

# Manual

## Guitar Amplifier G3 „Blues“



## Preface

So here it is, your G3 “Blues” kit and perhaps you’re wondering, if assembly is as easy as said and if this tiny 2-3W amp is worth the effort at all. The answer in both cases is YES, assembly will be pretty easy and the G3 “Blues” is great for playing a real tube amp with low volume, but there is one constraint:

The G3 “Blues” is not made for using it on stage, neither the mechanical design nor the power is made for using it „on the road“, please take care of that, otherwise you won’t have fun for too long with the amp ☹

Before we start, let’s just talk for a minute about your personal safety.

**Tube circuits are working with high voltages of up to some hundred volts in this circuit, these may be deadly. So be careful, when measuring, and take care of all security advices in this manual, it’s worth the time!**

This manual contains a brief overview of all features and connections plus (the main part) a detailed description, how to build the amp. If you have any questions, please use the Forum ([forum.musikding.de](http://forum.musikding.de)).

Please notice, that regardless of all checks and tests with the prototype we can’t avoid each and every error in this dokumentation. I will not be liable for any losses or damages originating from information from this document. Please send me a note, if you find any error.

OK, let’s come back to what you will have definitely:

Have lots of fun while building the Kit and discover the sounds !



**Important note:**

This version 1.0 of the manual includes some photos of the prototype (aluminium chassis). Due to the fact, that the power and output transformers also have been prototypes, some colors of the attached wires are not the same as in the layout plan. Please ignore those colors, the layout plan as well as the photos of the final version (black chassis) are showing the correct colors for both transformers.

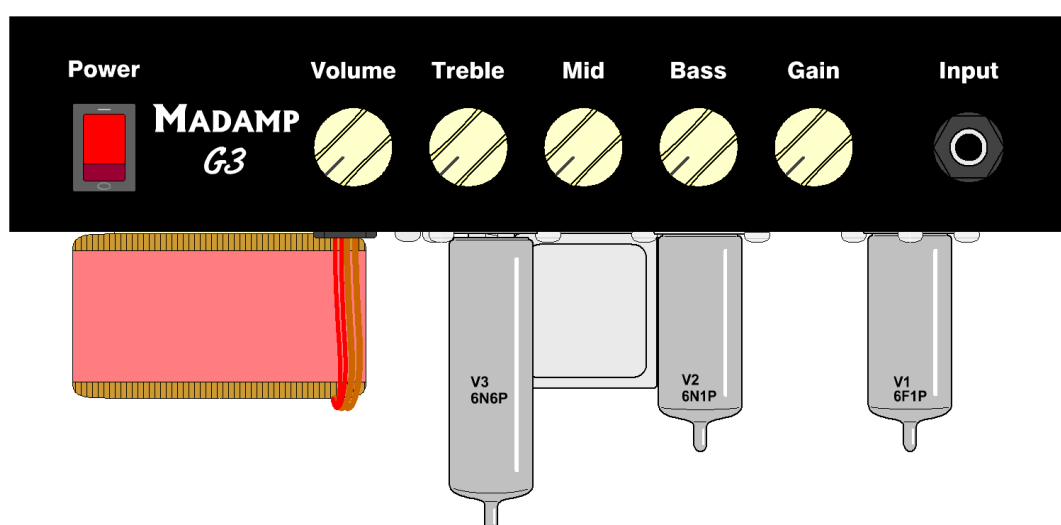
## Content

1	Preparation .....	5
1.1	Description .....	5
1.2	Bill of Material .....	6
1.3	Documentation Overview .....	8
	The following documents are supplied with the kit:.....	8
1.4	Tools needed .....	8
1.5	Security Advice .....	9
2	Building the Amplifier .....	10
2.1	Parts .....	10
2.2	Assembly of the soldering strip .....	10
2.3	Wiring the front elements.....	15
2.4	Assembly of the Chassis .....	16
2.5	Wiring the power switch, power plug socket and power transformer.....	18
2.6	Wiring the tube sockets .....	19
2.7	Wiring the output transformer .....	20
2.8	Remaining connections and testing the power supply .....	20
3	Full view of assembled chassis .....	21
4	Startup and measurements.....	22

# 1 Preparation

## 1.1 Description

The G3 is a singel channel full tube amp with a 3W Push-Pull power stage using a Russian 6N6P twin triode. The phase splitter (PI) is implemented using a cathodyne circuit using one triode of a Russian twin triode 6N1P. The other triode is used as amplifier stage after the three band tone stack with Treble Mid Bass (TMB). The first amplifier stage is based on the pentode of a russian 6F1P Pentode/Triode. The gain control is implemented by changing the screen voltage (g2) of the pentode, so this does not only change the gain but also the compression effect of the pentode. The following triode of the 6F1P is used as a cathode follower to feed the tone stack.



These are the **controls at the front panel**:

Input	Input plug socket
Gain	Amplification and compression control
Bass	Bass control
Mid	Mid control
Treble	Treble control
Volume	Volume control
Power	Power switch

While „Volume“ is implemented as a standard control (variable resistor between tone controls and amplification stage V2a), „Gain“ is something special. The variable resistor P1 controls the influence of capacitor C3 regarding the signal (how much the signal from screen g2 of the pentode is „shortened“ to ground). The component values are set in a way, that turning P1 clockwise results not only in some more gain, but is also reducing the compression of the signal (left hand side = less gain and some compression, right hand side = more gain and no compression). Just give it a try – less Gain and more Volume vs. more Gain and less Volume results in a much different sound at the same loudness level!

These are the **controls at the rear panel**::

Mains In	Power plug socket 230 V 50 Hz
Fuse	Fuse (0,25 A slow blow, Ø 5 x 20 mm)
Speaker 8 Ohms	Plug socket for 8 Ohms speaker
Speaker 16 Ohms	Plug socket for 16 Ohms speaker

The dimensions of the chassis are (WxHxD): 254mm x 51mm x 152mm.

The M4 nuts for assembly of the chassis in a headshell or combo cabinet are set symmetrically at 236mm (width) and 102mm (depth) from each other in the chassis.

The depth is the same as for a Fender chassis strap (4“).

**Please beware switching on the amp without a speaker or load resistor, otherwise the output transformer could turn to smoke soon. The speaker connectors are to be used alternatively, never at the same time.**

## 1.2 Bill of Material

The following parts are provided with the G3 “Blues” kit:

Reference	Qu	Type	Value	Comment
R6,R26,R27	3	Resistor MF 2W 5%	100	brown-black-brown-gold
R22	1	Resistor MF 2W 5%	150	brown-green-brown-gold
R20	1	Resistor MF 2W 5%	330	orange-orange-brown-gold
R4	1	Resistor MF 2W 5%	560	green-blue-brown-gold
R11	1	Resistor MF 2W 5%	1k	brown-black-red-gold
R15,R23,R24	3	Resistor MF 2W 5%	2k2	red-red-red-gold
R10	1	Resistor MF 2W 5%	22k	red-red-orange-gold
R2,R14,R16	3	Resistor MF 2W 5%	33k	orange-orange-orange-gold
R7	1	Resistor MF 2W 5%	39k	orange-white-orange-gold
R9	1	Resistor MF 2W 5%	47k	yellow-violet-orange-gold
R3,R19,R21	3	Resistor MF 2W 5%	68k	blue-gray-orange-gold
R8	1	Resistor MF 2W 5%	120k	brown-red-yellow-gold
R5	1	Resistor MF 2W 5%	330k	orange-orange-yellow-gold
R12,R13,R17,R18,R25	5	Resistor MF 2W 5%	470k	yellow-violet-yellow-gold
R1	1	Resistor MF 2W 5%	1M	brown-black-green-gold
C5	1	Capacitor	270pF 50V Styroflex	
C8,C9,C10	3	Capacitor	4,7nF 630V Polyester axial	
C1	1	Capacitor	22nF 630V Polyester axial	
C6,C7	2	Capacitor	22nF 400V Rubicon F2D	
C4	1	Capacitor	47nF 630V Polyester axial	
C3	1	Capacitor	100nF 630V Polyester axial	
C2	1	Electrolyte Cap	10µ 63V radial	
C11	1	Electrolyte Cap	220µ/16V radial	
C15	1	HV Electrolyte Cap	22µ/350V radial	
C12,C13,C14	3	HV Electrolyte Cap	47µ/350V radial	
P4	1	Variable Resistor	B50k Alpha 16 lin	MID
P2	1	Variable Resistor	A250k Alpha 16 log	TREBLE
P3	1	Variable Resistor	A500k Alpha 16 log	BASS
P1	1	Variable Resistor	C500k Alpha 16 rev-log	GAIN

P5	1	Variable Resistor	A1M Alpha 16 log	VOLUME
J1,J2,J3	3	6,3mm plug socket	¼" plug socket ampstyle	
V1	1	Tube	6F1P	Russian: 6Φ1Π
V2	1	Tube	6N1P	Russian: 6H1Π
V3	1	Tube	6N6P	Russian: 6H6Π
D1,D2	2	Diode	1N4007	
BR1	1	Rectifier	B500C1500 Bridge	
OT	1	Output Transformer	OT-G3-V1	China
PT	1	Power Transformer	PT-G3-V1	Toroid Badel
S1	1	Power switch	Arcoelectric H8553VBG3	Arcoelectric green
XP1	1	Rubber connector	with fuse holder, snap in	
F1	2	Fuse	Slow blow 250mA, 5x20 mm	Spare fuse in XP1
MP1	1	Chassis	CH-G3-V1	Steel Chassis G3
MP2	1	Soldering strip	2 rows 8x27, 2x 25 lugs	
MP3,MP4,MP5	3	Tube sockets	Noval for chassis assembly	
MP6,MP7	2	Grommet	Ø 6/8 rubber	
MP8	1	Grommet	Ø 8/10 rubber	
MP9,MP10,MP11	3	Roller	Ø 7/4 x 5 mm plastic	
	6	Screw	M3 x 6 DIN 7985	For tube sockets
	5	Screw	M3 x 12 DIN 7985	For soldering strip and ground
	2	Screw	M4 x 6 DIN 7985	For output transformer
	1	Screw	M5 x 50 DIN 7985	For power transformer
	12	Nut	M3 DIN 934	
	2	Nut	M4 DIN 934	
	1	Nut	M5 DIN 934	
	1	Washer	Ø5/15 DIN 9021	For power transformer
	12	Lock washer	M3 DIN 6797A	
	2	Lock washer	M4 DIN 6797A	
	1	Lock washer	M5 DIN 6797A	
	5	Lock washer	M7 DIN 6797A	For variable resistors
	0,25	Flexible wire [m]	0,5 mm² blue	
	0,25	Flexible wire [m]	0,5 mm² brown	
	0,10	Flexible wire [m]	0,5 mm² green/yellow	
	1,5	Hookup wire [m]	0,5 mm² green	
	1	Hookup wire [m]	0,5 mm² black	
	1	Hookup wire [m]	0,5 mm² red	
	1	Hookup wire [m]	0,5 mm² yellow	
	0,2	Shrinking tube [m]	Ø 4,8/2,4 black	
	4	Lug	M3, 45°	
	1	Power cable	Plug and joint	
	1	Screening sheet	254x152x0,2 mm Aluminum	To be cut to chassis size
	5	Knob	Toggle button beige Ø 19 mm	

### 1.3 Documentation Overview

The following documents are supplied with the kit:

- a) This manual,
- b) the schematic,
- c) the layout plan, and
- d) Measurement sheet (quiescent voltages).

All documents are supplied in electronic form.

### 1.4 Tools needed

For building the kit you will need the following tools. For every tool needed you can use optional additional (but not necessary) tools to simplify your work.

- a) Multimeter (Voltage/Current/Resistance)  
optional: signal generator, oscilloscope, secondary multimeter, capacitance meter
- b) Soldering iron and solder  
optional: desoldering iron
- c) Flat nose and wire cutting pliers, stripper
- d) screwdriver for slotted grub screws / screwdriver for slotted head screws  
optional: bench vice
- e) Socket or combination wrench  
size 5,5 (M3)  
size 7 (M4)  
size 8 (M5)  
size 10 (Pots)  
size 14 (for 1/4" plug sockets)
- f) Lighter for fireplace/grill (lighter with long nozzle)  
optional: heat gun for shrinking tube
- g) Folding rule and ruler  
optional: slide gauge
- h) Optional: Noval plug for tube sockets or old noval tube\*
- i) Wooden peg
- j) Tape
- k) An 8 Ohm Speaker >5W for testing purposes  
optional: Power Resistor 8 Ohm >5w

\* The noval plug or the old noval tube should be plugged in the tube socket during soldering the lugs of the tube socket to prevent it from warping.



## 1.5 Security Advice

Please be aware, that Tube Amplifiers are using high Voltages, so never touch a solder lug, wire or any other conductive parts inside the amp while switched on or connected to the wall outlet. Though all parts at the top of the amplifier are isolated, take care of high voltages even there, they are dangerous!

So the old guiding principle „never use both hands, when measuring high voltage“ is still valid, especially when you're wearing isolating shoes (soles) to minimize risk. In the case of touching a part with high voltages, the current won't flow through your heart then, which is the most dangerous issue with high voltages.

Derived from these facts you should neither experiment with the earth connection of your amp, nor doing some „quick changes“ to your amp layout, when connected to the wall outlet. For measuring voltages and current always use isolated spikes, specified for at least 500V by the vendor.

When turned off and disconnected from the wall outlet, all voltages will drop down to or near zero in one to two minutes. Last but not least please be aware, that the tubes are pretty hot and should cool down before touching or removing them.

A last word about the fuse: There is always a reason for a burned out fuse, most of the time your layout is incorrect, in some rare cases one of the parts (e.g. an electrolytic capacitor) is defective. Never replace a fuse with a bigger one (regarding max. current), always check the layout and the parts first and then replace the fuse with the same value as before.



## 2 Building the Amplifier

This chapter describes the complete assembly of the amplifier, you'll find a photo of the fully assembled amp in the last section.

### 2.1 Parts

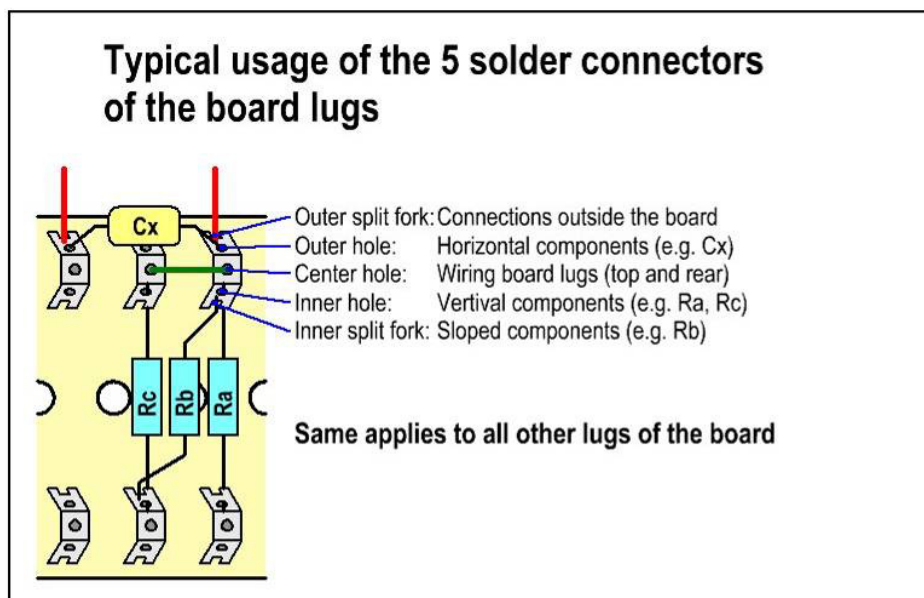
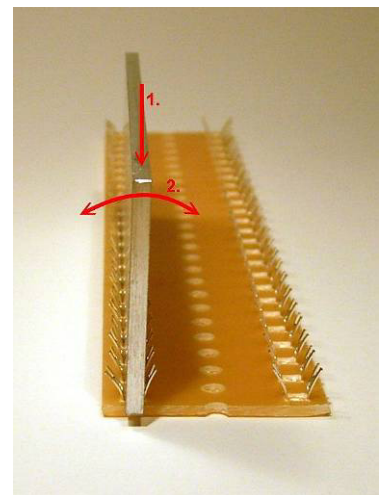
The bill of material includes color codes or lettering respectively. Please check the values of the resistors before assembly (colors like brown, red or orange look sometimes quite similar). The capacitor types may change over time, so the lettering might be different than shown in this manual. As long as the voltage rating fits ( $\geq 300V$  for all capacitors besides the capacitors in the tone stack), this is OK.

### 2.2 Assembly of the soldering strip

Before assembling the soldering strip (also called „board“) you should fix all lugs at the board. Place the board on a flat surface and move a ledger (width 3-3,5mm) to fasten the lugs.

It's helpful to number the lugs (at least lug 1) at both sides of the board.

Each lug of the board supplies 5 opportunities to solder a wire or a component, please refer to the below drawing for a structured way of wiring the board.



First assemble all wires to the rear side of the board as shown in the drawing below. The connection from lug 12 to lug 11 needs to be extended to lug 10 at the top side of the board.

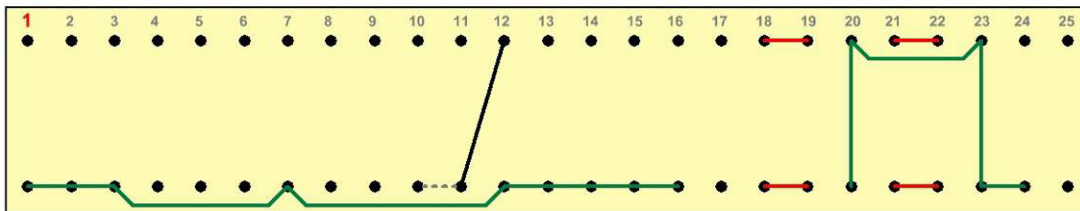
For connecting two lugs please use 2cm of stripped wire and bend it to U-size, insert it into both lugs and solder it.

For longer wirings to connect several lugs it's best to strip the wire completely and slide applicable pieces of isolation as needed on the wire. If the wire is bent some silicon oil helps.

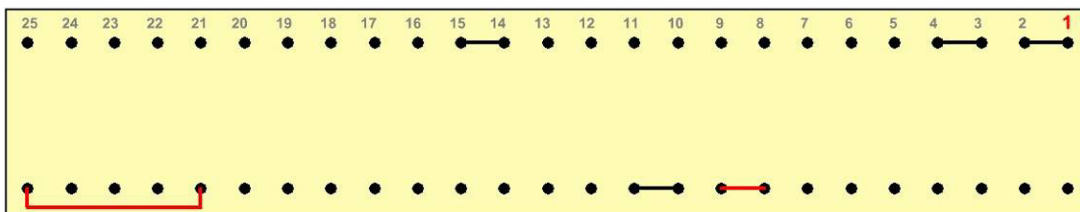
Next is wiring the connections at the top of the board as shown below.

The wire jumpers need to be inserted from the top and soldered from the bottom of the board. Please cut off overlaying wire as the distance to the chassis will only be 5mm when the board is assembled.

**Board Wiring - Rear View**

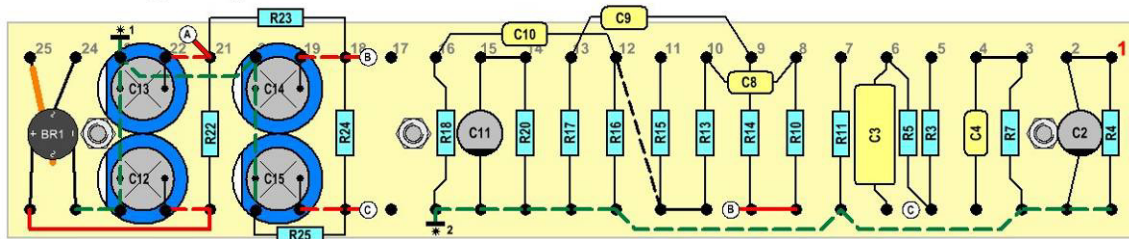


**Board Wiring - Top View**



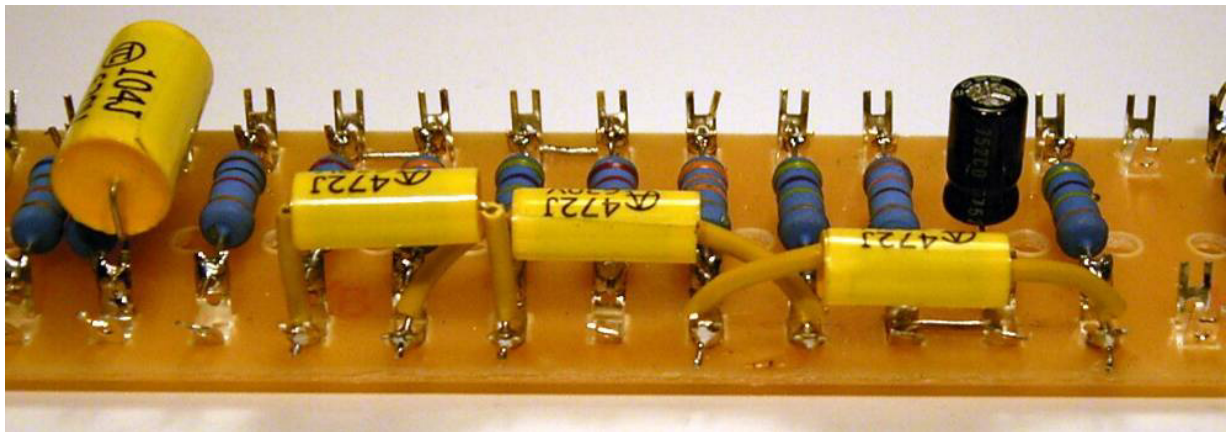
Please assemble now all components as shown and described below starting at the right hand side of the board. Please be aware, that lug 17 is not used!

#### Board Wiring - Fully Assembled



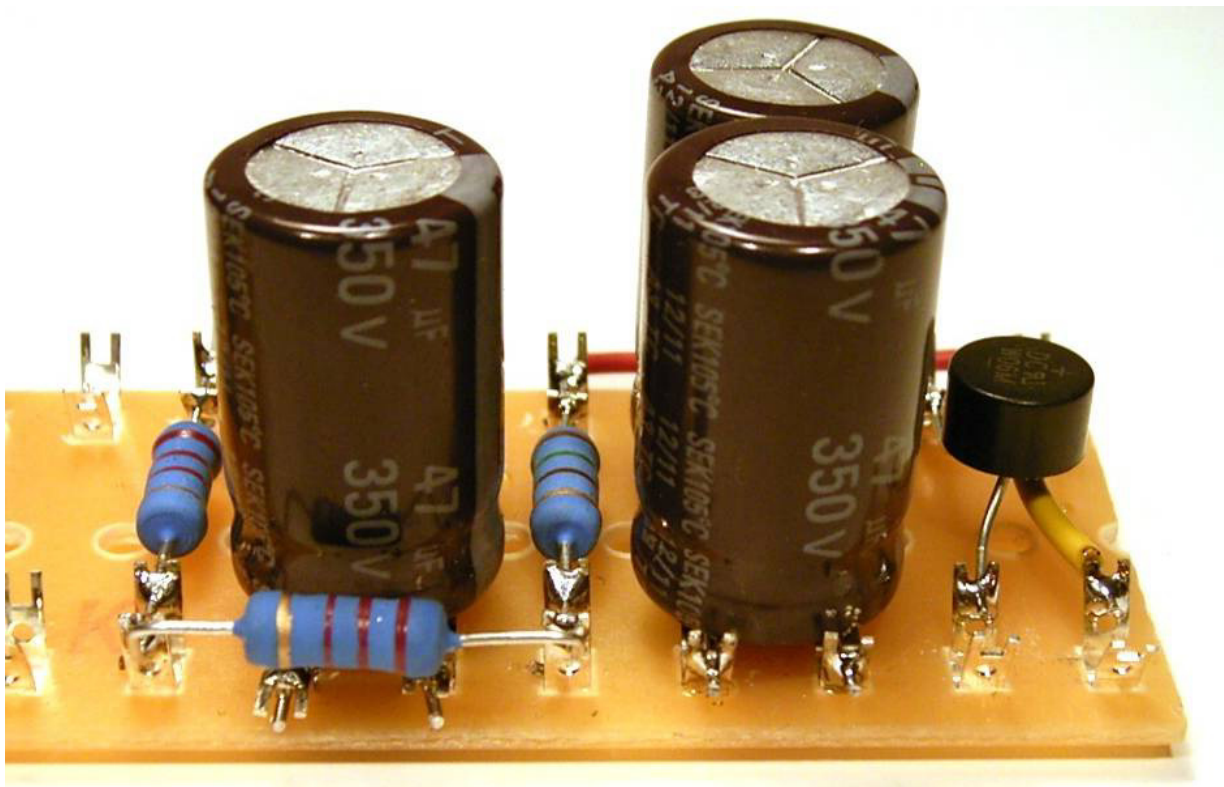
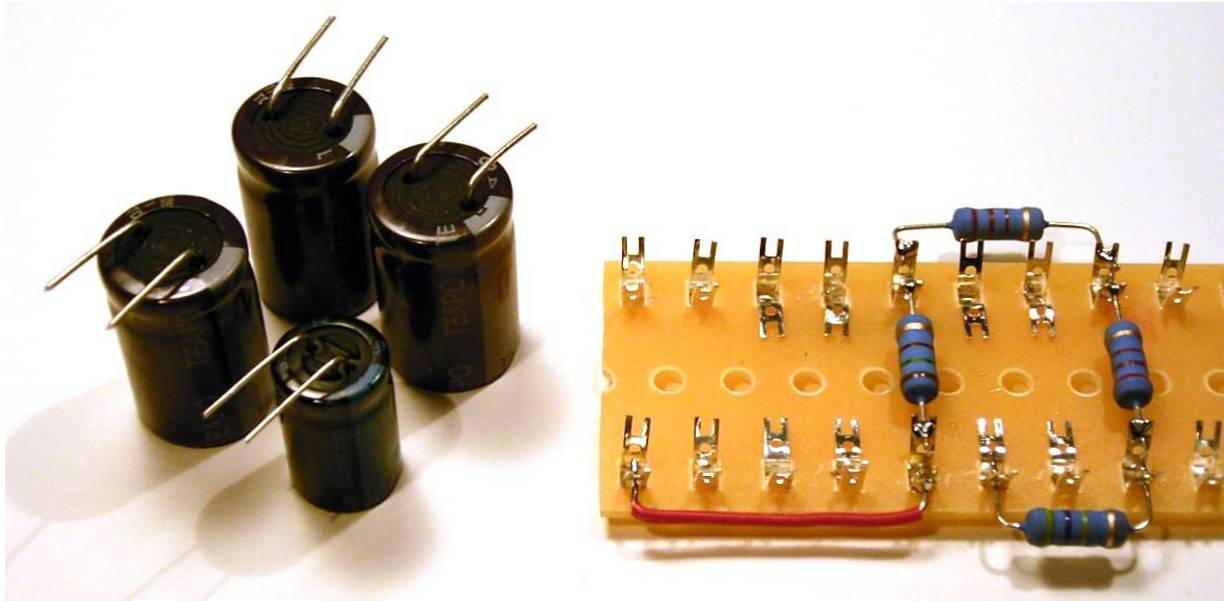
Please take care, that components C2, R7, R18 do not touch the nut (assembly of board in the chassis).

The leads of the capacitors C8, C9, C10 should be isolated using the stripped isolation of some wire.



The leads of the electrolytic capacitors C12-C15 for the power supply should be bent as shown below (the gap between the board and the caps should be about 1,5mm) and the remaining length of the leads should be 1,5cm. When the inner wing of the lugs at position 19, 20, 22 and 23 has been bent down to the board you can insert the caps into the outer holes and solder them (see photos below).

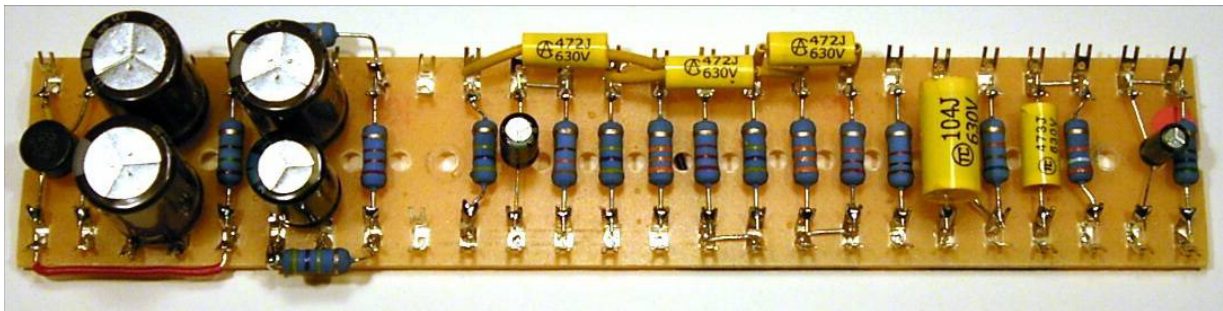




The leads of the bridge rectifier need to be bent and one "~" lead needs to be isolated as shown below.

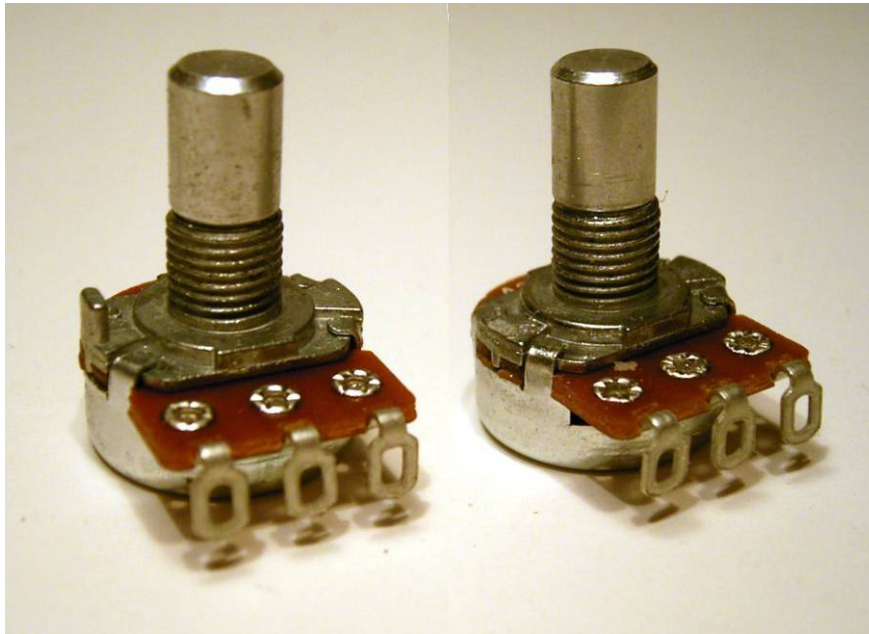


When everything is assembled, the board should look like this:



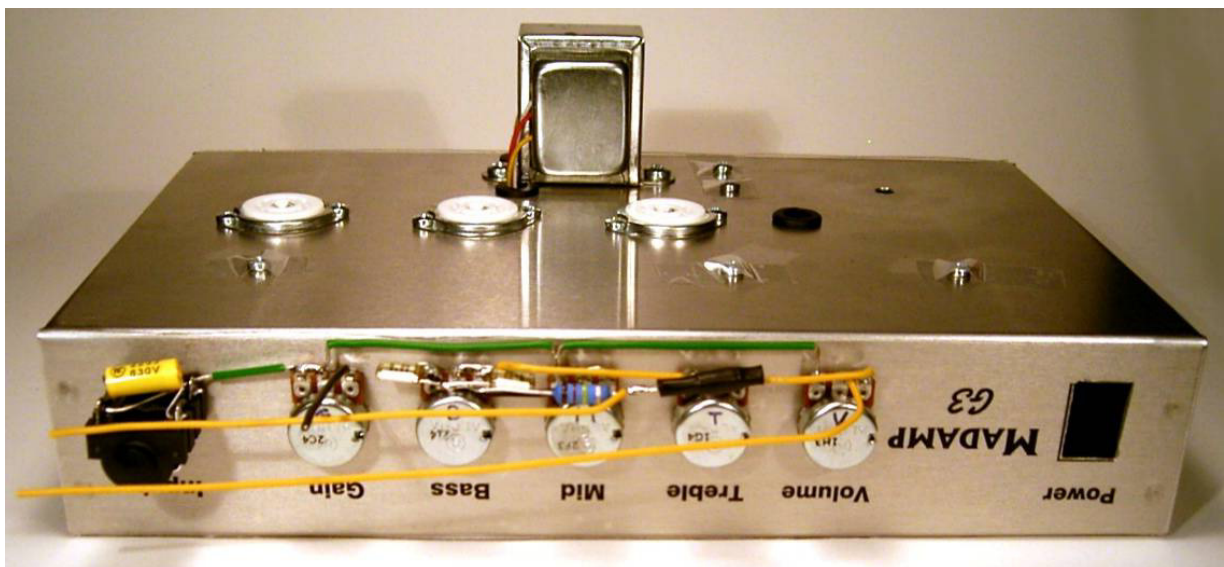
### 2.3 Wiring the front elements

First of all please remove the catch from each variable resistor (just break them off).



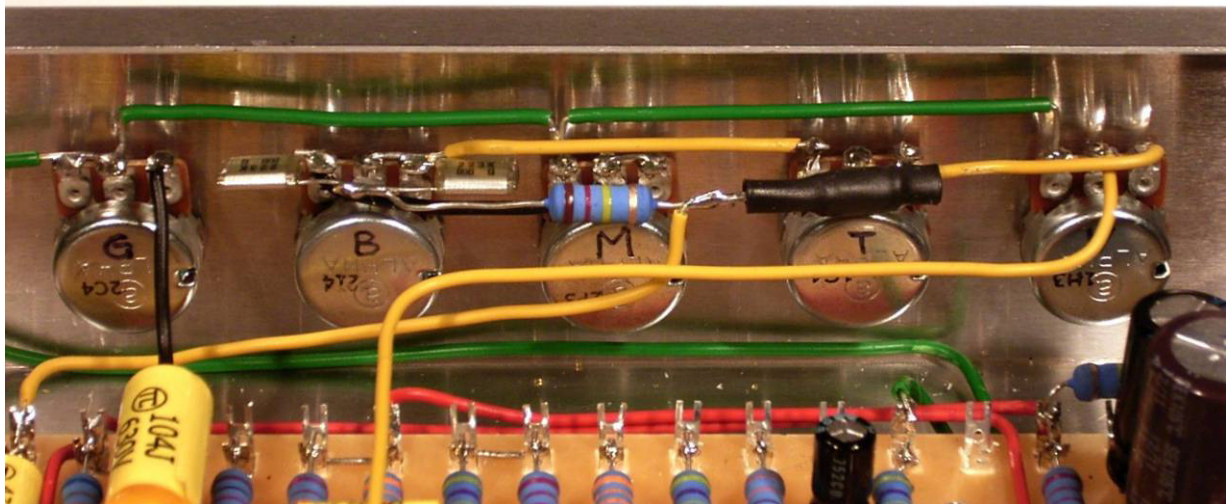
Next you should identify the pots and mark them (G, B, M, T, V) to ensure the correct position and sequence.

Now assemble the pots and the input plug socket at the front panel (from outside in), this will ease up the wiring of the pots and the plug socket (see photo below). Please use some shrinking tube to stabilize C5 and also attach the connecting wires to P5 and C5/R8 each.



Then take off the set of components and assemble it from the inside of the chassis placing a washer and a lock washer at each axis (see photo below).





## 2.4 Assembly of the Chassis

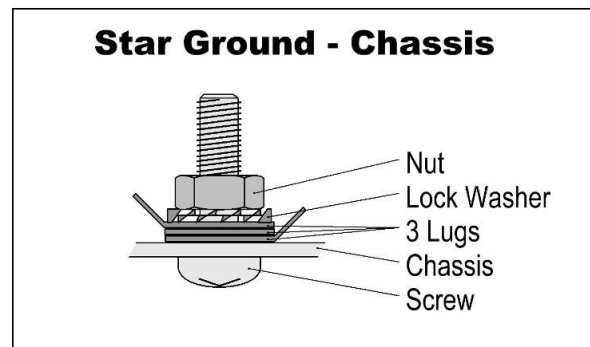
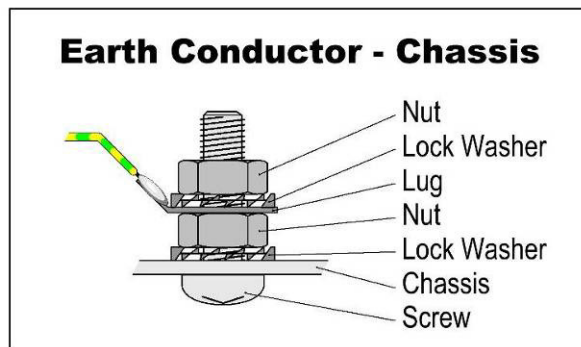
Please prepare the tube sockets before assembly by bending over the lugs as shown below, this will make the wiring of the lugs more easy. The best way to do this is by using a small screw driver, but first enter a noval plug or an old tube to keep the socket stable.



The tube sockets are assembled with screws M3x6, lock washers and washers. Please take care, that the gap between pin 1 and pin 9 of each tube sockets are pointing to the front panel of the chassis.

Now assemble the connector for ground and signal ground as shown below. To ensure proper electrical connection please remove the lacquer inside the chassis around the holes.





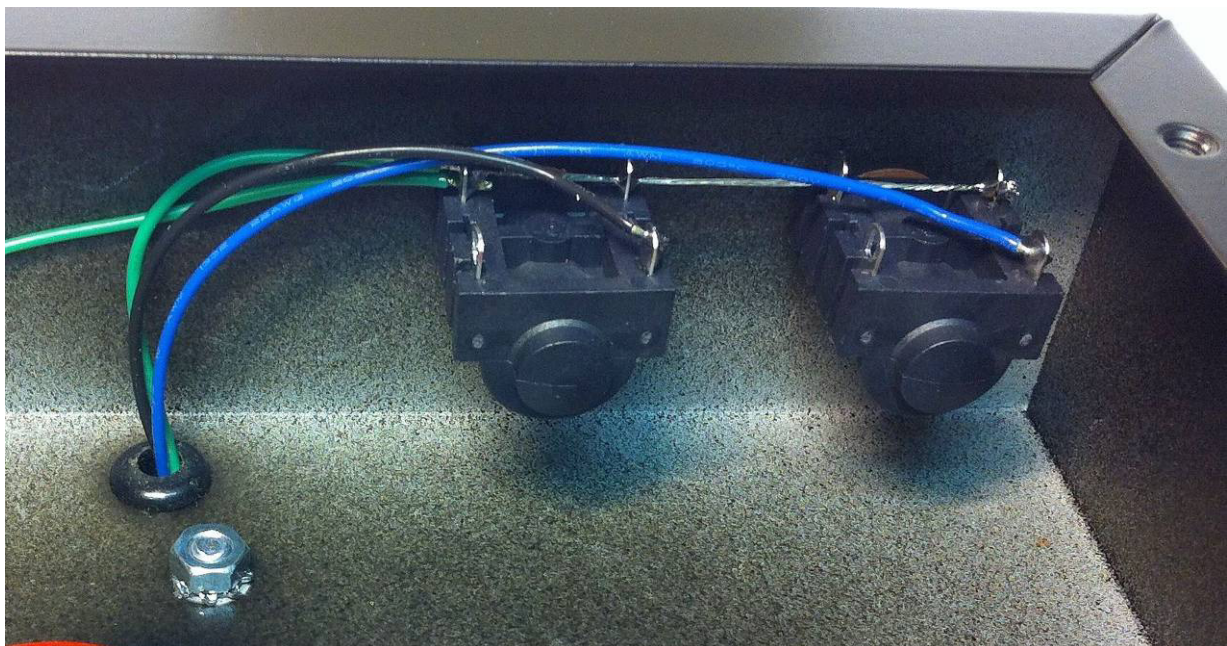
Now insert the three grommets into the respective holes, the bigger one is for the power transformer leads.

The power transformer itself will be assembled with the M5x50 screw, the order of assembly is screw - large shim - toroid transformer - rubber shim - chassis – lock washer – nut.

If you need to shorten the power transformer leads, please be aware, that the wire is lacquered. To remove the lacquer, put the lead on a flat surface and remove it with a blade. Turn around the lead until all lacquer is removed.

The output transformer needs to be assembled with 2x M4x6 screw, lock washer and nut.

Now assemble and wire the speaker plug sockets as shown below.



Before assembling the board to the chassis please connect the green ground wire of the input plug socket to GND #3 of star ground.

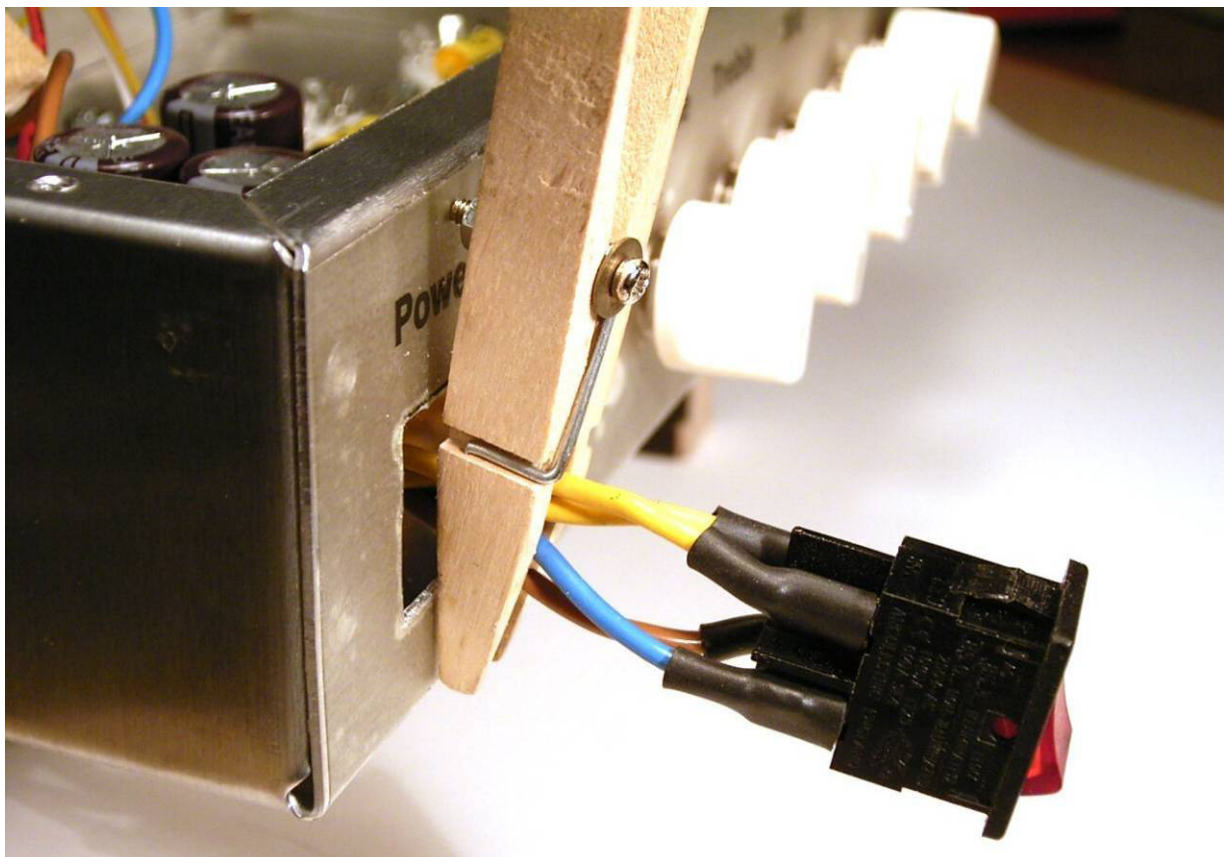
Now assemble the board, this is easier, when you temporarily fix the M3x12 screws in the chassis holes from the top with some tape. Then turn around the chassis, add the rollers and the board (take care to use the correct holes of the board) and add a lock washer and a nut. Please take care to not damage the components near to the nuts when tightening the nuts.

## 2.5 Wiring the power switch, power plug socket and power transformer

First solder and isolate the power switch outside the chassis as shown below using the wooden peg. Please take care to wire the switch correctly - the two wider spaced terminals are the input of the switch!

Please twist the wires to minimize hum and slide 1,5cm shrinking tube onto the wires (as far away as possible to avoid it from shrinking when soldering) before soldering them.

Then shrink the tube and push it into the chassis until it snaps in.

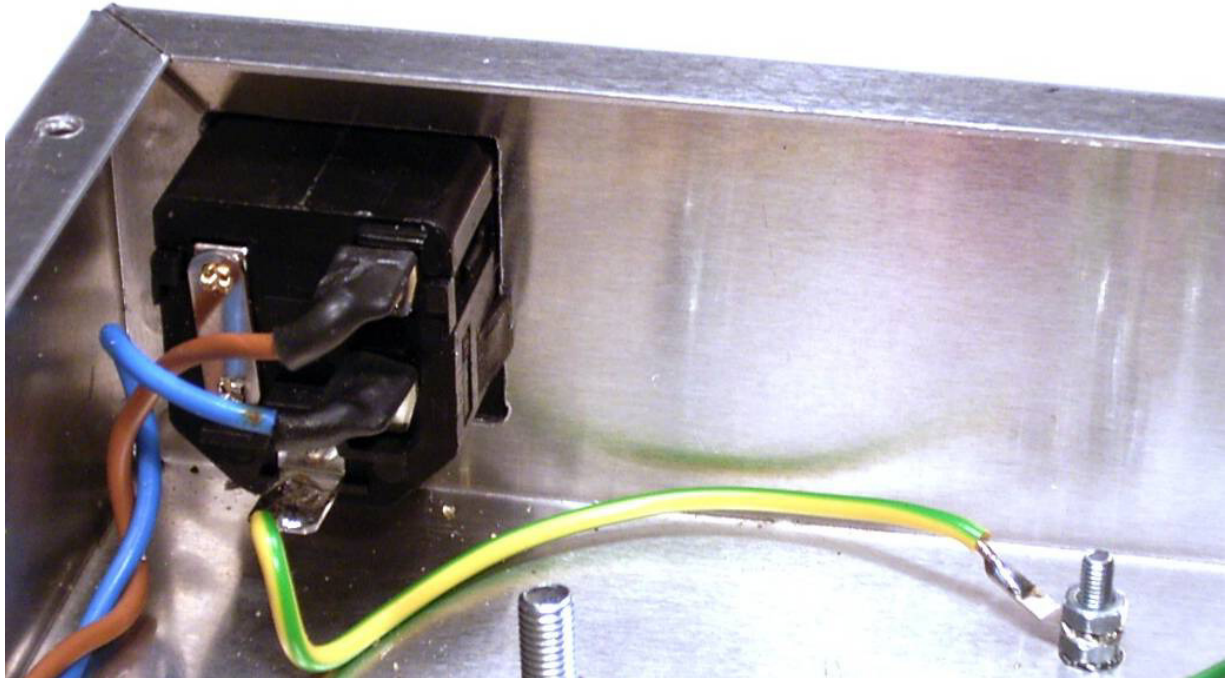


Next is the power plug socket (the earth connector should be near the chassis bottom), please wire this terminal first. The easiest way is again to solder it outside the chassis, please use 2 cm of shrinking tube for the brown and blue wire. After soldering and shrinking push the power plug socket into the chassis until it snaps in.

Now place the fuse (250mA slow blow) into the fuse holder and bend the wires from the plug socket to the switch into the corner of the chassis, this also reduces hum.

Please connect now the earth connector to the earth terminal as shown above.

It is essential to carefully check the connection of the earth terminal at the power plug socket to the earth connector at the chassis, this includes measuring the resistance – it must be 0 Ohm to protect your life!



Next are the heater wires from the power transformer (red-red), please shorten them as needed, twist them and connect them to lug 4 and 5 of V3. Now twist some red-black wires and extend the heater wires to V2 and to V1. Please bend the wires down to lay near the metal surface (see full picture of the chassis). Finally solder R26/R27 to V3 for a symmetrical ground reference.

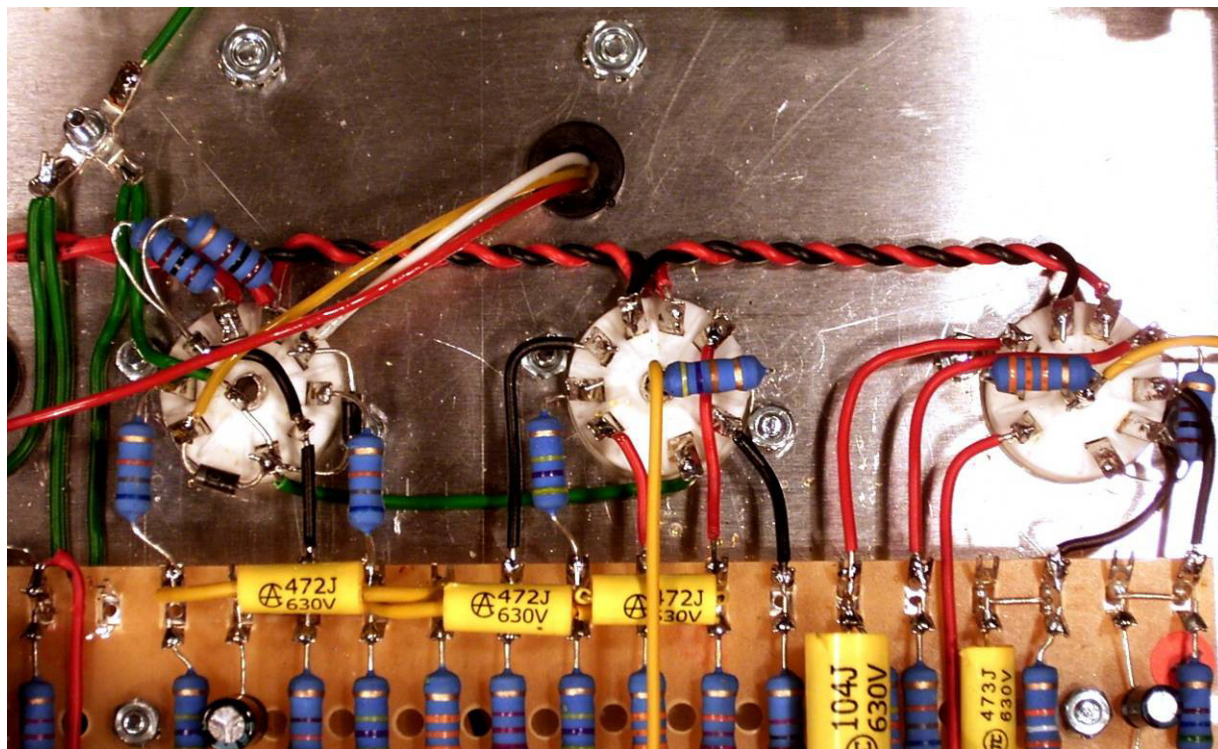
Now shorten and twist the plate voltage wires (brown-brown) and connect them to lugs 24 and 25 of the board.

## 2.6 Wiring the tube sockets

Start with V1 and continue with V2 and V3, first connect the wires to the tube socket (lower hole of the respective lug at the tube socket), then add the resistors and the diodes to the upper hole of the respective lug at the tube socket.

Before soldering the tube sockets please enter a noval plug or an old tube to keep the socket stable.





## 2.7 Wiring the output transformer

First shorten and connect the secondary connections of the output transformer to the speaker plug sockets and assemble the ground connection (green wire) to lug #5 at the star ground connector.

Then shorten and connect the wires for the primary connections of the output transformer to V3 and point (A) of the board. Please place the wires as shown in the layout plan to prevent hum and stray pick up.

## 2.8 Remaining connections and testing the power supply

Start with the remaining ground connections #1, #2 and #4 to star ground. Next are the connections of the tone stack at the front panel and the connections to the input plug socket (push the wires into the corner of the chassis as shown). Last but not least connect the Gain control pot to lug 6 of the board as shown in the layout plan.

Before connecting the amp to 230V and turning it on please check the complete wiring against the layout plan and the photo below. Now measure the “output voltages” of the power supply (+/- 10% is OK when the power supply input voltage is 230V, the variance could be more, if the power supply input voltage deviates from 230V):

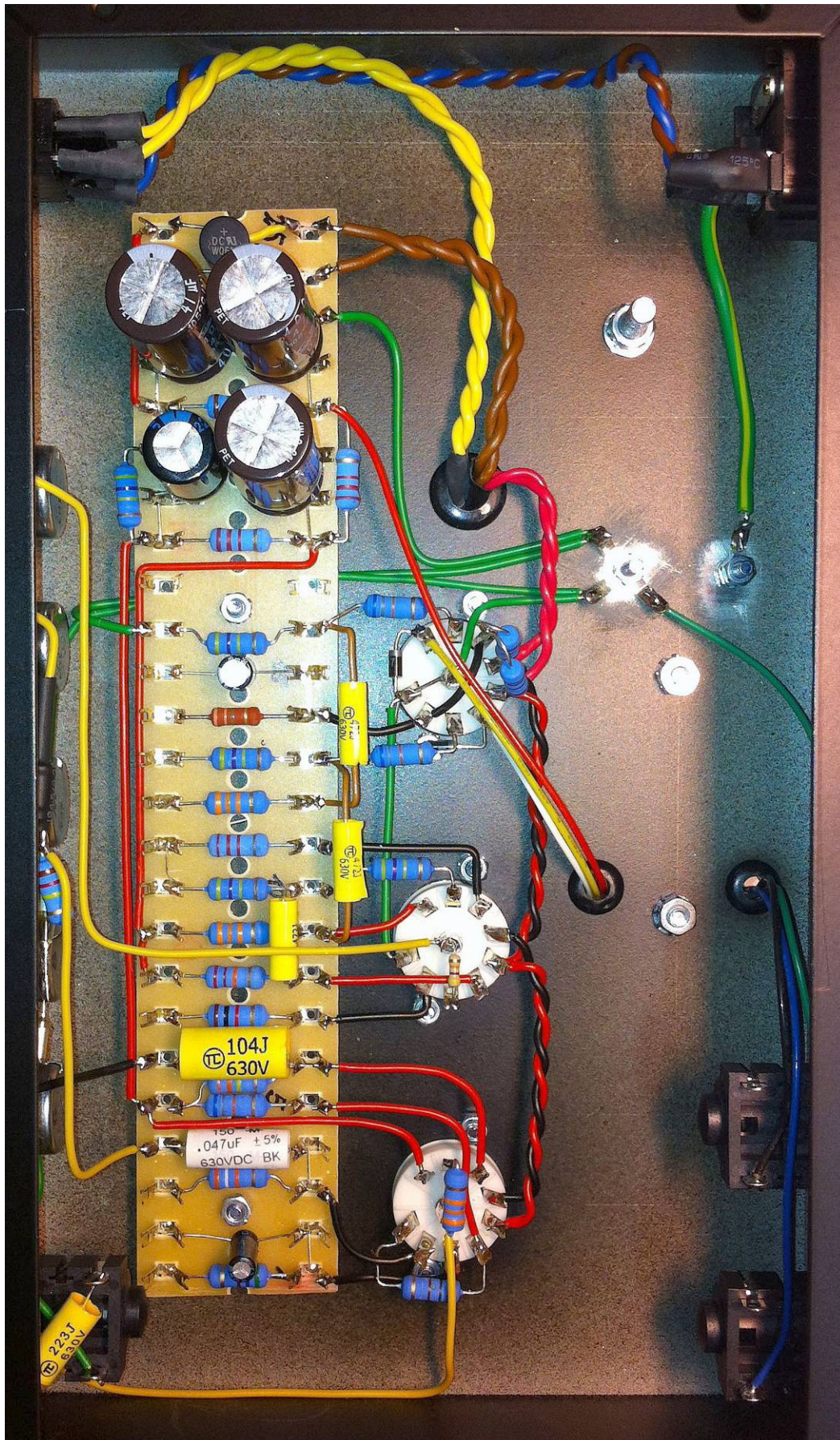
Point (B): 320 V DC

Point (C): 318 V DC

If the voltages are OK, please create the connections from (B) and (C) to the respective lugs of the board (see layout plan). Now the wiring is completed and should look like shown below.



### 3 Full view of assembled chassis



## 4 Startup and measurements

Though you're keen to start using the amp now, please take your time for a final check of the circuit. The best way is to check the circuit by comparing it to the layout plan and the photo above component by component. It's also a good way to make yourself familiar with the schematic and check the circuit against the schematic. You will find the assignment of the tube sockets (numbering) in the schematic and the layout plan.

If you're sure that everything is wired correctly, plug in the tubes, connect the amp to the wall power plug socket and turn on the amp. Watch the amp carefully, only the heater wired inside the tubes need to glow, nothing else should glow, stew or smoke.

If everything is OK, please measure all voltages as shown in the schematic. Variances of +/- 10% are OK when the power supply input voltage is 230V, the variance could be more, if the power supply input voltage deviates from 230V. Especially the heater voltage should be 6,1 V to 6,8 V AC, otherwise the lifetime of your tubes could be reduced. To keep all measurement values available for later comparison, please document them in the respective sheet for quiescent voltages.

In case of something not working as expected or documented, please also fill out the sheet with your quiescent voltages to ensure proper support and publish this sheet and your questions in the Madamp forum ([forum.musikding.de](http://forum.musikding.de)).