

The Anvil

**a MIDI controlled 3-channel tube guitar
preamplifier**



Construction Manual

(rev. 0.93 - 04/2011)

... typical builds ...



Preface

In 2006 the MUSIKDING-Preamp - a three channel tube guitar preamplifier controlled by MIDI - was introduced and many people asked for modifications to add a modern vibe to the channels which were originally based on the design of Mike Soldano's SLO guitar amp head but with individual controls for all three channels.

A nice idea and a good opportunity to test some other preamp design that could expand the SLO's capabilities and of course could also be used as the sole preamplifier for the new centuries musicians in a modern rack system.

So I started to mess around with some ideas and took a deeper look in several designs and finally found the three channels I really liked to have: a fenderish clean channel, a modern rhythm channel that can go from light crunch to almost high gain territory and a very tight high gain lead channel for heavy riffing, absolutely non mushing with an immediate response.

Sometimes things in life become more important than building guitar amplifiers so the project stopped for a while until until Lasse Lammert (LSD Studios) almost accidentally noticed the preamps sound qualities. He asked me to build a SLO preamp for him and I told him there was "something similar" laying around here that he could also try out before. He did and we both were surprised about the result, that lead him to order a custom units for his studio and live touring (we called it the *Subcutane Preamp*). As it seemed that the amp was used by people that mostly play the heavy music stuff the amp got named *the Anvil*.

Now - in the beginning of 2009 - the preamp has been revised again and is ready to be presented as a DIY kit. I'd like to thank Klaus Brunner from Musikding for the distribution, because I never would have any chance to do spread the kit.

The analog circuit design is still based on that original prototype. Midi controllability was added over the years and the alternate loop first introduced with the SLO type preamp (so there is basically no need of using a looper if you already own a preamp that has no standby functionality) was added.

This manual will show you how to assemble the preamp. Please note that the complete project is absolutely **not** suitable for beginners. The tube circuit contains lethal voltages and knowledge in building, debugging and initial operation of tube circuits is absolutely needed. So if you are thinking "Cool, I could get a top notch device for very little money and only need to learn how to solder..." then please stop here!

On the other hand - for those who already have experience in building tube amplifiers on pcbs this a way to get a really good instrument amplifier.

Please remind that the overall sound of your electric guitar will depend on more than just the preamplifier - you still need a good power amp (or head with fx return), a cabinet and last but not least some playing skills ;-)

As you might have noted: this project is hosted on a german webserver and the author is no native English speaker or writer. With so many people asking for a construction manual written in English this is the try to guide you through the process of building. Feel free to ask questions and give comments at the Musikding forum or write an email to info@andyszeugs.de.

Content:

1.	Getting started	5
1.1.	Download the zip-File	5
2.	Chassis preparation	6
2.1.	drilling and cutting the front and back plate	6
2.2.	drilling the bottom plate.....	6
2.3.	drilling the side plates.....	7
2.4.	drilling the top plate	7
3.	Painting the front and back plate.....	8
4.	Labeling using Waterslides	8
5.	Assembling the boards	8
6.	The chassis ground connectors	10
7.	Preassembling the Back Plate.....	10
8.	Preassembling the Chassis	12
9.	Preassembling the Front Plate	13
10.	Prewiring the front plate.....	13
11.	Wiring the boards (backside)	15
12.	Wiring the EQs.....	16
13.	Wiring the mains switch.....	16
14.	Wiring LEDs and Gain pots	17
15.	Start me up!.....	18
15.1.	Fuses	18
15.2.	PE resistance	18
15.3.	First start.....	18
15.4.	Tubes.....	18
15.5.	Channel Switching	18
15.6.	Midi Switching and programming	18
15.7.	Bypass	18
16.	High Voltage startup	19
17.	Schematics	19

1. Getting started

The kit you might have bought at MUSIKDING contains almost all parts you need to build the preamplifier. Only paint and knobs are excluded to give you the chance to implement your own design.

You can also find a complete bill of materials online and order the parts on your own but believe me - it is much cheaper to buy a complete kit!

*You don't like drilling or painting? Then you could also spend some money and let someone do that for you. I tested the Schaeffer-Company from Berlin - they can drill the holes in the front plate and apply some font by engraving it. You can use my construction files in the **cad**-folder. Note that you will still have to drill the holes in the dide and bottom plate but that's not very hard.*

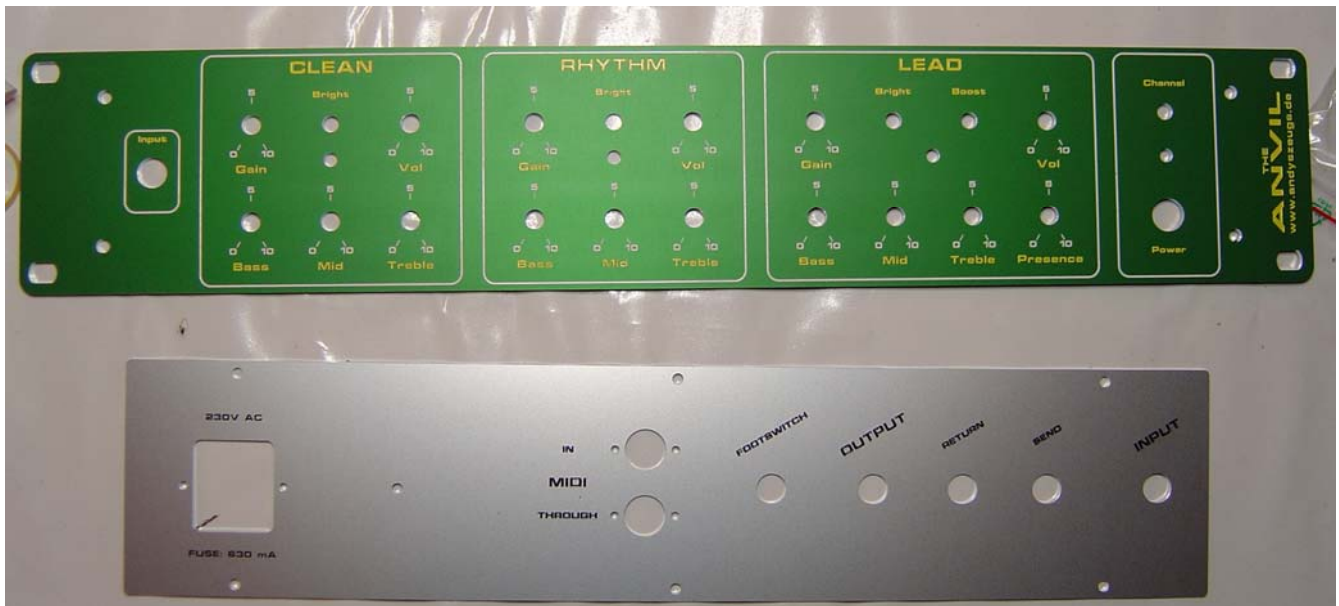


figure 1: engraved plates

1.1. Download the zip-File

This manual will refer to some files. They all are collected in the zip archive **anvil.zip**. You can download the file at my website.

2. Chassis preparation

2.1. drilling and cutting the front and back plate

Take the unmachined chassis parts out of the box and start with the front plate. Download the templates (files: `template_front.pdf` and `template_back.pdf`) and print them to paper without any automatic scaling - check your printer dialog! There are two measurements (8,5 cm and 10 cm) that can be used for verification. Cut out the template and join the two parts with some adhesive tape (see picture below). Then apply the template to the plate - oriented to the left border of the plate.

The next step is to center punch all holes (don't forget the LEDs) and predrill all holes (1.5 mm - 2 mm) before drilling the holes to their final sizes:

table 1: front plate's drilling diameters

<i>Part</i>	<i>hole diameter</i>
LEDs	3 mm
Switches	6 mm
Potentiometer	7 mm
Power Switch	12,5 mm

Then go on with the back plate. Use `template_back.pdf` to enable an easy way for center punching and don't forget the protective earth connector located in the Caution-Box! If you can not mill the cutout for the mains connector apply some holes there, too (you then will have to do some drilling and filing to place that cutout). Predrill all holes and then apply their final sizes which are printed next to the holes (see template).

2.2. drilling the bottom plate

Print the main pcb's template (`pcb_template.pdf`) or build you own by using the actual pcb and `tran_template.pdf`. Again check the sizes of your hardcopy! The pcb template must have a size of 284mm x 170mm . otherwise the board will not fit! Place them like shown in figure 2. Make sure that you do not confound the front and the back side of the plate (some chassis only contain mounting holes at the back side). Again predrill the holes and then apply their final sizes. After drilling mount the rubber feet underneath the plate.

table 2: base plate's drilling diameters

<i>Part</i>	<i>hole diameter</i>
pcb screw	3 mm
earth connector	4 mm
transformer screw	5 mm

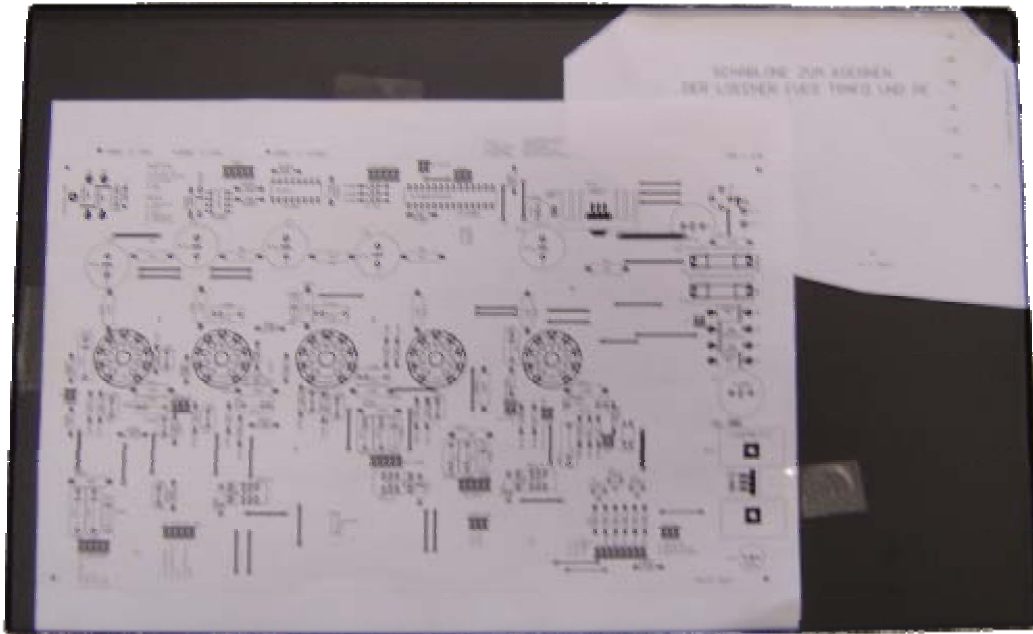


figure 2: templates on the base plate

2.3. drilling the side plates

That's easy - just drill a 4 mm hole in the center of the plate's backside. For those of you that need a template - just use `side_template.pdf`.



figure 3: side plate with ground connector

2.4. drilling the top plate



figure 4: top plate earth connector

Because all removable chassis parts need a ground connector apply a 4 mm hole at the top plate right behind the vents. Check first in which direction this plate will be mounted, otherwise the hole might get a place at the front left side...

3. Painting the front and back plate

Check twice if all holes are drilled to their final size. Start with cleaning the plates to have them free of grease (use ethyl alcohol or something similar. Apply ground-coat if your finishing topcoat tells you to. While the plates dry start assembling the boards!

4. Labeling using Waterslides

Take the templates you already used to centerpunch the holes to and print them to the waterslide. Cut out the parts and apply them to the boards. Then apply some clear coat to create a durable surface. Test the compatibility of the coat and the waterslides before you apply it!

5. Assembling the boards

In figure 7 you can see the main pcb. Apply all parts like shown there.

Please take a look at the pcb connectors. There are different types which have different color. The position of the nuts on the pcb is shown for connectors with a brown plug but you may have gotten some different types of white color. Then either solder all sockets vice versa or "translate" your current colors to those shown in the pictures below. Don't let the colors showed in the pictures below fool you, yours *may* be different! In figure 6 you find the two different types. Again: The position printed to the board is responding to the brown types. As you can see below I used the white ones for the prototype and thus changed their positions at the board to have the same colors as shown in figure 20. The high voltage connector on the top right side needs to have pin 2 removed - just touch it with the soldering iron and push it out.

Please note: the Relays you recieved with the complete kit are AQY410EH and that's ok.

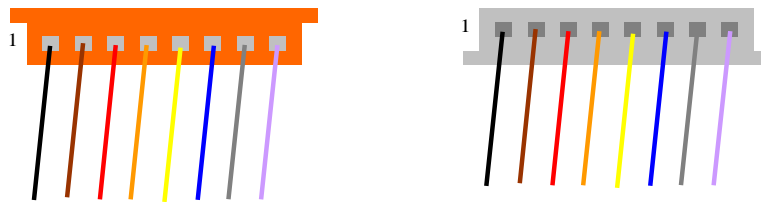


figure 6: different types of pcb connectors

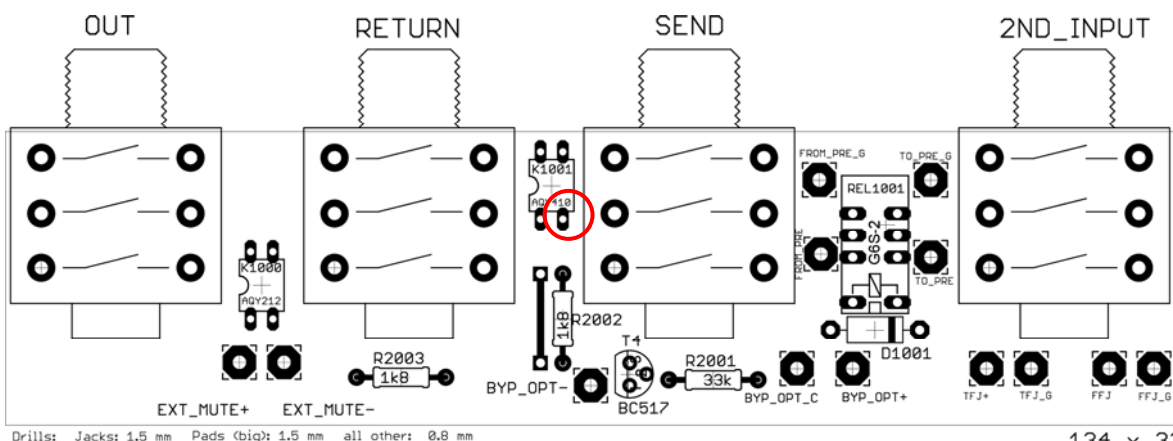


figure 5: output board

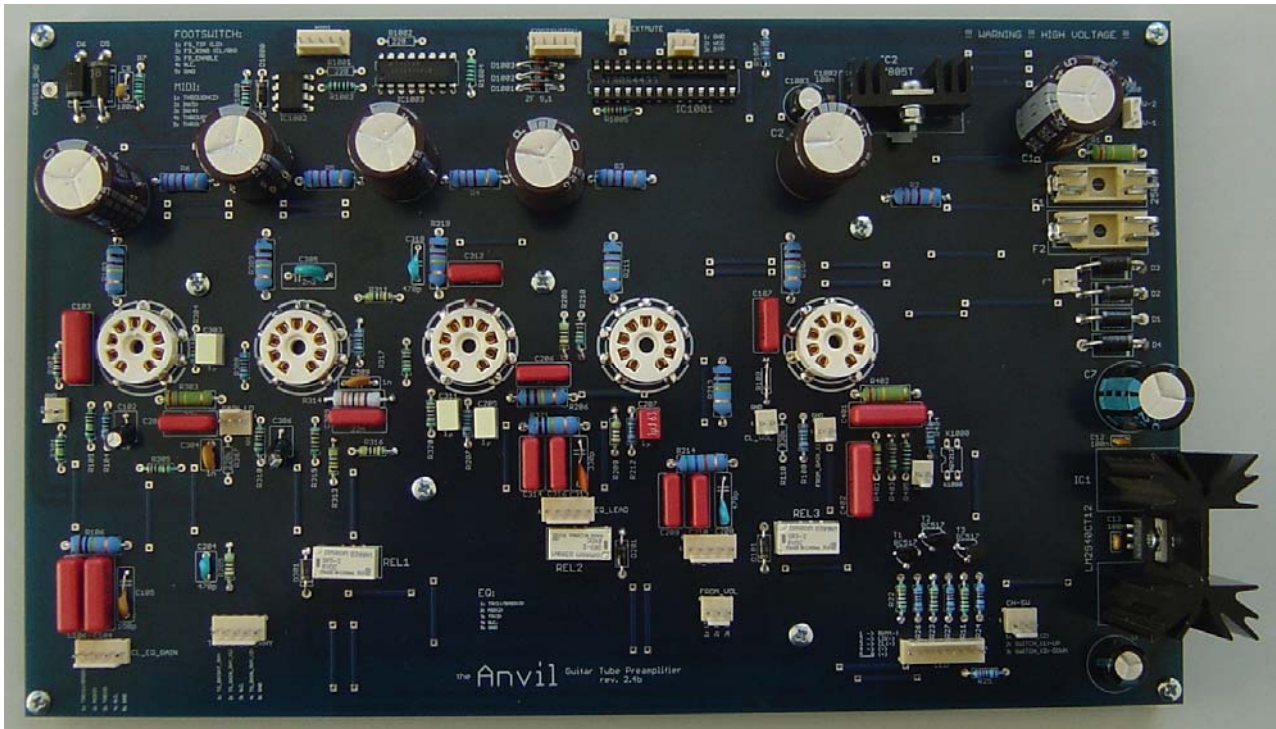


figure 8: the mainboard is completed

6. The chassis ground connectors

Always remember: the preamp needs lethal voltages to operate so safety is a main issue. To ensure a proper connection to the protective earth conductor (PE) of the mains power supply to all chassis parts, we will additionally connect the side plates and the top plate to the bottom plate (left connector) and install the mains connector right to this. Just refer to figure 13 and install the connectors like shown there: Take a M4 screw, two contact washers and a M4 nut. Install them to the connectors such that the contacts will directly cut through the paint to the metal body of the chassis (both sides). Then apply a solder lug another nut and an additional self locking nut like shown in figure 3. Repeat this procedure for all ground connectors except the left connector of the main board. This connector will be our star point - it will need 6 solder lugs (one of them will be left unconnected – you can place a testing terminal there in case you want to measure to ground).

7. Preassembling the Back Plate

Take a look at the following pictures. Mount all parts like shown there but don't tighten them too hard – we will remove it when soldering the wires to it. Use washers and self locking nuts for the midi and mains connector to have all parts safely in their places for the next decades.

The protective earth connector is shown in detail in.



figure 9: back plate



figure 10: back plate (inside)



figure 11: earth connector and mains filter

8. Preassembling the Chassis

Mount a transformer bold with the tram M5 screw, washer and nut.

Then mount the transformer carefully!

Mount the side plates and wire their pe connectors before you mount the back plate!

Rasp the paint from the area of the side plate where the front plate will touch them. Also rasp the paint from the front plate there to ensure that there will be a conductive contact.

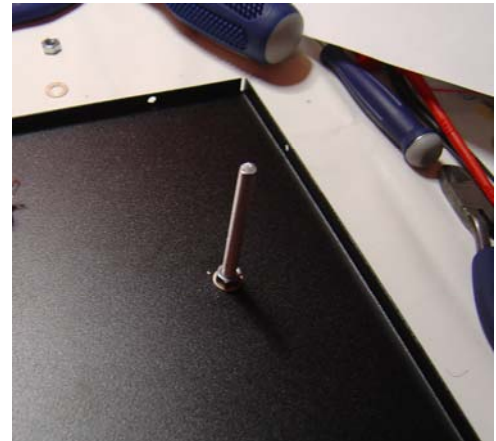


figure 12: transformer nut

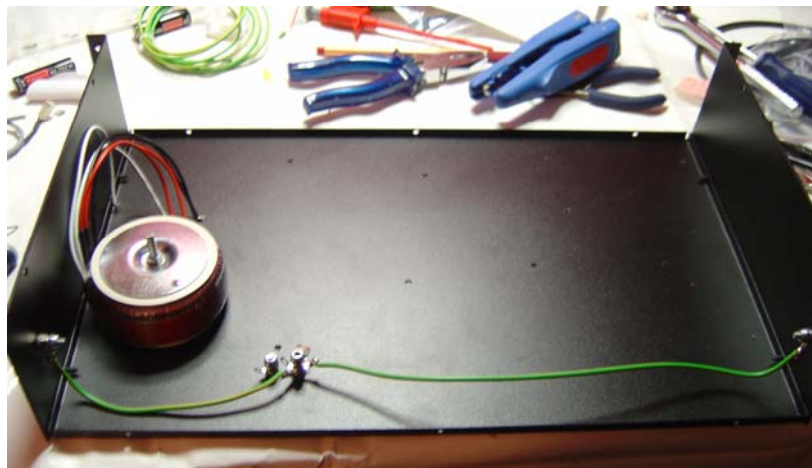


figure 13: side plate's pe connectors



figure 14: pcb mounted to the chassis with pcb

9. Preassembling the Front Plate

Mount the input jack and the power switch. Then glue the leds to their holes. Remember their direction before you shorten their connecting leads (I always have the anodes faced towards the upper side of the plate) Then remove the little positioning lugs from the pots and mount them like shown below.



figure 15: front plate with assembled parts

10. Prewiring the front plate

Apply the wires like shown below:

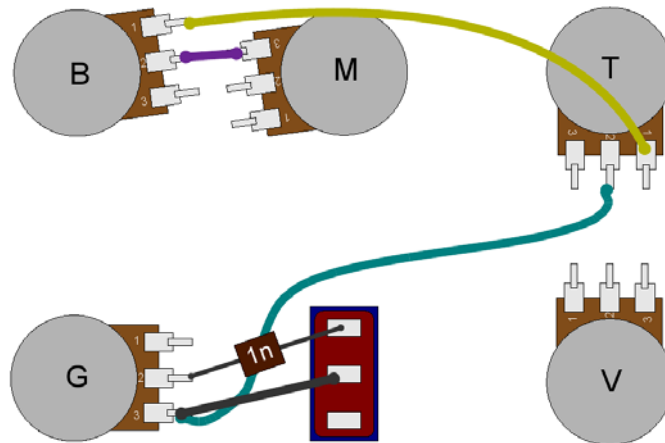


figure 16: prewiring the frontplate (clean channel)

Yes, there is no ground wire from volume to middle!

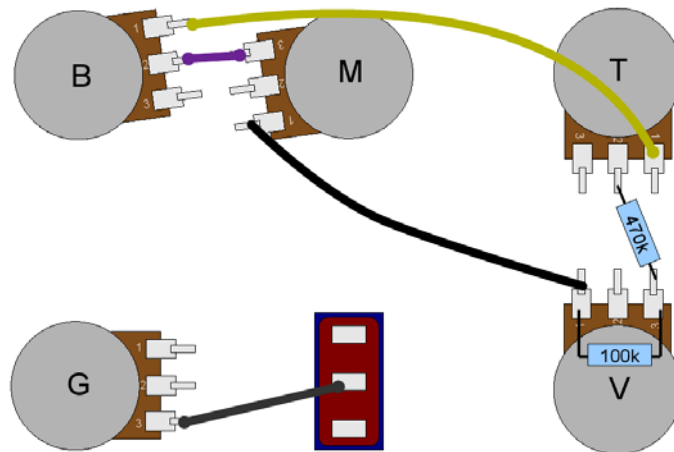


figure 17: prewiring the rhythm channel

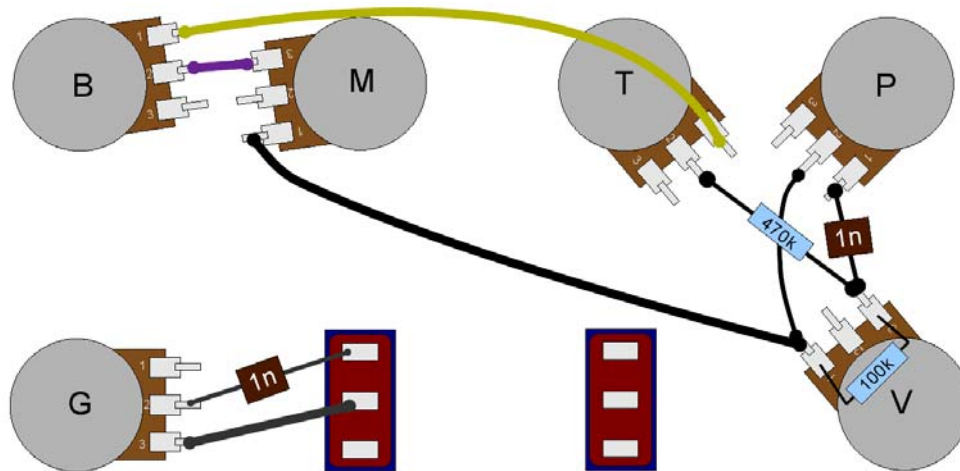


figure 18: prewiring the lead channel

The lead channel's shape switch will be left unconnected until later...

Then mount the input jack to the board and put the leds to the holes and fix them with some glue.



figure 19: the frontplate prewired

11. Wiring the boards (backside)

Apply the wires like shown below and don't forget to ground the circuit.

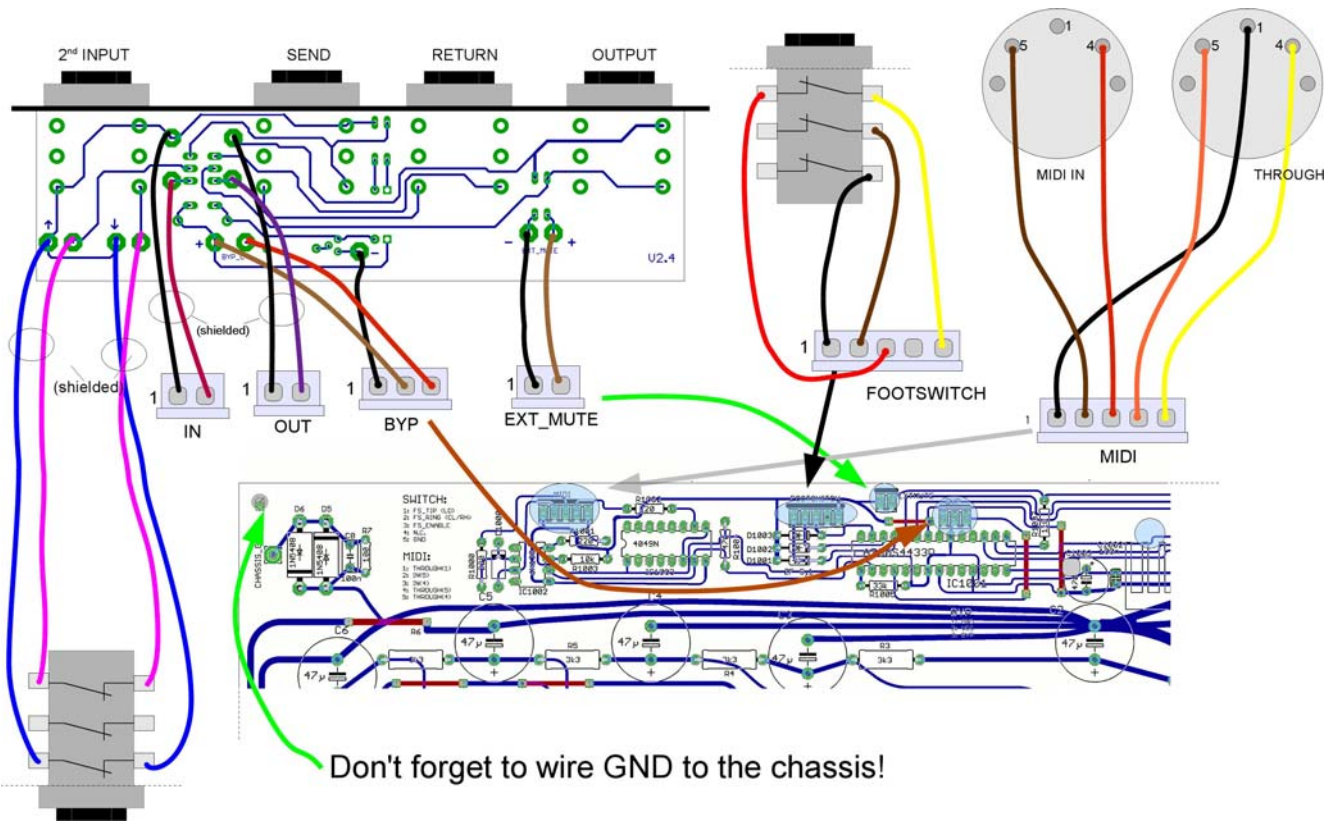


figure 20: backside wiring

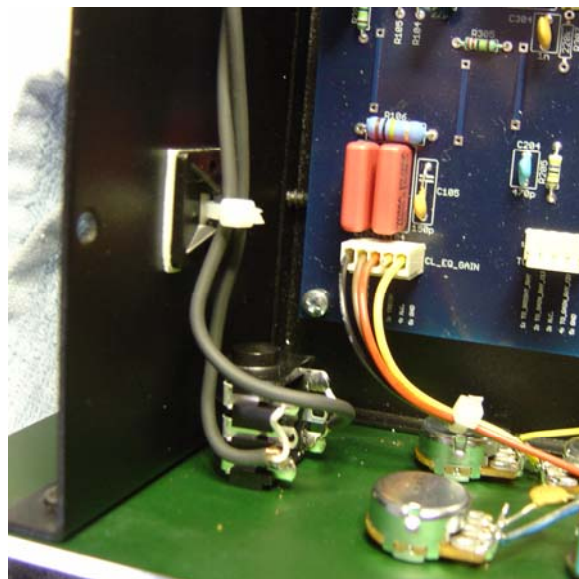


figure 21: front jack

12. Wiring the EQs

Mount the front plate just in front of the chassis and start wiring the components from bottom to top, so start with the tonestacks like shown below.

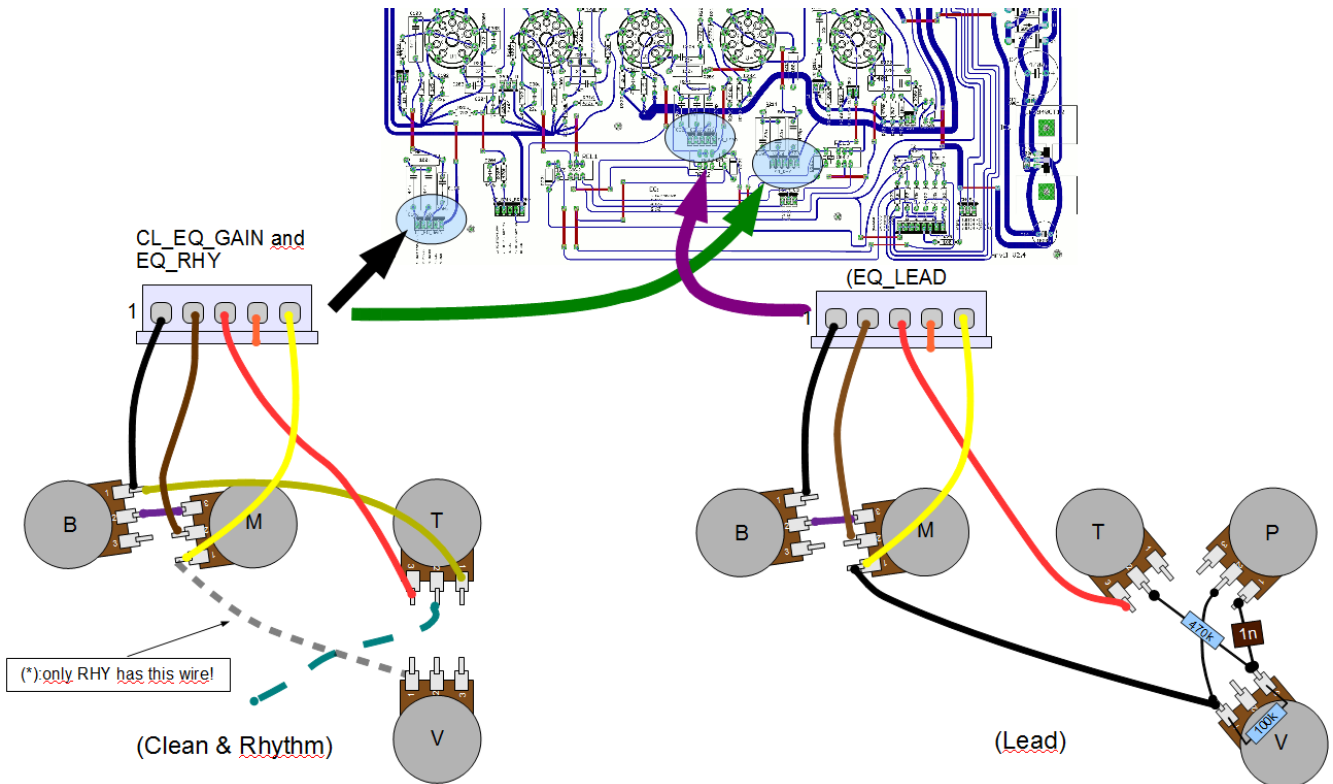


figure 22: eq wiring

13. Wiring the mains switch

Mount the front switch and connect the wires from the mains filter and the transformer's primary (black wires). Isolate the connectors at the switch and at the filter with heat shrinking tubes.

14. Wiring LEDs and Gain pots

Continue with the leds (isolate them with heat shrinking tubes) and then wire the gain pots and bright switches. The last thing you need to do is wiring the volume pots and the channel select switch.

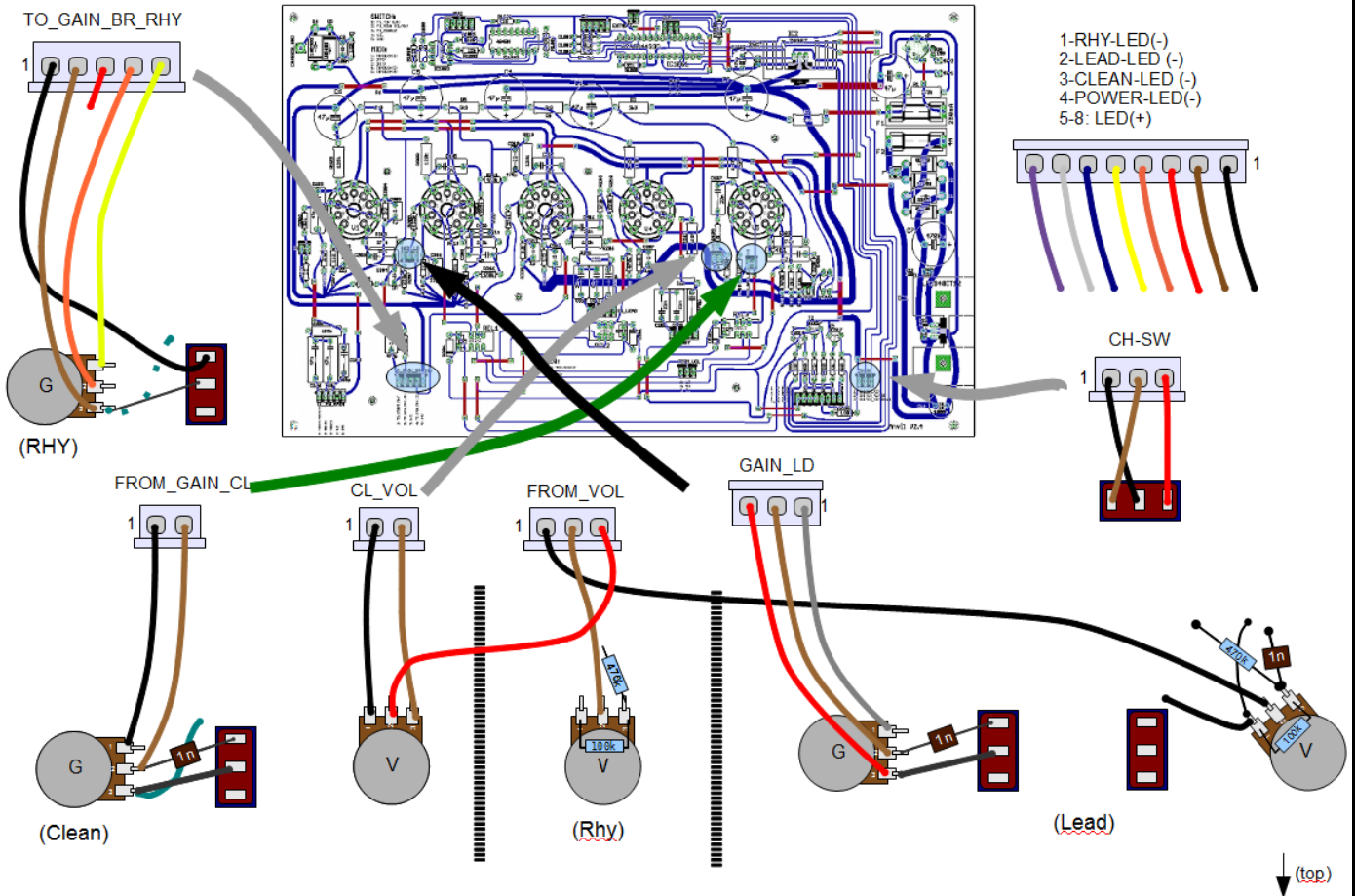


figure 23: gain pots and leds

That's it - we will left the boost switch unconnected until the amp will operate completely.

15. Start me up!

First check the chassis for any "leftovers" like wires, isolation.

15.1. Fuses

Then install the mains fuse at the mains filter (630 mA) and the fuse for the relay circuit F2 (4A). Do NOT install fuse F1 for the high voltage.

Again check the orientation of the electrolytic capacitors, then plug the mains cord to the amp and socket.

Insert the microcontroller to its socket.

15.2. PE resistance

Measure the resistance from the power chord plug connector to the chassis. You must have resistance smaller or equal to 300 milliohms. If that is the case you can continue.

15.3. First start

After flipping the power switch the amp must start immediately. The power led must light and the channels will be toggled once (including bypass). Check the function of the channel select switch, it must switch the channels up and down and you will see the currently selected channel's led active. The bypass must also be selectable. You will notice the relay switching. Then switch the amp to off.

15.4. Tubes

Install the tubes and leave the high voltage connector unconnected. Turn on the amp. As faulty tubes often fail when inserted first so we just watch them glowing and proceed with the:

15.5. Channel Switching

If you own a two button footswitch with common ground plug it to the jack on the back side. You should be able to switch lead on/off with one of the switches and change from clean to rhythm when lead is not selected. The front plate's channel switch is disabled when you plug something in the jack at the backside. If you have no footswitch to test plug a guitar cable in there and leave the other plug open. The preamp must immediately switch to the clean channel. Shorten the plug you left open and watch the amp switching to lead.

15.6. Midi Switching and programming

Remove any footswitch that may be connected and apply your midi switching device to the midi in jack send a program change. Then change the channel and send the same program change again. The amp will light up all leds and so tell you that you assigned the channel to the program number. That's how easy programming is: just send - switch - send.

15.7. Bypass

Not kidding: checking the bypass will tell you if the wiring if the front jack is ok and you'll have a reasonable testing setup for the next steps. Connect the output of the

preamp to something that can amplify music, a guitar amp will also suit this need. Then connect the input of the preamp to something that can output music (portable or mp3 cd player). Don't use a guitar - keep your hands free. Play some music through the bypass of the amp. Check if the front input will override the back input and ensure they both have the desired functionality. You should hear no signal when switching to each of the channel.

Warning: Do NOT proceed the first startup until all (!) switching functions are working like they should!

16. High Voltage startup

Turn off the amplifier. Install F1 (100mA) connect the high voltage to the board. Remember that in a moment we apply lethal voltages to the circuit. These dangerous will not disappear directly after switching off the amp but have to be dissipated by the resistor R_1 .

Switch on the unit. It should be operatable in less than 30 seconds. Keep your hands off the innards from now on, just play with the knobs. Test all channels' pots with the external signal you applied already in 15.7.

If you encounter any problems take a look at the schematics or drop a line in the forum. No, there's no Q&A here - it's too dangerous so STOP if you don't have any idea where to start the search.

17.Schematics

The actual schematics are presented in the file **anvil.zip**.