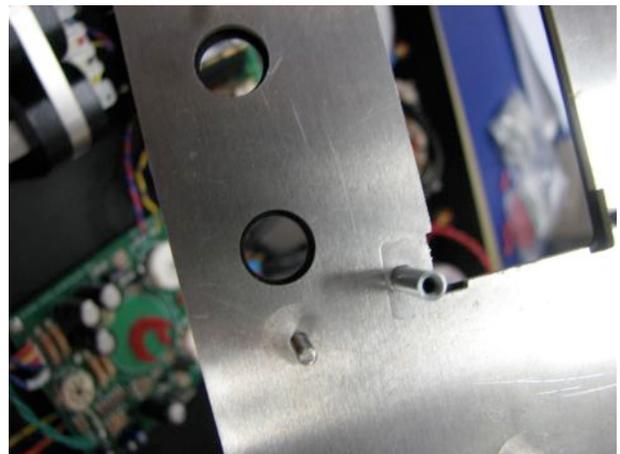
Clean both surfaces using white spirit, or another suitable cleaner



Put sufficient dots of suitable glue all over the surface. Bring the 2 panels together.

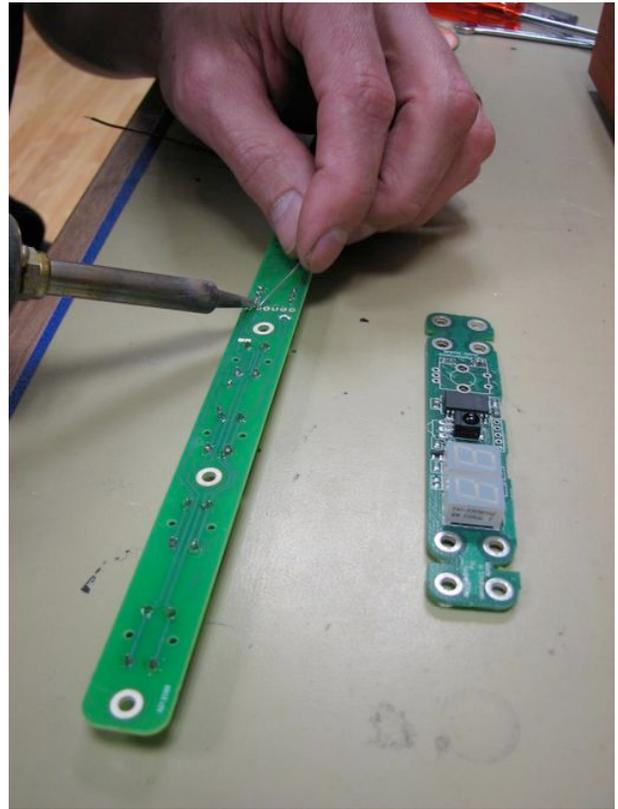


Make sure the panels are well aligned. The front switch holes are a suitable point to focus on; these holes shall be well centered as shown right.



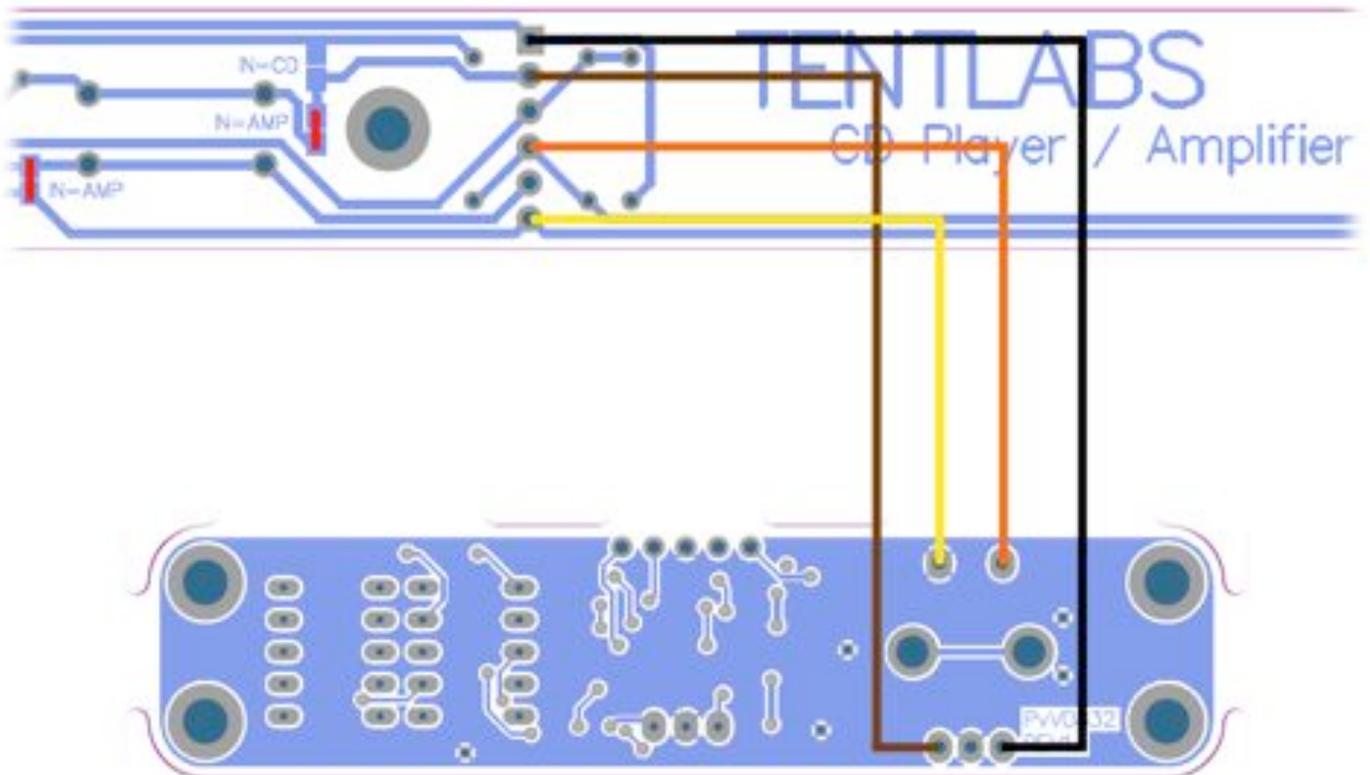
## 20 Mounting the button PCB

Take bag #5. Place the 5 switches on the button PCB and solder their (20) legs to the PCB. Also solder the 4 diodes on the button PCB. Watch their polarity, the stripe on the diode and the PCB should coincide.



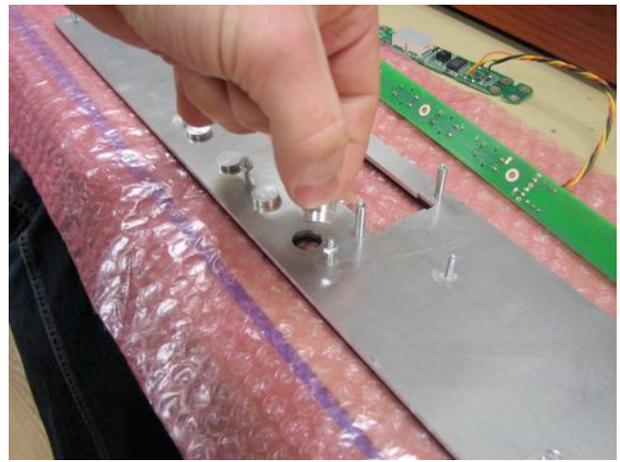
### 20.1 Connecting the button PCB to the volume control control-module

Solder the jumpers indicated with the red stripe, and wire the colored wiring from button board to volume control board, as shown below.

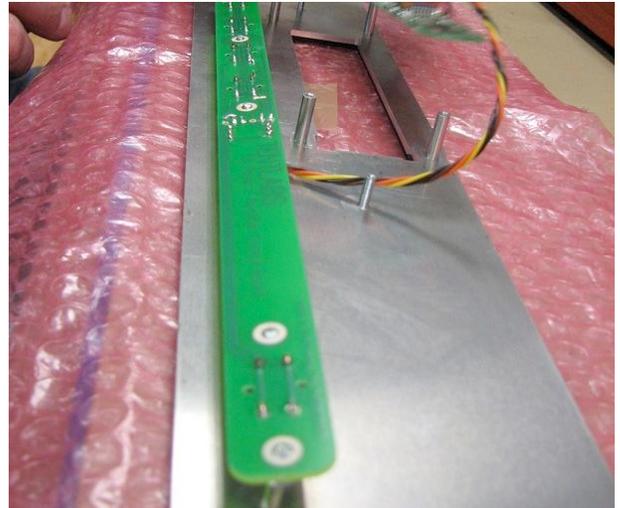


## 21 Preparing the front

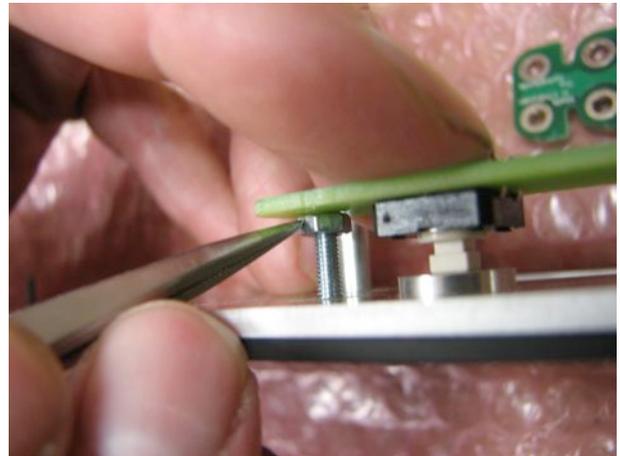
Place the 5 buttons. On the same row, 5 studs are present. Place M3 nuts on these studs, so that about 3mm of thread remains.



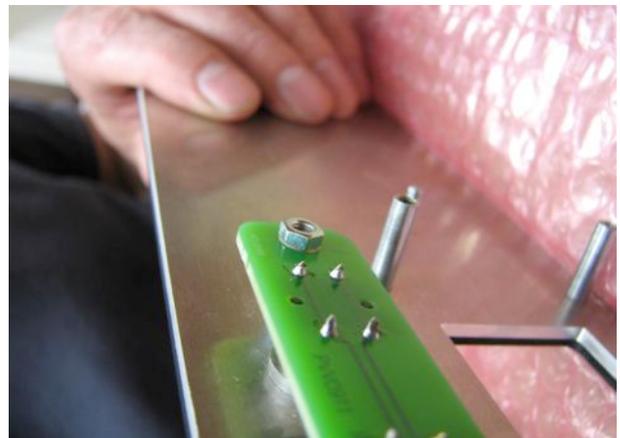
Place the button PCB on top



Adjust all 5 nuts so that the buttons "just" touch the switches.



Secure the button PCB using another 5 pieces of M3 nuts. Keep checking if the button to switch distance is OK.



## 21.1 Finishing the front panel

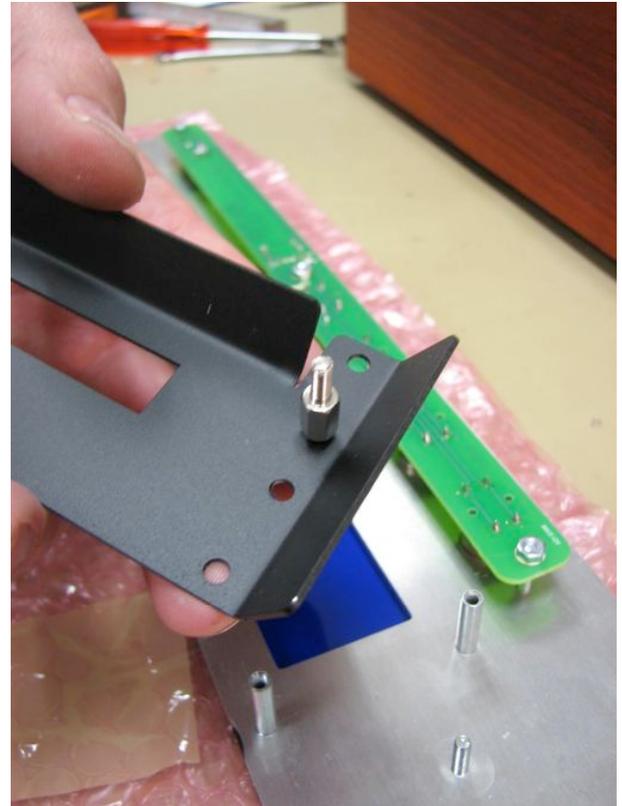
Place the blue acrylic. They should gently snap into its place. Do not remove protective foils yet !



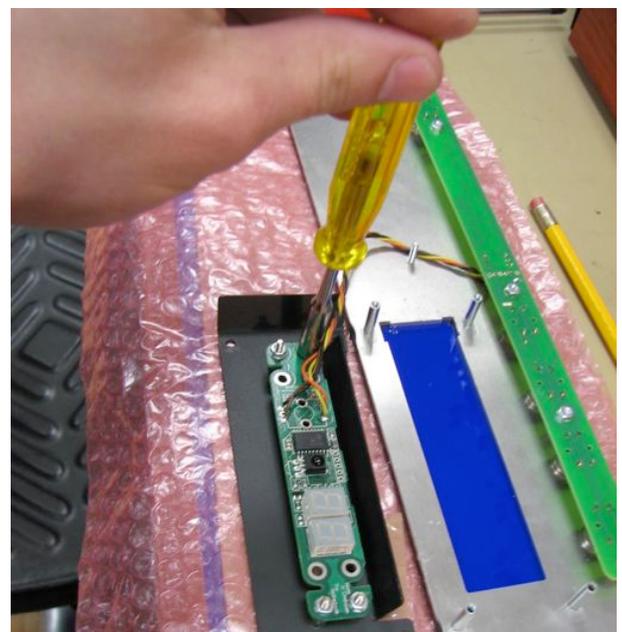
Take the Display cover and mount 4 studs, using M3\*6 screws.

### Note

An error has been made in production. Use the inner 4 holes, of which 2 of them are made by hand.



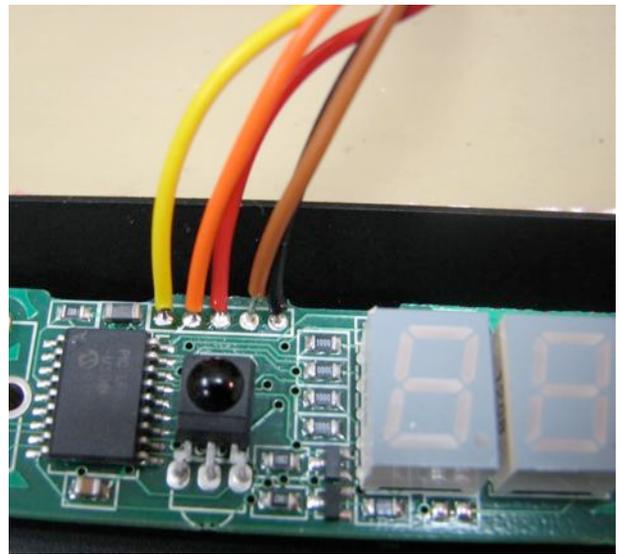
Place the front panel PC on the Display cover, and secure it with 4 M3 nuts.



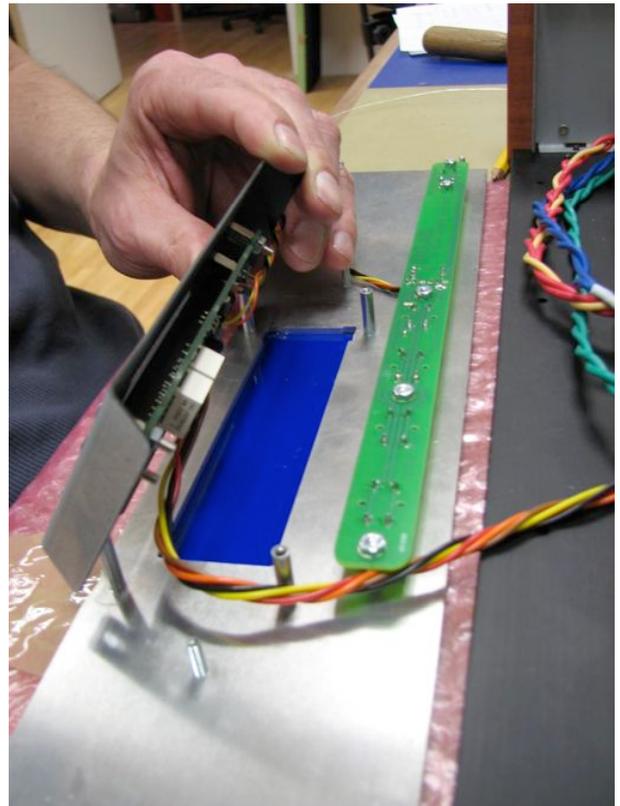
## 22 Wiring the front PCB

Take the coloured wiring (5 colours) from the volume control relay board, the white connector can be released.

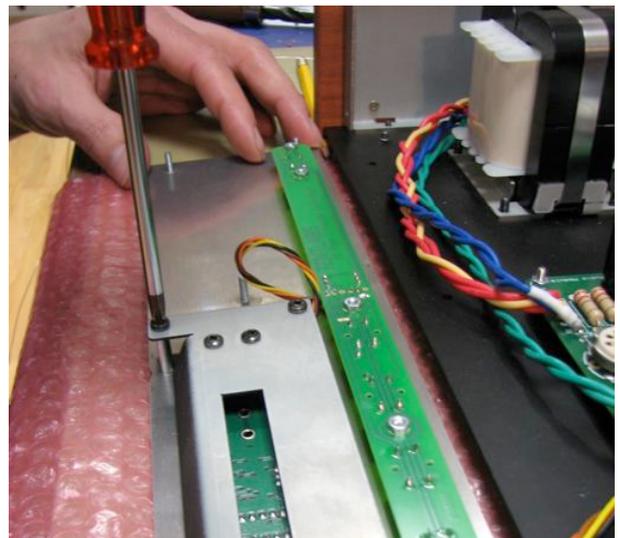
Solder the 5 coloured wires to the front panel PCB, as shown right.



Place the new assembly on the 4 remaining studs on the front panel assembly

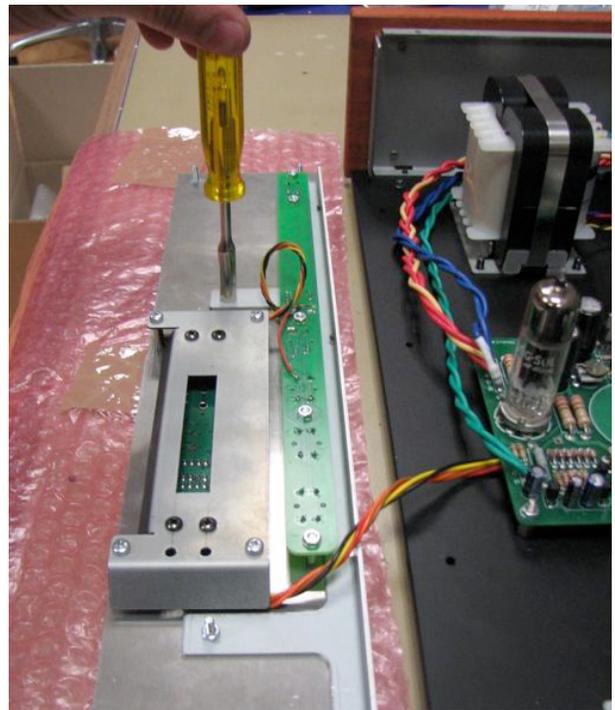


Fix the Display cover using 4 pieces M3\*6 screw.



## 22.1 Placing the front panel

Mount the front panel support on the 2 studs, use 2 pieces M3 nut.



Now the front panel is fully prepared, it can be mounted in the cabinet.

Release the screws that connect the base plate with the sides, a little.

Place the front panel and secure it with 4 nuts M3

Guide the interface cable from the volume control below the valve driver board, through the central bridge (middle grommet) towards the relays board: Connect using the white connector.



The moment of truth is coming nearer...

Ask a friend or neighbor to carefully check all wiring. Fatal damage may occur when errors are made in:

- Transformer to supply module wiring
- Power supply to UCD module wiring
- Transformer to valve driver module wiring

So give these points extra attention when checkng



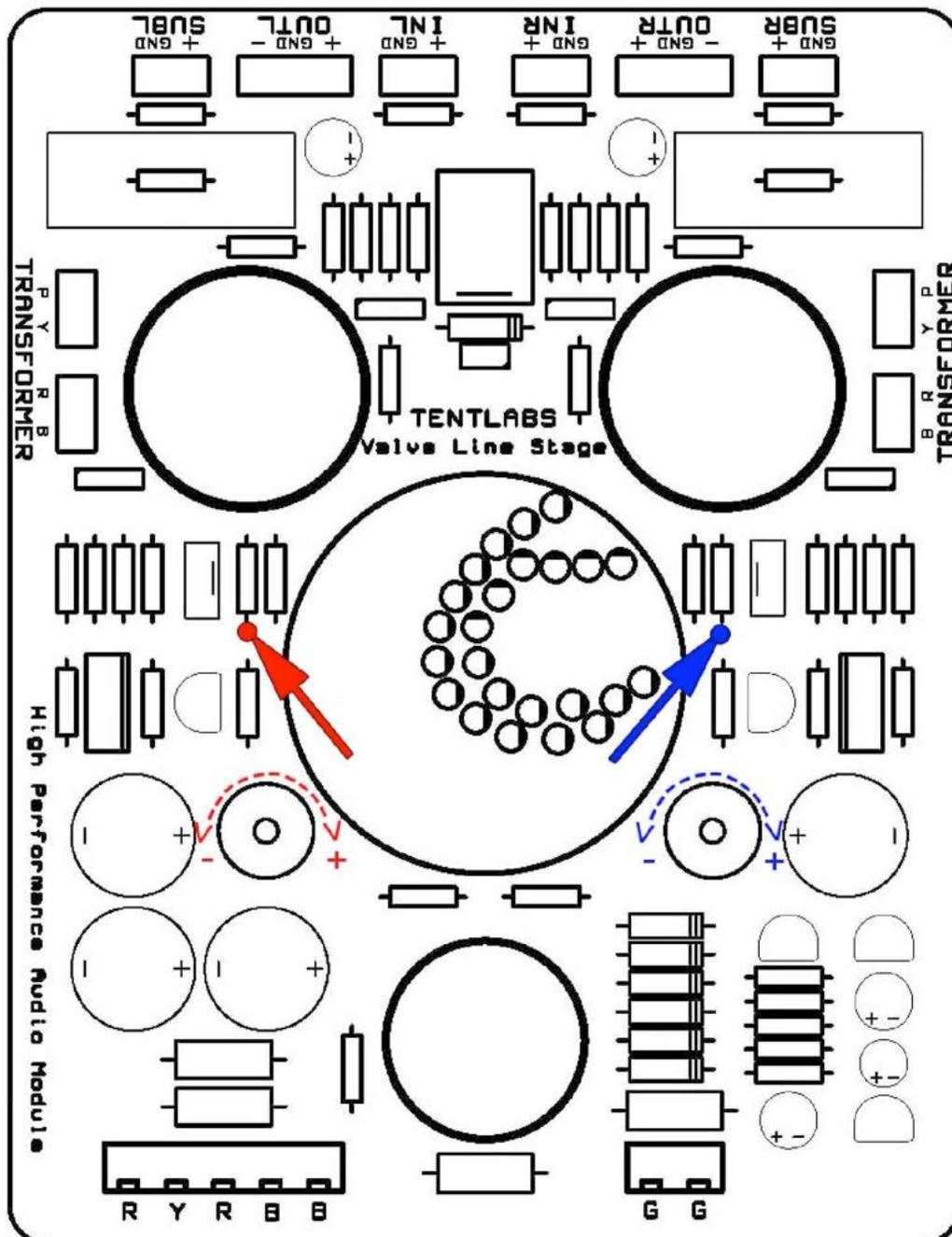
## 23 Switching on amplifier / Adjusting the valve driver bias

Place the tubes on their holders on the board. Gently wiggle them, while pushing downwards. After careful checkup, the amplifier can be switched on. Normally after about 15 seconds the valves and the LED logo will light up. Let the amp stabilize for 10 minutes, than the adjustment can be carried out.

On the driver module, 2 potentiometers are present. These adjust the standing current through the shunt regulator. These are factory adjusted, but may need some fine-tuning. Take a screwdriver that neatly fits in the black trimming potentiometers.

Connect the black probe of a multimeter (range 200mV DC) with the speaker ground (either channel OK), and the red probe on the points indicated on the drawing below (red for left channel, blue for right).

Trim the trimmer until the multimeter reads 60mV (+/- 6mV). Repeat for other channel.



**24 Congratulations !**  
Enjoy the glow, and the sound !

