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L3 Phono Stage V2



Construction Manual Version 2.00, June 2019

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1-613-822-7188

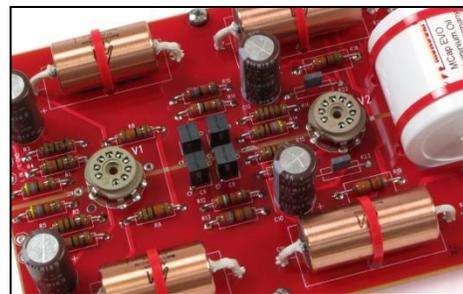
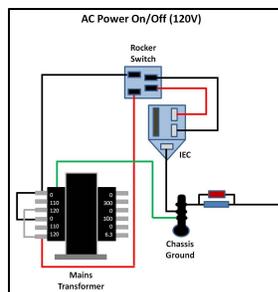


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Section 1

Introduction

Thanks for purchasing the ANK Audio Kits L3 Phono Stage V2. Our goal is to provide you with the highest quality kit that you will build from scratch with these instructions.

This is very high end and sophisticated piece of audio equipment that will surely become a showpiece of your sound system. We're excited that you have chosen to join us in enjoying and appreciating superb audio and we've created this manual to help guide you through each step of the assembly process with as much detail and clarity as possible. To facilitate the build process, the manual has been divided into a number of sections, each focusing on a separate aspect of the system: follow the sections in order and we guarantee you not only a problem-free experience, but a pleasant time doing so. If you are new to building kits, or if at any time you feel as though you need help or advice, feel free to contact us and we will do whatever it takes to get you on the right track.

1.1 About ANK Audio Kits

Audio Note (UK) started out in the early '90s developing several DIY audio kits while they were building up their finished product business. DIY Audio has a long history and it was an opportunity for knowledgeable customers to take advantage of world class designs and components. Audio Note (UK) was focused on using the very finest materials and components custom-made to their specifications, across their entire product line — from custom film and electrolytic capacitors to tantalum resistors, transformers, binding posts, wires, etc. The Kit1 300B Single Ended integrated amplifier was born during development of the Meishu and it proved to be extremely popular worldwide. The ANKit business was born!

As the finished product business and dealer network started to flourish, Audio Note (UK) eventually moved the kit business off into a separate division; thus, in 2004, Audio Note Kits started up and was supported by a website so that customers not located near Audio Note (UK) dealers could order kits and have them shipped direct. Kit development continued in earnest during the 2000s with development assisted by Audio Note (UK) engineering. Audio Note (UK) parts were used throughout the kits, depending on the various levels and budgets. By 2013, ANK Audio Kits (as it came to be called) had developed a wide product range covering all areas of two channel audio: a single-ended 300B product line, an EL34 classAB and single-ended product line, digital to analog converters, pre-amplifiers, Phono stages, and Audio Note (UK) speaker kits. The end result today is that customers worldwide with DIY skills can now build an entire high end audio system to their liking. With the introduction of higher levels in 2013 and the release of the Level 5 Mentor Pre-amplifier and the DAC 5.1 Signature, some customers wanted these high end products assembled by a professional builder. As a result, ANK Audio Kits began offering this service for Level 4 and 5 products so that a significant investment in a kit could be turned into a work of art! Since ANK Audio Kits was born in 2004, over 2,500 kits have been shipped to customers worldwide. Clearly, there is a real demand for high end audio kits and ANK Audio Kits has been delivering the goods now for 15 years.

We believe and hope that you will have a great experience building your kit and we look forward to hearing from you about your experience.

Regards,

Brian Smith — Director ANK Audio Kits



1.2 Basic Operation of the Phono Stage

1.2.1 Overview

The ANK Audio Kits L3 Phono V2 is a development of one of our longest running products with a significant following. Responding to customer requests for a Phono stage that uses standard NOS tubes like the 12AX7 and 6922, the L3 Phono Stage V2 is a breeze to build and delivers superb sound quality with incredibly quiet operation and no special tube matching required.

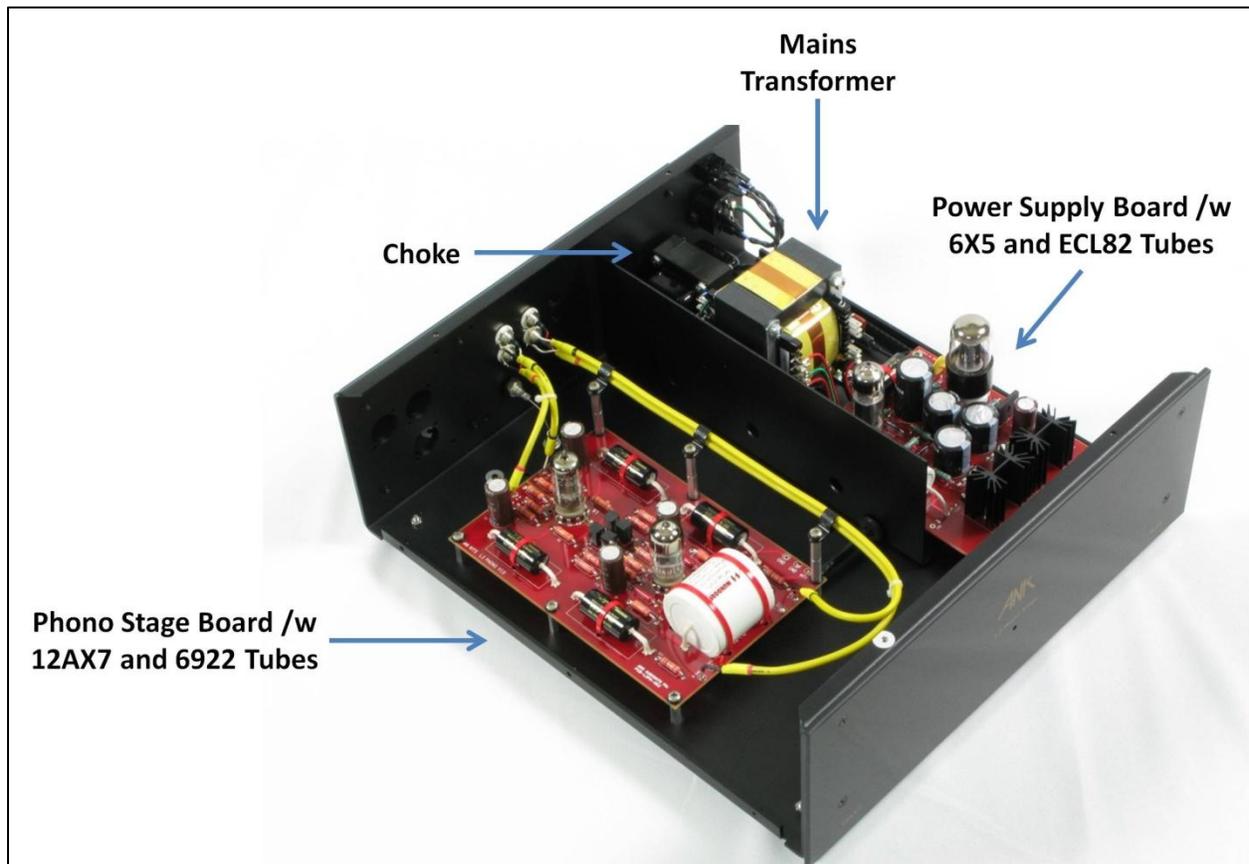
Design Elements

Our highly acclaimed and upgraded M2 Power Supply is an enhanced PCB version of the original M2 Power Supply taken from Audio Note (UK)'s finished products line. It uses a Mains transformer and Choke combination with a 6X5 for tube rectification and an ECL82 for regulation of its HT supply. This latest version uses vertical heatsinks, Mundorf Mlytic capacitors, Rubycon electrolytics, and Takman 1W resistors. We believe the M2 Power Supply provides an excellent quality/value ratio — it has also proved itself in terms of both its reliability and sonic virtues many times over in our other product lines. Critically, for listening to vinyl, it delivers ultra quiet power supply voltages.

The Phono stage uses the best RIAA components, including Takman metal film non-magnetic resistors, a Mundorf EVO oil film bypass capacitor, four Audio Note (UK) Copper Foil capacitors, four Elna SILMIC cathode bypass capacitors, and four Rel-Caps. The circuit has a similar architecture to the L3 Phono V1 with a high gain input stage followed by passive RIAA and no feedback, followed by an output driver tube. The sound is classic vinyl.

With the L3 Phono V2 you can build a quiet Phono stage with no tube rush, zero hum, and a pure black background. We use our specially terminated ground cables for a perfect hum free Phono stage. We cut, trim, twist, and terminate all the required cables for your build using high quality Silver Plated Teflon hookup wire. The Phono Stage board also supports large film capacitor locations for the four critical signal path locations.

1.2.2 Component Placement



Here's a completed L3 Phono Stage V2

1.3 Equipment

Here is the list of equipment that will be required:

- ❖ Philips screwdriver
- ❖ A pair of quality wire strippers
- ❖ A large, organized work area
- ❖ Soldering iron station with wet sponge
- ❖ Lead-based solder (4% Silver is recommended)

1.3.1 Overview of the Kit

In your kit you will find a series of kit bags containing all the hardware, wire, and parts for the associated sections of the amplifier. See the Parts List files on the disk to match up the parts in the kit bags with the lists. There is also a Master list for the kit.

1.4 Tips and Suggestions

We have learned a lot about kit building over the last decade from our customers and I'd like to share some tips with you to ensure a successful project. Please read through this section thoroughly, it will give you a good idea of what's ahead and help ensure your success!

1.4.1 Soldering

We highly recommend using lead-based solder with some silver content¹ on the build. You should use lead-free ONLY if you are experienced using it and confident. Lead-free solder requires a higher melting temperature and thus is more difficult to use. We don't recommend lead-free solder for first-time builders.

We suggest that you practice your soldering before starting on the kit. Feel free to request practice parts with your kit so that you can practice tinning wires and making nice solder joints. The key is a good soldering station with a sponge, the right temperature, a good size tip, and experience; remember, tips can wear out so make sure your tip is working. (You can also check out YouTube videos for soldering lessons and examples.) The solder should flow freely; if it's forming balls then there is likely a problem with the tip, the temperature, or (sometimes) the surface. Feel free to contact us for help!

¹ For example, WBT-0800.

1.4.2 Components

Using the Ohm setting on your multimeter is very useful when building a kit. It's a good, practical way of measuring resistors and continuity and is much easier than reading the color codes on the side. (With practice, the color codes can also be a good way to determine the resistance, but that method is better left to experienced builders.)

1.4.3 Resistor Sizes

Resistors today, particularly metal film resistors, are often smaller than you might expect. It used to be that the difference between a 1/2W and a 1W resistor was obvious: the 1W was considerably larger. That way of looking at things sometimes now no longer applies. Please be assured that all resistors supplied with ANK Audio Kits are rated at least per the specified wattage: in some cases, a higher than specified wattage may be supplied.

1.4.4 Capacitor Manufacturers and Voltage Ratings

Occasionally, depending on parts availability, we may use capacitors from different manufacturers. These will always be of equal or higher quality! As a result, some of the pictures in the manual may look a bit different at times. With regard to voltage ratings, normally, the voltage rating of the supplied capacitors will be exactly what you see on the parts lists. Occasionally, a part may be supplied with a higher voltage. Think nothing of it!

1.4.5 Electrolytic Capacitors

For those who have not built a piece of electronics before, here is a little lesson on capacitors. There are basically two types of capacitors that we use in the kits: electrolytic and signal capacitors. Of these, electrolytic capacitors require special attention. Electrolytic capacitors are "polarized," which means they have a POSITIVE (+) and a NEGATIVE (-) lead and typically have values like 100uf 450V, 10uf 160V, or 470uf 35V. *These capacitors need to be installed correctly or else they will possibly blow up at some point!*

Each electrolytic capacitor will have a *wide stripe* on the NEGATIVE side. Always ensure that this stripe (NEGATIVE) is positioned correctly. There are several keys on a printed circuit board to help you to know how to position the capacitor:

1. There may be a "+" on the board indicating where to position the POSITIVE lead.
2. The segmented half of the circular stencil on the board shows where to position the NEGATIVE lead. The unsegmented ('half-moon') part of the circle is where the POSITIVE lead goes.
3. The POSITIVE lead goes to a square solder pad while the NEGATIVE lead goes to a round solder pad.

1.4.6 Diodes

When installing diodes note that they are oriented with a stripe — *match the stripe on the diode with the banding (//) stencil on the board.*

1.4.7 Hardware/Mechanical

Not all of us are mechanically oriented. So, the kit is well laid out such that all the hardware is provided and bagged in individual sections, so things should make sense. Start thinking mechanically because about a third of the kit is mechanical. The first thing to remember is that good hardware is beautiful: we use all stainless steel metric hardware in the kits. It truly is a thing of beauty: don't rush your hardware! Here are a few helpful things to understand:

- ❖ We use British metric hardware (M3, M4, M5, screw size 10mm, 15mm, etc..) as opposed to the American imperial system (5/1000th or 50/1000th, 1 inch, 3/4 inch). Please familiarize yourself with the hardware in the kit.
- ❖ The screws will be called M3 or M4, which is the diameter of the shaft. The length of the shaft will be in millimeters, so you will encounter things like an M4 screw 16mm, a PAN head screw (which is a round spherical head), or a COUNTERSUNK or FLAT head screw (a screw head that needs to be flush with a surface — for example, under a transformer). So if you are asked to use an M3 16mm CSK screw, this is an M3 size (obviously), which is a thinner shaft diameter than an M4; 16mm is the length of the shaft; and the head type is CSK, which is a countersunk or flat head screw.
- ❖ Once you have the screws mastered, look at the matching nuts such as M4 nut or M3 nut and corresponding washers.
- ❖ Standoffs are common in the kits (again, they are either M3 or M4 size, with different lengths). They are typically threaded, so the screw goes into them.
- ❖ If any of the hardware is confusing or something is not fitting right, please email us.

1.4.8 Wire Stripping and Tinning

When it comes to wires, we typically use 18 gauge (thicker) and 22 gauge in the kits. It's PTFE: Teflon silver-plated copper wire. Basically this is classed as hook-up wire; we typically twist wire for you when it needs to be. The other wire we use is called shielded cable, like an AN-A (Audio Note (UK)) for signals. This is two-conductor wire: one is for the signal and the other (a big ground braid wrapped around the signal wire) is the shielding, which helps prevent the cable from picking up noise. You should practice stripping some 18g or 22g wire, and then try tinning this wire; this is the process of adding solder to the bare wire so that the invisible coating on the wire is burned off. This makes for easy soldering to a PCB, an RCA connector, or a transformer terminal. So it's a good idea to practice this a little before starting the kit.

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1.4.9 Wire Color

In the earlier sections of this manual, particularly those sections dealing with the Mains transformer and Choke wires, the colors of the wires should match the color of the wires in your kit. If they don't, or if you're unsure about things, contact audionotekits@rogers.com. Later on, at the Interwiring stage, there may be some differences between the descriptions (or pictures) of the color of wires that you will connect and the color of the wires supplied with your kit; for example, depending on inventory, we may supply a Black-Red twisted pair instead of a Green-Red (or vice-versa). Don't worry! Just be sure to check the wiring diagrams carefully and connect the correct points together and all will be well!

1.4.10 Optional Finishing Touches

From time to time we get asked about some of the build details of the ANK Finished Products that you can see in the pictures in the "Assembled Kits Gallery!" (<https://ankits.smugmug.com/>) on our website. It's important to understand that these stunningly beautiful products were done by an accomplished professional builder with decades of experience and that some particulars of the build may be beyond most of us. However, experienced builders who want to incorporate some of these finishing touches should feel free to do so. While we don't officially support or supply parts for these optional enhancements, there's no reason why you couldn't or shouldn't do them if you want to and feel that you can handle them. Without getting into the details (you're on your own here), what you'll want to get hold of are: heatshrink (to bundle wires), cable ties (to secure large capacitors), stacked (male/female) standoffs and cable clamps (to elevate and secure signal cables), and cable sleeving. You can get some of these from your local hardware store (for example, 1/4" Cable Clamps) and other, more specialized, parts from online distributors such as Grainger, Digi-Key, Mouser, or Cable Ties and More. If you do decide to dress your build with some of these, please send us a picture or two. We'd love to see what you did!

1.5 Build Process

1.5.1 Some Good Rules of Thumb for Building Your Phono Stage

- ❖ Take your time, prepare, and try and work on a small task each time you start to build the kit.
- ❖ Instead of rushing through another section — use the end of your session to check your work. Always ask yourself if the step you are performing makes sense.
- ❖ Have fun with your build and savour the experience. Take the time to do a really good job!
- ❖ Feel free to contact us via email audionotekits@rogers.com if you have any questions or suggestions during your build — and feel free to send us pictures, etc. We'd be pleased to give you tips along the way.

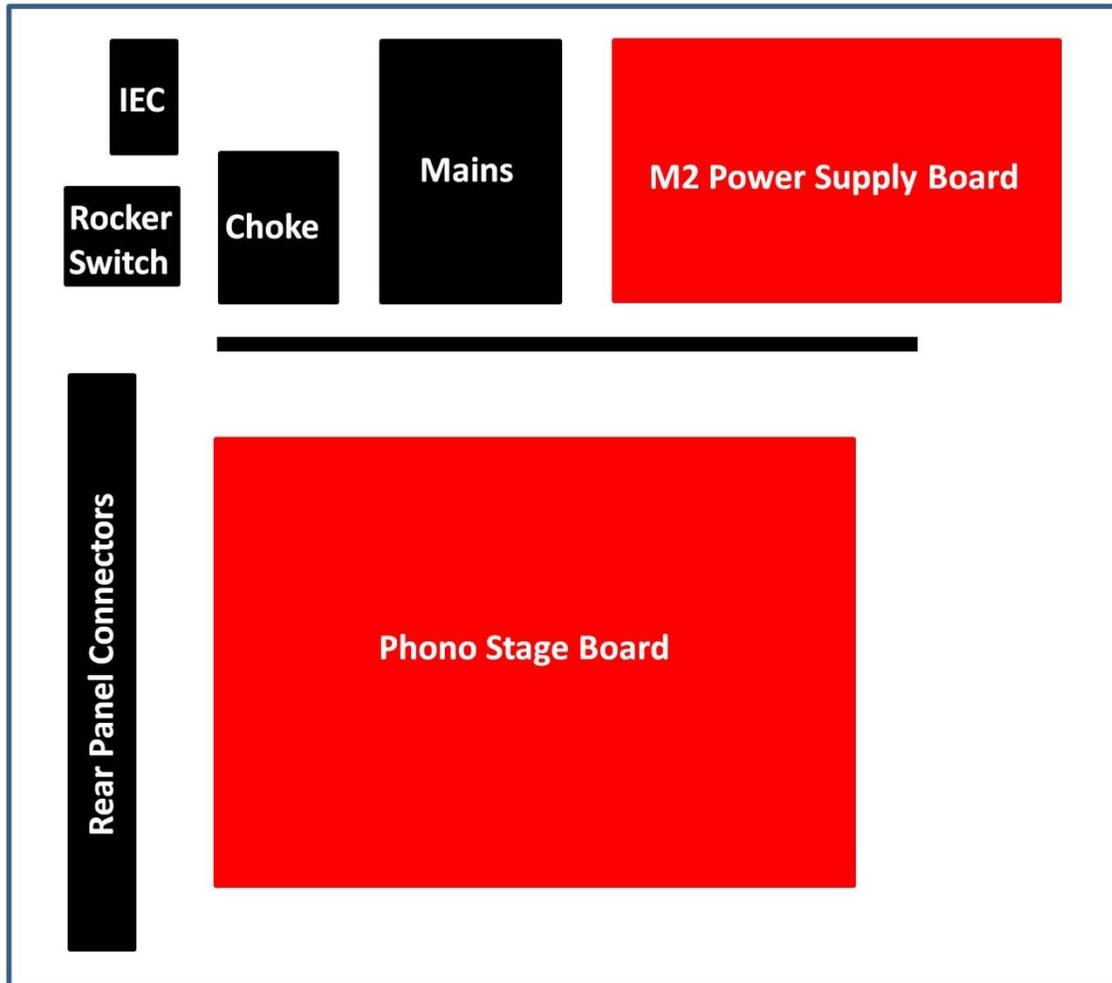
1.5.2 Organization of this Manual

We have divided the build and the manual into the following sections:

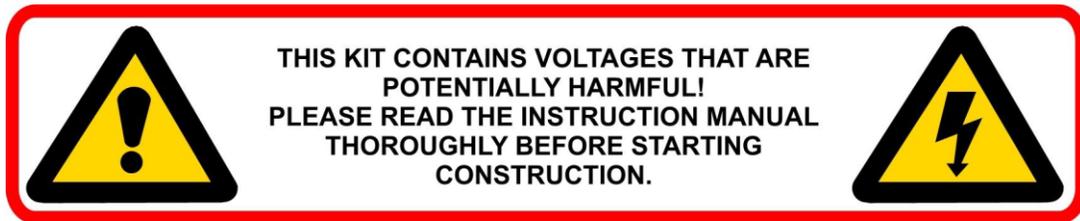
1. Introduction
2. Mechanical Assembly and Initial Mains Transformer Wiring
3. M2 Power Supply
4. M2 Power Supply Testing
5. Phono Stage Board
6. Phono Stage IO Connections
7. Testing
8. Finishing Touches
9. Final Thoughts

Appendix

Here's another way of looking at how the manual is organized and how the sections fit into the 'big picture': the main sections are mapped so that they mirror how the components will be positioned in the Phono Stage chassis:



1.5.3 Electrical Safety Warning



Please be aware of proper electrical safety.

There are sufficient voltages in this kit to give you a very nasty and harmful shock, so be careful when powering on, debugging, and probing around.

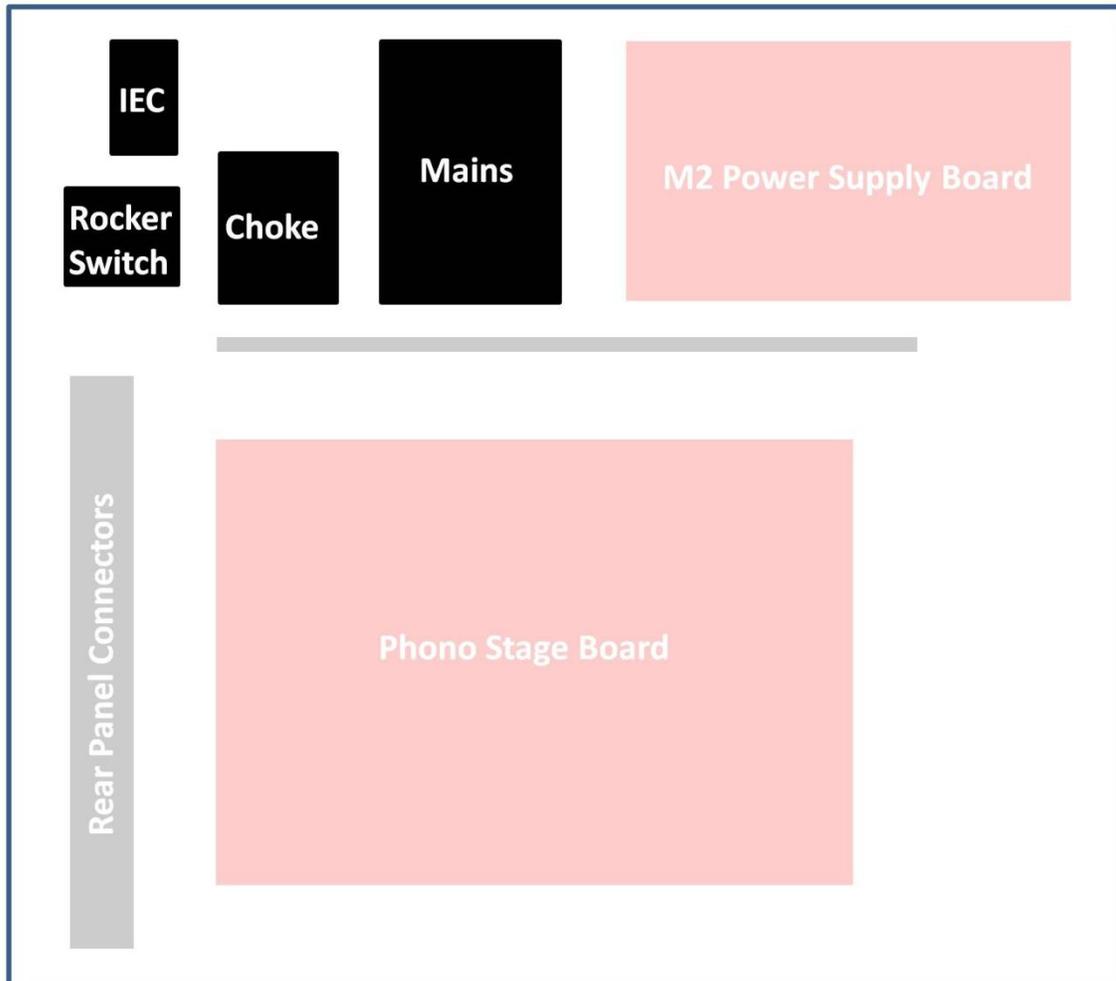
Please contact ANK Audio Kits via phone or email (audionotekits@rogers.com) to discuss any precautions necessary when building the kit if you feel unsure about what you are doing at any stage of the build.

Section 2

Mechanical Assembly and Initial Mains Transformer Wiring

2.1 Overview

In this section we will install the feet, IEC socket, rocker switch, and the Choke, as well as make the important initial connections to the Mains transformer and install it in the chassis.



When you receive the kit you will have a series of kit bags. In the following sections we'll be using the:

- ❖ Hardware bag (made up of individual bags for each section of the kit)
- ❖ IEC bag (containing the Rocker Switch, IEC and premade cables, fuses, etc.)

2.2 Installing the Feet

Let's start by installing the feet on the chassis — this will make it easier to work with as we install the transformers, Choke, etc.



- Turn the chassis upside down.
- Take a foot and insert an M4 screw with washer into the foot — it'll be tight but push it in.
- Install each foot in the hole in the chassis closest to the corner and secure it with an M4 nut on the inside of the chassis. Don't overtighten the screw; you could damage the foot.

When completed your feet will look like the picture below. You're on your way!



2.3 Installing the Choke

We're about to start on the first major section of the Power Supply, including the installation of the Choke, the chassis ground, IEC, and rocker switch, and the preparation of the Mains.

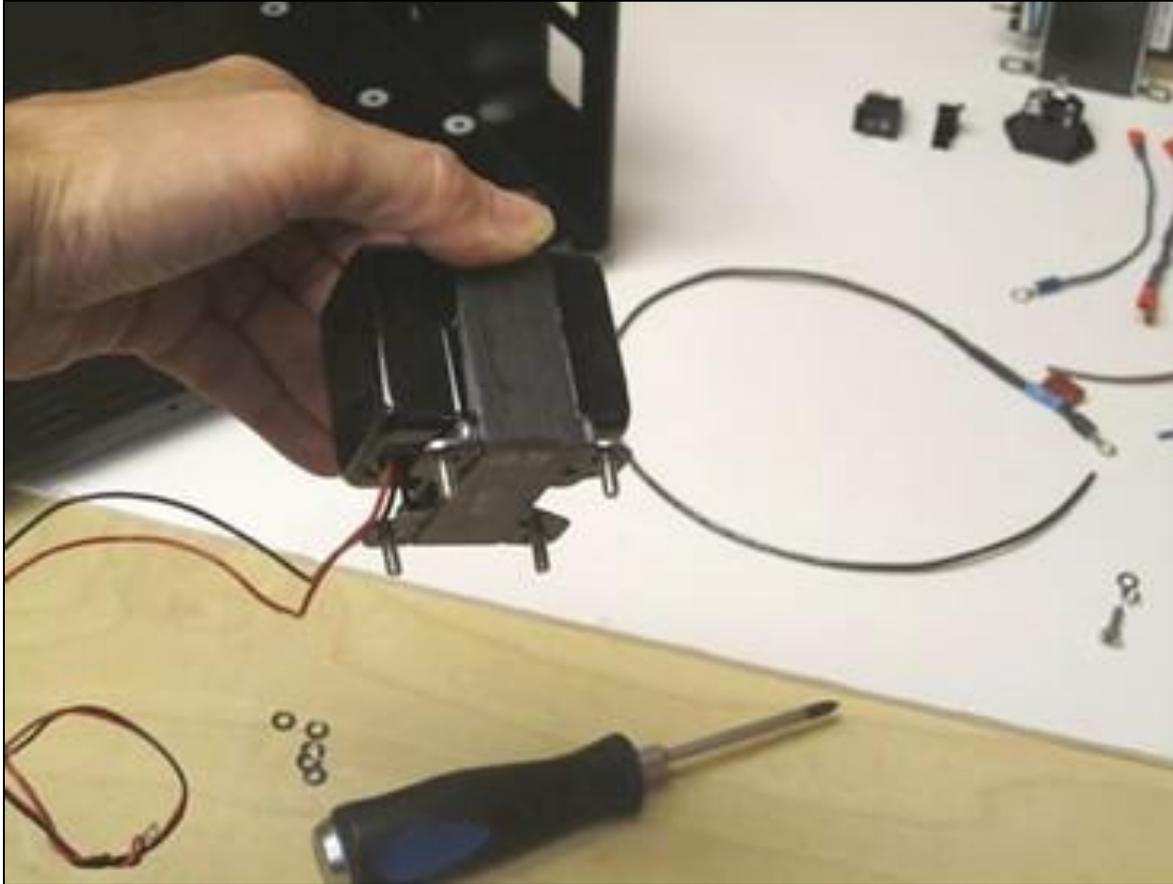


Let's begin by installing the Choke. This looks simple, but given the tight clearance between the Choke and the back of the chassis, it can be a bit frustrating. Here's a suggested way to go about it:

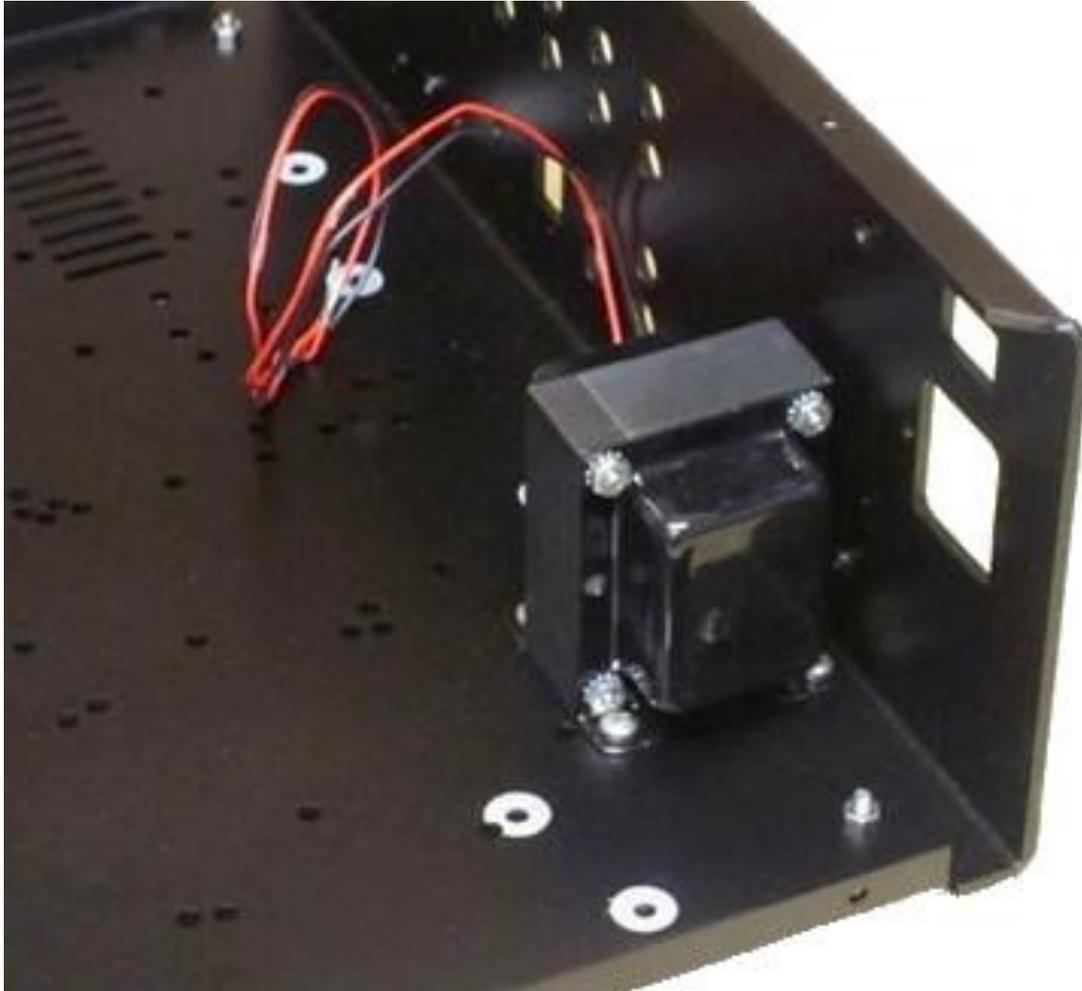
- Arrange for good lighting from above so that you can see well, especially towards the rear of the chassis.
- Neatly lay out the necessary hardware close at hand:
 - ❖ 4 M4 screws
 - ❖ 4 M4 washers
 - ❖ 4 M4 Keps K-Lock Nuts (these are M4 nuts with attached locking washers)



- Turn the chassis right side up.
- Take the Choke — which is marked CH-180 underneath — and hold it in one hand in mid air while you install the four M4 screws and washers from above into the four holes on the base of the Choke, so that you can then insert the whole unit into the chassis.

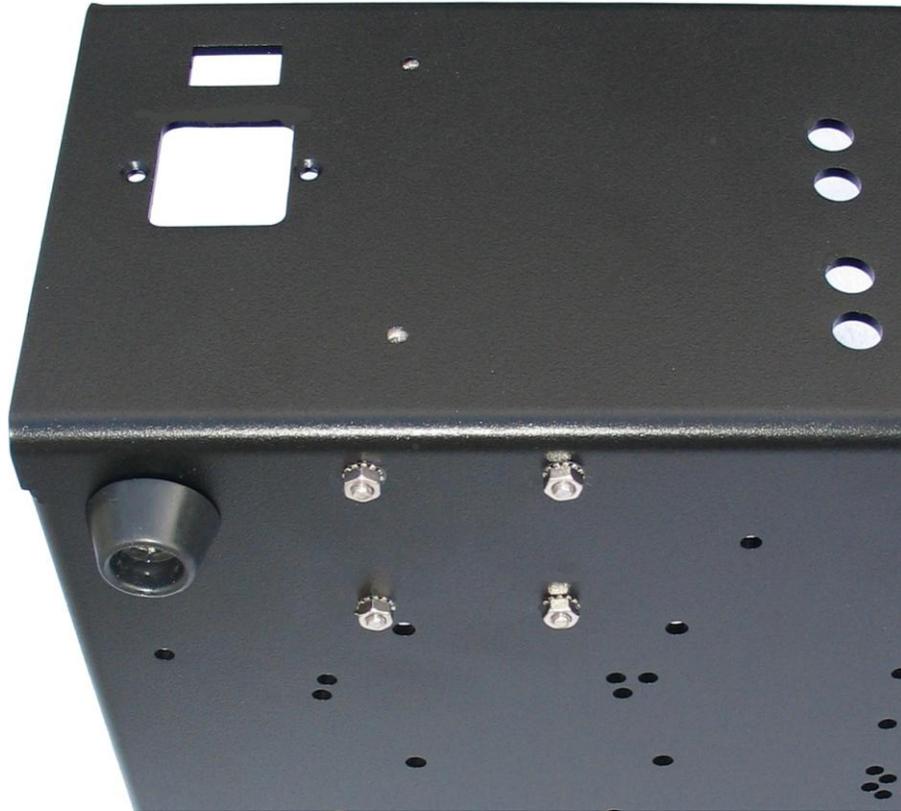


- Carefully lower the Choke, with the leads pointed toward the middle of the chassis (as shown below) and with the screws and washers in place, into the holes in the chassis. The critical need is to get the 2 screws at the rear to go through the correct holes. If the other 2 screws (the ones towards the interior of the chassis) fall out, just leave them for a moment.



- Do not turn the chassis over.
- With at least the back 2 screws now through the bottom of the chassis, successively push down on each screw from above with one hand while simultaneously securing the screw to the chassis from underneath with the lock nuts with your other hand.
- Finish up by tightening things up from below with a pair of pliers.

When installed, the Choke should be positioned as shown below:

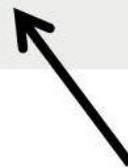
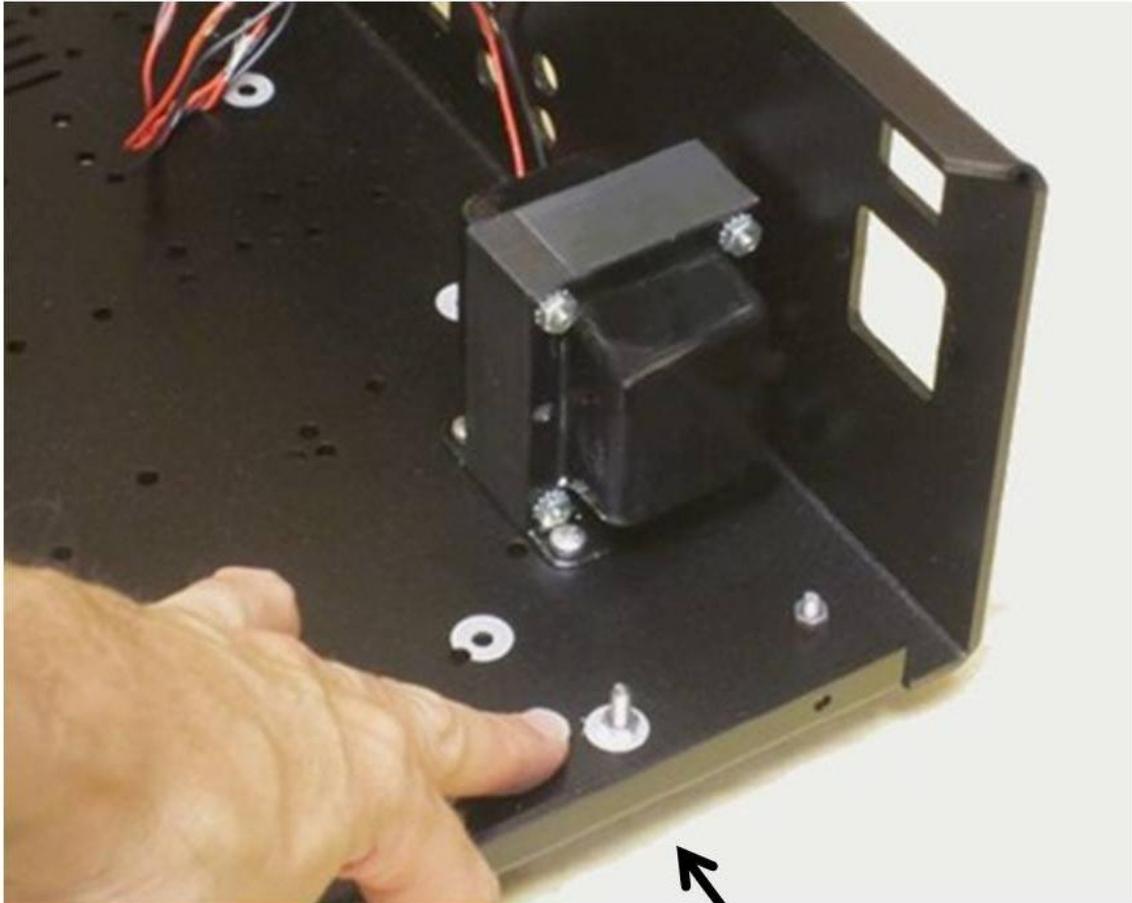


Time for a break!



2.4 Installing the Chassis Ground

- Install an M4 16mm PAN head screw, washer, and nut into position in the unpainted area on the chassis near the Choke, as shown below. This will act as the chassis ground.



**Chassis
Ground**

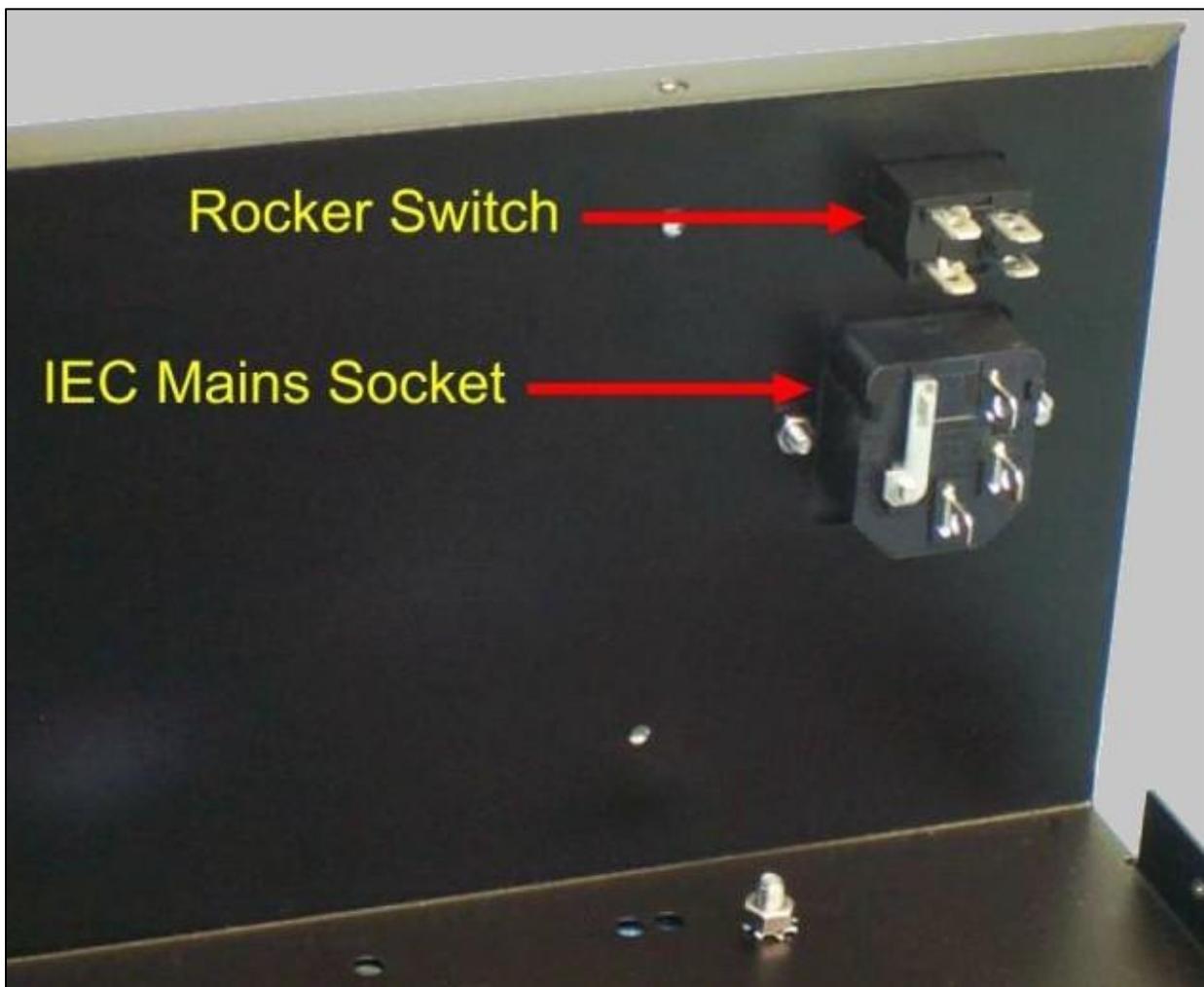
2.5 Installing the IEC Socket and Rocker Switch

- Take the IEC socket and install it in position as shown below, with the fuse holder on top and the GND on the bottom. Use M3 10mm CSK flat head screws to secure it using M3 nuts.



Have a look at the picture below: Note the orientation of the rocker switch with the smaller pair of tabs towards the side of the chassis and the larger pair towards the middle.

- Install the self-locking rocker switch by pressing it in from the back of the chassis; it will snap into position.



The correct orientation of the IEC and Rocker Switch

Here's a view of the rear of the chassis:

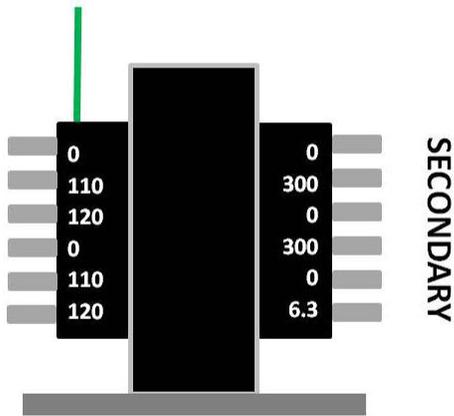


2.6 Mains Transformer Preparation

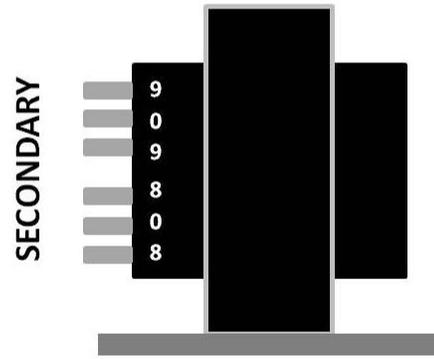
Now we'll prepare the Mains transformer — we'll do this *outside* of the chassis. Once all the wires are added it will be easier to install and secure in the chassis.

The Mains transformer is a complex device: its primary can be configured for many world voltages and its secondary supplies a number of voltages for different needs throughout the Phono Stage. It's important to understand what these connections are and where they're located. We recommend that you hold the transformer while looking at the three diagrams below to familiarize yourself with 'what goes where'.

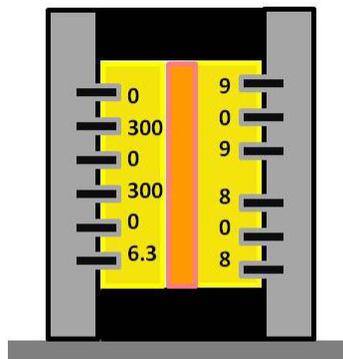
Mains Primary and Secondary Tabs Configuration



Mains Transformer



Mains Transformer
(reverse view)



Mains Transformer
(Secondary view)



In these diagrams and throughout this manual, the Mains transformer will be shown as having three lugs, marked '9', '0', and '9'. While these are used in some products that also use this transformer, they are not used in the L3 Phono V2. Just ignore them.

2.6.1 Attaching the Ground Lug

The Mains transformer has a Green wire coming out of it — this is a ground wire that attaches to the chassis ground screw on the chassis. We'll trim this wire to the proper length; then we'll strip the end of the wire and tin it.

- Trim the Green wire to 7", strip 1/2" from the end, tin it, and insert it into the Ground lug provided in the kit bag.



- Solder the Ground lug in place. Do this by adding solder through the front of the lug, as shown above.

2.7 Configuring the Mains Primary Winding

Let's take a moment to talk about how the source AC power enters the L3 Phono V2 and how it is transformed into the various voltages needed throughout the unit. The basic theory of what's involved is as follows:

- ❖ The AC that comes out of the wall socket will enter the L3 Phono V2 through the IEC switch and the rocker switch into the Mains transformer.
- ❖ The Mains will take the input AC voltage (120V AC for North America and 240V for many other parts of the world) and convert it to the different AC voltages that will be used by the various circuits.
- ❖ The Mains transformer has two windings of 0–110–120. By using these windings in various parallel or series configurations, the L3 Phono V2 can be wired for 110V, 120V, 220V, 230V, and 240V operation to meet the requirements in countries throughout the world.

The Mains secondary includes the following:

300-0-0-300	used for HT voltage
8-0-8	used to feed the DC filaments for the 12AX7 and 6922 tubes
9-0-9	not used
0-6.3	used for the AC filament voltage for the tubes on the M2 Power Supply board

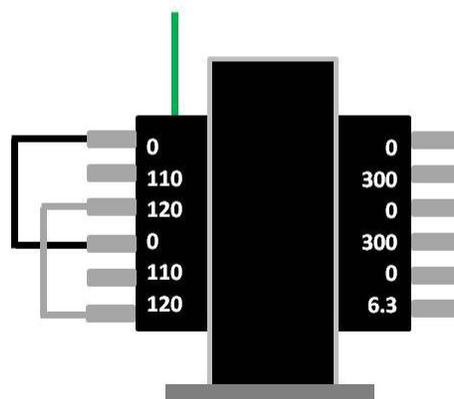
We're now going to focus on the primary of the Mains transformer — this is where you see the 0–110–120 0–110–120 windings. This will allow us to configure the Mains for the correct wall voltage in your region.



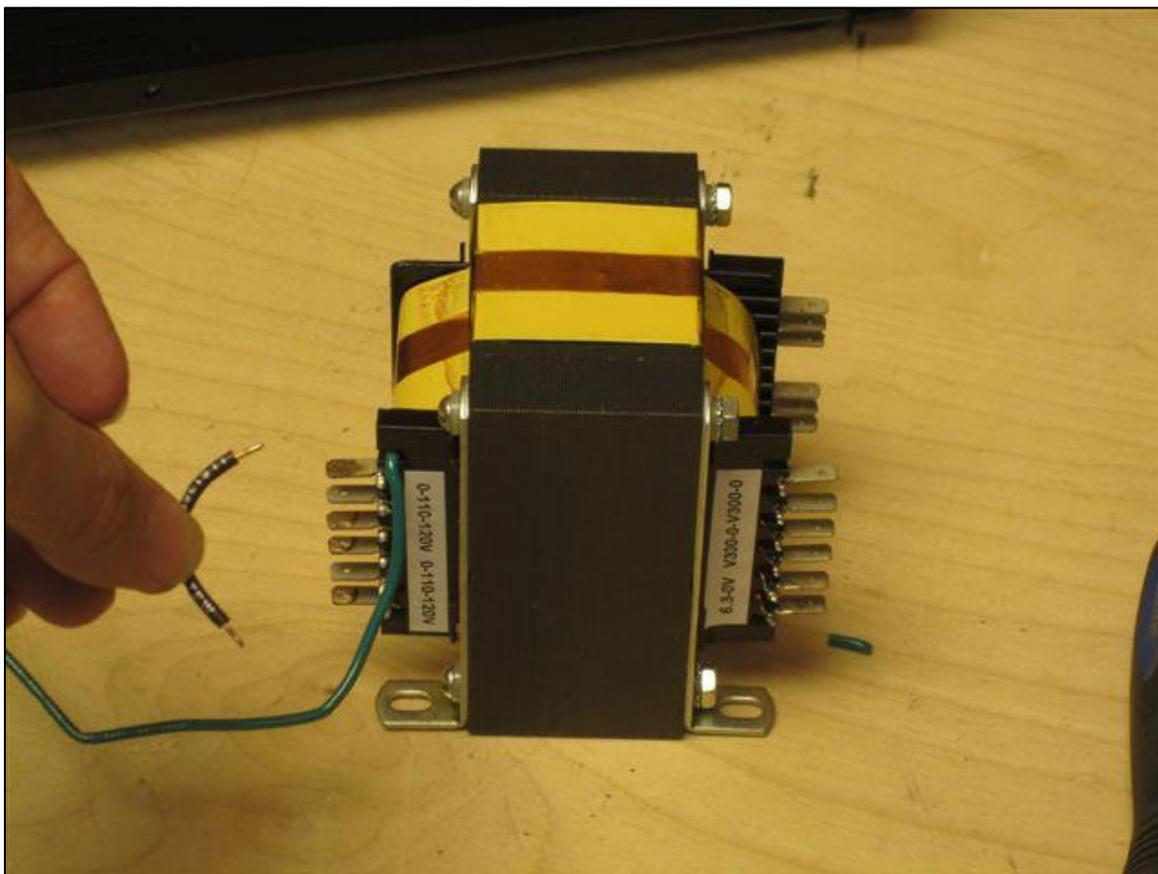
During the lifetime of a product, we occasionally change some parts to upgrade performance and reliability. This can sometimes lead to some minor differences in the manual between the text, current graphics, and older pictures, particularly. If you find a picture that shows any gaps other than the gap between the two sets of three tabs on the secondary just ignore them. Gap or no gap, the tabs will always be in the same order from top to bottom.

The graphic below shows the correct wiring of the primary for 120V operation where the 0 of one winding connects to the 0 of the second winding and the 120 of one winding connects to the 120 of the second primary winding. If you live in a part of the world with a different Mains voltage, see Appendix A.1 for the correct primary wiring for where you live. This section of the manual shows the complete 120V setup procedure.

Mains Primary Wiring (120V)



We're now going to set up the Mains for 120V operation by wiring the two windings in parallel. The first step is to add a wire from the 0 of one winding to the 0 of the other winding.

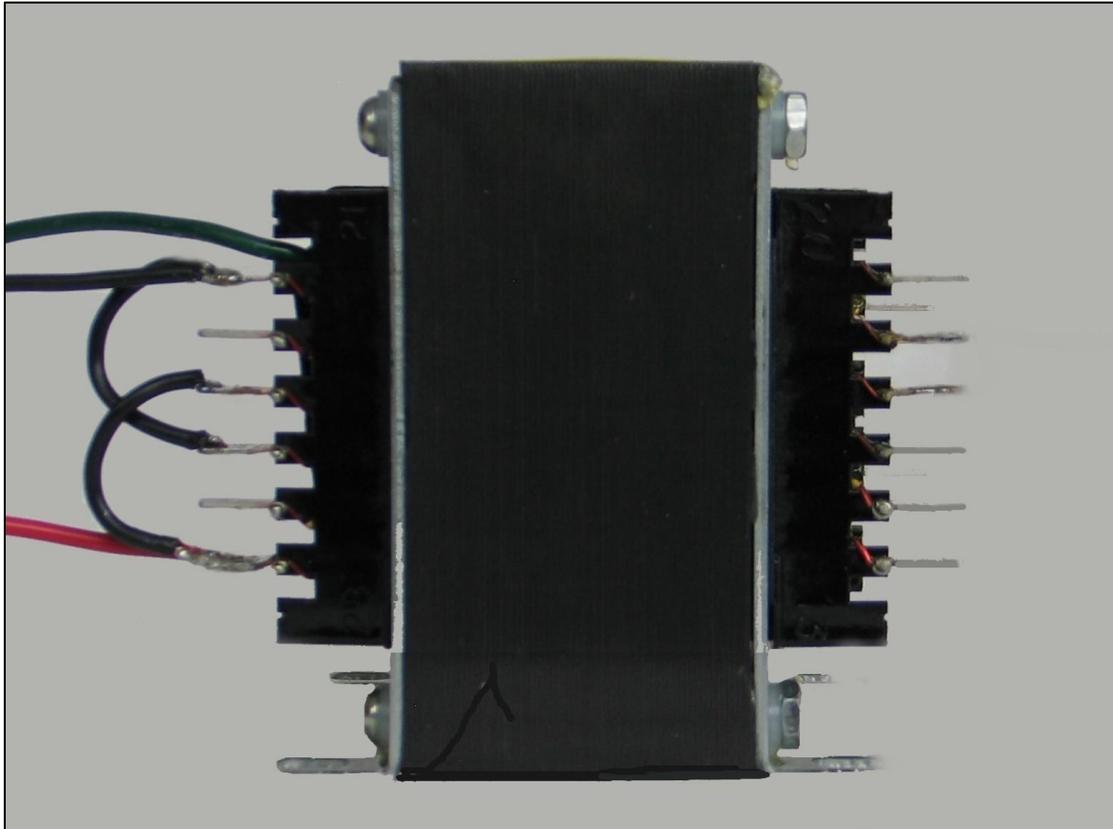


It's a really good idea to tin a Mains transformer lead before you connect a wire to it; this will make it easier to solder the wire to the lead. BUT, don't spend too much time soldering the Mains transformer, you could melt the bobbin: Don't exceed 5 seconds. If you don't connect in that time then stop, let it cool down, and try again later.

-
- Cut a piece (about 2 inches) of Black wire (as shown) that will bend comfortably between the two 0 tabs.
 - Strip the ends and lightly tin. (This can be difficult on a short piece of wire so take your time.) Tin the 0 lead at the top of the Primary and then position the wire on the lead and add heat — the tinned effect of the two surfaces will melt them together.

Examine the picture below before attempting the next steps.

- Connect the wire to the fourth tab down so that the 0 and 0 are connected.
- Similarly prepare another Black wire and connect the 120 and 120 tabs (the third and sixth tabs from the top).



Now we'll add two more prepared wires to the Mains transformer primary.

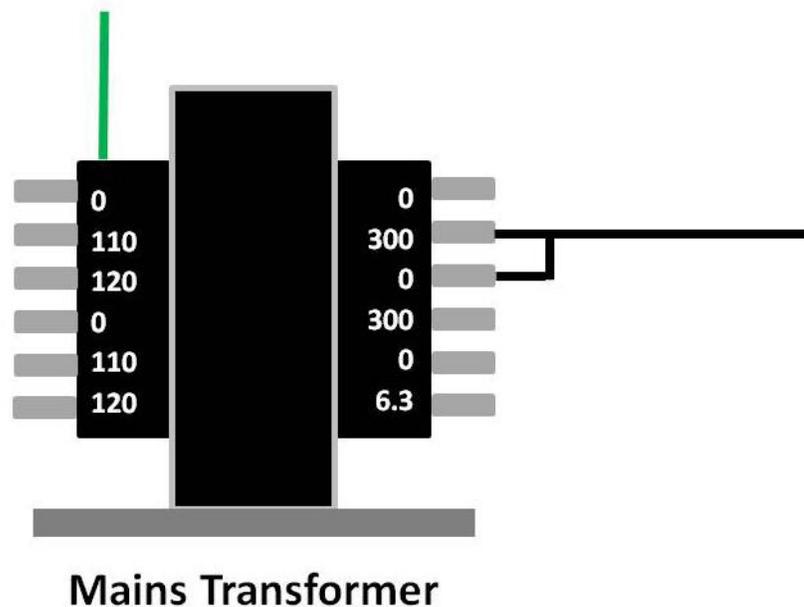
- Take the Black prepared wire with the crimp on the end, tin the unprepared end, and solder it to the top 0 tag.
- Similarly, take the Red prepared wire with the crimp on the end, tin the unprepared end, and solder it to the bottom 120 tag.

To recap: the Black wire is connected to the top 0 connection and the Red wire is connected to the bottom 120 connection.

2.8 Initial Mains Secondary Wiring

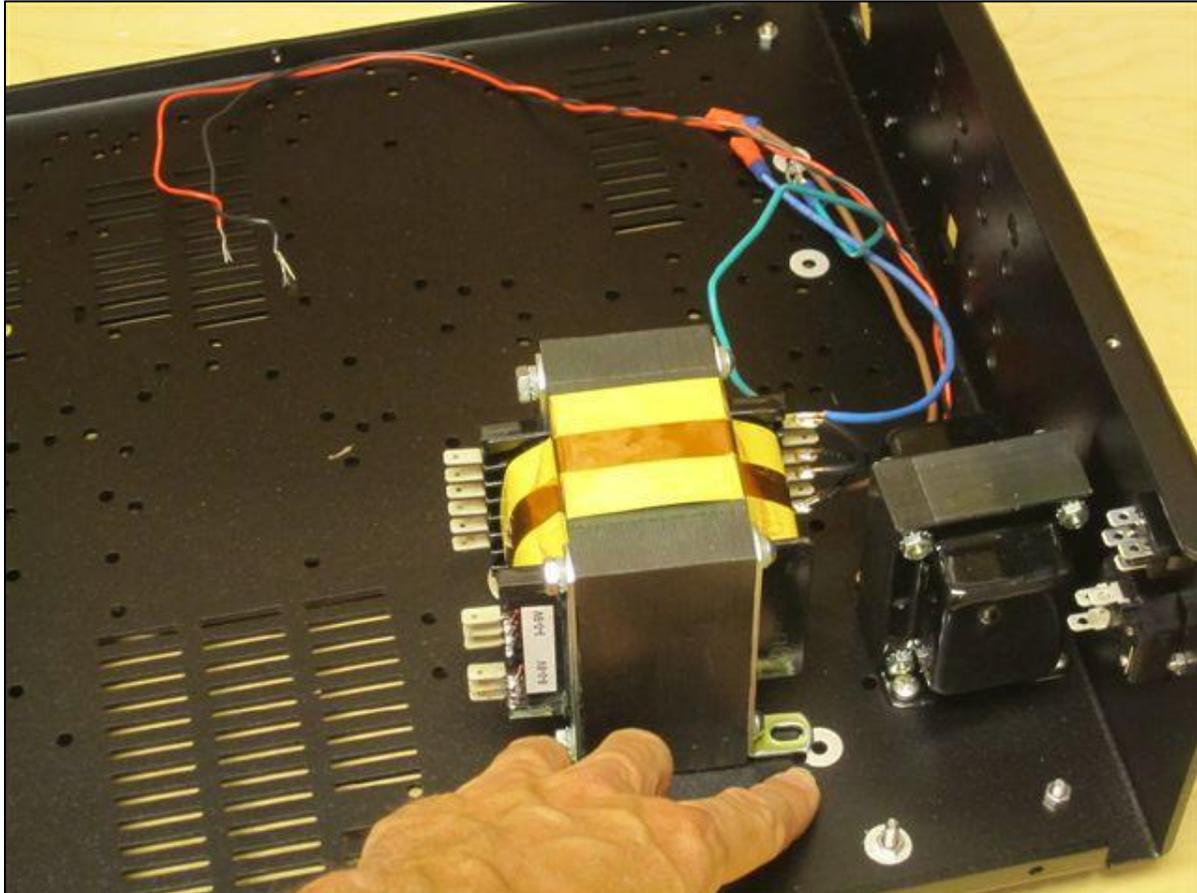
- Have a look at the diagram below. Use a short length of Black wire to make a connection between the second and third from the top taps (300-0): at the same time add a 12" piece of Black wire to the second tap (300) as shown. Later we'll solder this wire to the M2 Power Supply board.

Mains Initial Secondary Wiring



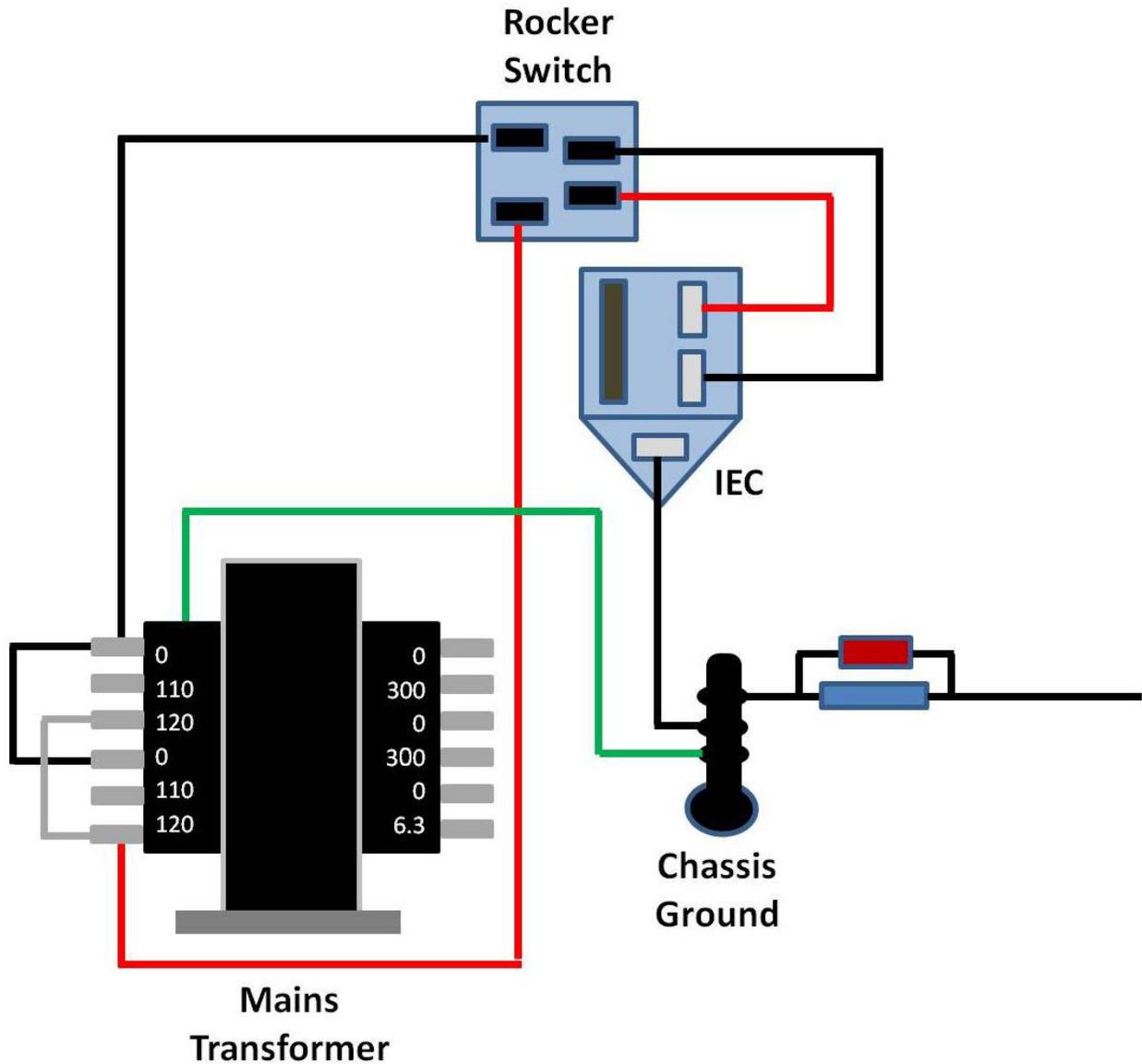
2.9 Installing the Mains Transformer and AC Connections

With the wiring above now completed we can now position the Mains transformer into the chassis... *but do not secure it as we have more work to do around the IEC section.*



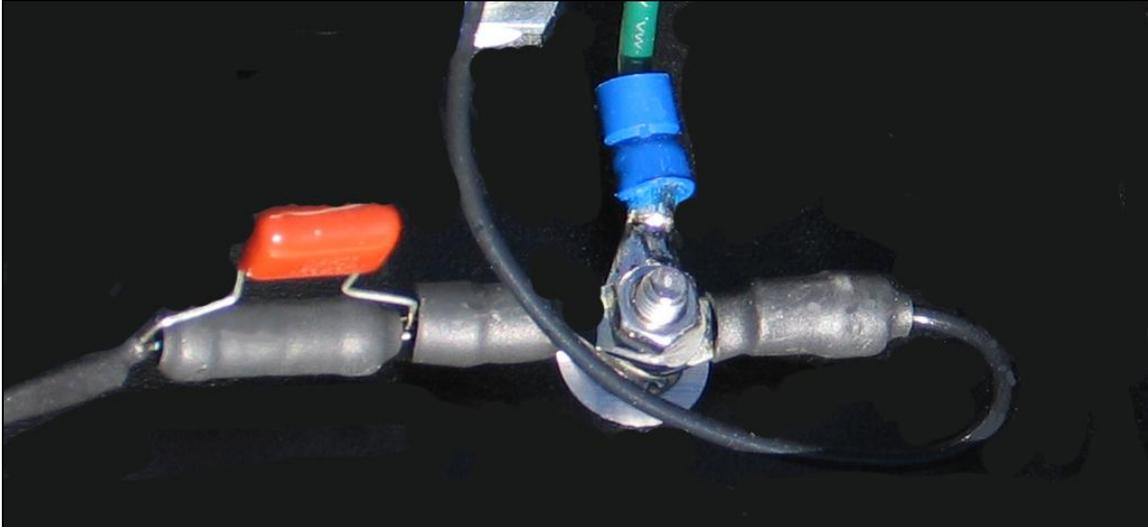
In this section, refer to the diagram below for the AC Power On/Off and Ground Connections for 120V.

AC Power On/Off (120V)



➔ *After completing the following steps, return here to review the connections.*

We are now going to attach 3 wires to the chassis Ground, as in the picture below. As you go, place each wire's Ground lug onto the protruding screw; when all 3 are in position, secure them to the chassis Ground with an M4 nut.



- Take the prepared Black cable with the Ground lug on one end and the square crimp on the other and install it on the chassis Ground screw.
- Take the Green wire coming from the Mains with the Ground lug on the end that you prepared earlier and install it on the chassis Ground screw.
- Take the prepared wire from the IEC bag with the 10R resistor and capacitor in parallel and install it on the chassis Ground screw.

There should now be 1 Green and 2 Black wires attached and secured to the chassis Ground.

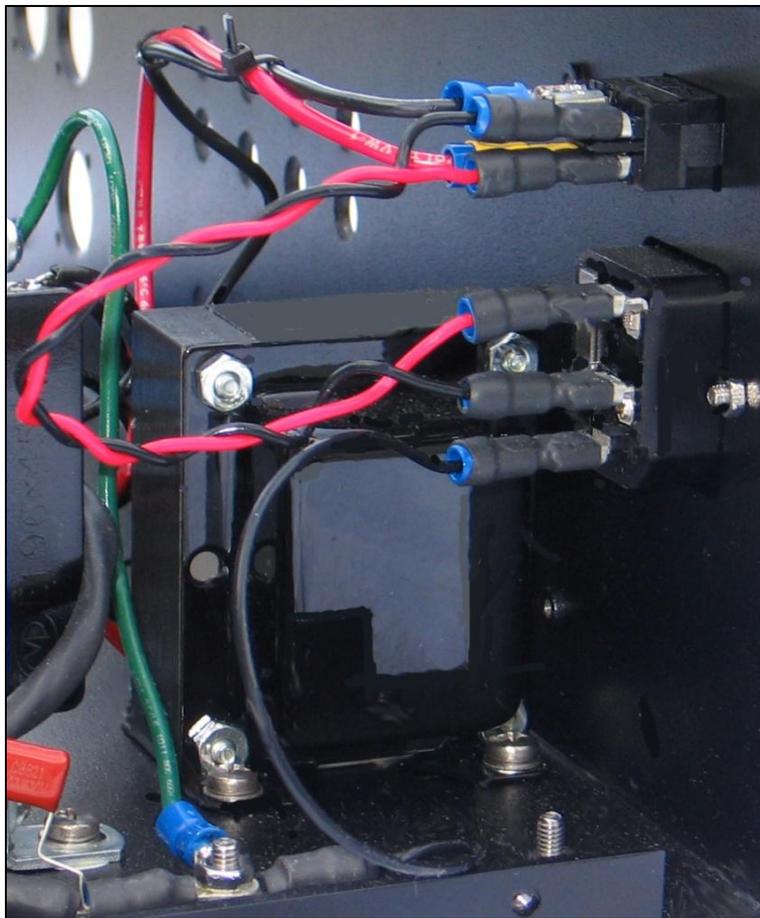
➔ *In some graphics you may see the IEC plug shown upside down. While it can go in either way we have chosen to have it installed in the chassis with the GND lug at the bottom — this will match the orientation in the graphics. But you can do it either way as long as the connections are the same.*

- Now take the Black wire attached to the chassis Ground screw with the unattached square crimp and connect it to the GND connection on the IEC socket as shown.
- Take the prepared Black and Red wires with the 4 crimps on the ends (2 on each end). Carefully examine the IEC graphic on the previous page, then attach the prepared Black and Red wires to the IEC socket as shown.

Before you complete the next step, have a close look at the crimps on the unattached ends: *you'll notice there is a flat edge and a slightly rounded edge.* Attach the crimps such that the flat edges face each other so they are the maximum distance apart.

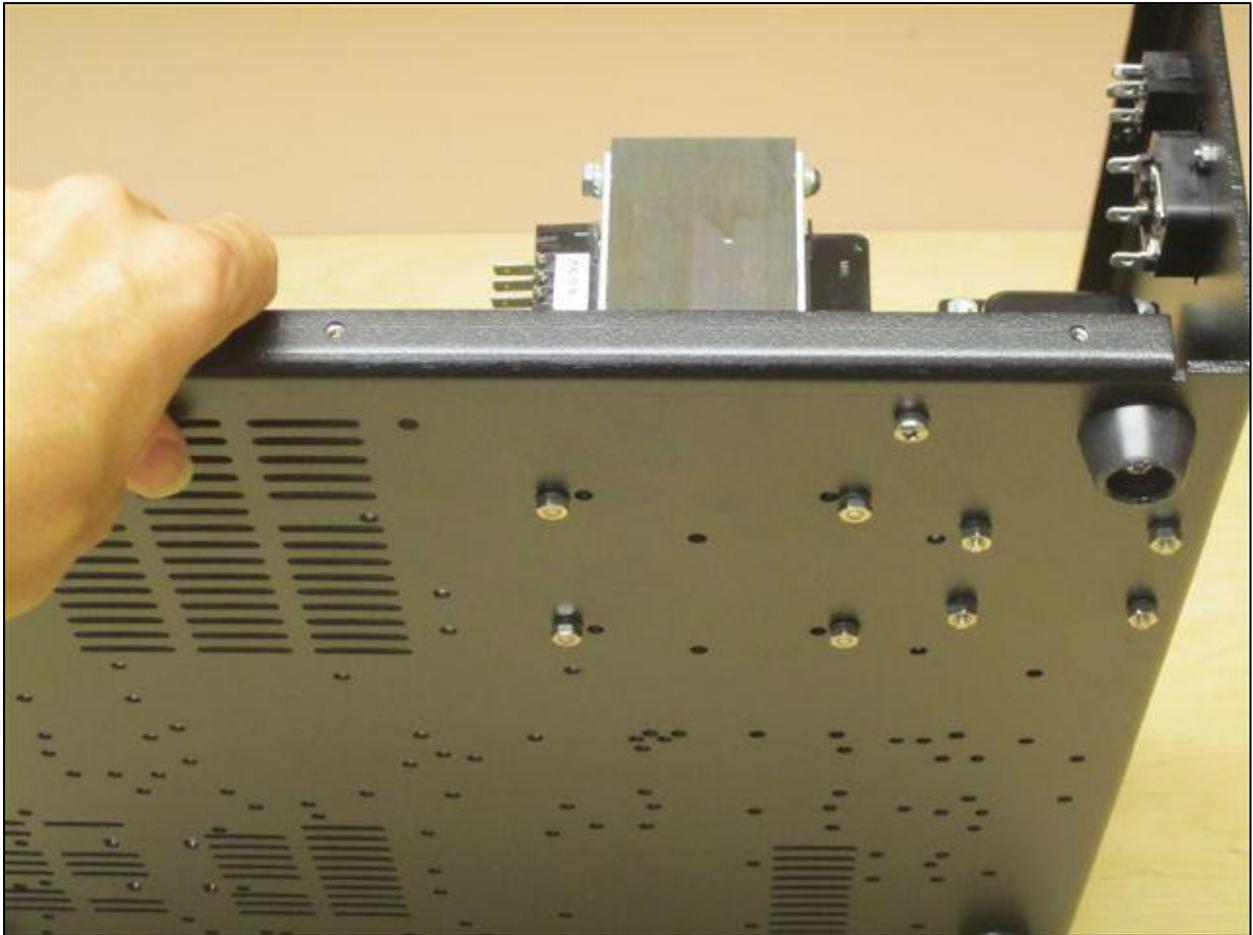
- Complete the connection of the other end of the Black and Red prepared cable to the more narrowly spaced tabs of the rocker switch — closest to the corner of the chassis, as shown in the graphic.
- Now take the Black and Red wires with crimps that are attached to the Mains transformer and connect them to the more widely spaced tabs on the rocker switch — towards the Mains, as shown in the graphic.

Here's a picture of the completed rocker switch and IEC wiring:



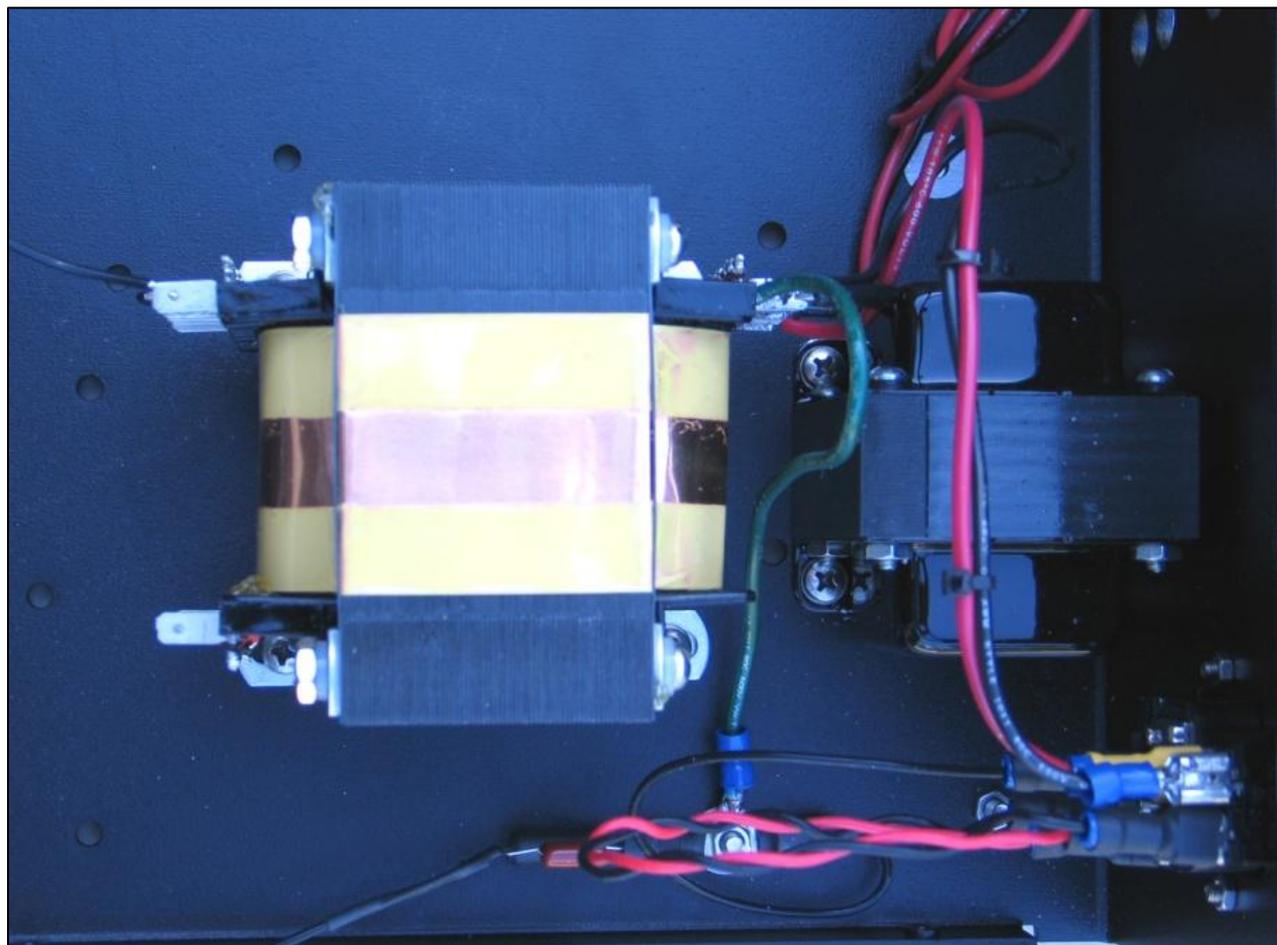
Now that we've completed this wiring, *check it carefully.* Go back and go over each step again. Take your time.

Now that you've checked your work, you can secure the Mains transformer into position with M4 screws, nuts, and serrated washers. Position the serrated washers closest to the M4 nut, on the underside of the chassis.



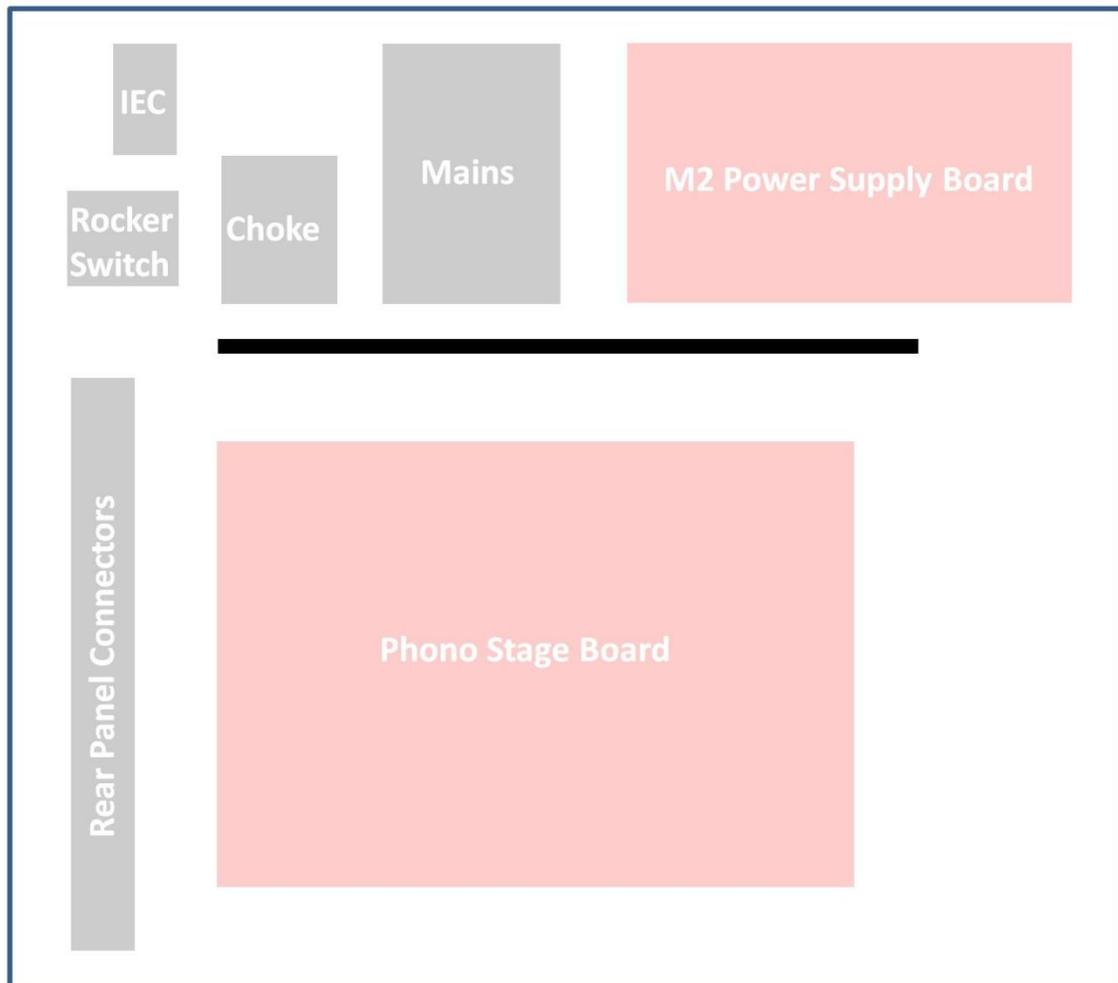
Here's a view underneath the chassis, showing the screws in position...

...and here's a view from the top:

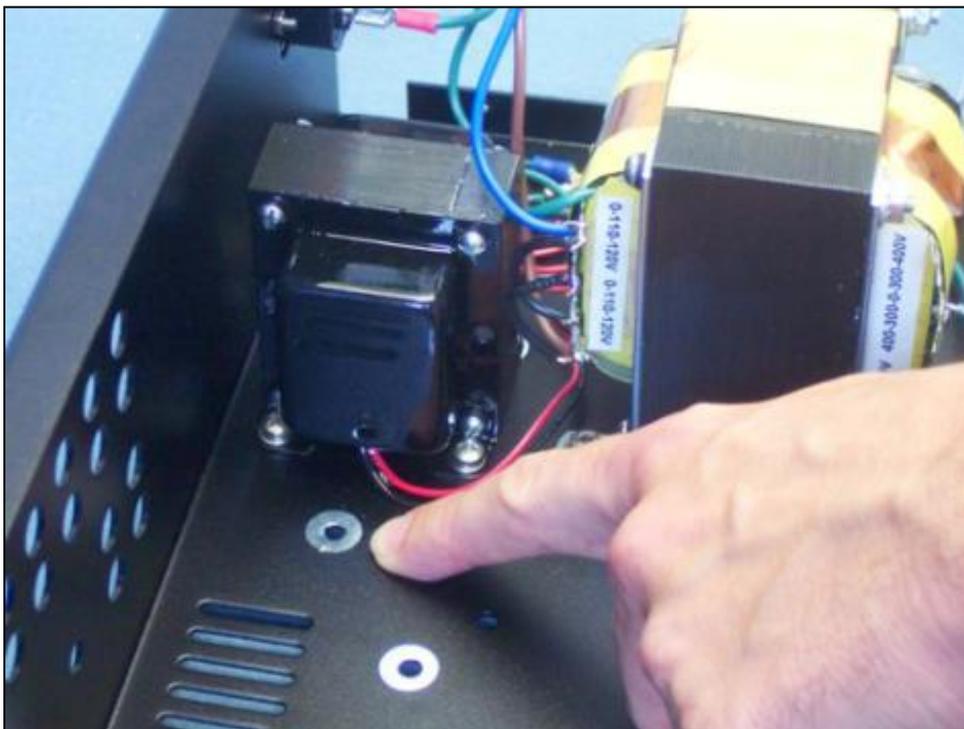


2.10 Shield Positioning

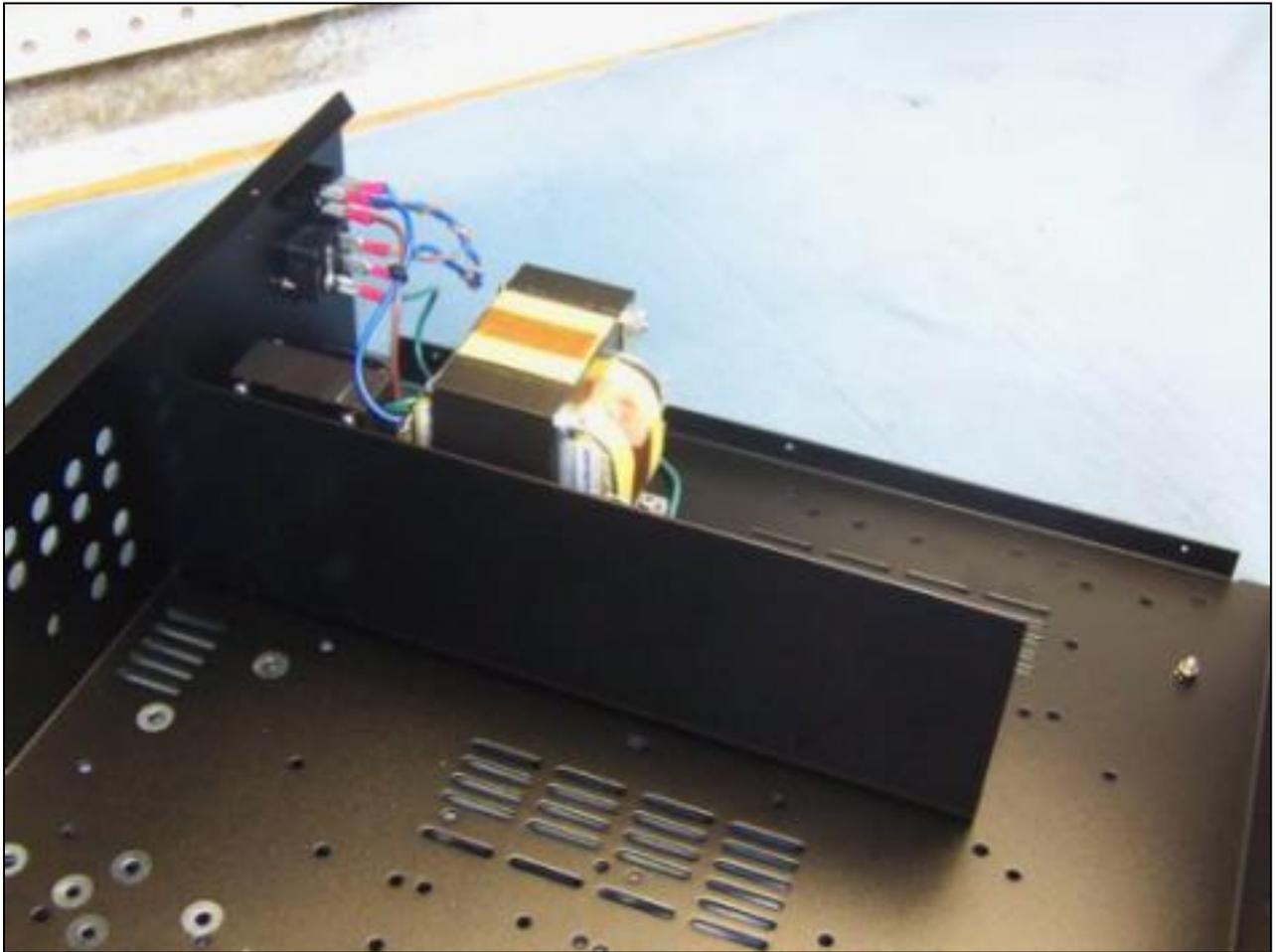
We would like to explain where the shield fits at this stage; you won't actually be installing it until later; by then there will be a number of things inside the chassis so becoming familiar with how it will be positioned should be helpful.



Take a look at the shield provided and locate the hole underneath that has no paint on it — this will match up with a hole on the chassis that is also unpainted in order to ensure a good grounding of the shield when installed in the chassis.



Here you can see the correct installation of the shield:



You'll also see several holes in the shield panel: these will be used to route wires from the Mains transformer and M2 board (on the far side of the shield in the picture above) to the Phono Stage. You will need to remove the shield later on when we wire up to the Mains transformer but for now you can leave it in.

Congratulations on the Choke and Mains installation! Now we'll move onto the M2 Power Supply board. But first,

Time for another break.

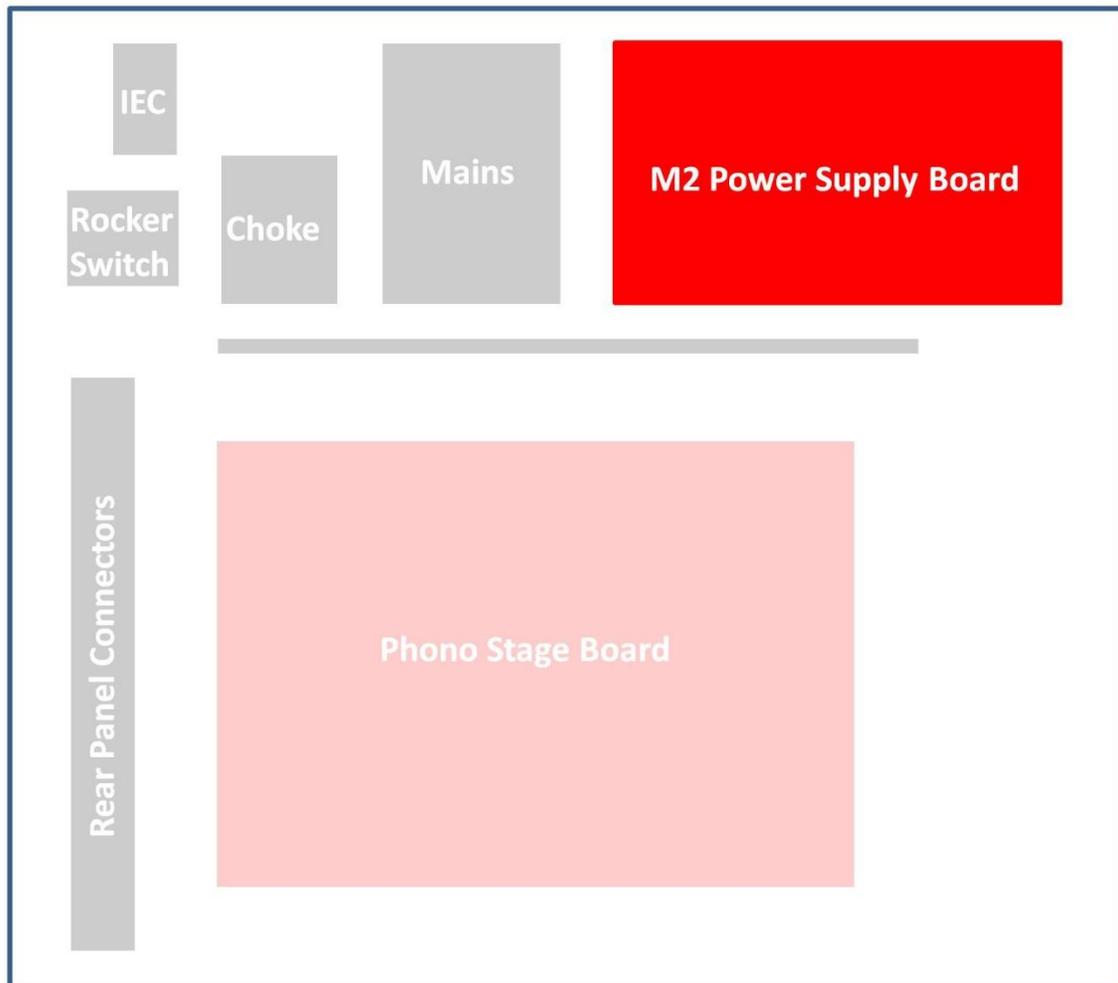


Section 3

M2 Power Supply Board

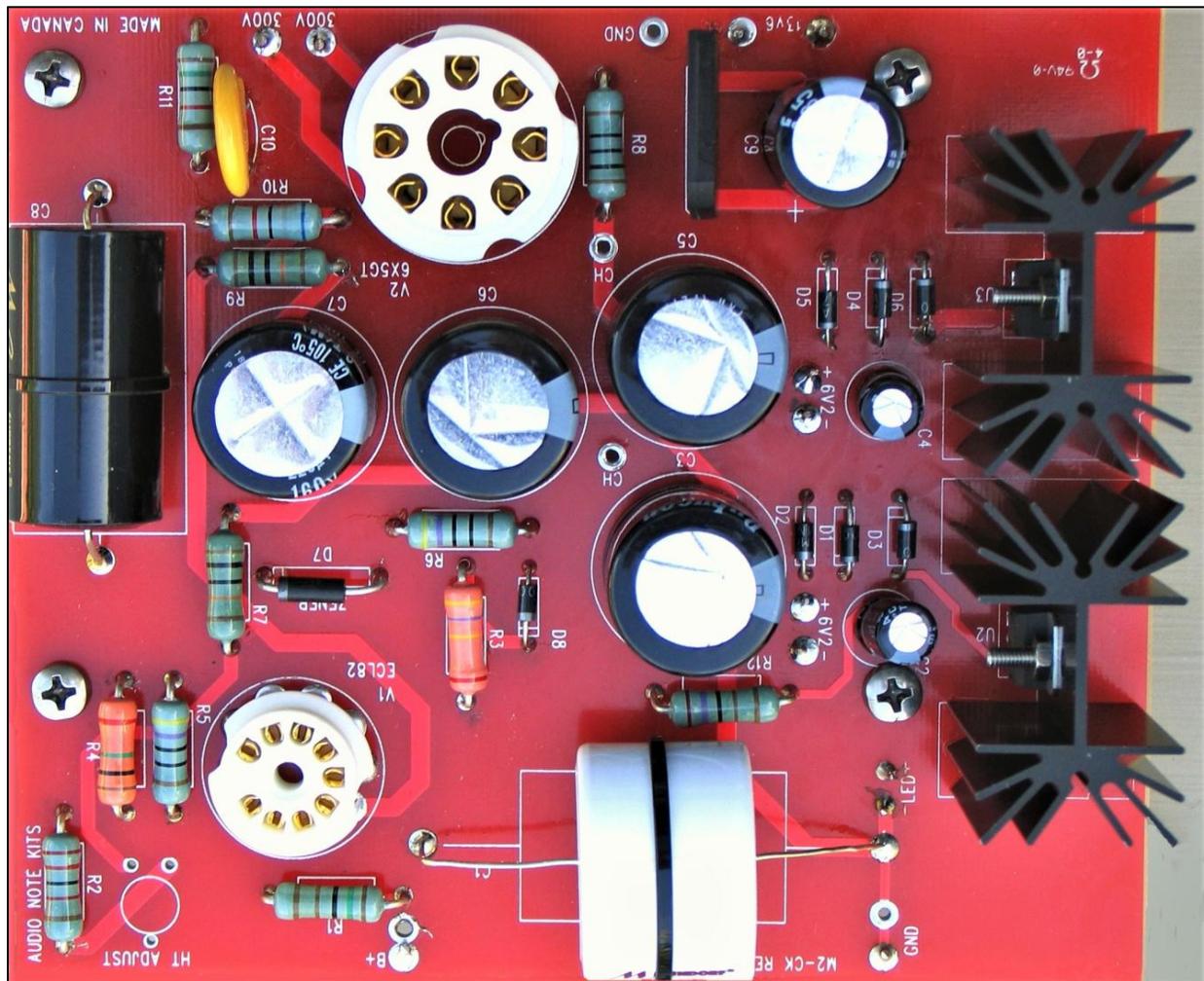
3.1 Overview

In this section we'll be building the M2 Power Supply board. The parts (the PCB, resistors, capacitors, etc.) are in the M2 Power Supply bag.



Once this section is built we'll run tests for both ohms and voltages to make sure your power supply is working perfectly. If there are any problems, we'll try and diagnose what's wrong. If that doesn't help, please contact us by phone or email (audionotekits@rogers.com) and we will help you resolve the issue.

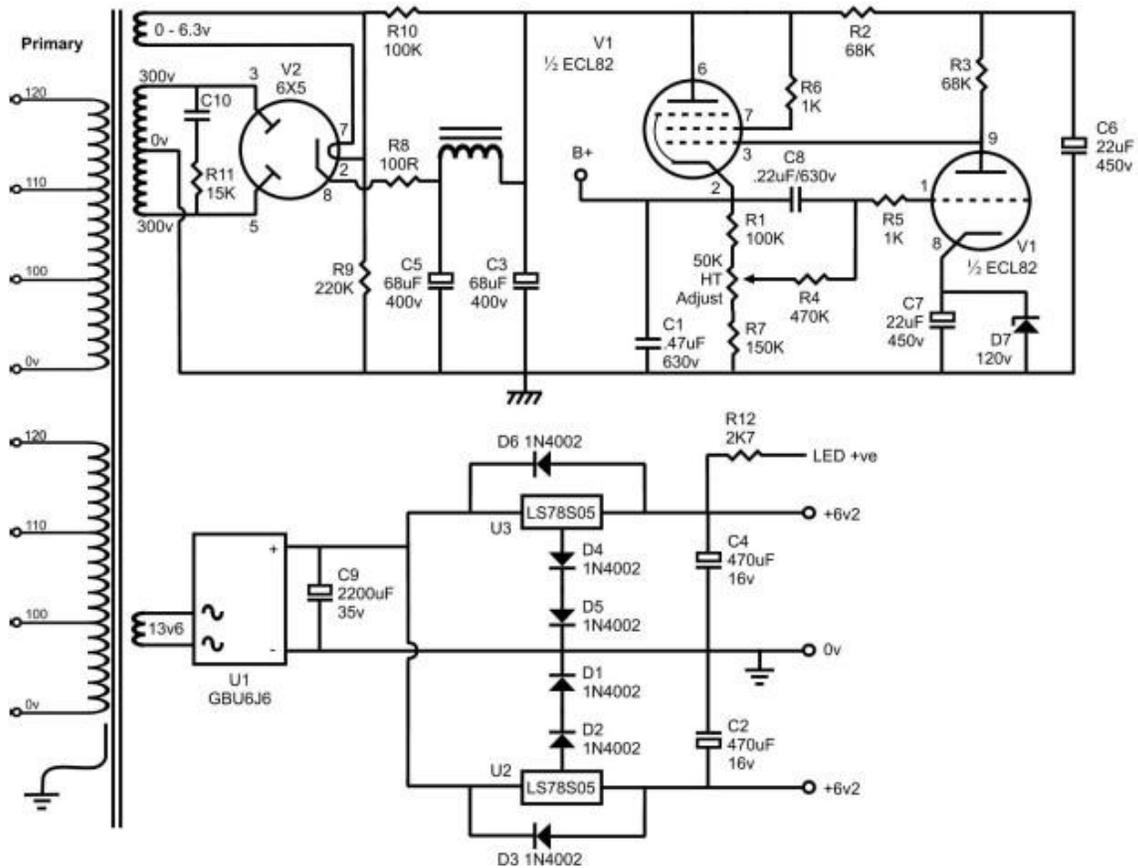
Here is a view of the completed M2 Power Supply.



We'll construct the M2 Power Supply board first and then fit it into the chassis. The steps we'll follow are:

- ❖ Install the Valve Bases
- ❖ Install the Resistors
- ❖ Install the 6V2 Wires
- ❖ Install the Capacitors
- ❖ Install the Bridge Rectifier
- ❖ Install the Zener Diode
- ❖ The Filament Section
- ❖ Additional Wiring

Let's begin by examining the schematic² and a completed board.



3.2 Installing the Valve Bases

Let's start by installing the valve bases. There are two valve bases in the tube rectified and regulated Power Supply.

Valve Bases

QTY	Designation	Description
1	9-pin Valve Base	V1
1	8-pin Valve Base	V2

² Schematics may change from time to time, but we've included this schematic as a guide. If you find any differences between this schematic and your board and parts — and it concerns you, just give us a call.



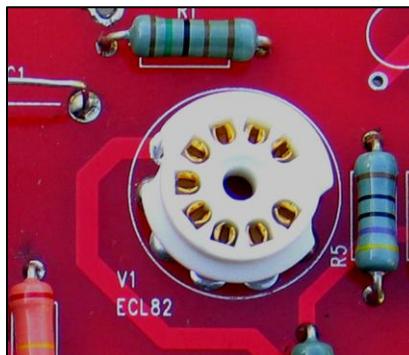
Use some masking tape to secure the valve base to the board prior to soldering. *The key is to make sure the valve base is level:* if your base is soldered on an angle then your tube will lean over! You'll want to solder from the underside of the board. We suggest that you use just a little solder to secure each pin to the board: perhaps just start with two pins which are opposite to each other to make sure the base stays level — then you can add more solder to the pins. In the end you can fill up the entire valve base hole.

➔ *Be very careful not to let any solder bridge to the next pin as this will cause a short and your Power Supply will need some serious debugging or resuscitation!*



Insert the 8-pin valve base into the board at position V2.

➔ *The key in the valve base lines up with the stencil on the board — they both have little notches.*



Once completed, you can insert the 9-pin valve base at V1; it only goes one way. Again, use some masking tape to secure it so that it's level and then solder it into position. Well done!

3.3 Installing the Resistors

Let's take a look at the parts list for the resistors:

Resistors

Quantity	Value	Designation
1	100R	R8
2	470R	R5, R6
1	2K7	R12
1	15K	R11
1	22K	R2
1	470K	R3
1	68K	R10
1	150K	R1
2	100K	R7, R9
1	1M	R4

Note: The part marked 'HT ADJUST' on the board is no longer used; it has been replaced by a fixed resistor.

A quick lesson about resistors:

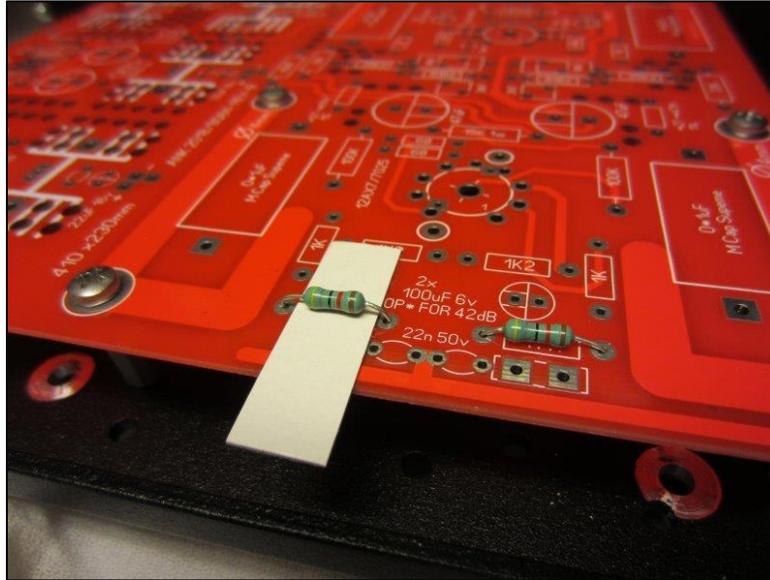
- ❖ A resistor that reads 100R means that it is 100 ohms; the 'R' stands for resistance
- ❖ A resistor that reads 2K7 means it is 2700 ohms ; the 'R' is assumed and the K (which stands for Kilo or 1000) is positioned like the decimal place, so it's like reading 2.7K ohms (K = multiplied by 1000) — but it's shortened to 2K7
- ❖ Another example like this is the 1M resistor, which is 1 Mega ohms

Use an ohmmeter to measure each resistor to verify its correct value. There's a resistor calculator chart on the audionotekits.com website and we've included a chart in Appendix A.1.



It's a good idea to orient your resistors so that the color codes can be read from left to right; it makes it easier to spot any issues.

It's also a good idea to not have the resistors installed right against the board, for a couple of reasons: 1) it's better for heat disposition, and 2) in some cases there are circuit traces running under the resistors and we really don't want resistors touching them. So, as shown below (on a board from a different kit), we use a narrow piece of cardboard cut to size as a 2–3 mm spacer: this will still let you solder while ensuring that the resistor is not pressing against the board.



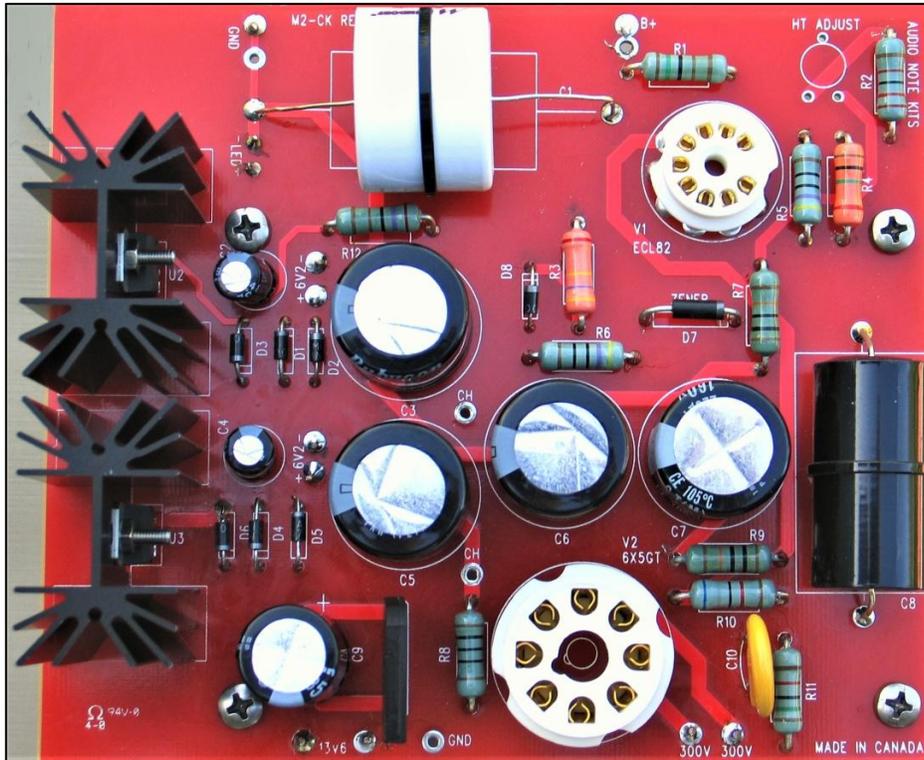
Also, be sure to solder on the underside of the board and check that you have nice little “volcanoes” on each solder joint. And, when you go to clip a lead be sure to clip above the volcano so that you don't slice off this nice joint.

- Populate the Power Supply board with the resistors, first checking the value and then installing them into the correct designation (R1, R2, etc. as shown on the board). Then bend the legs *slightly* once they are in the board to secure them; this way they won't fall out and you can check your work again prior to soldering. Once all the resistors are in and you feel confident then you can start soldering from the underside of the board.

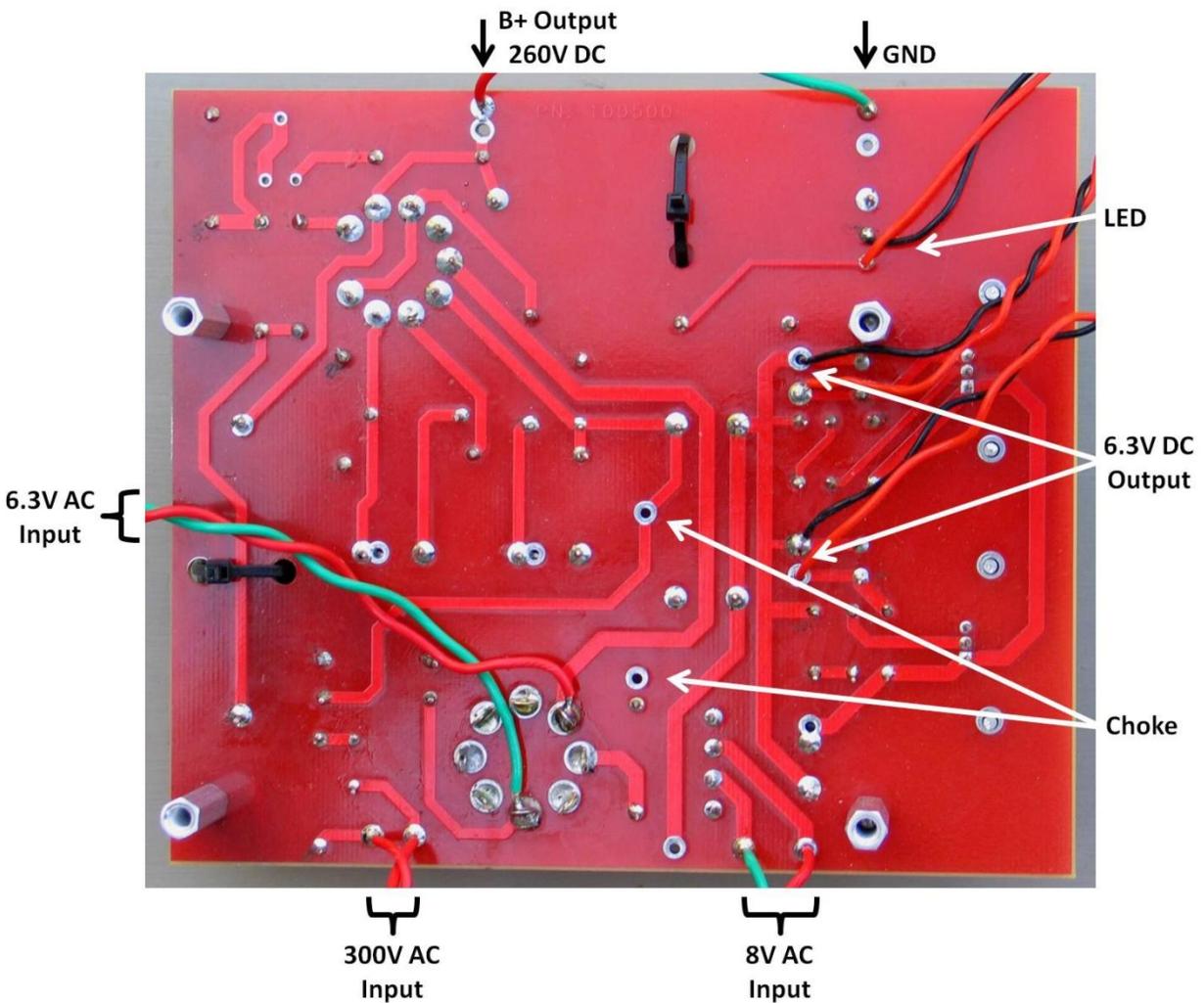
Once the resistors are soldered into position clip the leads.



Hold the lead that you are about to clip with one hand so that it does not go flying off and hit you in the face or eye! Another great tip: Orient your resistors so that the color codes can be more easily read from left to right with consistency.



Resistors in Place



The solder pads on the M2 board, through which you'll be inserting wires, are quite small, so, when you tin a wire, don't use too much solder. Then, if there's a small solder 'nub' at the end of the wire, you can just cut off about 1 mm and it should fit nicely through the hole.

- Cut the long twisted Red and Black wires in half, strip off the ends, twist them tight, tin them, and then place them from underneath the board into the +6V2- holes found on the board besides C3 and C5. Place the Red wire in the + hole and the Black wire in the - hole. Solder from the top side of the board and then trim.

3.5 Installing the Capacitors

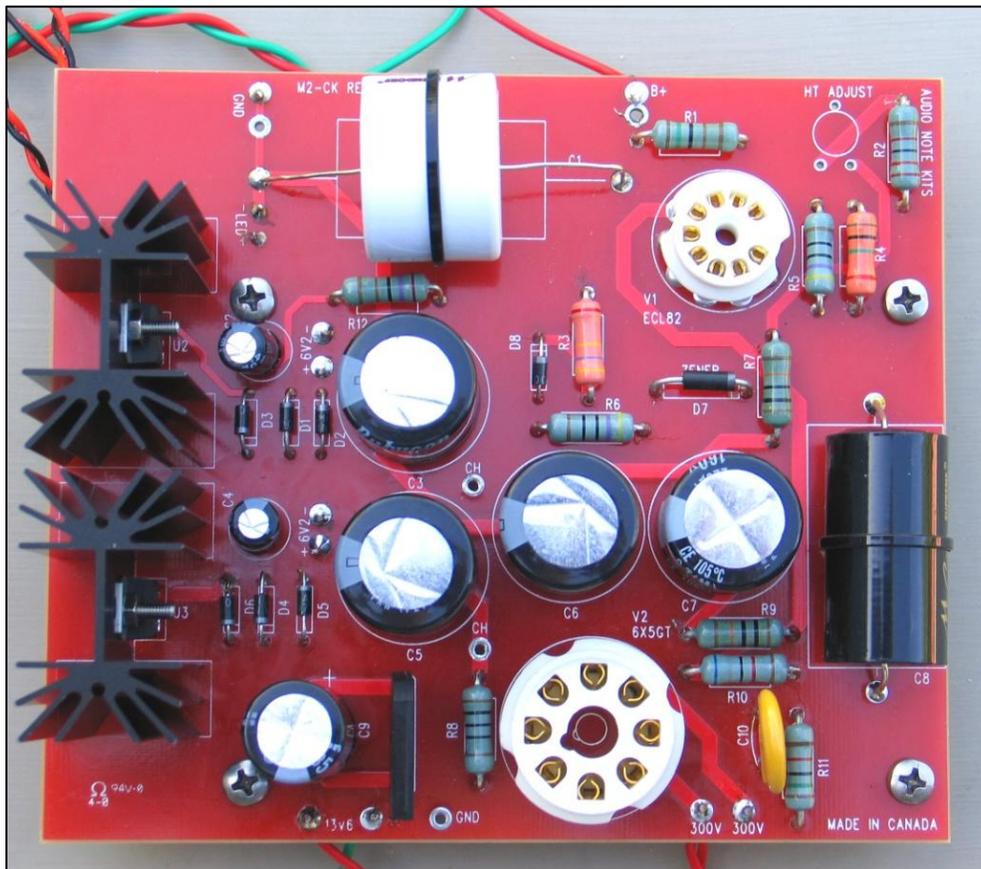
Next we'll install the capacitors. We'll start with the electrolytic capacitors:

Electrolytic Capacitors

Quantity	Value	Designation
1	2200uf 35V	C9
1	220uf 160V	C7
3	100uf 450V	C3, C5, C6

There are several different types of capacitors that will be installed in the M2 Power Supply. The first type are called electrolytic capacitors: these are the capacitors like, for example, the 100uf 450V capacitor, which has a stripe down one side. You'll remember from the Introduction to the manual that the stripe denotes the **NEGATIVE** side. On the board you'll see a + sign which denotes the **POSITIVE** side. Be sure to align the capacitors correctly into position.

Here's what we want to achieve:



Looking at the picture above you will see the 7 cylindrical electrolytic capacitors standing straight up: we'll install 5 of these now (C3, C5, C6, C7, C9) and 2 (C2 and C4) later.

- Install C3, C5, C6, C7, C9 so that they look like the ones in the picture, again being so careful to orient them correctly.

Disk Capacitor

Quantity	Value	Designation
1	Disc 4700pf 3KV	C10

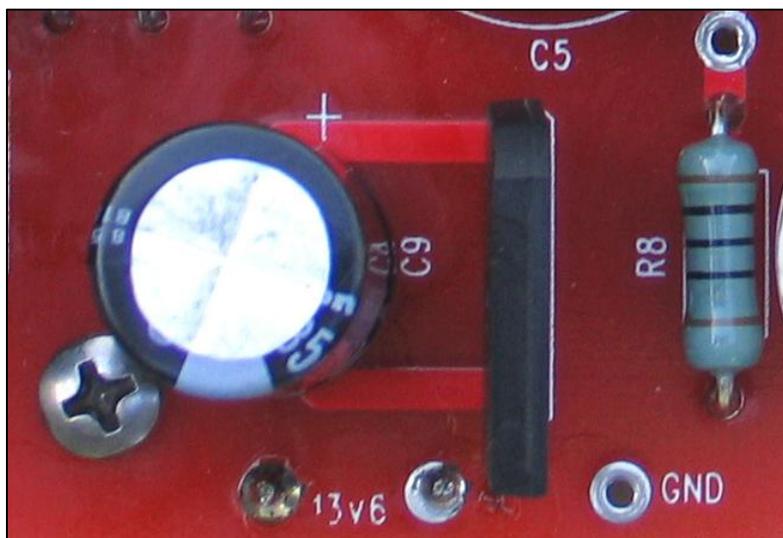
- Install the disk capacitor (C10). Its orientation does not matter.

3.6 Installing the Bridge Rectifier

Bridge Rectifier

Quantity	Value	Designation
1	GBU6J6A	U1

The Bridge Rectifier accepts AC voltage and generates a DC voltage which will be used to create the DC filament voltages used by the line stage on the Analog board. You'll see a notch on the Bridge Rectifier (part number: GBU6J6A) on the right side in the picture below. Match the notch with the stencil on the board, which has a notch on the rectangle. The notch points towards the middle of the board.



- Install the Bridge Rectifier into position in U1.

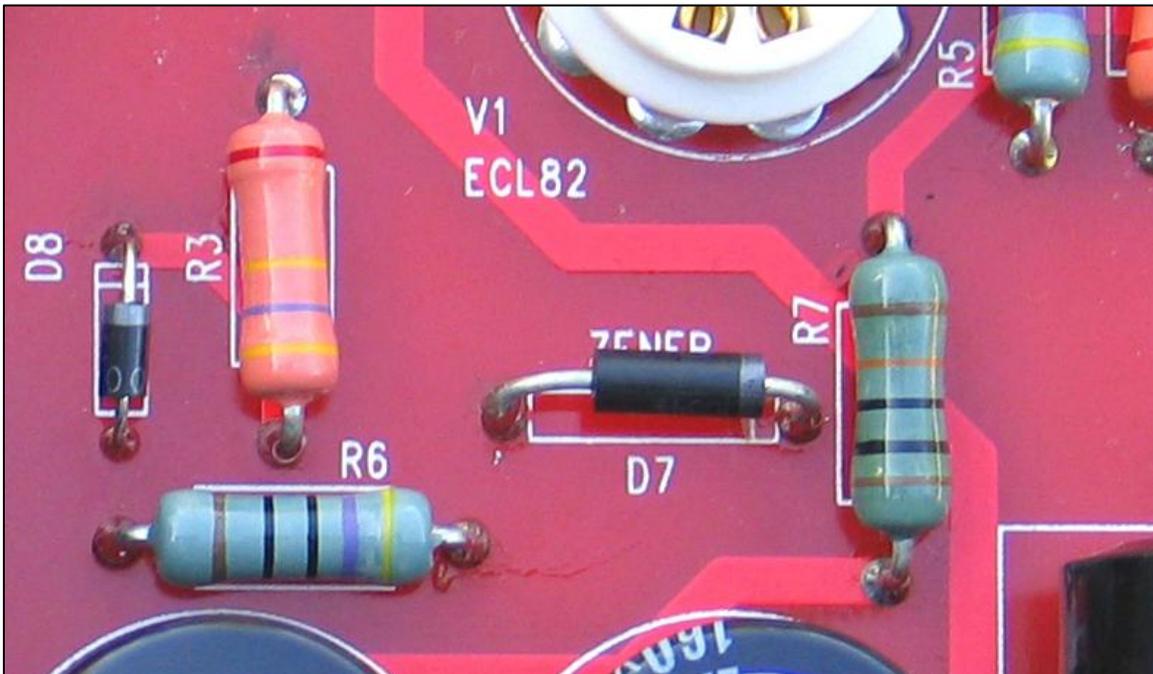
3.7 Installing the Zener Diode

Zener Diode and Regular Diodes

Quantity	Value	Designation
1	3.25W 100V Zener (IN5378B)	D7
1	1N4007	D8

The Zener Diode is in its own bag so as not to confuse it with the 1N4007 diodes also used in the kit (the 1N4007 diodes are typically a little smaller). Be sure to notice the stripe on the Zener Diode and match it with the board stencil.

- Install the Zener Diode in location D7.



Also in this picture, on the left side in the middle, you can see the stencil for D8 which is for one of the 1N4007 regular diodes.

- Let's take this opportunity — while we're in the neighbourhood — to install one of the 1N4007 regular diodes in D8: again, be sure to align the silver stripe on the diode with the bar on the stencil on the board. You can also use the small piece of cardboard (narrowed a bit) to maintain 2–3 mm clearance above the board, as you did above with the resistors.

3.8 Filament Section

Now we're going to look at the Filament section. We recommend that you read over this entire section before starting.

Let's begin by understanding what we want to accomplish in this section and by sharing a little background on how and why some key components 'fit in.' The Filament section of the M2 Power Supply is, in fact, two distinct sections that generate a voltage on the +6V2- points on the board:

- ❖ U3 filament section: U3 heatsink and regulator, diodes D4, D5, D6, and capacitor C4
- ❖ U2 filament section: U2 heatsink and regulator, diodes D1, D2, D3, and capacitor C2

The M2 Power Supply is used in a number of ANK Audio Kits and can be configured to meet their different needs by putting different components in locations that, in effect, program the U3 filament section or the U2 filament section to output either a 6.3V filament or a 12V filament voltage. In the L3 Phono Stage V2, the 12AX7 and 6922 tubes on the Phono Stage board need 6.3V for the filament and we'll configure the U2 and U3 sections to meet that need using the 78S05 regulator and 6 1N4007 diodes.

Diodes

Quantity	Value	Designation
6	1N4007	D1, D2, D3, D4, D5, D6

- Install the remaining 6 1N4007 diodes in positions D1, D2, D3, D4, D5, and D6.



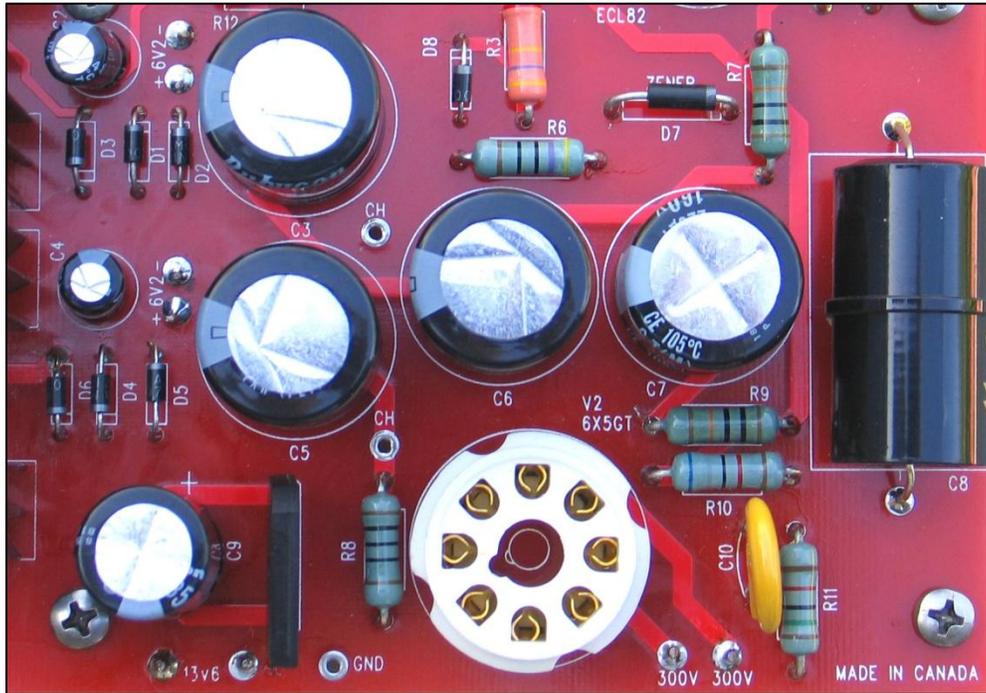
*Note that the diodes need to be oriented with the silver line on the diode matching the stripe on the silkscreen of the board. Look carefully: they are **not** all oriented in the same direction. Also, take care to position the Red and Black 6V2 twisted wires out of the way as you work so that your soldering iron will not burn the wires accidentally.*

Electrolytic Capacitors

Quantity	Value	Designation
2	470uf 16V	C2, C4

- Now install the last of the electrolytic capacitors in the C2 and C4 positions, again making sure to orient them correctly. Note the '+' (POSITIVE) on the board and the stripe on the NEGATIVE side.

Before we go on, let's have another close look at the capacitor installation:

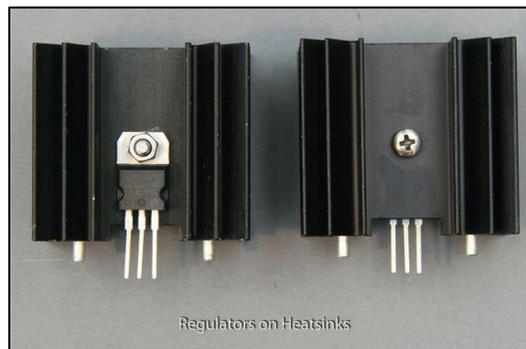


3.8.1 Installing the Regulators and Heatsinks

Regulators

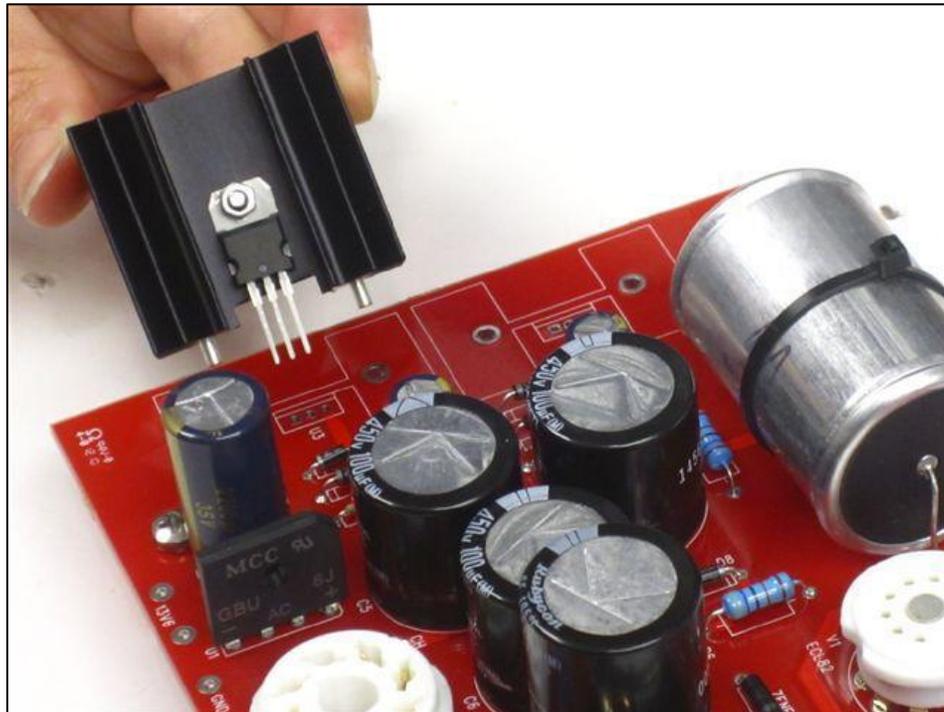
Quantity	Value	Designation
2	L78S05	U2, U3

Have a look at the picture below: Notice that the Black heatsinks have the regulator installed in them. The L3 Phono Stage V2 5V regulator is part number L78S05. (I know, it's really hard to read!)



The picture shows one regulator, from the front and back.

- Take an M3 PAN head screw and connect the regulator as shown in the picture. The heatsink is the same front and back but be sure to position the regulator pins and the heatsink pins in the same direction. You'll also want to be sure that the regulator is straight: a good way to do this is do the final tightening of the screw while holding the regular and heatsink in position on the board where it will go.
- Insert the regulator and heatsink into the board as shown in the picture below and solder the 3-pin regulator from underneath the board. Let's leave the heatsink itself (the 2 pillars) unsoldered for the moment.



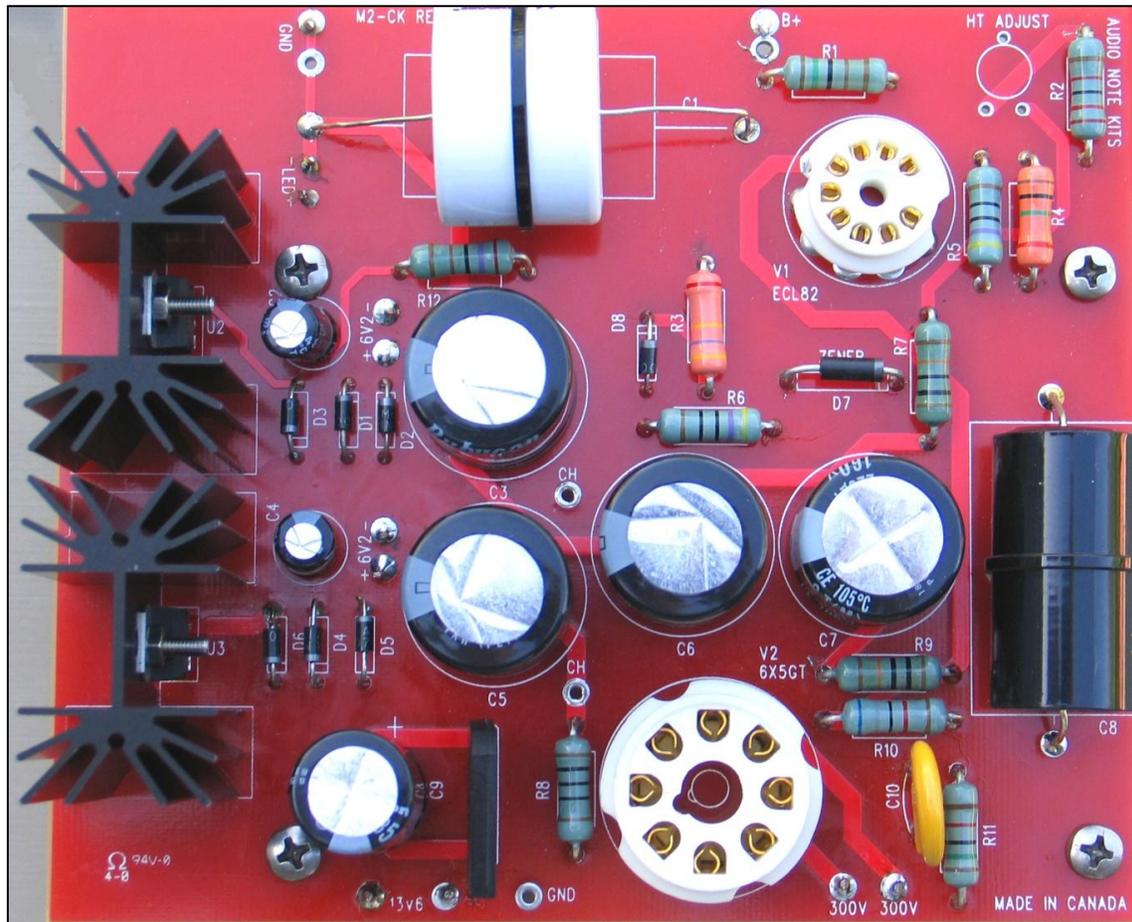
- Repeat the 2 previous steps with the other regulator and heatsink.

3.8.2 Installing the Remaining Capacitors

Capacitor

Quantity	Value	Designation
1	.22uf 600V (or greater)	C8
1	2.7uf 450V EVO Oil	C1

Here you can see the installation of the Mundorf .22uf film capacitor and the large MCap 2.7uf EVO Oil capacitor. Film capacitors do not have a specific orientation: they can be installed in either direction.



- Install the 2 film capacitors, C1 and C8. It's not a bad idea to secure these large capacitors with cable ties, as shown; there are holes in the board for that purpose.
- Add the 4 M4 standoffs to the board.

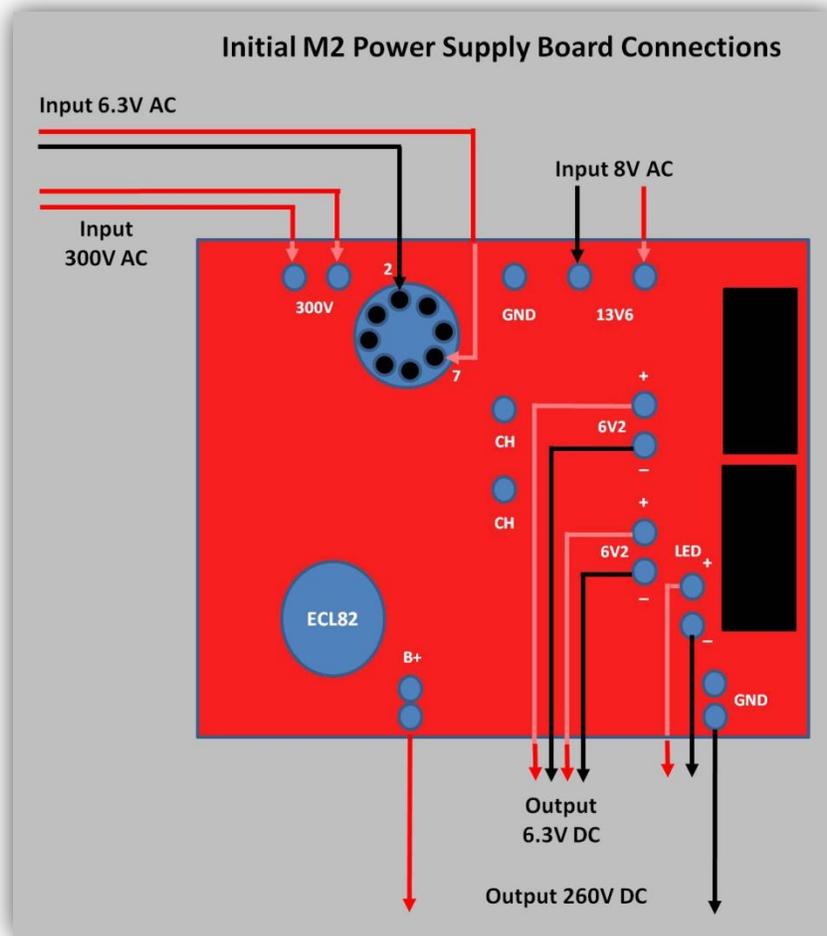
That completes the build of the M2 Power Supply board! Now we'll tackle the additional wiring.

3.9 Additional Wiring

In this section we'll be adding the following wires to the M2 Power Supply board in advance of installing it in the chassis:

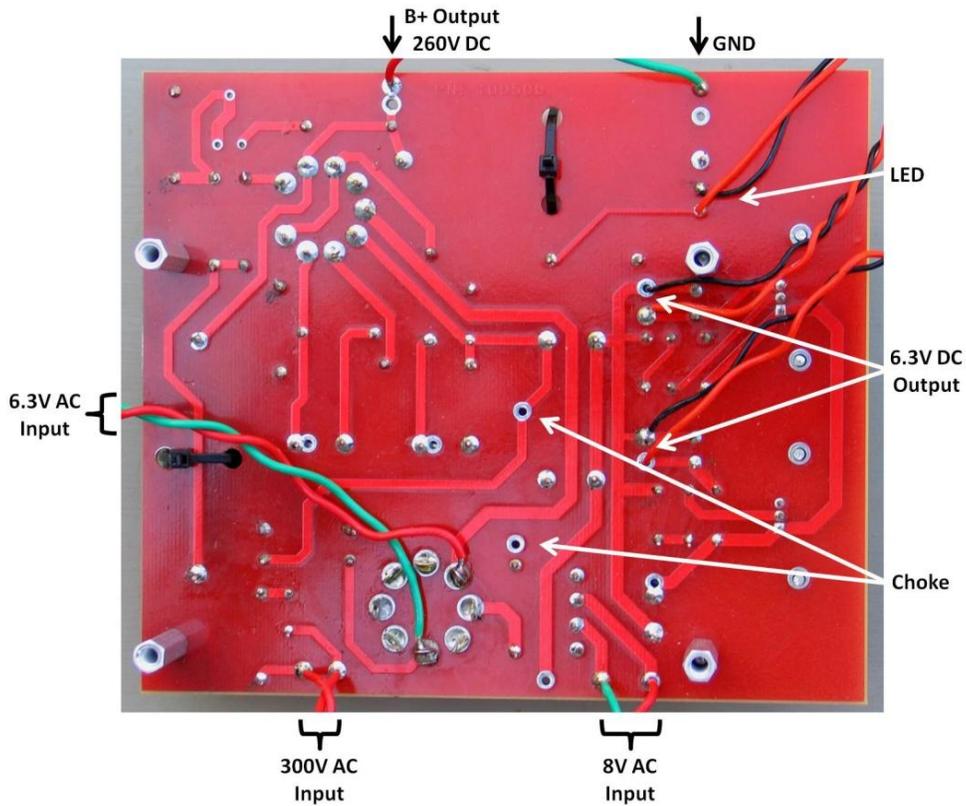
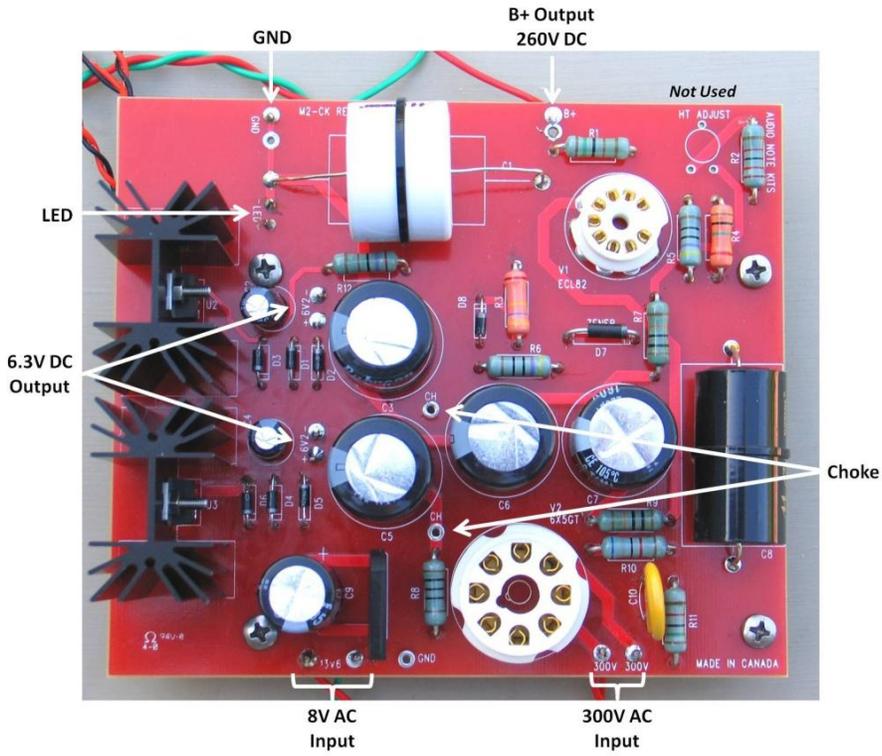
- ❖ Red-Red twisted pair of 18g to connect to 300V 300V
- ❖ Black-Red twisted pair of 18g to 13V6
- ❖ Black-Red twisted pair of 18g to the 8-pin valve base, pins 2 and 7
- ❖ Red HT wire from B+
- ❖ Black HT wire from GND
- ❖ LED wires

Have a look at the graphic and pictures below to familiarize yourself with these wires and where they're located:



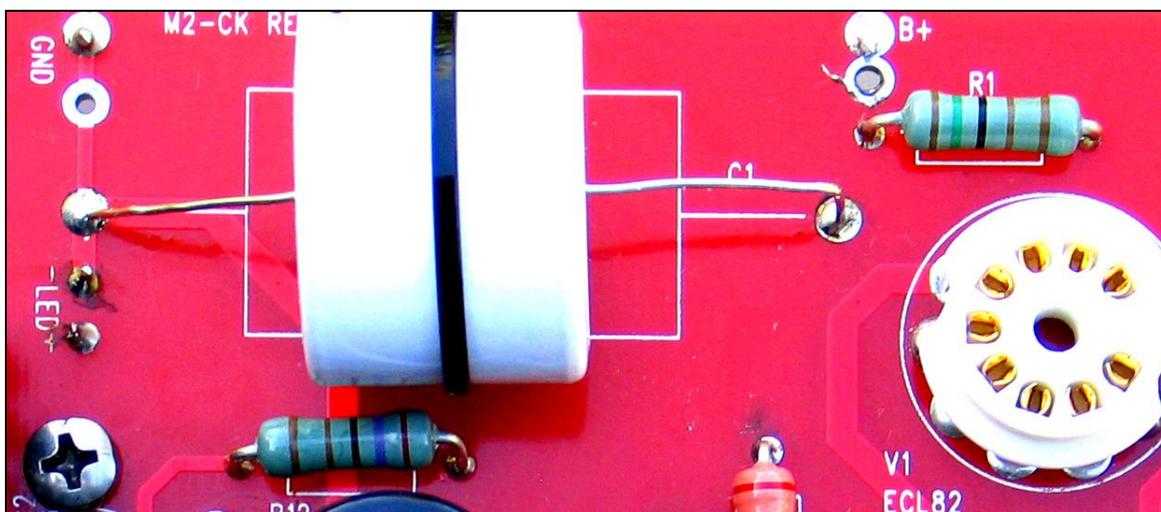
The marking '13V6' on the board is a legacy of the original design: we'll be attaching the 0-8 wires from the Mains secondary here. Don't worry about it!

Let's have another look at the top and bottom of the board:



Now let's go through these tasks step by step; be sure to consult the picture above or the high resolution picture on your CD, as needed.

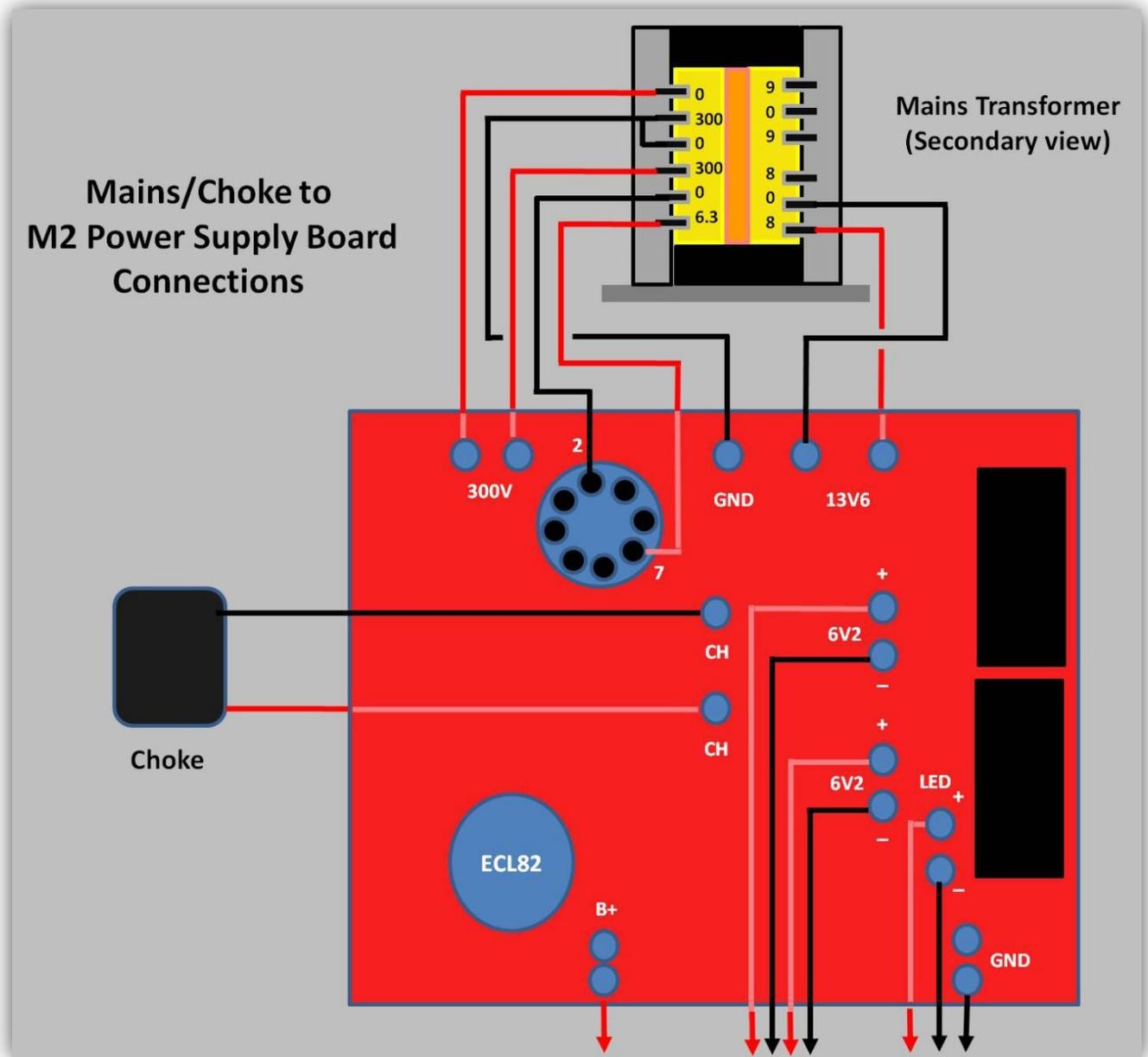
- From Wire Bag #1, take the Red-Red twisted pair. Strip the end of the wires, tin them, insert them from the underside of the board into the two holes on the M2 board that are marked '300V', then solder them on the top side and cut off the excess.
- Similarly, take a Green-Red twisted pair and connect it to the two holes on the M2 board that are marked with '13V6' in the middle. It doesn't matter which color wire goes to which solder tab.
- Now take the last Green-Red twisted pair and, similarly, connect these wires directly to pins 2 and 7 of the 8-pin valve base. Again, it doesn't matter which color wire goes to which pin.



- Look closely at the picture above. From Wire Bag #3, take a Red wire and connect it to the B+ and a Black wire to the GND (on the far side of C1, the 2.7uf capacitor), from the underside of the board. Clip off the remaining lead on the top side. The other ends of the wires will be connected later to the Analog board.
- Connect the twisted wires of the LED harness to the underside of the board where it is marked LED '+', '-'. Connect the Red wire to the '+' and the Black wire to the '-'.

Next we'll be making wire connections between the Mains transformer and the M2 Power Supply board. It's probably a good time to take a bit of a break.

Here's a graphic showing what we're going to do.

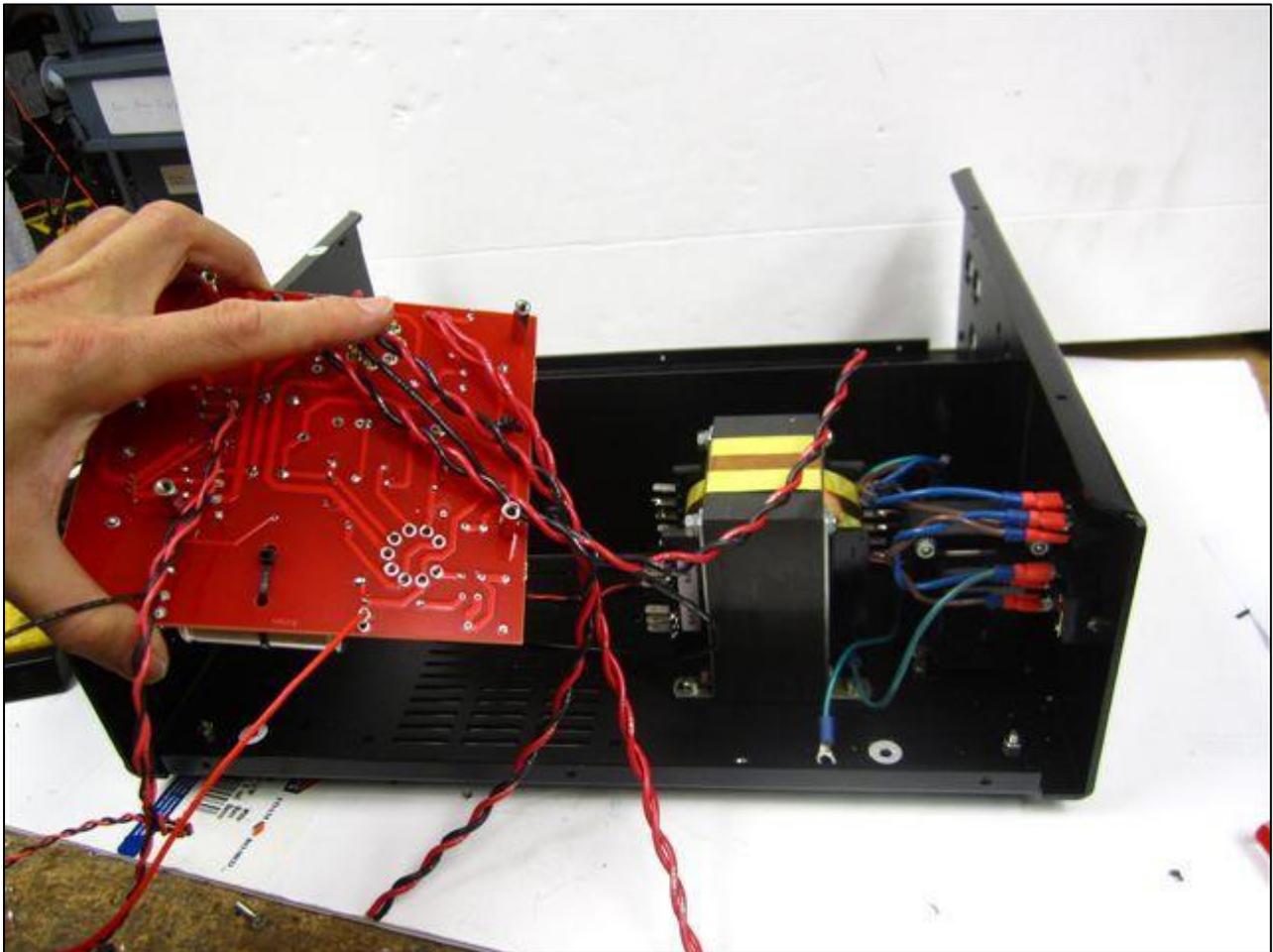


Let's get started:

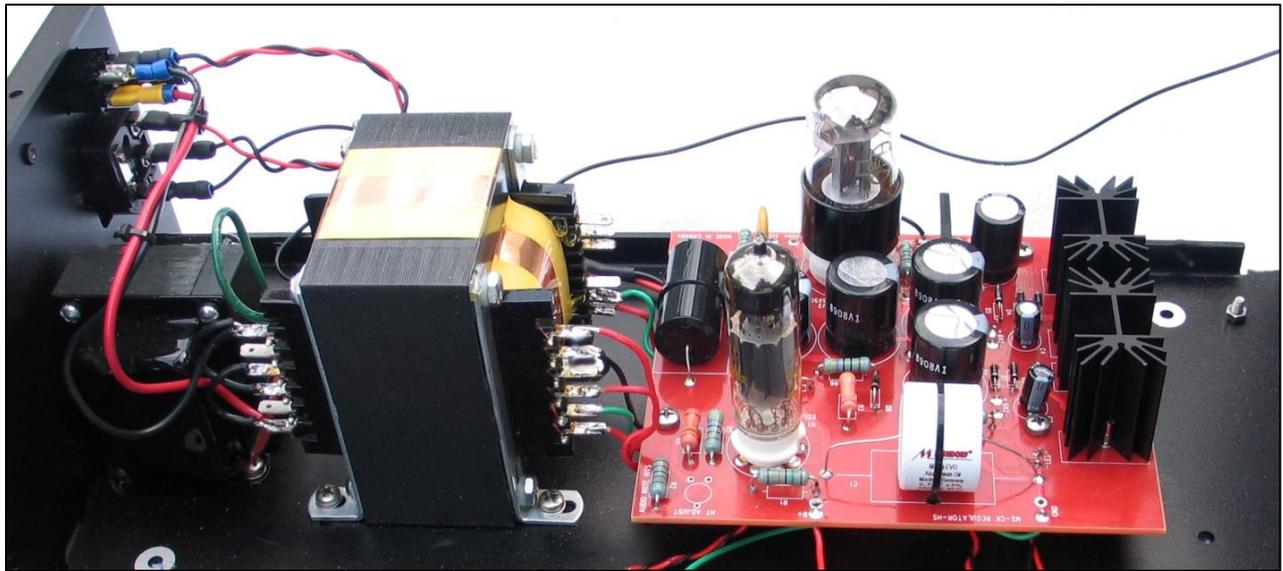
A good first step is to collect the wires that you've already attached to the M2 board, position them so that they are pointing in the direction of the Mains transformer and will be coming out from underneath the board between the two standoffs towards the Mains.

While the board is upside down, let's connect the Choke wires from the CH-180.

- Twist the Red and Black wires from the Choke, route them behind the Mains transformer and along the shield towards the M2 Power Supply board (you can use some heatshrink here, if you like) to CH CH on the M2 board: there is no orientation — either wire can go in either CH. Trim the Choke wire lengths, and thread them through the underside of board, and solder. Then flip the board right side up and trim the wires.



Here is the M2 Power Supply board in the correct orientation:



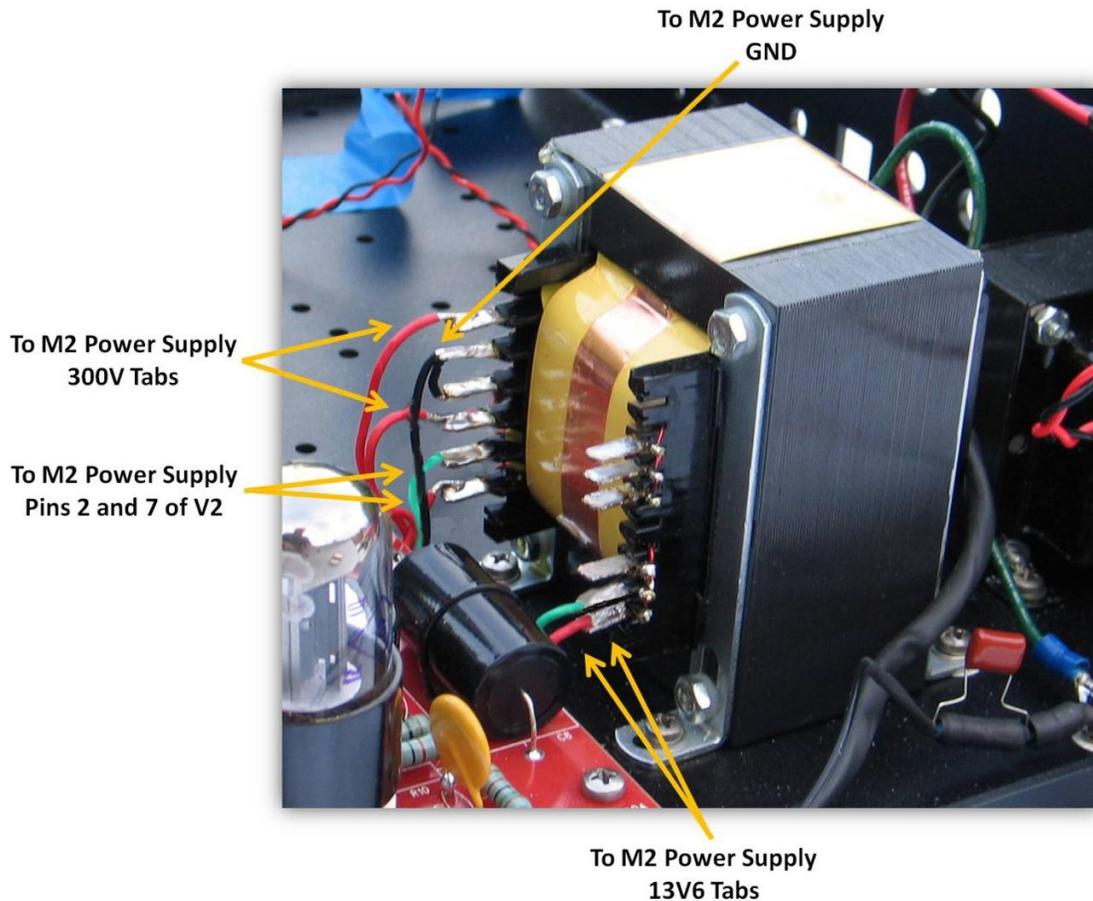
Now we'll make a number of connections from the M2 Power Supply board to the Mains transformer. We suggest at this stage to remove the black shield so that we can work on this side of the chassis.

We recommend that you use 2 screws to lightly secure the M2 board in the chassis: it's quite tight to the Mains, but the screws will ensure that you'll know what the M2 board's final position will be and that will help you figure out how long the wires need to be and how to route them.

When you make these connections, you'll want to cut the wires to length, giving yourself a little slack. Then strip and tin the ends. You'll also want to tin the Mains transformer pins, so that you'll be able to make good connections as you apply heat. That way, the two tinned surfaces should adhere quickly.

Note that, earlier you made a bridge between the two middle pins on the 0–300–0–300 windings of the Mains and connected a long Black 18g wire to it. Now,

- Connect the Black wire coming from this bridged point to the M2 Power Supply board in the GND position located near the '13V6' tabs.
- Connect the Red–Red twisted pair that comes from the '300V' points on the M2 board to the top and bottom pins of the 0–300–0–300 windings of the Mains. Here's a picture of that connection:



- Now connect the Green–Red twisted pair that comes from the '13V6' on the M2 board to one of the two '8's and the '0' on the 8–0–8 winding of the Mains, as shown.
- Connect the Green–Red twisted pair that comes from pins 2 and 7 of the 8-pin valve base to the 0–6.3 winding of the Mains, as shown.

NOTE

The following wires coming from the M2 Power Supply board are not yet connected:

- ❖ B+ Red
- ❖ GND Black
- ❖ Filaments for the Phono Stage board
- ❖ Prepared wire from the chassis Ground with the 10R resistor and capacitor

That completes the M2 Power Supply board. Feel free to reinstall the shield back into position or you can wait until nearer the end of the kit build if you prefer.

Let's test it!

Section 4

M2 Power Supply Testing

In this section we are going to electrically test the M2 Power Supply to make sure all is well before we build and connect the other boards in the Phono Stage.

4.1 Installing the Mains Fuse

Let's start by installing a 1A Slo-Blo fuse (from the IEC bag) into position as shown.

- If the fuse holder is already installed in the IEC plug, use a screwdriver, a flat edge, or your fingers to pull it out — you'll need to squeeze it to completely remove it.
- Install the fuse in the small plastic fuse holder and insert it into the IEC. (You can ignore any lettering like '240V only' — there is only one fuse holder type for all world voltages.)

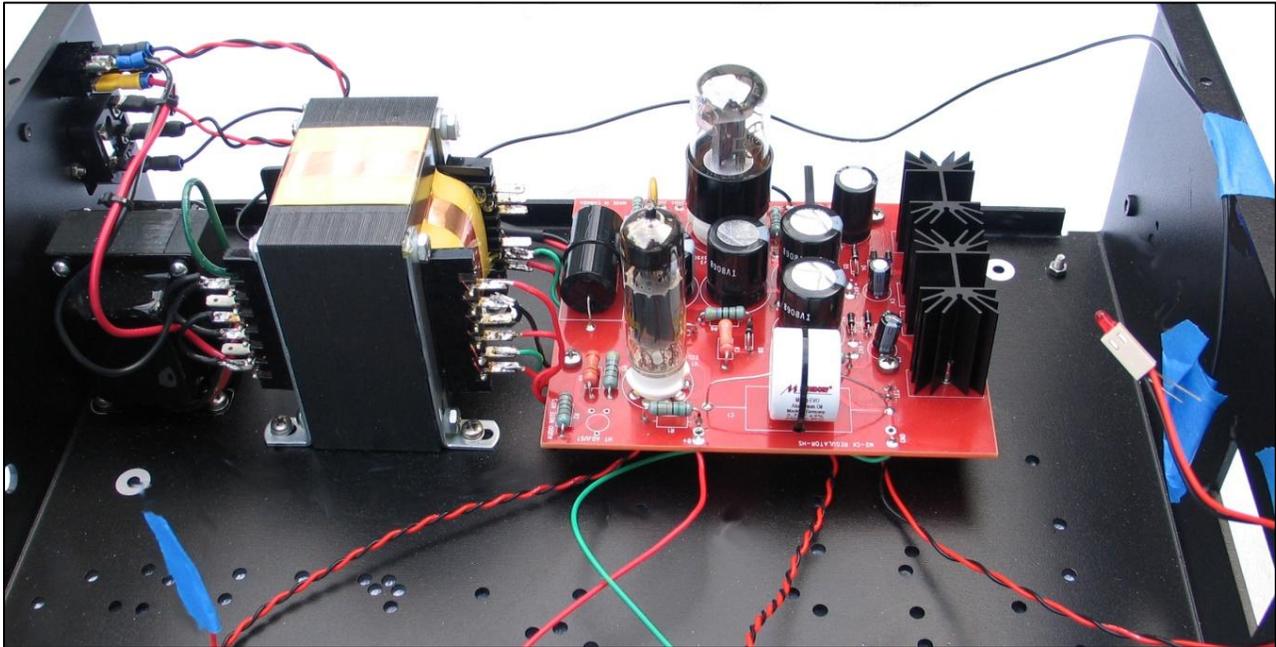


- With the fuse installed insert the holder into the IEC plug. Now let's test the Power Supply.

READ THE ENTIRE REMAINING SECTION FIRST BEFORE TAKING ANY ACTIONS

4.2 Installing the LED Indicator

The LED connected to the M2 Power Supply board will be the first indicator that we have power. We suggest taping the LED temporarily to the chassis as shown. *Make sure the metal leads of the LED are not touching each other or any other circuitry or chassis. Also make sure that the longer LED lead (POSITIVE) mates with the Red wire in the connector and that the LED is pushed in all the way.*



4.3 Installing the Tubes

Now let's install the tubes into the M2 Power Supply board: the 6X5 goes in the 8-pin valve base and the ECL82 (or 6BM8) in the 9-pin valve base.

4.4 Tidying Up

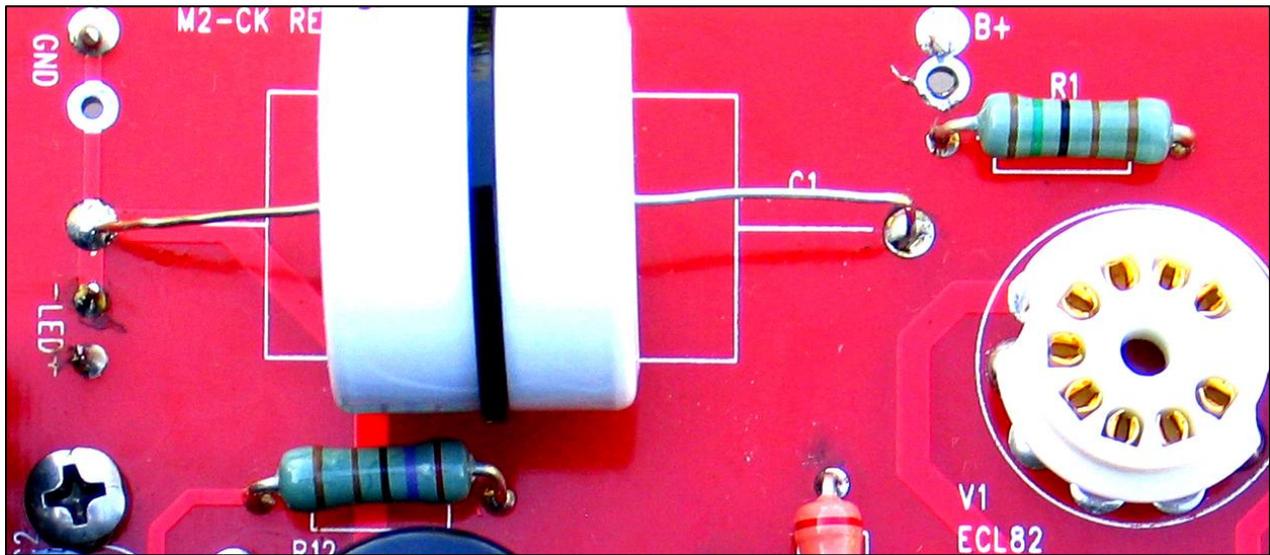
Seeing that we have a number of loose wires coming from the M2 board, let's tape the ends of these wires to make sure that they do not short with one another when we test with power. This includes the filament wires and the B+ and GND wires coming from the M2 board that are not connected, along with the prepared wire from the chassis Ground with the 10R resistor and capacitor.

- Put some masking tape on these wires and make sure they not in contact with anything!

4.5 Ohm Check

THE UNIT IS STILL OFF AT THIS POINT

Before we do these checks, let's go over an important term: the High Tension, HT voltage, and B+ are all the same thing. This is typically the highest DC voltage in the circuit and is the voltage that we will be supplying to the tubes in our audio signal path.



If you have a multimeter set it to Ohms and measure the resistance from B+ to GND on the M2 Power Supply board. You can see from the picture above the location on the board to find these two points. You should see a high impedance reading in the 125K ohm range: this is a good sign! *If you have a very low ohmage there could be a problem and you may want to contact us first before going any further.*

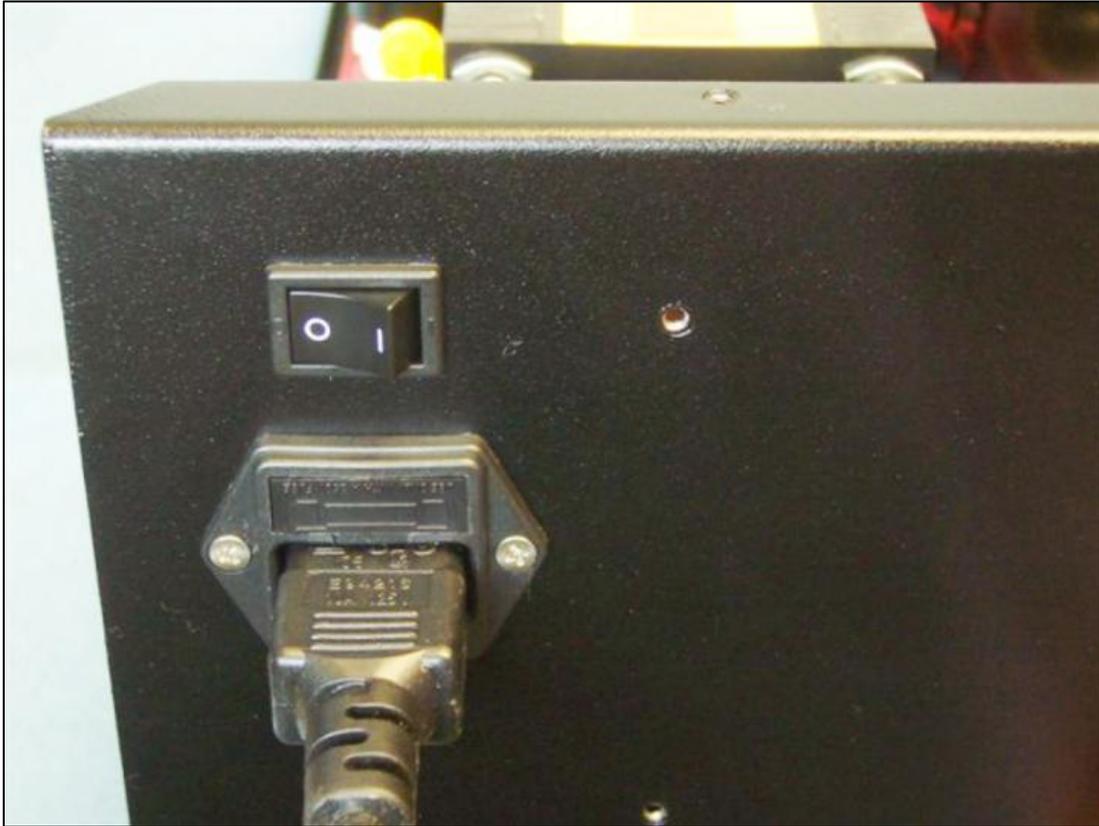
4.6 Electrical Testing

THE UNIT IS STILL NOT PLUGGED IN AT THIS POINT

Before the first power on we suggest the following steps:

- ❖ Make sure that you have a quiet environment when you are turning the unit on for the first time: that way, if there is a problem with the circuit, you will be able to see and hear a crackle or a vibration or hum, etc., if there is any.
- ❖ If you have a Variac it would be helpful to use it so you can power on slowly and check DC voltages. If not, we'll just turn it on.

- Make sure the amplifier is OFF: press the rocker switch (ON is '1'/OFF is '0') so that the '0' is flat against the chassis and the '1' is off the chassis — this is the OFF position, shown below.



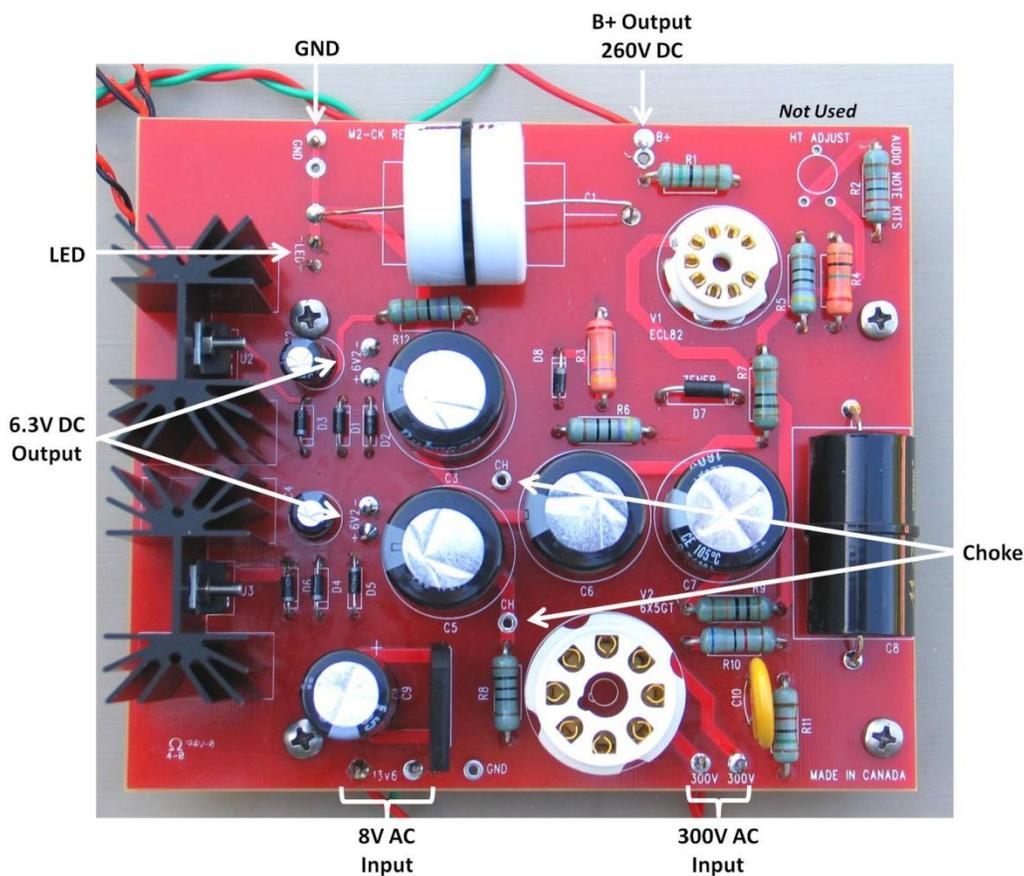
- Take a power cord and plug the unit in.
- Press the rocker switch such that the '1' is pushed flat against the chassis — this is the ON position.
- Observe the LED turning on and look for a glow from the tubes.

GET READY TO SWITCH THE UNIT OFF IMMEDIATELY IF ANYTHING GOES WRONG

Get your multimeter ready — we'll need it for the High Tension (HT) check.

➔ *Be very careful as you do this not to touch anything in the unit with your body or create a short with the multimeter leads.*

Use the following graphic as a guide as to the location of the test points:



- Measure from B+ to GND on the M2 Power Supply board: use the ground point (GND) closest to the LED section. You should read approximately 260V DC.
- Measure the filament voltages: these are the two connections labeled '+6V2-³' on the top of the board. Connect your Black probe to the '-' and your Red probe to the '+'. These should read approximately 6.3V DC.

If there is a problem with any of the above voltages, switch to AC volts and measure the 300 300 points on the M2 board — you should get somewhere over 600V AC. If your meter does not go that high try measuring from the GND beside 13V6 to each one of the '300' inputs on the board and you should get approximately 300V AC or slightly higher.

- While in AC mode on your multimeter measure the '13V6' pads on the M2 board: we've used one of the 8 taps and the 0 tap from the 8-0-8 taps, which should give us approximately 8V AC. Just a reminder to ignore the implication of the '13V6': we want 8V AC.

³ We can't remember why these are stenciled as '6V2', rather than '6V3', but it makes no difference. Think 6.3V.

4.7 Voltage Check Summary

4.7.1 DC Voltage Checks

Location	Approximate Reading
B+ to GND	260V DC
+6V2-	6.3V DC
+6V2-	6.3V DC

4.7.2 AC Voltage Checks

These are optional if DC voltages are correct.

Location	Approximate Reading
300 300	> 600 AC
13V6 13V6	8V AC

If you have correct voltage readings on the M2 Power Supply board then "Congratulations!" are in order and you have completed the first half of the kit.

4.8 Last Steps

UNPLUG THE KIT FROM THE WALL

- One last step: you'll remember that we did not solder the heatsinks to the M2 Power Supply board earlier (we wanted to complete our testing first). Now go back and solder the 2 heatsinks to the board.
- Install 3 grommets in the shield and secure it in place using 3 M4 10mm screws and nuts place; insert the screws from underneath the chassis.

You're done!

Definitely time for another cup before we build the Phono Stage board!

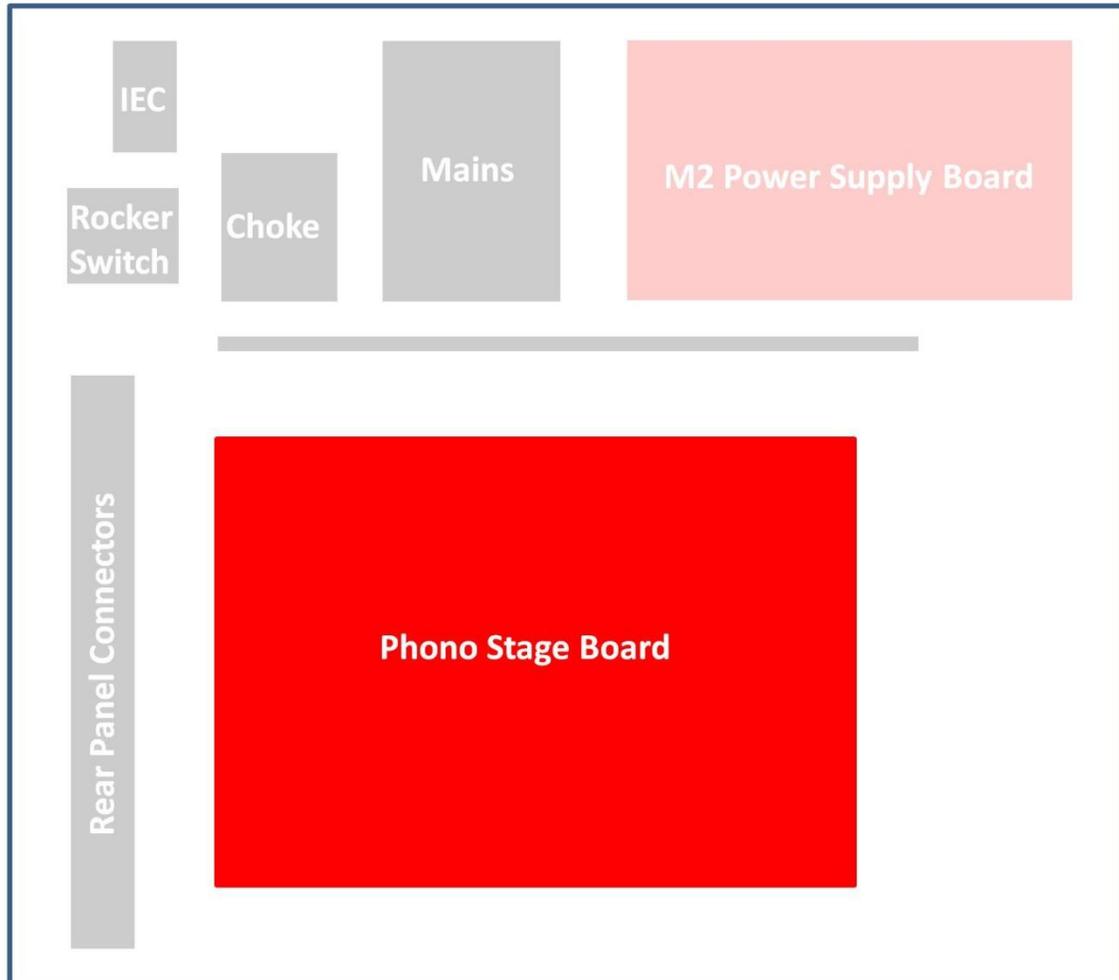


Section 5

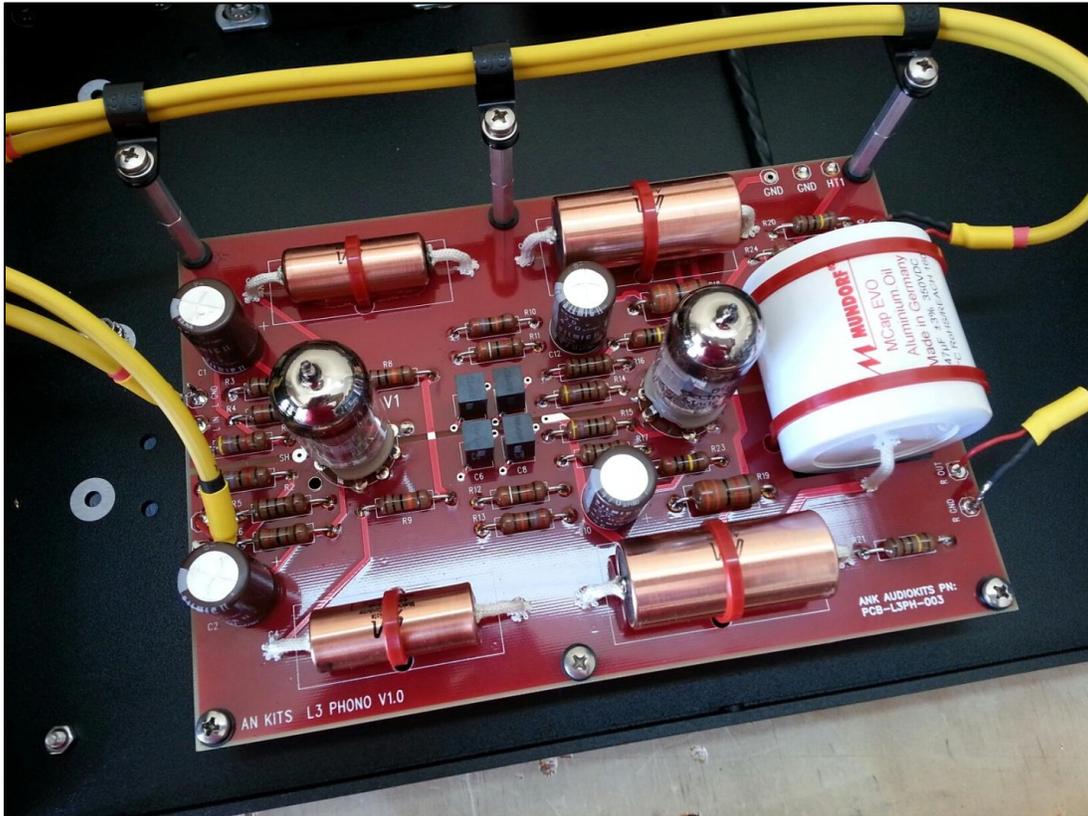
Phono Stage Board

5.1 Overview

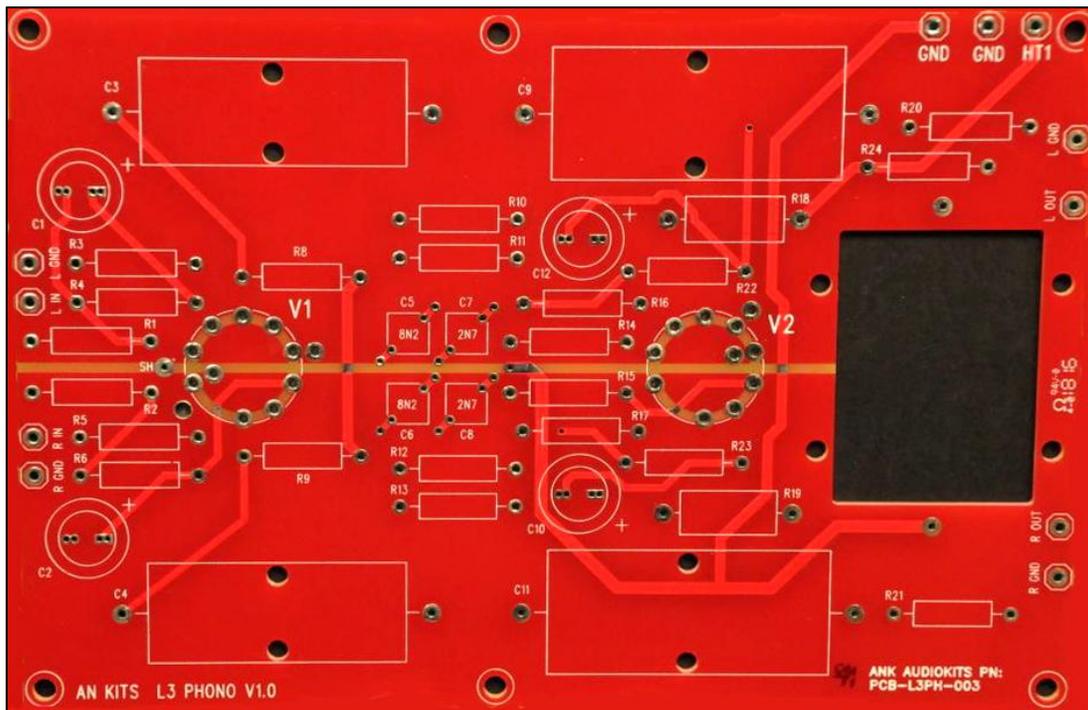
In this section we'll be building, installing, and testing the Phono Stage board, the main board of the L3 Phono V2.



Here's a picture of the completed board...

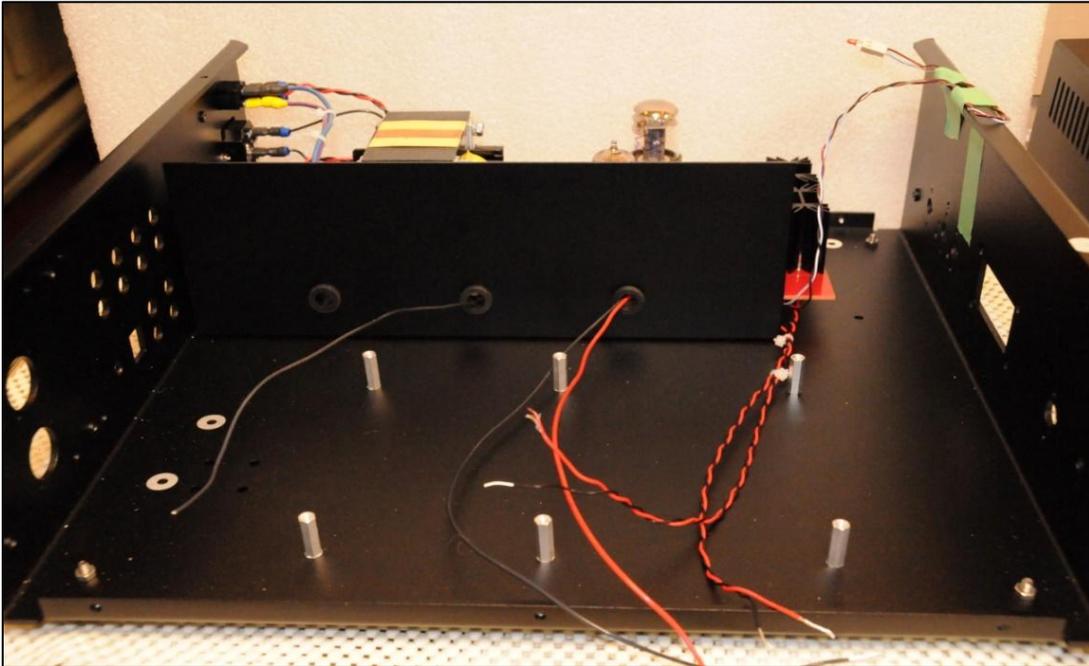


...and one of the bare board:



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Let's start by installing the 6 M4 standoffs in the chassis, as shown below.



5.2 Installing the Valve Bases

Now let's install the two 9-pin valve bases: one for the 12AX7 and one for the 6922.

Valve Bases

QTY	Designation	Description
2	9-pin Valve Base	V1, V2

As you did with the M2 board, use some masking tape to secure the valve bases to the board prior to soldering, to keep the bases level — and use just a little solder to secure each pin to the board before you fill up the entire valve base hole. Also, be careful not to make any solder bridges.

- Insert the 9-pin valve base at V1, and solder it to the board.
- Similarly insert and solder the valve base at V2.

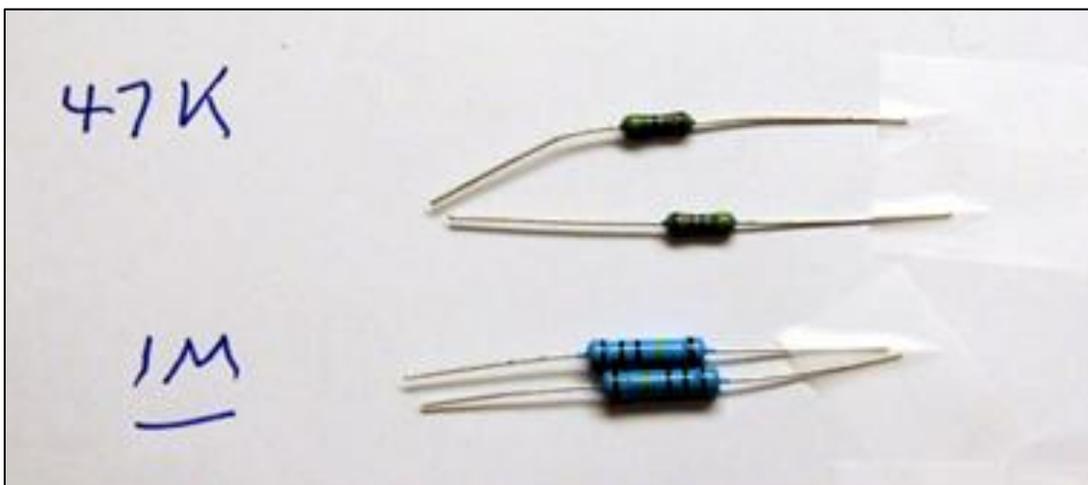
5.3 Installing the Resistors

We are now going to install the resistors, all 1W and mostly Takman metal film non-magnetic resistors.

Quantity	Part	Designator
2	47K	R1, R2
2	1K	R3, R5
2	1K2	R4, R6
2	100K	R8, R9
2	270K	R10, R13
2	39K	R11, R12
2	470R	R14, R15
2	1K2	R16, R17
2	33K	R18, R19
2	1M	R20, R21
2	2M2	R22, R23
1	2K2	R24



A good way to reduce the possibility of errors is to measure each resistor with an ohmmeter. Once this is done, you might want to attach the resistors to a sheet of paper and mark the appropriate resistance next to it. You can then refer to the parts list and see where each one goes on the board.



- Install the resistors into their correct positions. You can compare your installation with the picture below.



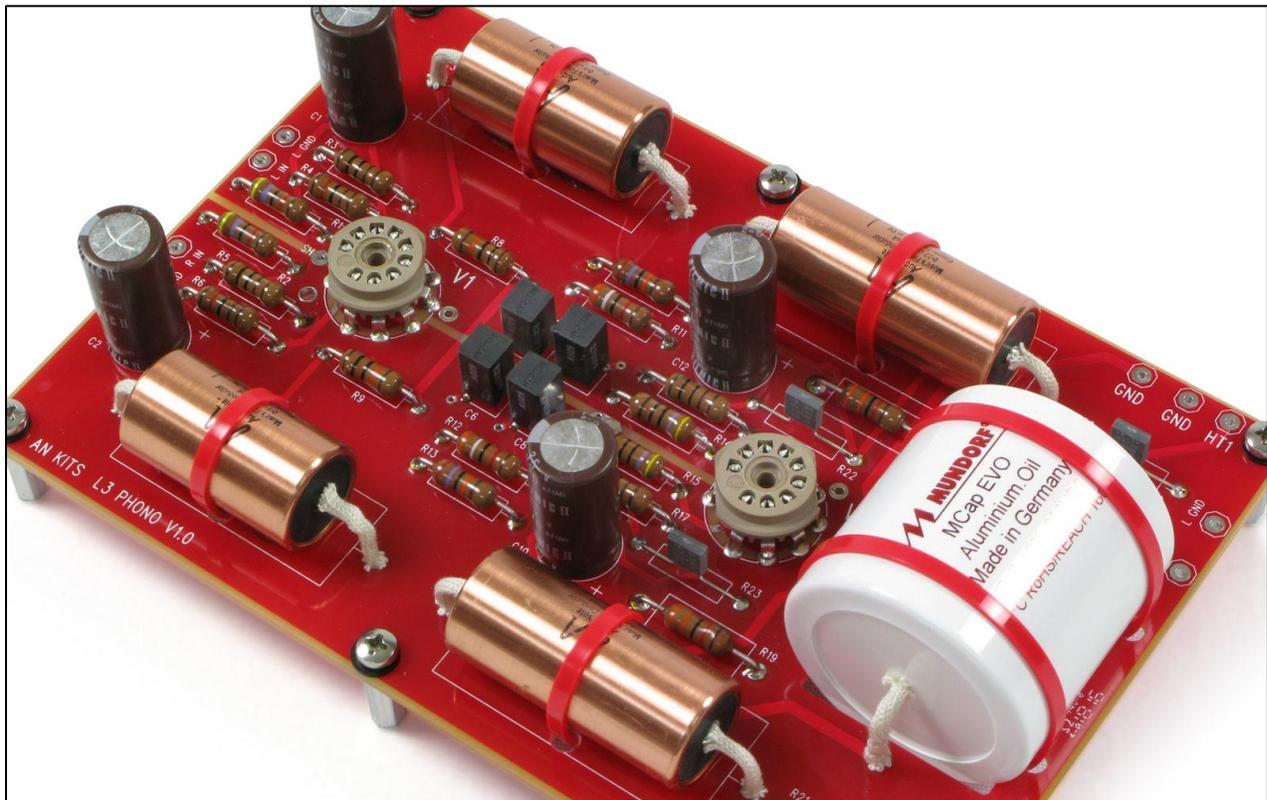
5.4 Installing the Capacitors

We are now going to install the capacitors.

Capacitors

Quantity	Type	Value	Designation
4	Elna SILMIC Electrolytic	470uf, 35V	C1, C2, C10, C12
2	Audio Note Copper Foil	.22uf	C9, C11
2	Audio Note Copper Foil	.1uf	C3, C4
2	Rel-Cap	2n7 (2700pf)	C7, C8
2	Rel-Cap	8n2 (8200 pf)	C5, C6
1	Mundorf MCap EVO Oil	47uf, 350VDC	large cut out

Let's start with the 4 Rel-Caps (small, square, Black) to be installed in the center of the board.



➔ *Take care when installing these Rel-Caps. They look identical in the picture but they are in pairs with different values, which are identified on the side of each capacitor.*

These four capacitors can be oriented either way.

- Install 2 2n7 capacitors in C7 and C8.
- Install 2 8n2 capacitors in C5 and C6.

Next, let's install the 4 Elna electrolytic capacitors. As always, take great care to orient them correctly with the stripe being the NEGATIVE lead. The POSITIVE solder tab is marked '+'.
(Note: The text in the image incorrectly refers to 'Elna' capacitors, but the image shows Mundors capacitors.)

- Install the 4 Elna SILMIC Electrolytic capacitors in C1, C2, C10, and C12.

The following film capacitors do not have a specific orientation: they can be installed in either direction. However, they are large and heavy so it's not a bad idea to secure them with cable ties, as shown, to reduce stress on the solder connections. There are holes in the board specifically for this purpose.



Install the large 47uf Mundorf MCap EVO oil capacitor in the large cut out.

➔ *Take care when installing the 4 Audio Note Copper Foil capacitors. They all look the same in the picture, but they are actually in pairs, with different values.*

Install 2 Audio Note Copper Foil .22uf capacitors in C9 and C11.

Install 2 Audio Note Copper Foil .1uf capacitors in C3 and C4.

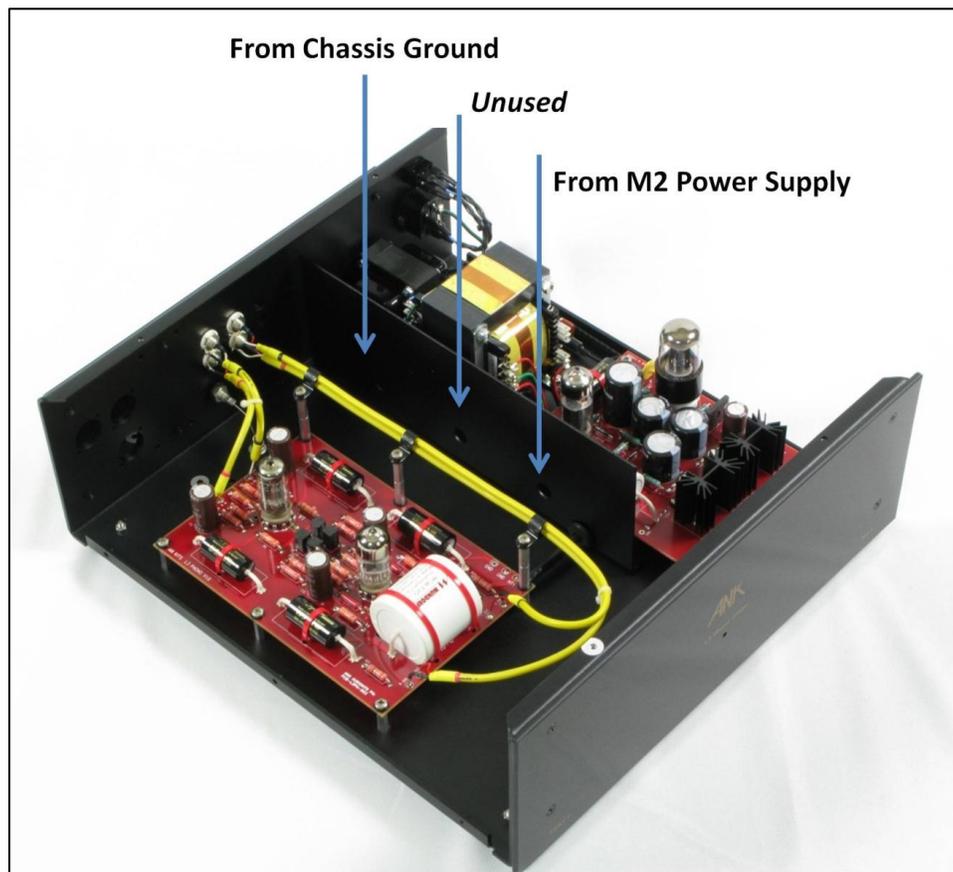
5.5 Connections from the M2 Power Supply Board

As we know, the M2 Power Supply provides the necessary voltages to operate the Phono Stage board. In this section we will be connecting 6 wires from the M2 Power Supply board to the Phono Stage board.

➡ *These wires can be inserted from the top of the Phono Stage board and soldered underneath, or you can elect to insert the wires under the board (recommended, it's neater!) and solder on top. Do it the way that is most comfortable for you.*

Let's review the leads that we wired to the M2 Power Supply board that are still unconnected:

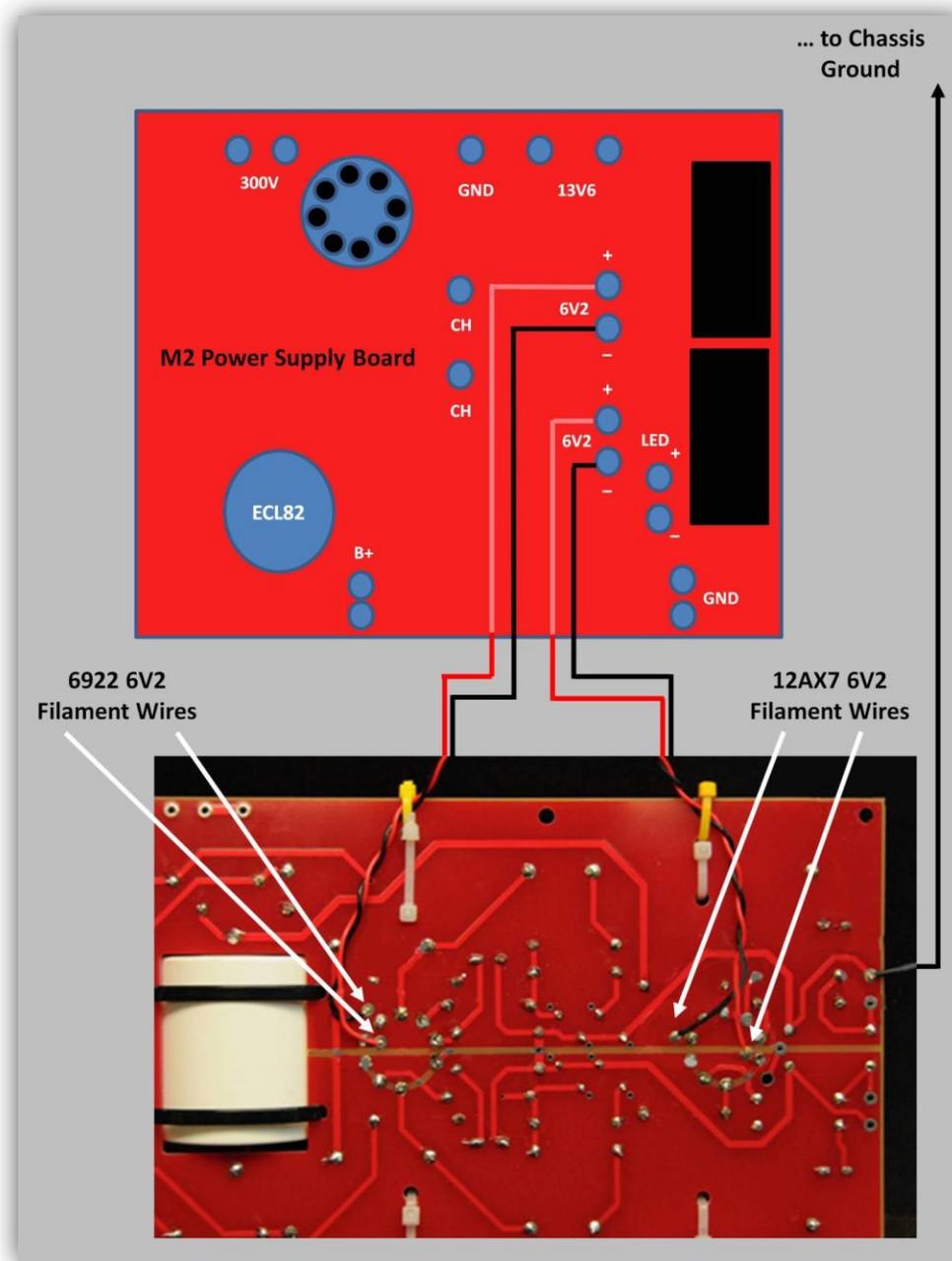
- ❖ B+ Red
 - ❖ GND Black
 - ❖ Filaments for the Phono Stage board
 - ❖ Prepared wire from the chassis Ground with the 10R resistor and capacitor
- With the shield now in place, let's route the 6 wires coming from the M2 Power Supply board through the right grommet in the shield.



- While we're at it, route the chassis Ground with the 10R resistor and capacitor through the left grommet.

➔ *The middle grommet is unused.*

Now let's make the connections⁴. Here's the big picture:



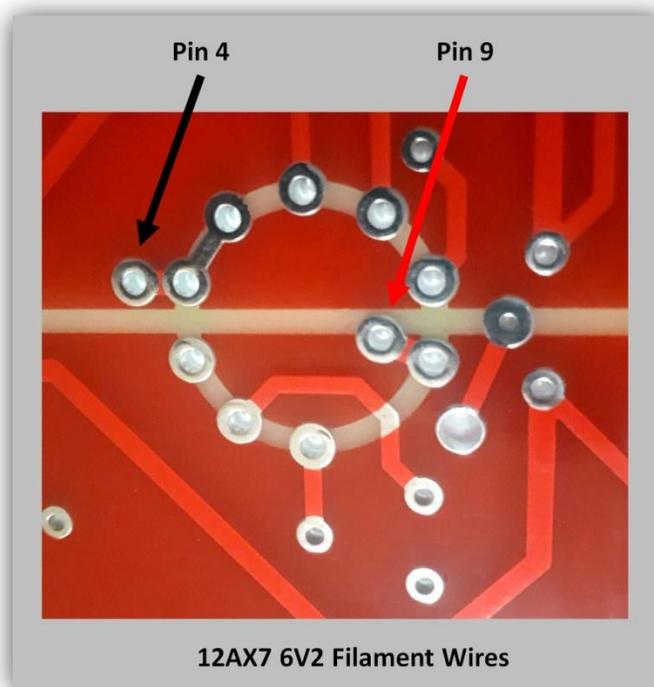
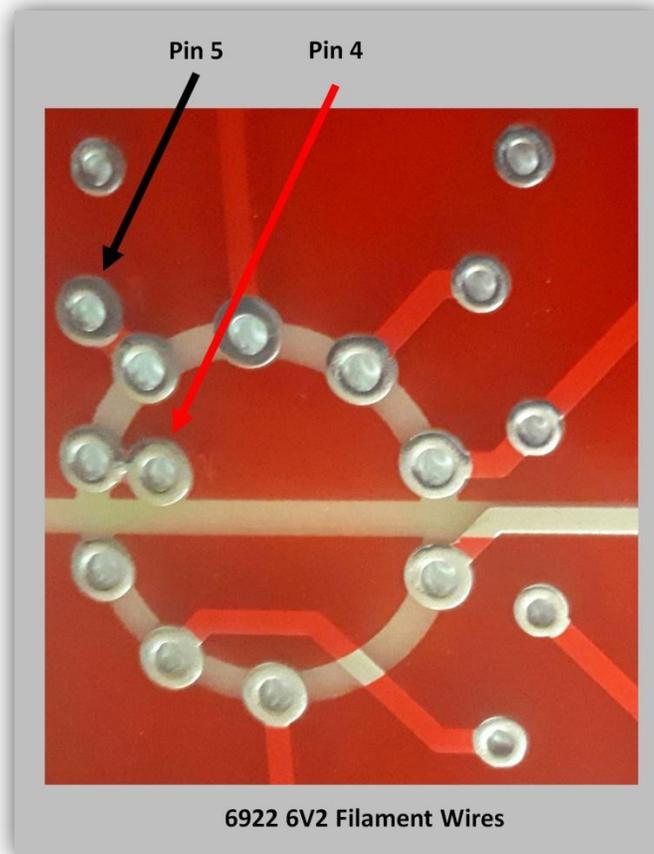
⁴ Truth to tell, you could reverse the Red and Black wire connections (it doesn't matter for the filaments) but let's do it as shown so that the text and pictures remain aligned. This will also make it easier to troubleshoot, if need be.

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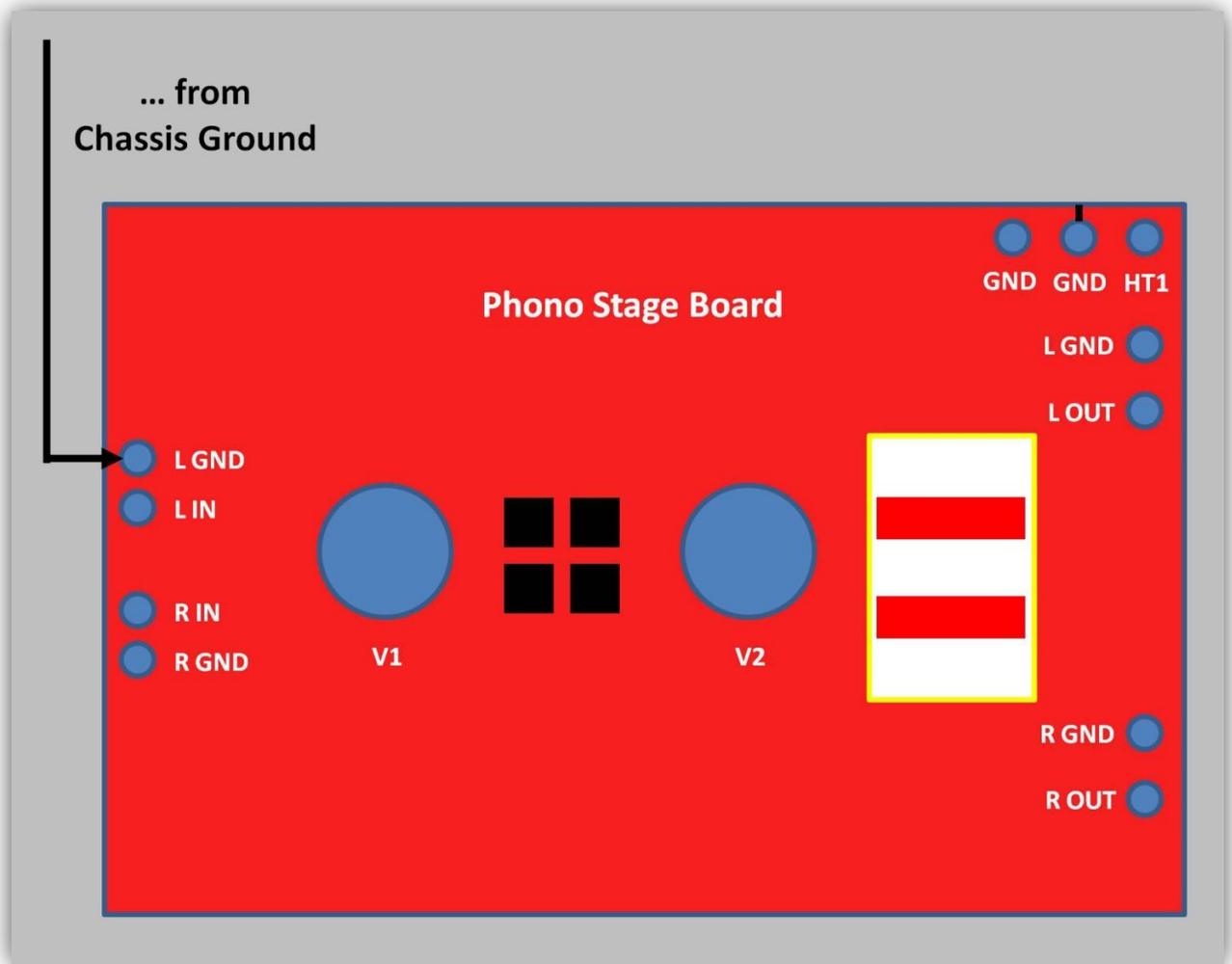
and here are close-ups to double check your work:



- Now let's connect the prepared wire coming from the Chassis Ground (through the left grommet) with the 10R resistor and capacitor to the solder tab shown on the underside of the board (above).

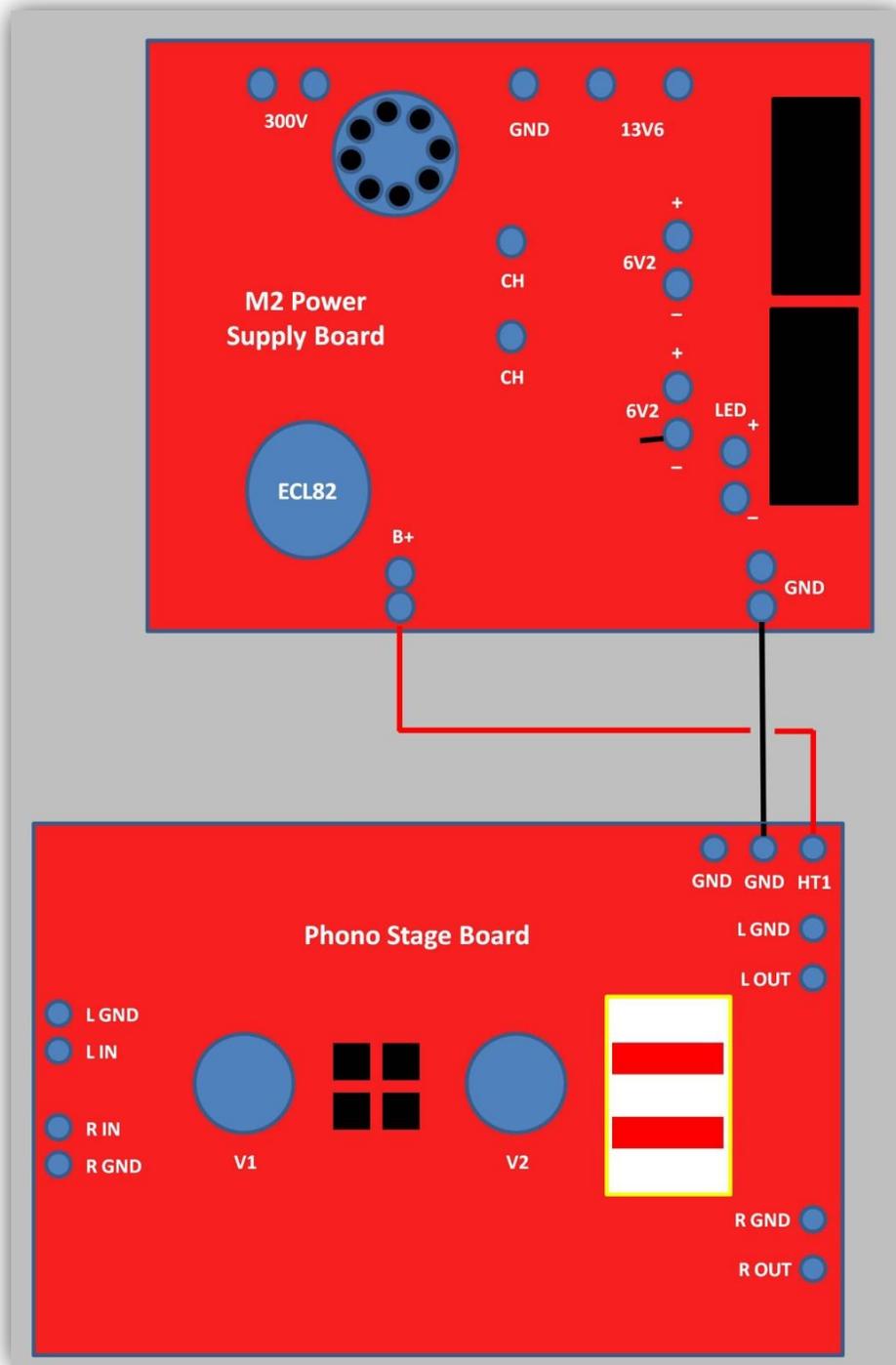


You can double check this connection: it should emerge on the top of the board in 'L GND' as shown below.



- Connect the 2 pairs of twisted Black-Red wires coming from the M2 Power Supply board (through the right grommet) to the solder tabs shown on the underside of the board in the graphic on the previous pages. *Take great care and double check that you've made the correct connections.* These feed the 6.3 volts to the filaments of the two tubes on the Phono Stage board.

Next, have a look at the following graphic:



- Connect the B+ Red Wire coming from the M2 Power Supply board to HT1 on the Phono Stage board.
- Connect the GND Black Wire coming from the M2 Power Supply board to GND (beside HT1) on the Phono Stage board. These wires will bring 260V DC to the Phono Stage board.

5.6 Installing the LED

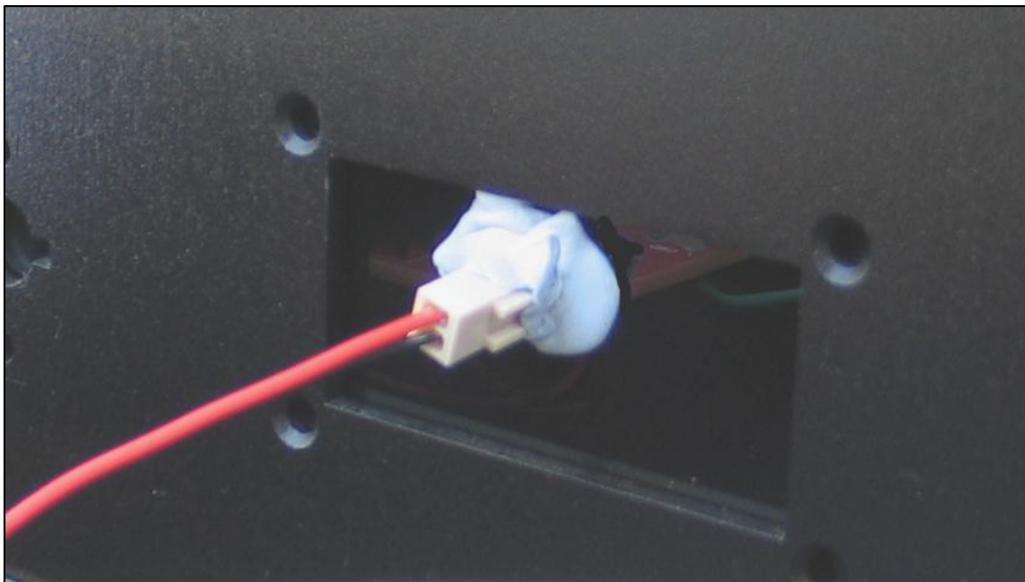
Let's revisit the LED.

- Carefully trim the LED leads so that they are not exposed.



*It's a good idea to trim the **NEGATIVE** lead a bit shorter than the **POSITIVE** lead so that, if you need to remove the LED later for any reason, you'll know which is the **POSITIVE** lead (the longer lead) and will be able to reinsert it correctly.*

- Glue or attach (Blu-Tak works well) the LED holder to the front panel so that the LED protrudes through the designated hole, as shown below:

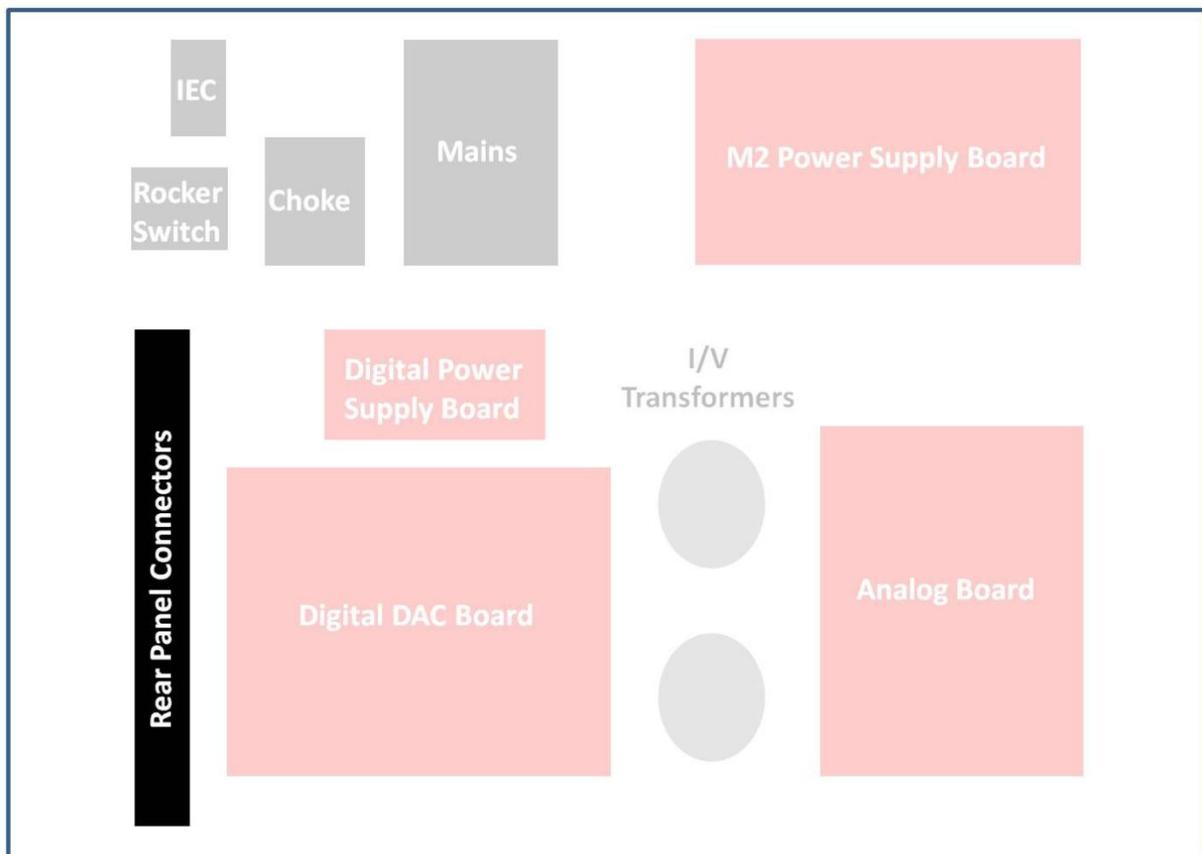


Section 6

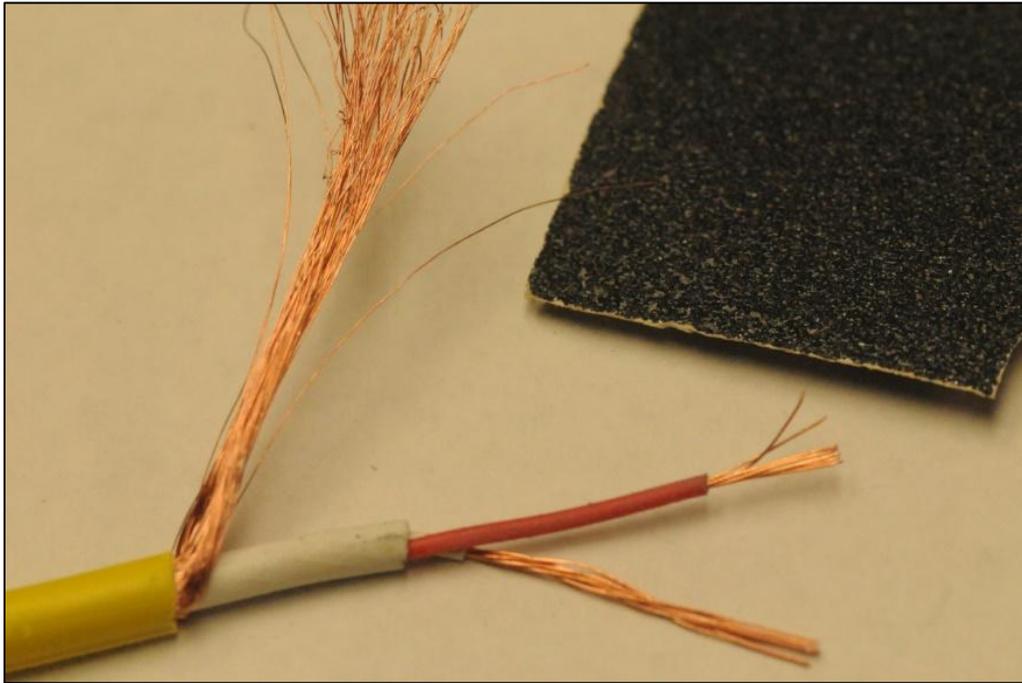
Phono Stage IO Connections

6.1 Overview

Now that the connections from the M2 Power Supply board to the Phono Stage board have been made, it's time to install the AN-A shielded cables that carry the input and output signals. In this section we'll install the RCA jacks on the rear of the chassis and connect them to the Phono Stage board: one cable will come from the MM input RCA jacks to the inputs on the Phono Stage board and the other from the outputs on the Phono Stage board to the output RCA jacks.



Before we start, let's familiarize ourselves with the AN-A cable and consider several tips that should make things a bit easier.



Look closely at the AN-A cable: it has Red and White leads and a thick shield. In the following sections, we will connect the Red and White leads at both ends, but we will only connect the shield at the end that connects to the Phono Stage board; we will not connect the shield at the RCA jacks end.



When working with the RCAs jacks, we recommend the following procedure:

- Tin the RCA ground lead and put a puddle of solder in the center of the RCA jack
- Heat the solder puddle and slide the tinned (signal) lead to be connected into the center of the RCA
- Similarly, hold the tinned (Ground) lead against the tinned Ground tab of the RCA and apply heat; it will usually adhere immediately

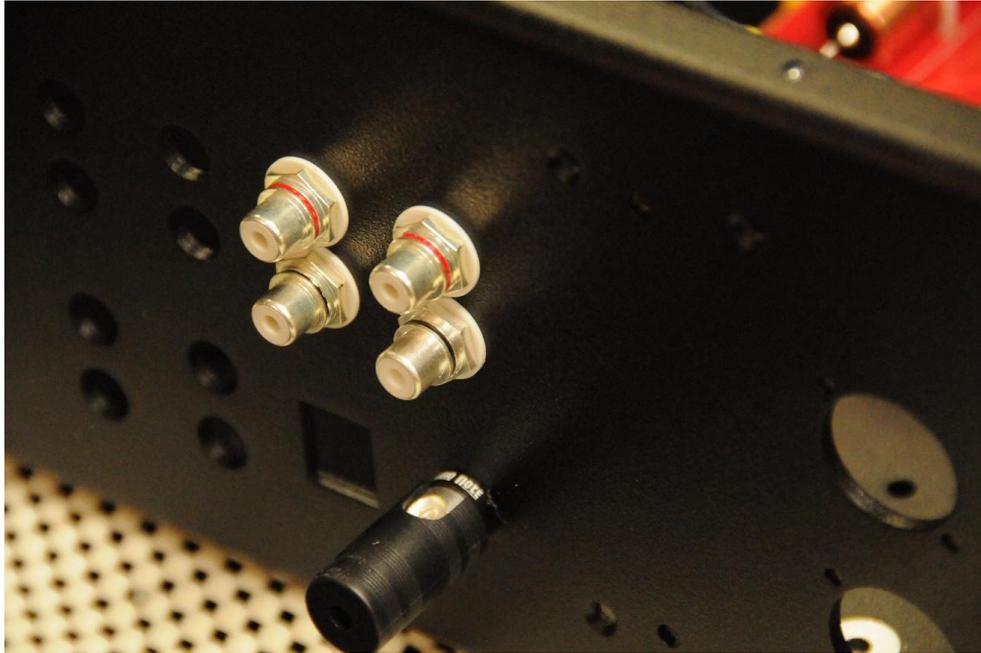
Also,

- In order to make a better solder joint, you may find it useful to take a fine sandpaper and brighten all wires [including the shield] before tinning. This will remove some of the coating.

6.2 Installing the RCA Jacks

Now we'll install the four RCA jacks. Let's put the Red jacks on top and the Black jacks on the bottom, as shown.

- For each jack, use the following steps:



Insert into the chassis from the outside:

- ❖ The white insulating washer with the raised ring facing inwards into the hole
- ❖ The RCA jack

Attach, from the inside of the chassis, onto the protruding jack:

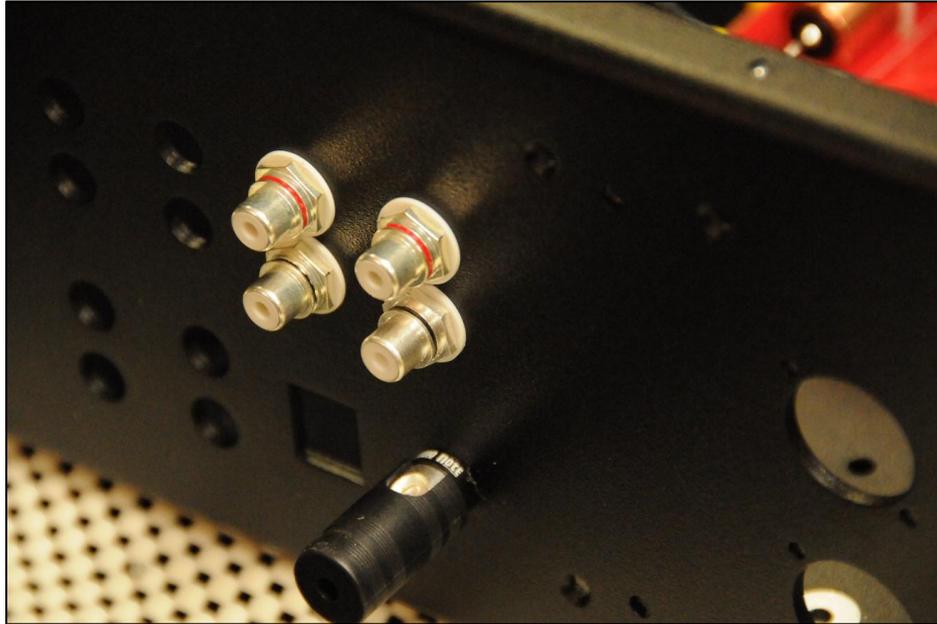
- ❖ The other white insulating washer
- ❖ The ground lug
- ❖ The nut (don't immediately tighten this more than one or two turns)

- Bend each ground lug up about 30 degrees and position at about 2 o'clock. *Make sure they are away from the chassis.*
- Tighten the jacks *such that the inner lug is facing up/open*; it'll make soldering much easier in that position.

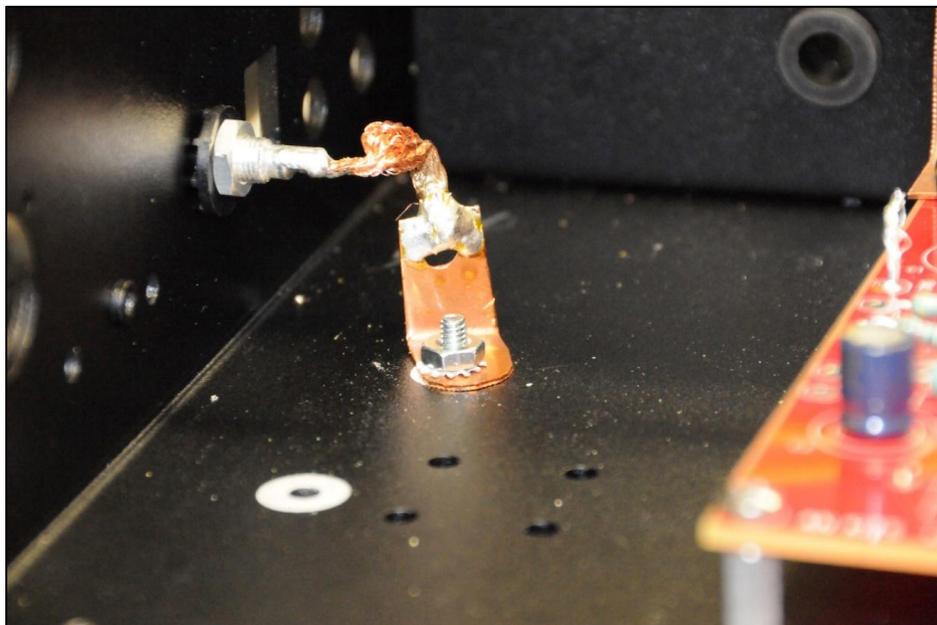
Make sure everything is snug and well tightened. We'll wire the jacks shortly.

6.3 Installing the Ground Jack

Let's look at that picture again:



- Install the Ground jack, as shown. This will be used to ground the turntable to the chassis.
- Install a Ground lug to the chassis, as shown below, using a 4 mm screw, serrated washer, and nut and connect it to the Ground jack using some copper braid or other wire. (It isn't pretty, but it does the job.)



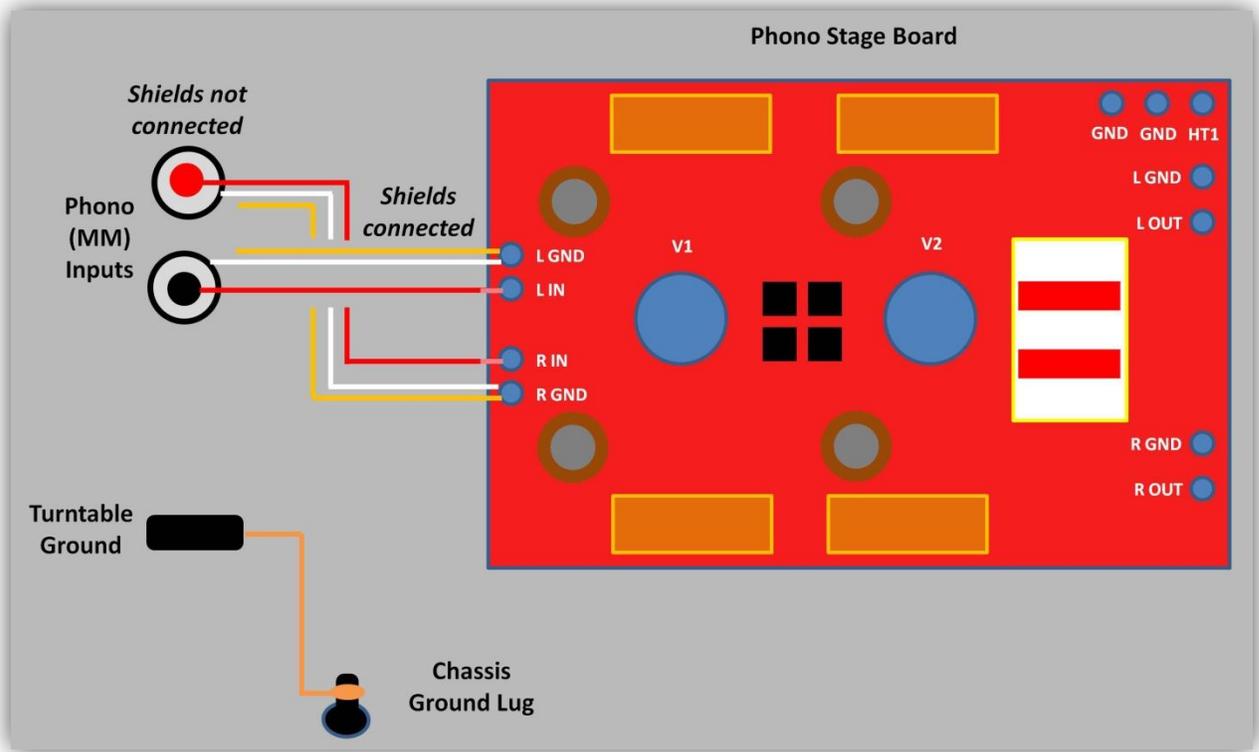
6.4 Wiring the MM Input Connections

Now we'll wire the MM input connections. These are the two jacks on the RIGHT in the picture below.

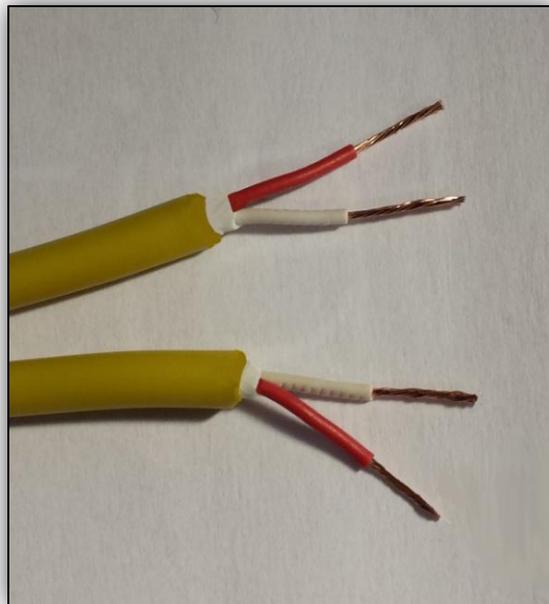


 *Please refer to the beginning of this section for tips on how to solder to RCA jacks.*

Following the diagram below, we'll now make the connections to the MM Input jacks.

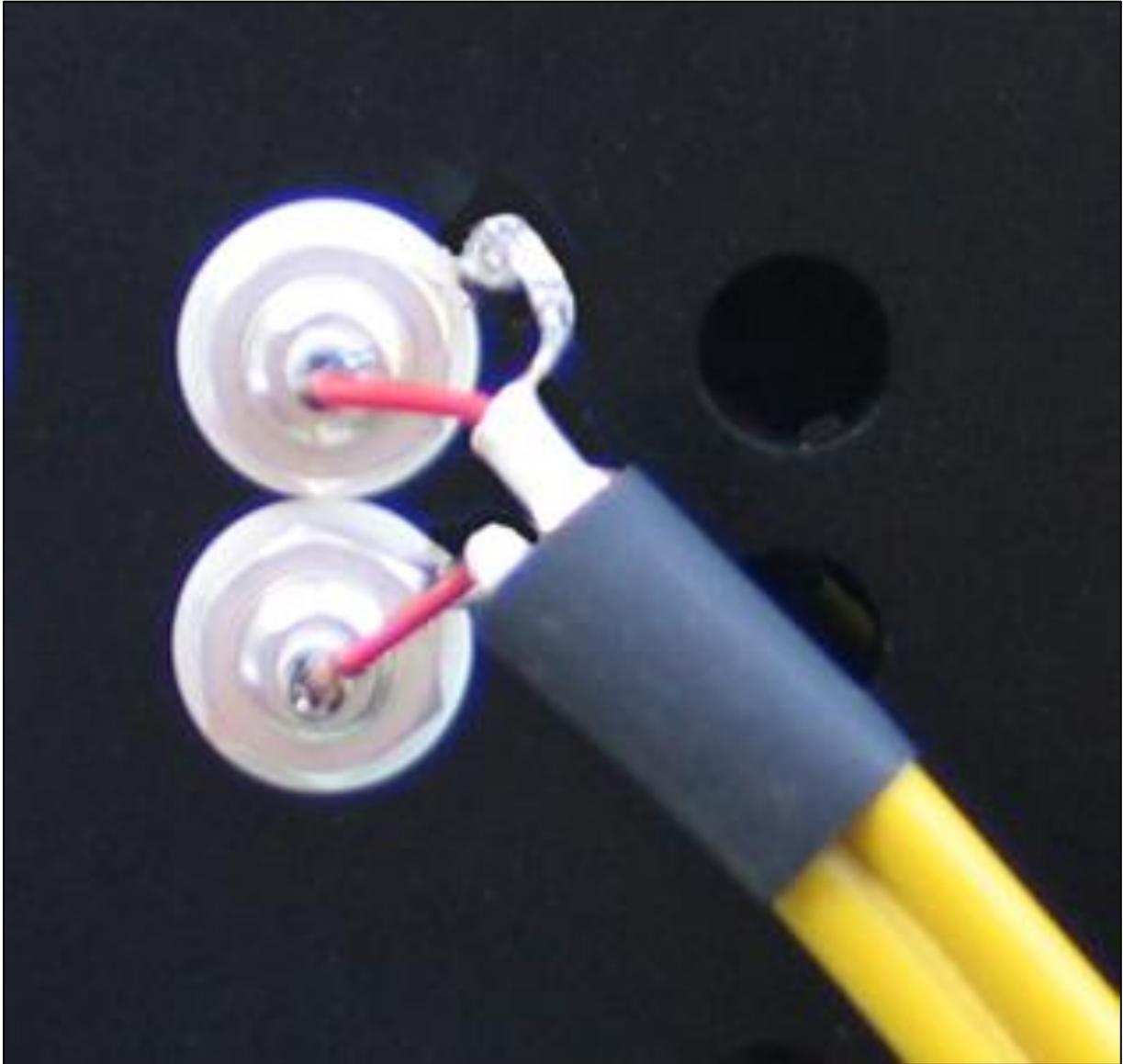


- Remove the shield from the end of the AN-A wire and prepare the Red and White leads, as shown.



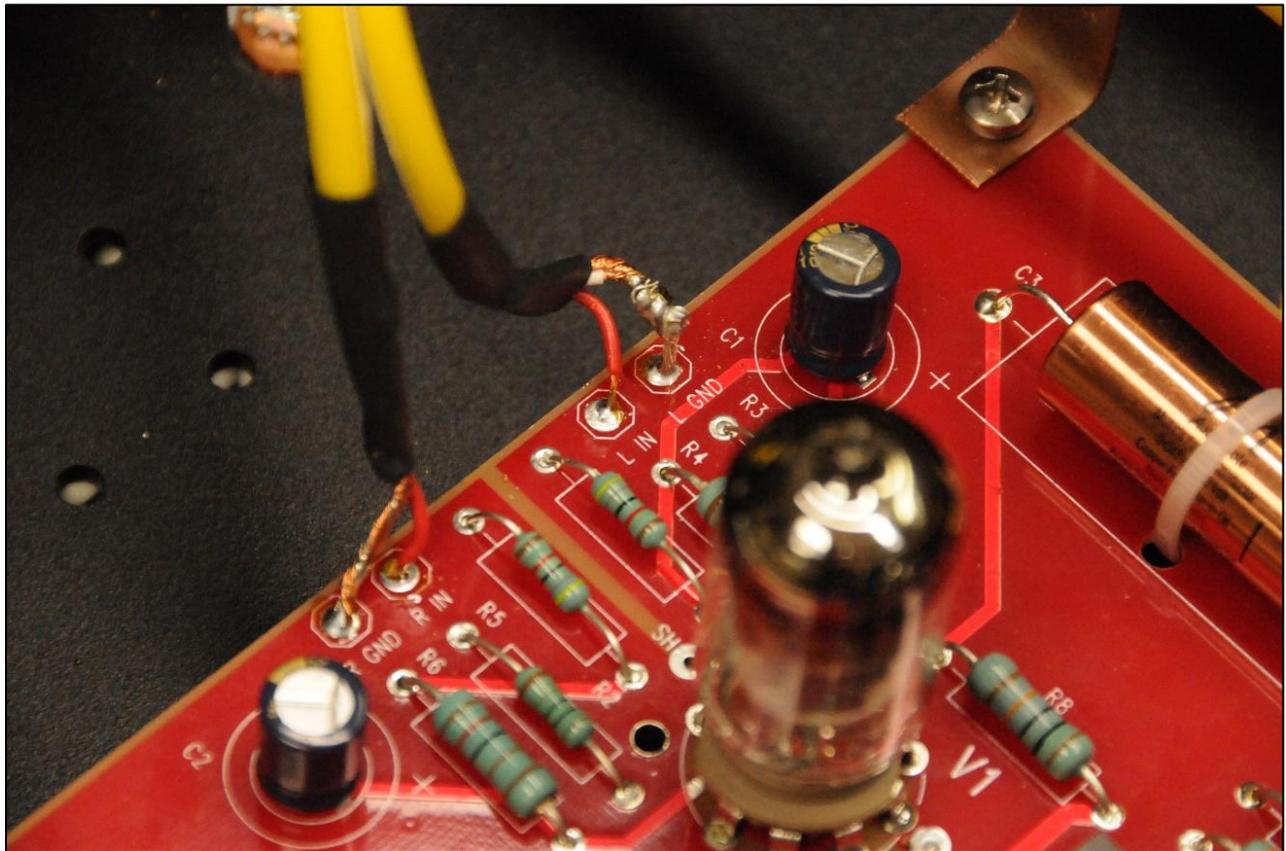
- Connect the Red signal wire to the center of the Right (Red) input jack (on top).
- Connect the White Ground wire to the Ground tab of the Right input jack.

Here's what it should look like:



- Similarly make the Red (signal) and White (Ground) connections to the Left (Black) input jack (on the bottom).

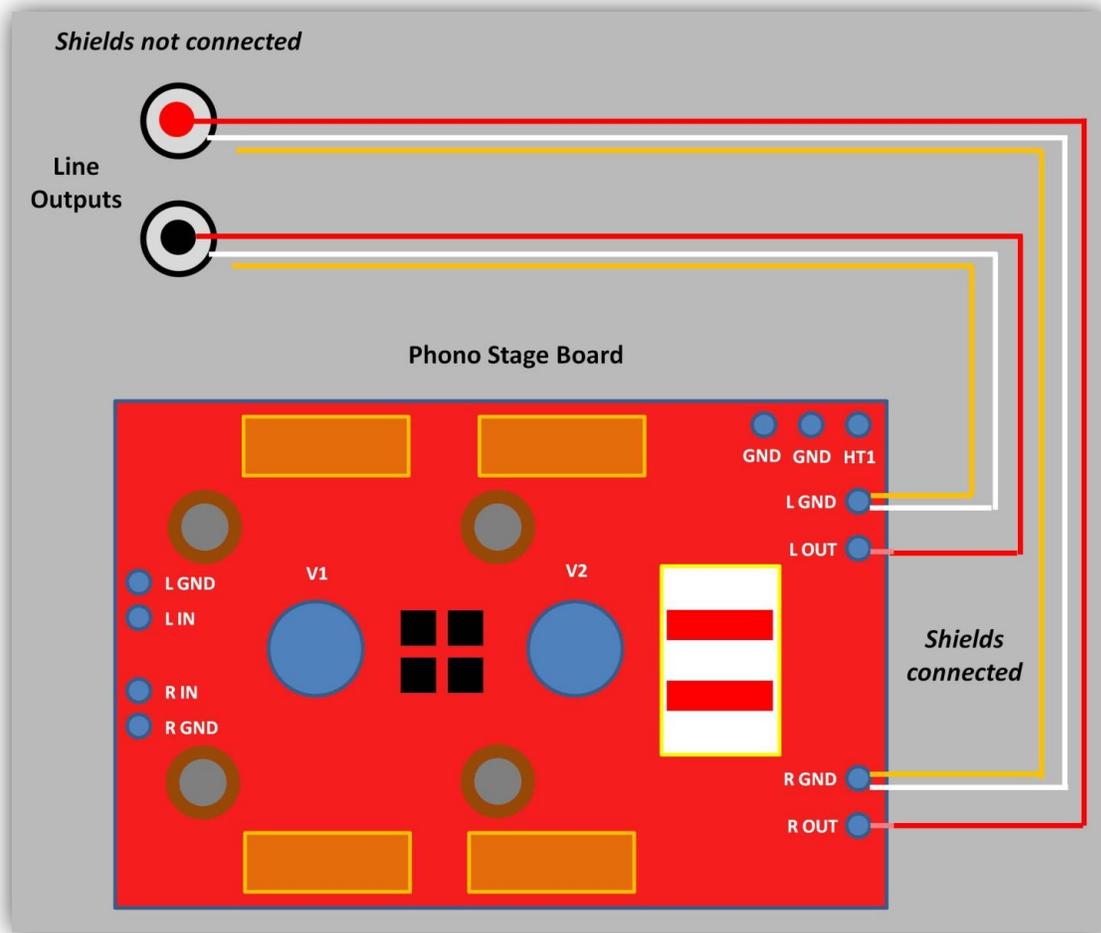
Next we'll make the connections to the Phono Stage board. Have another look at the graphic above and the picture below:



- Twist the shield and the White wire together (refer to the picture above) and tin them.
- Connect the Red signal wire coming from the Right input jack to R IN on the Phono Stage board.
- Connect the White Ground wire and the shield coming from the Right input jack to R GND.
- Similarly, make the connections from the Left input jack to L IN and L GND.

6.5 Wiring the Output Connections

Next we'll make the connections from the RCA line output jacks to the Phono Stage board. As we did above with the input jacks, we'll connect the shields at the Phono Stage board end, but not at the RCA jacks end.

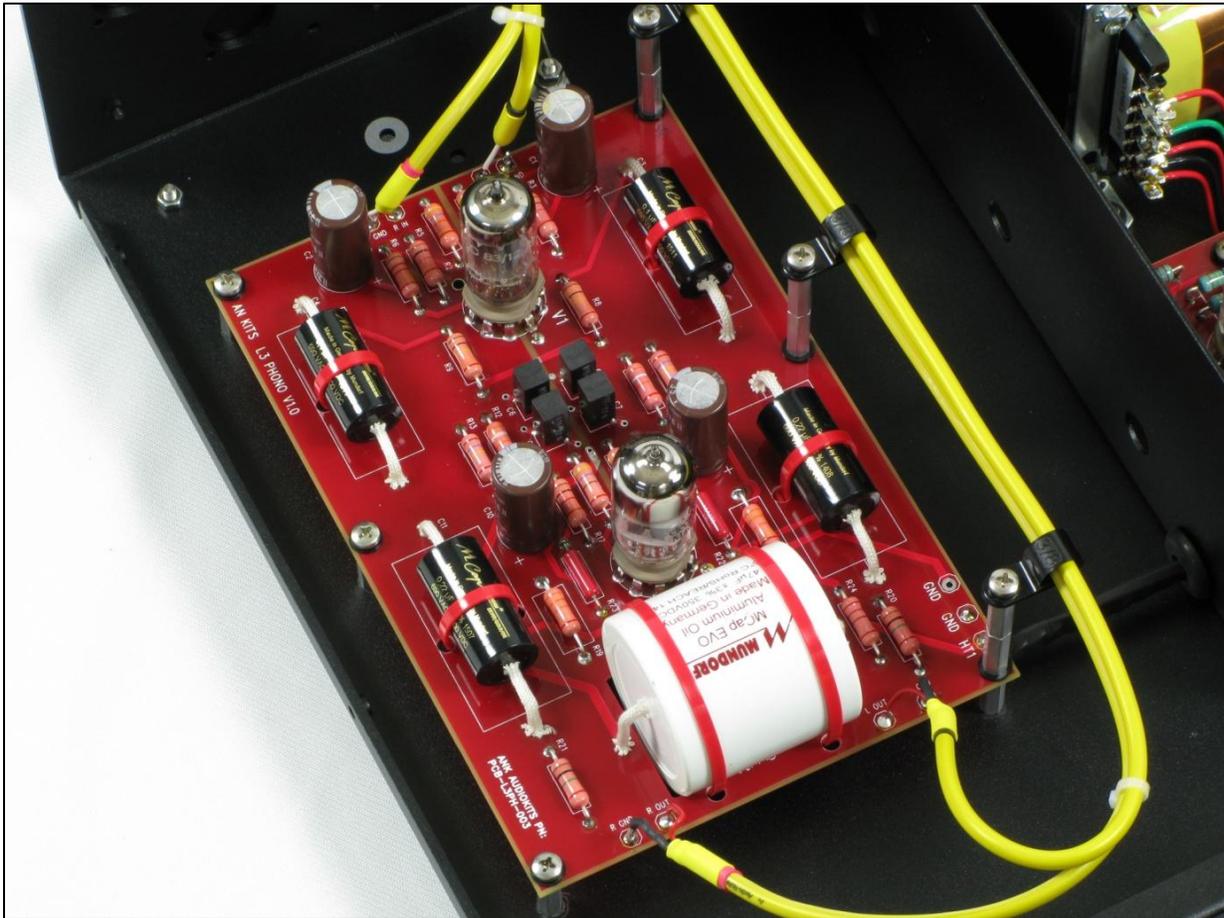


- Connect the Red signal wire to the center of the Right (Red) output jack (on top).
- Connect the White Ground wire to the Ground tab of the Right output jack.
- Similarly make the Red (signal) and White (Ground) connections to the Left (Black) output jack (on the bottom).

Now we'll make the connections to the Phono Stage board. Again, here's a close-up:

- Twist the shield and the White wire together and tin them, as you did earlier with the input jacks.
- Connect the Red signal wire coming from the Right output jack to R OUT on the Phono Stage board.
- Connect the White Ground wire and the shield coming from the Right output jack to R GND.
- Similarly, make the connections to L OUT and L GND.

Here's another look at these connections:



This was done by a professional builder. Note how he used some black heatshrink over the R GND and L GND twisted White and shield wires connection to improve the look. It's really beautifully done.

- Finally, secure the Phono Stage board to the standoffs with six M4 screws.

That's it! Well done.

Section 7

Testing

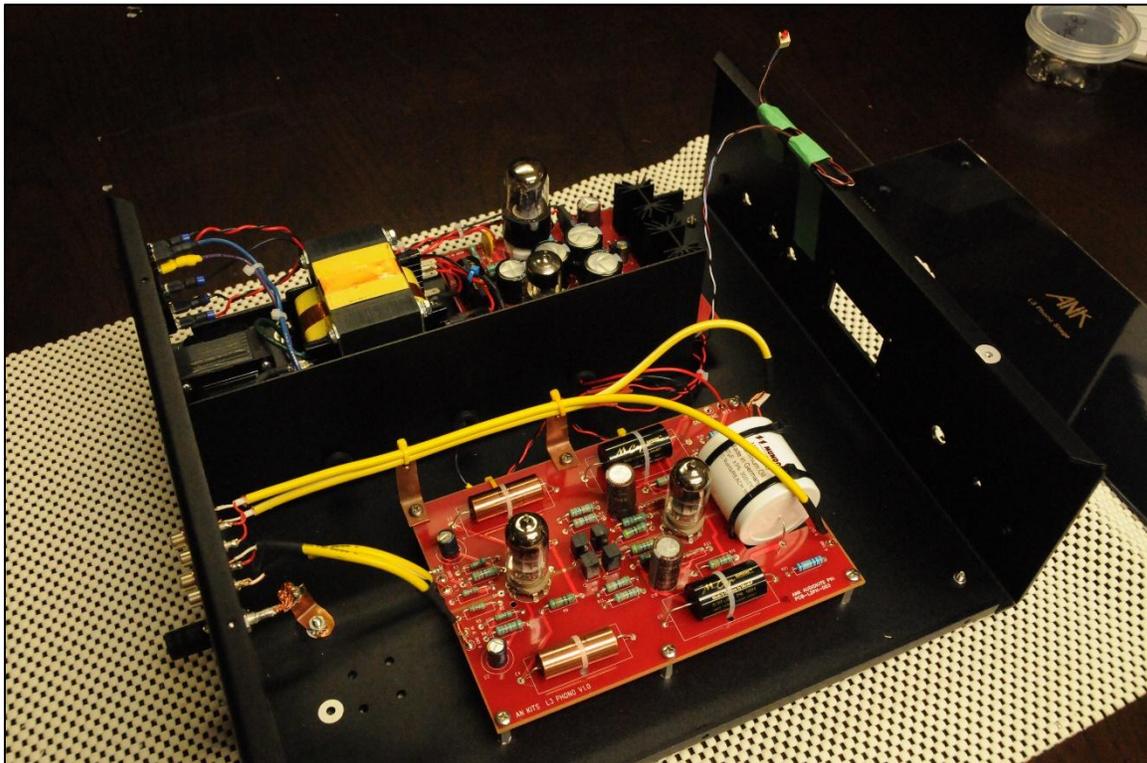
Now that we've built the unit, let's install the tubes and test it!



Before testing, it is a good idea to blow some air into the unit and make sure that there are no small pieces of wire or solder floating around. You can also hold it upside down and shake it gently in case there's still some debris inside.

7.1 Installing the Tubes

- Install the 12AX7 on the input side, on the left in the picture below.
- Install the 6922 on the output side, on the right in the picture below.



7.2 Turn-on

We've already checked the voltages in the M2 Power Supply Testing section, so we should be good to go to turn the unit on.

However, before we do that, let's do the following:

- Choose a favorite LP and place it on the turntable.
- Connect your turntable interconnects to the input jacks on the L3 Phono unit.
- Connect your turntable Ground wire to the Ground jack on the back of the L3 Phono unit.
- Connect the output jacks of the L3 Phono stage to a line input of your preamplifier.
- Turn the volume on your preamplifier to '0' and select the input into which you've plugged the Phono stage.

TURN EVERYTHING ON.

If you see (or smell!) nothing alarming coming from the Phono stage, cue up some music and turn up the volume a bit. If you hear your favorite music with no hum or distortion, then... Congratulations! — you have a working L3 Phono Stage V2!

Feel free to contact us to share your excitement or if you are having any problems debugging things.

7.3 Debugging

If you have no sound, then the best place to start is with doing some basic checks.

- Try another line source in your setup just to be sure the problem isn't elsewhere.
- Make sure that the IO connections on the back of the unit are solid; you could also try some other interconnects, just to be sure.

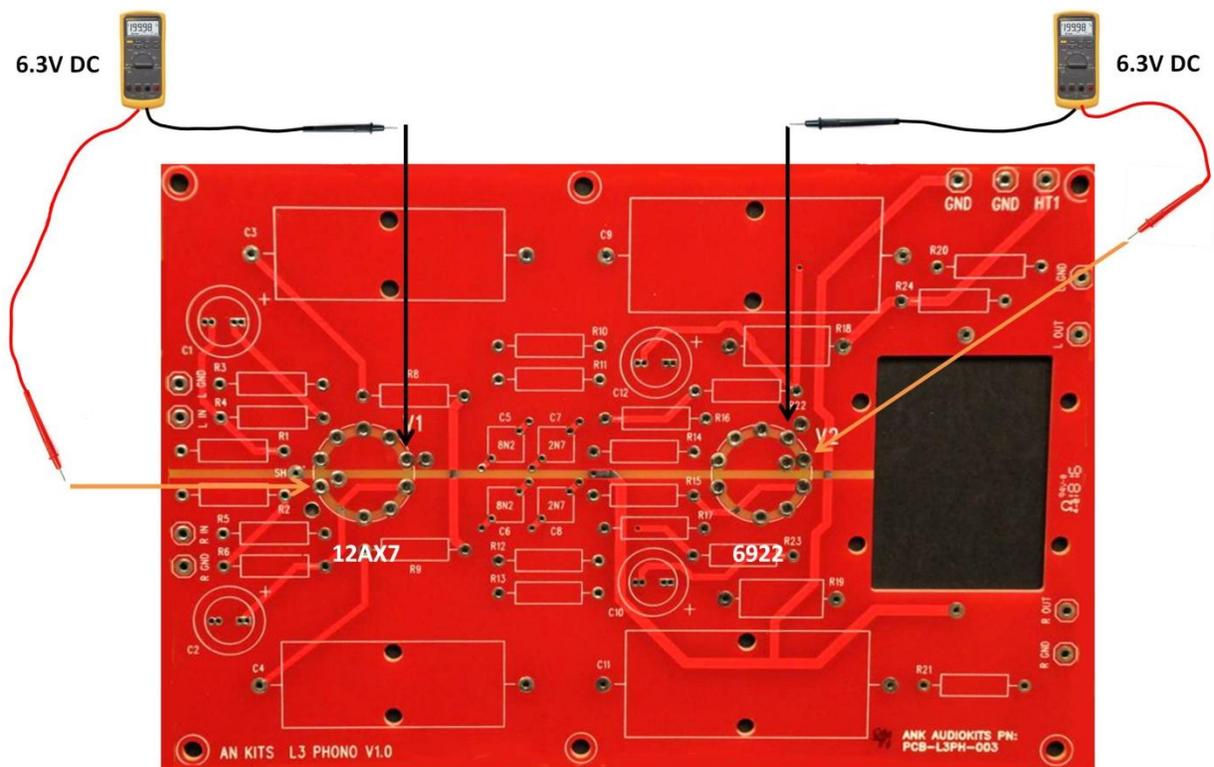
If all that's working, check to see if all the filaments are lit, especially the 6922 and 12AX7 on the Phono Stage board. If not, check these voltages on the M2 Power Supply board:

Location	Approximate Reading
B+ to GND	260V DC
+6V2-	6.3V DC
+6V2-	6.3V DC

If they're OK, then check them also on the Phono Stage board, as follows:

1. Turn off the unit and wait until the tubes are cool.
2. Remove the 6922 and 12AX7 tubes.
3. Turn the unit on.
4. Verify the following voltages, measuring in the valve bases on top of the PCB, using the following pinouts:

Test	Black Lead	Red Lead	Approximate Reading
B+ to GND	GND	HT1	260V DC
6922 +6V2-	Pin 5	Pin 4	6.3V DC
12AX7 +6V2-	Pin 4	Pin 9	6.3V DC



If all these tests and voltages are correct then contact ANK Audio Kits at audionotekits@rogers.com. We'll help you figure things out.

Section 8

Finishing Touches

8.1 Installing the Front and Back Faceplates

- Remove the protective films from the front and back of the front and back faceplates.
- Install the front faceplate using four Black M4 CSK flat head screws.



- Install the back faceplate using four Black M3 CSK flat head screws.



8.2 Installing the Chassis Top

- Install the chassis top using the provided hardware.

Section 9

Final Thoughts

9.1 Congratulations

If you've made it to this point then CONGRATULATIONS! — you are ready to insert your L3 Phono V2 into your system and enjoy it.



9.2 Cables

In our experience, high quality cables make a difference. A good power cable should make a noticeable improvement to the sound, and the interconnects do as well.

9.3 Tube Rolling

The sound of the ANK Audio Kits L3 Phono V2 is very highly regarded and it is one of our most popular kits. It provides a detailed and transparent presentation with gorgeous sonics. Rolling some nice NOS tubes will allow you to tailor the sound to your particular preferences.

9.3.1 12AX7/7025



The 12AX7 dual triode tube can be substituted by the premium NOS 7025 low noise tube or a number of other current production tubes at reasonable prices. *Before considering any other tube substitution please mail me at audionotekits@rogers.com to discuss it.*

9.3.2 6922



The 6922 dual triode tube can be substituted by the readily available 6DJ8 at reasonable prices. *Before considering any tube substitution other than a 6DJ8 please mail me at audionotekits@rogers.com to discuss it.*

9.3.3 6X5



The kit comes with a NOS Russian military equivalent of the 6X5, a 6U5C rectifier made by Reflector. Should you wish to substitute this, there is an ample supply of NOS 6X5, 6X5GT, or 6X5WGT rectifiers available at reasonable prices. *Do not substitute any other 5V rectifier for the 6X5/EZ35 type for which this amplifier was designed; there are some significant differences between a 6X5 and other rectifiers, with respect to voltage drop and current specifications, and the result of a substitution is unpredictable and could damage your Phono Stage.*

9.3.4 ECL82



The ECL82 triode and beam tetrode tube can be substituted by readily available 6BM8 tubes.

9.4 Thanks

Thank you for investing in the ANK Audio Kits L3 Phono V2 and congratulations on working your way through the build. As always, we would welcome your feedback. Please email us at audionotekits@rogers.com and let us know how everything went: were there any errors in the manual or instructions, parts lists, etc.? Your ideas regarding greater clarity or tweaks will also be truly appreciated.

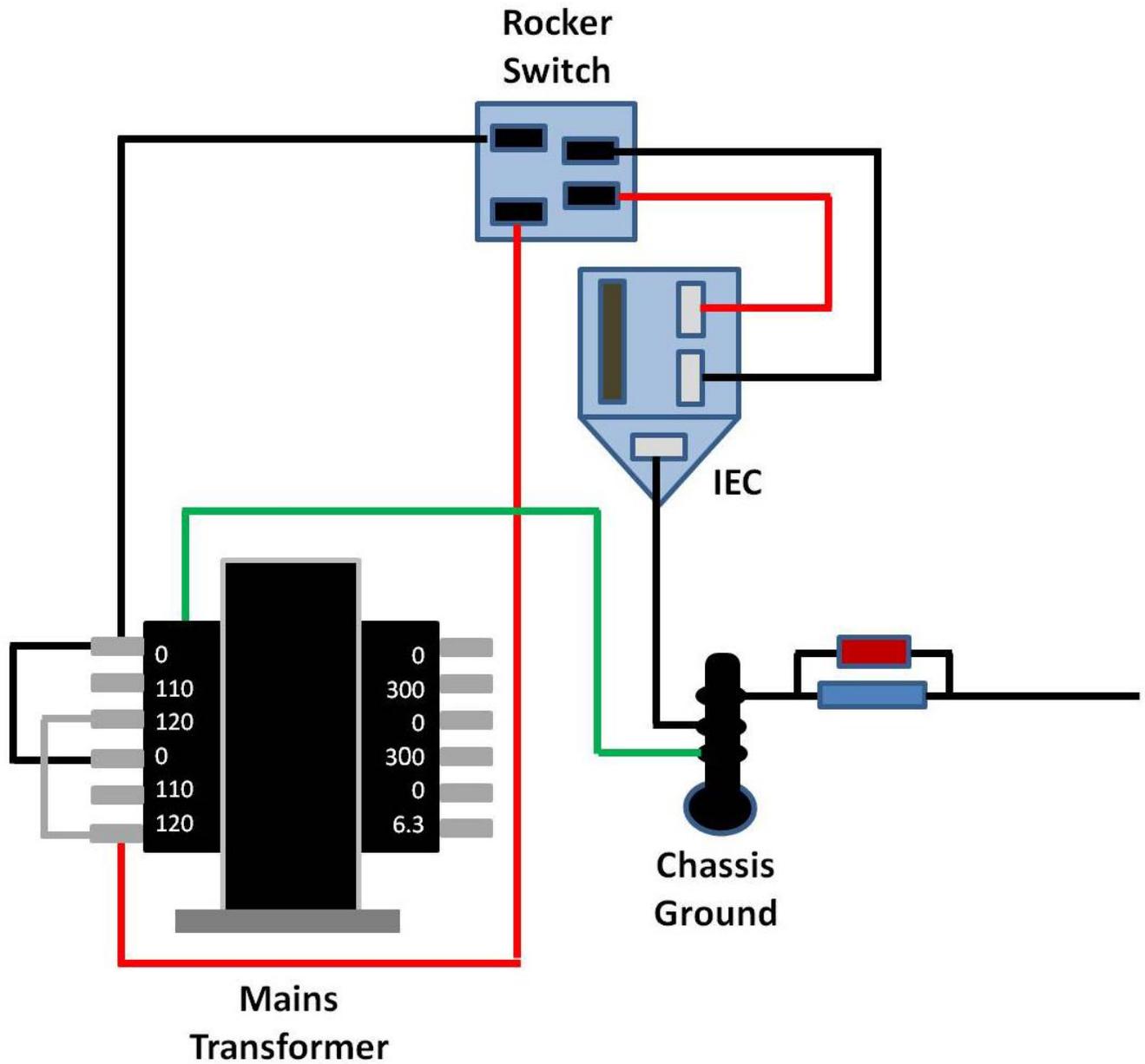
If you have some suggestions that you feel would help other kit builders please let us know. We can put them on a support page for other users. We'd also love to see some great pictures of your build process or your built unit. We can post them on our website or on our Facebook page. And we'd love a review from you regarding the sound.

We hope the unit brings you many years of joy and we look forward to hearing from you.

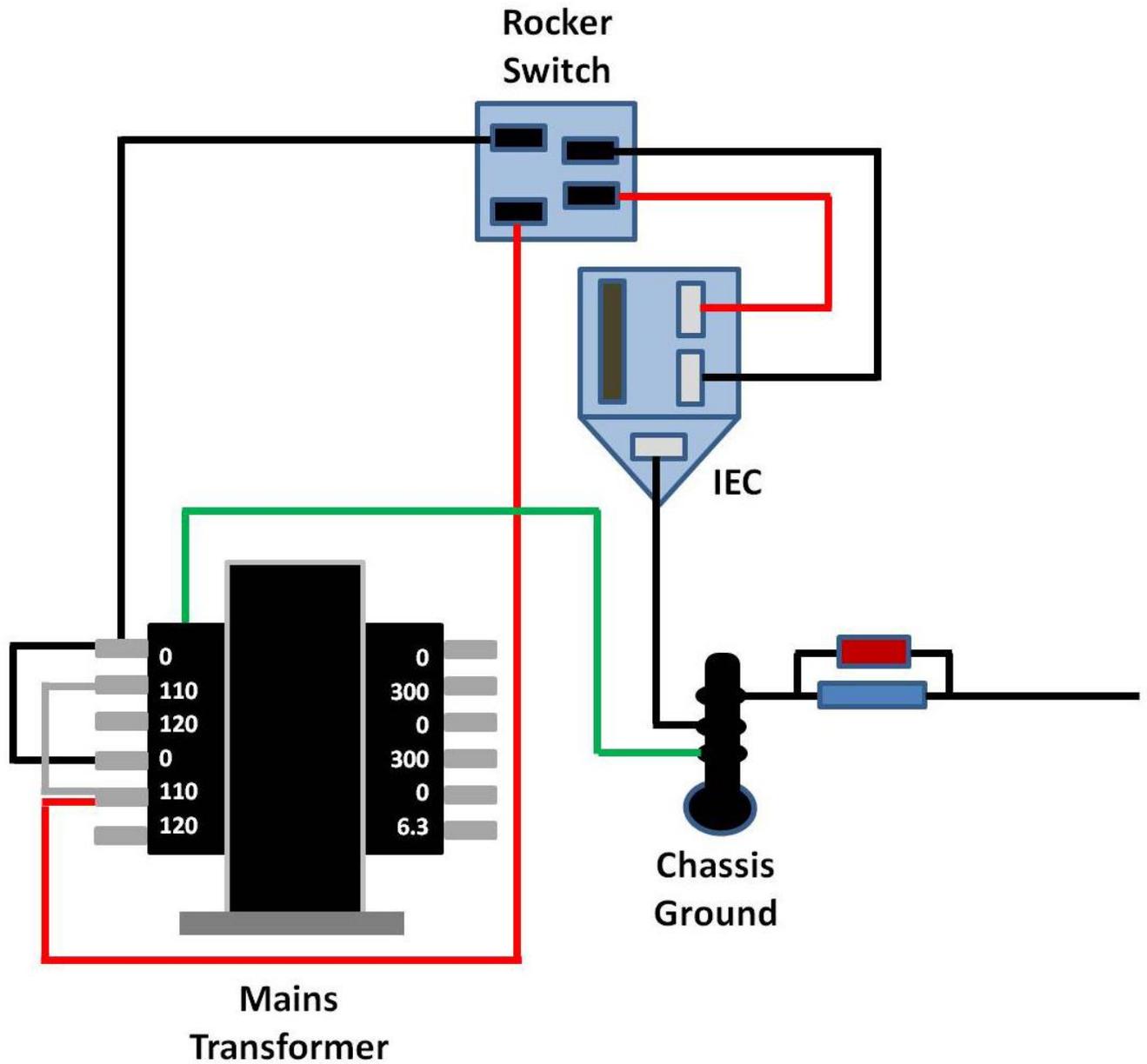
Appendix

A.1 World Mains Voltages Wiring Diagrams

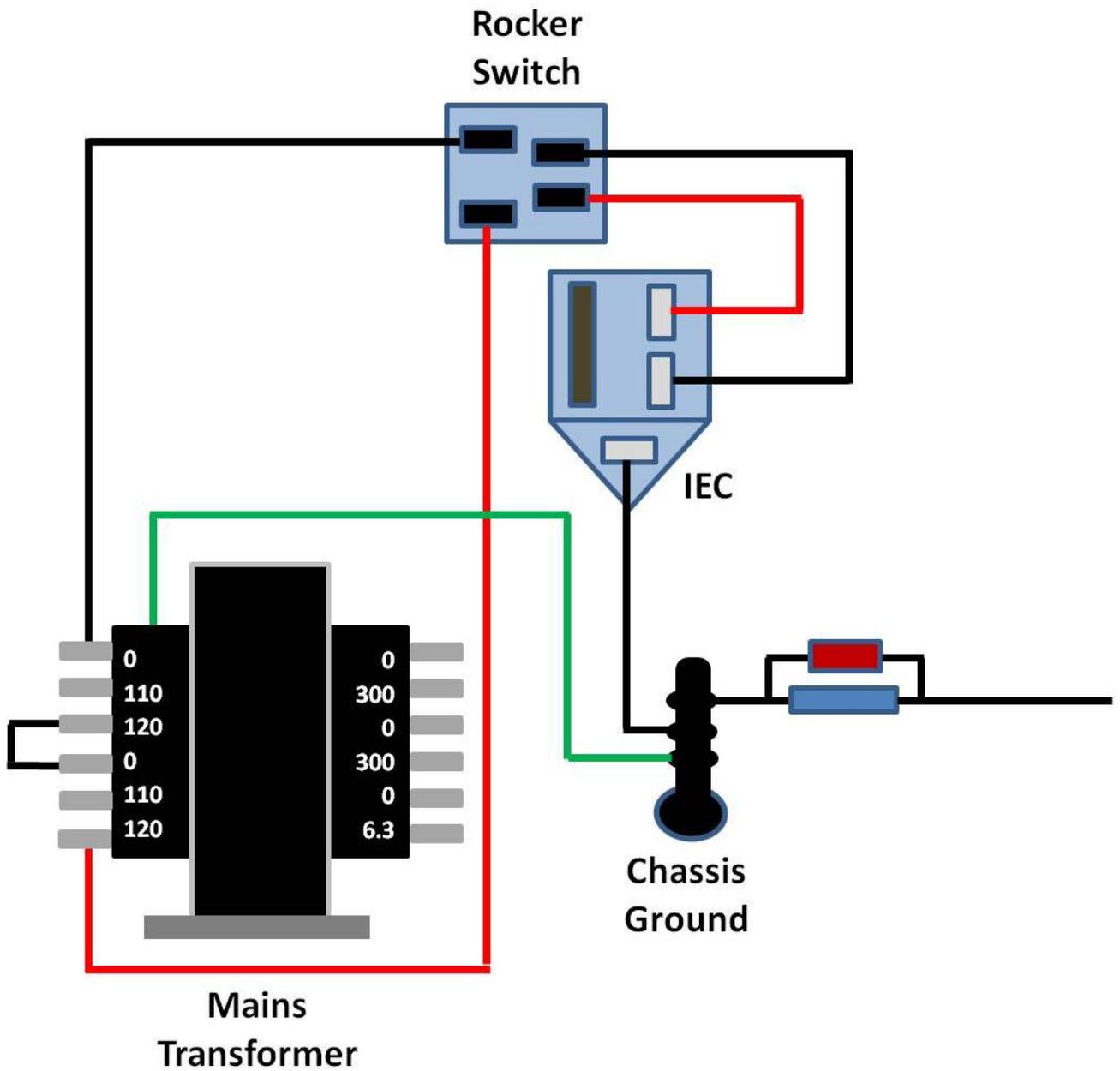
AC Power On/Off (120V)



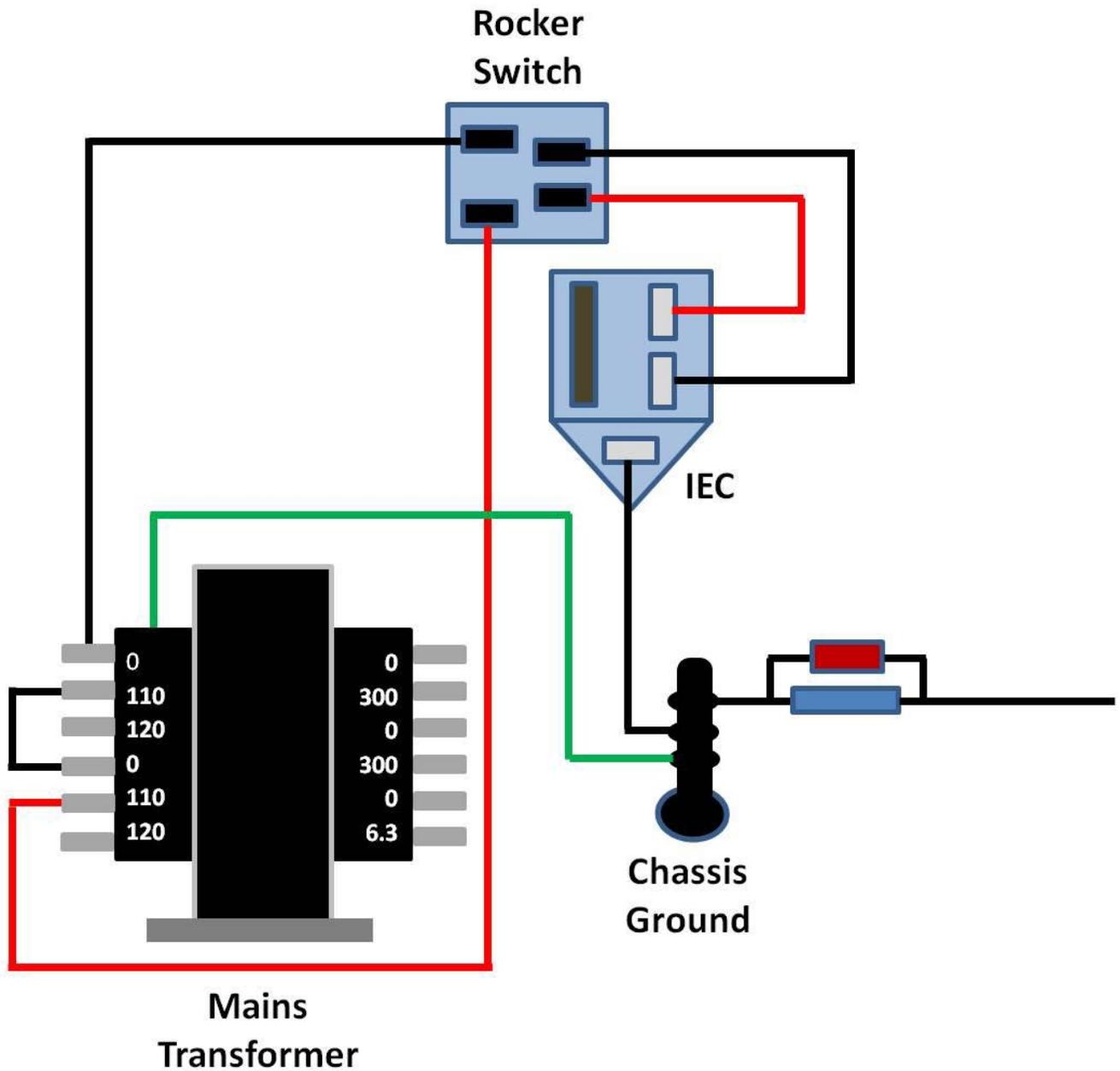
AC Power On/Off (110V)



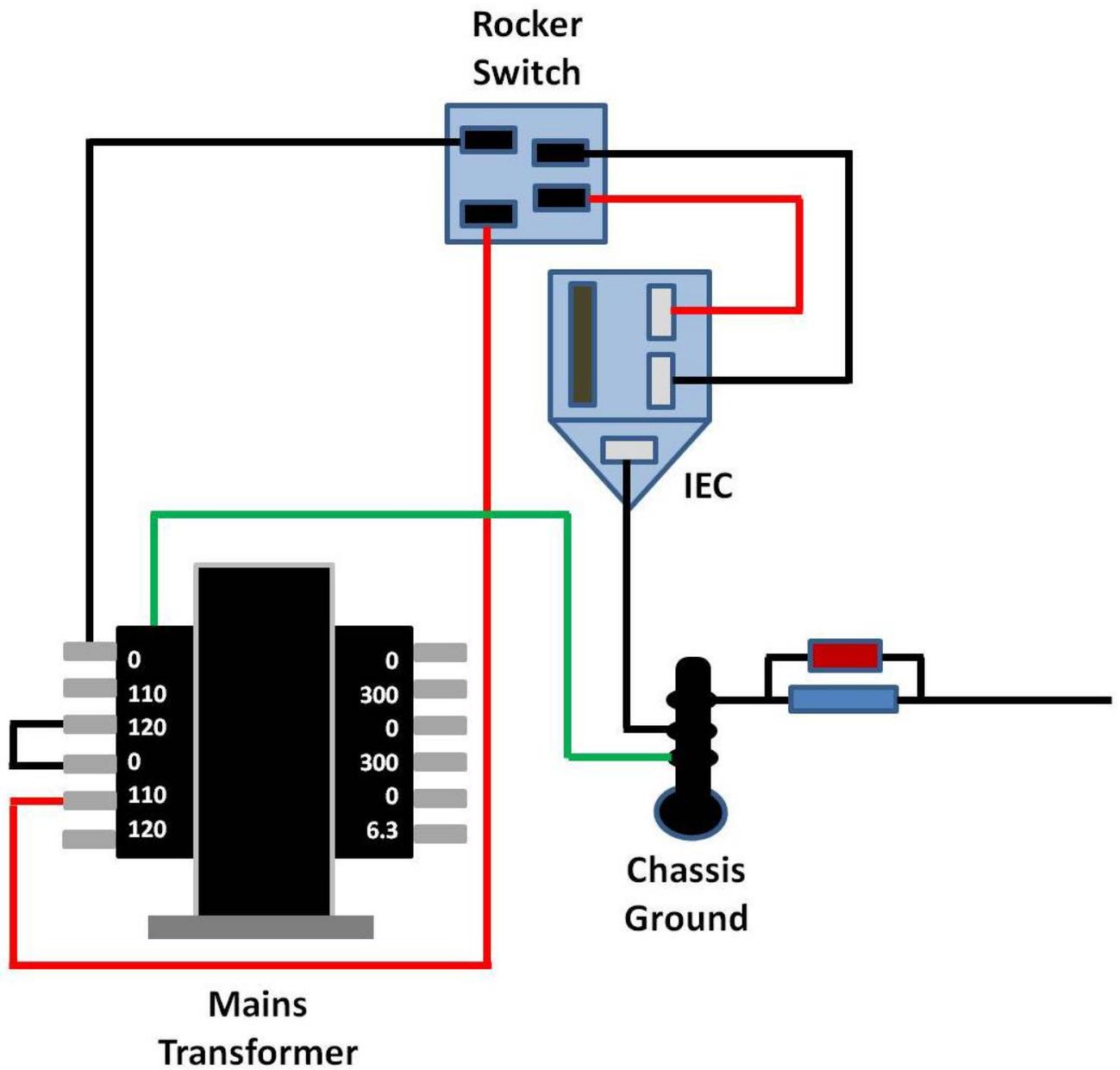
AC Power On/Off (240V, UK)



AC Power On/Off (220V)



AC Power On/Off (230V)



A.2 Color Code Reference

Resistor Color Codes (5 band)

	Black	- 0
	Brown	- 1
	Red	- 2
	Orange	- 3
	Yellow	- 4
	Green	- 5
	Blue	- 6
	Violet	- 7
	Grey	- 8
	White	- 9

Resistor color codes are read from the color that is nearest the edge of the resistor - that is treated as the first column.

The first column of a 5-band resistor is the 100's column, followed by a 10's column, followed by a units column.

The fourth band is a multiplier (or decimal point shifter). The multiplier can use the additional colors silver and gold. These are used for very small values and turn the multiplier into 0.01(silver) and 0.1 (gold). For the standard colors, it determines how many times the column value is shifted to the left (i.e. multiplied by 10)

The fifth column is a tolerance value. These can be quite complex but we will not concern ourselves with these.

Examples

100R					
	1	0	0	x 1	
680R					
	6	8	0	x 1	
820R					
	8	2	0	x 1	
1K					
	1	0	0	x 10	
2K2					
	2	2	0	x 10	
2K7					
	2	7	0	x 10	
3K3					
	3	3	0	x 10	

10K					
	1	0	0	x 100	
68K					
	6	8	0	x 100	
82K					
	8	2	0	x 100	
330K					
	3	3	0	x 1,000	
220K					
	2	2	0	x 1,000	
470K					
	4	7	0	x 1,000	
1M					
	1	0	0	x 10,000	

You can also find an 'Interactive Resistor Color Code Calculator' on our website (available from the Links page).