The Trinity Amps

THOR

Amp Builder's Guide

January 2022, Version 22.1

For the sole personal use of Trinity Amps Customers.

www.trinityamps.com

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Thank You!

Thank you for purchasing your kit from Trinity Amps. We truly hope that you enjoy building it. If you have any questions please do not hesitate to contact us.

We are always looking for feedback form our Customers on our products. We have checked the build instructions over thoroughly and are confident in our product. However, mistakes do happen so our advice is that as you connect each wire and part according to the layout, cross-check against the schematic. If you find any inconsistencies, or have any concerns, please let us know. Do not hesitate to contact us! We want this build to be successful for you and for Trinity Amps!

Please check over your parts carefully and the Bill of Materials and notify us of anything that does not seem correct.

We're confident that you will like our product and our support and when you're completed, we'd appreciate your comments posted on any of the internet forums such as thegearpage.net, 18watt.com, AX84.com or trinityamps.com. You will find some extra business cards in the package. Please keep one and pass the rest around.

We know you have a choice in suppliers and we do appreciate your business.

Have Fun!!

Cheers,

Stephen Cohrs,

Trinity Amps

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email: **stephen@trinityamps.com**

Introduction

This guide has been prepared for builders of Trinity Amps Kits. It is always being improved and we would appreciate your feedback and comments to: stephen@trinityamps.com

Accordingly, content and specifications are subject to change without notice.

We do try to make it as accurate as possible, but it is sometimes hard to keep up with the changes. Therefore, if you do find an error, please let us know about it and we will correct it. Suggestions are welcome so if you have one, please get in touch with us.

Sources of help.

Forums: Please use the various forums to get help. They are an excellent resource and can be found at trinityamps.com, AX84.com, the Gear Page etc..

Color assembly pictures and the latest drawings, tips, techniques are all in the Trinity Amps Forum, in the Resources Forum.

Email: We can't help with every problem but if you cannot get your problem resolved, email us and we'll do our best to help.

Phone Call: If your problem can't be solved, email for a phone appointment.

Acknowledgements

Much of the content in this document is original. Rather than reinvent content, some parts are based on content from other excellent sources and are hereby acknowledged.

Thor is based on original work by RobRobinette.com

R.G. Keen's site www.geofex.com - Tube Amp FAQ, Tube Amp Debugging

AX84.com site www.AX84.com - Gary Anwyl's P1 construction guide version 1.0

GM Arts website http://users.chariot.net.au/~gmarts/index.html - Guitar Amp Basics

www.18watt.com - website for various content and diagrams – Richie TMB

Aron from diystompboxes.com

WARNING

Please Read this Information Carefully

The projects described in these pages utilize **POTENTIALLY FATAL HIGH VOLTAGES.** If you are in any way unfamiliar with high voltage circuits or are uncomfortable working around high voltages, **PLEASE DO NOT RISK YOUR LIFE BY BUILDING THEM.** Seek help from a competent technician before building any unfamiliar electronics circuit. While efforts are made to ensure accuracy of these circuits, no guarantee is provided, of any kind!

USE AT YOUR OWN RISK: TRINITY AMPS EXPRESSLY DISCLAIMS ALL LIABILITY FOR INJURY OR PROPERTY DAMAGE RESULTING FROM THIS INFORMATION! ALL INFORMATION IS PROVIDED 'AS-IS' AND WITHOUT WARRANTY OF ANY KIND.

REMEMBER: NEVER OPERATE YOUR AMP WITHOUT A LOAD. YOU WILL RUIN YOUR OUTPUT TRASNFORMER!

Version Control

Version	Date	Change
21.1	19Sep21	Draft Version
21.2	10Oct21	Reversed OT wires connection to tube sockets
21.4	2Dec21	Added control & socket wiring graphics; reversed presence control.
22.1	14Jan22	Added managing PT leads and addendum 1&2

Builders Guide General Theory

For a discussion on Guitar Amp Basics and Tube Amp Theory, please refer to our Web-Site Support Page document **Builders Guide General Theory**

Marshall High Gain Amps

extracted from www.robinette.com

Introduced in 1974, the "Master Volume Lead" series amps were Marshall's first true high gain amplifiers. They cascaded the Plexi's bright channel into the normal channel, added a pre-phase inverter master volume and cold biased "cold clipper" gain stage and tweaked the resulting circuit for an aggressive but sweet overdrive tone.

The guitar signal enters the High "Lead" Channel input jack. The signal is amplified by the V1B preamp stage then flows through the Preamp Volume pot to the V1A cold biased "cold clipper" gain stage which generates asymmetric clipping. The signal then flows through the V2A preamp then directly through DC coupling (no coupling cap) to the V2B cathode follower which supplies the tone stack with a low impedance signal to keep the tone stack from loading down the guitar signal. After the Tone Stack the signal goes through the Master Volume and into the Phase Inverter. The Phase Inverter creates two mirror image signals that are 180 degrees out of phase to feed to the Power Tubes.

The "High Sensitivity" or "Lead" Channel has an extra preamp gain stage compared to the Low Channel. The guitar signal is amplified by V1B (one 12AX7 triode) which has a cool bias from its 2.7k cathode resistor. Its small .68uF bypass cap boosts the gain of mid and high frequencies which reduces the High Channel's lower frequencies early in the circuit so it can focus on mids and highs that sound good when later stages push into heavy distortion. The signal then flows through the Low Channel input jack (where the Low Channel input would start) to the Preamp Volume pot. The pot's output flows to the V1A "cold clipper" gain stage.

The Cold Clipper

The cold clipper is very important to these Marshall high gain amps' smooth overdrive tone. For minimum distortion a tube should be biased halfway between cutoff (when all electron flow is stopped) and saturation (when electron flow is maxed out). A 1.5k cathode resistor for a typical tube amp 12AX7 triode gain stage is very close to center bias. The cold clipper's very large 10k cathode resistor sets a cold bias that leaves little room on the shutoff side so the input signal can easily be clipped when the input signal's negative lobe on the grid reduces electron flow through the tube and electron flow is shutdown completely. This clipping is asymmetric because there's plenty of room on the saturation side of the bias point. Asymmetric clipping generates mostly sweet-sounding 2nd harmonic distortion. The positive, saturation side of the guitar signal lobe isn't distorted and carries the original musical content.

The JMC800 uses a cold clipper stage with an unbypassed 10k cathode resistor. Soldano liked to use a more aggressive 39k cathode resistor for an even colder cold clipper. The following gain stage is biased warm with an 820 ohm cathode resistor. Since a guitar signal's phase if flipped after each gain stage putting a warm biased stage after the Cold Clipper helps keep the distortion asymmetrical by keeping the undistorted lobe clean.

Asymmetric clipping tends to sound smoother and creamier than symmetric clipping where both the + and - signal lobes are clipped equally. With asymmetric clipping one signal lobe carries the clean signal while the clipped lobe carries the distortion. The cold clipper generates early, relatively low volume, smooth, musical preamp distortion that can be controlled by the Master Volume for high gain tone at lower volume than their earlier non-master volume amps. Without the cold clipper stage the preamp would stay too clean and the amp would have to rely on distortion from the power amp making the Master Volume less useable. As the cold clipper distortion comes on it blends seamlessly into the downstream phase inverter and power tube distortion into a cacophony of delicious high gain tone.

The cold clipper's asymmetric output signal can be clipped in later gain stages at high volume levels but note the gain stage following the Cold Clipper is biased warm with an 820 ohm cathode resistor (V2A). Because a guitar signal's phase if flipped after each gain stage, putting a warm biased stage after the Cold Clipper helps keep the distortion asymmetric by keeping the guitar signal's undistorted lobe clean. The warm bias leaves more room on the cutoff side to reduce clipping to the undistorted signal lobe.

The cold clipper is also a relatively low gain stage compared to one with a fully bypassed cathode. Soldano used the cold clipper cathode resistor value to trim gain to make his preamp work as desired. The higher the resistance value the lower the gain. That's one of the reasons Soldano used such a very large (39k) cathode resistor in his cold clipper.

The Attenuator Circuits

After the first preamp stage the guitar signal flows into an attenuating voltage divider. The OD Channel divider is made up of a 470k Attenuator resistor + the 500k OD Gain pot. Attenuating voltage dividers are an important part of high gain amp tone. This divider dumps 48% of the guitar signal to ground to keep from over overdriving the following gain stages. Signal attenuating voltage dividers are present in all high gain tube amps to control the level of overdrive and saturation. The Attenuator resistor is bypassed with a 470pF Bright cap (also called a Treble Peaker) to allow high frequencies to go around the voltage divider to boost high frequencies. Low and mid frequencies are cut by 48% by the attenuating voltage divider while high frequencies are not cut. If you remove or bypass the upper resistor in a voltage divider then there is no voltage divider. Removing this Treble Peaker cap is a common mod for overly bright amps to cut ice pick highs and reduce shrillness. There are four other attenuating voltage dividers in the OD and Clean Channels that moderate gain to keep things under control at high gain settings.

The Treble, Mid & Bass (TMB) Fender style tone stack uses variable RC filters to block high, mid and low frequencies. It's a passive tone control that cannot boost frequencies, only remove them from the guitar signal. It's a low impedance circuit that places a heavy load on the guitar signal so the V4A Tone Stack Buffer Cathode Follower acts as a buffer between the low impedance tone stack and the high impedance signal from the preamp. Without the cathode follower the tone controls would raise and lower the overall signal volume even more than they already do. The guitar signal leaves the tone stack through the treble pot's wiper and flows to the Master Volume pot.

The Master Volume is a pre-phase inverter master volume that controls the signal level flowing into the phase inverter and controls the distortion level of both the phase inverter and the power tubes. The 12AX7 phase inverter gets hit with a hot signal from the preamp and being able to tame that signal before it hits the inverter's grid can help prevent unwanted blocking distortion at extreme volume levels. The down side of having the master volume on the input side of the phase inverter is you don't have the phase inverter's gain to create distortion before the master volume.

The "Low Sensitivity" or "Normal" Channel

The Normal Channel's guitar signal bypasses the High Channel's first gain stage V1B and flows directly to the Preamp Volume pot then on to the V1A Cold Clipper gain stage. From there it follows the same path as the High Channel described above. With one less preamp gain stage the Normal Channel has more clean headroom and tends to be more pedal friendly.

Output Stage

The large 1 kilohm 5-watt screen resistors are required to control the screen current that flows from the EL34 true pentode's screen under heavy power tube overdrive. A true pentode flows more screen current than a beam tetrode such as the 6L6 and 6550 tubes. The screen voltage drop caused by the voltage drop across the screen resistor during heavy overdrive is the main difference in overdrive tone between the EL34 and beam tetrode tubes. If you want Marshall style power tube overdrive you need to use EL34's with 1k 5-watt screen resistors.

Amps bound for the USA had 6550 power tubes so the 56k bias resistor shown above was reduced to 47k and the 220k grid leak resistors were reduced to 150k.

The power supply's solid-state rectifier and the use of a choke between the power tube plate and screen power nodes offers up minimal dynamic voltage sag to keep the overdrive tone tight and reduce the chance of power supply induced oscillation.

Building an Amp

Warning: Do not attempt to build a guitar amp unless you know how to work safely with the dangerous voltages present in a tube amp. These voltages can exceed 700 volts.

Introduction

If you have purchased your Trinity Amp as a kit, this guide will help you build a tube guitar amplifier. It is oriented towards someone who knows a little about electronics but is new to do-it-yourself amps. It outlines a simple path to getting a quality amp build.

Switches and wire

Use standard UL approved switches with a 125V/3A rating for the Power and Standby switches. Use 22 or 20 Gauge insulated solid wire with a 600V rating. It is good to get a variety of colors so you can color code your wiring.

Physical layout

Make sure the jacks, sockets and pots mounted along the edge won't interfere with parts mounted on the underside of the chassis. Imagine how chassis will be mounted in the cabinet and make sure there is enough clearance for the speaker and mounting brackets. Trinity amp chassis are laid out with serviceability and neatness in mind.

Grounding

It is recommended that you follow the layout provided with your Trinity Amp. It has been tested and has proven reliable. If you choose to deviate, consider the following information.

Amps traditionally use the chassis for signal ground. This is not the best choice since it can create ground loops and bad ground connections may develop over time. It is better to use star grounding in which all of the local grounds are collected at a single 'star ground' point. With star grounding there is only one connection between the chassis and signal ground.

Here are some rules for laying out a star ground. More information on grounding can be found in the Tube Amp FAQ and the Tech Info page of Aiken Amplification.

(1) Connect the power transformer center tap directly to the negative terminal of the first power supply filter capacitor (cap) then run a separate wire from the negative terminal to the star ground point.

(2) Collect the ground points of each tube and its associated resistors and capacitors to a local ground point that is not connected to the chassis. Run one wire to the star ground point from each collection.

(3) Run exactly one wire from the star ground point to chassis.

(4) Insulate the input and output jacks from the chassis.

The safety ground wire from the mains is separate from the signal ground. Run a wire from the AC ground to the chassis near where the AC power enters the chassis.

Insulated jacks

To insulate the input and output jacks either use plastic insulated jacks or metal jacks with insulating washers. Some people prefer the increased durability of metal jacks. Insulating a metal jack requires a shoulder washer with a 3/8' internal hole that fits a ½' panel hole.

Minimizing transformer interference

To minimize coupling between the power transformer and output transformer orient them so their plates are at right angles. If possible, place them at opposite ends of the chassis.

Keep the input stage wiring short and away from the output stages. This minimizes the possibility of oscillations caused by coupling of the output signal into the input.

Mount the grid resistors as physically close to the grid pins as possible.

Use a twisted pair of wires for the tube filament wiring. Route it away from AC lines and close to the chassis.

Wiring

The traditional method of constructing amps involved mounting the components on tag board or fiberboard. This is the technique that is used for Trinity Amplifiers and is the recommended approach for service and reliability.

Assembling the amp

Before You Begin

When you first receive your kit, remove all of the parts from the shipping box and place them on a well-lit, clean surface. Check all of the parts against the parts list and verify that you have everything before you begin. Contact us at once if you are missing anything, or if something appears to be damaged.

Tools

To assemble the amp you need:

1. 25 watt pencil tip soldering iron. (Minimum for ROHS)
2. 60/40 rosin core solder .030" dia (lead-free 97/3 tin/copper for ROHS turrets)
3. wire stripper
4. wire cutter
5. needle nose pliers
6. small screwdrivers (Phillips, Standard)

7. multi-meter with minimum 500V range

Use a stand for the soldering iron, a sponge to keep the tip clean, de-soldering wick material and clip leads. You should also have a multi-meter with at least 500V range, preferably 1000V and an audible continuity checker. Try to get a multi-meter that measures capacitance. This lets you verify the value of your components before you install them.

Soldering

Soldering is accomplished by heating the components to be soldered and allowing the molten solder to flow onto them. Do not try to melt solder on the tip of the iron and transfer it to the solder joint. It doesn't work.

Follow these steps when soldering to boards. **Note ROHS instructions**:

1. Use 60/40 rosin-core solder. (use **lead free** when soldering ROHS boards.)
2. Keep the tip of the soldering iron clean. If it's dirty, wipe it on a damp sponge to clean it.
3. Set the temperature of your soldering iron to about 700F.

   ROHS: 725-750F when soldering ROHS turret boards, the dwell time (time to heat and complete the connection) is a little longer and temperature is set a little hotter. The solder used was Lead-free solder 97/3 formula tin/copper with a Rosin Core.
4. Melt some solder on the tip of the iron. The molten solder helps to efficiently transfer heat from the soldering iron to the component leads.
5. Make a good mechanical connection first, and then make a good solder joint.
6. Heat the leads to be soldered by touching it with the tip of the iron.
7. Touch the solder to the leads. The solder should flow onto the leads. Avoid breathing the fumes.
8. Remove the soldering iron and allow the solder joint to cool.

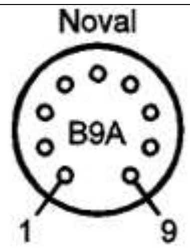
Note: Do not apply the tip of the soldering iron to the turret board any longer than it takes for the solder to flow.

Some people do have success using leaded solder on ROHS boards. Your experience may vary.

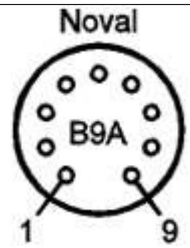
The solder joint should be clean and shiny. (ROHS joints are not as shiny as non-ROHS). If it is dull looking it may be a ‘cold solder joint’ which is not a good electrical connection. If a solder joint is suspect, heat it with the iron to reflow the solder.

Tube Pin Numbering

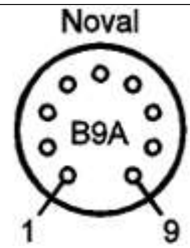
The pins on a 9-pin tube socket are numbered 1 to 9 in a clockwise direction when a tube or socket is viewed from the bottom. Note that there is a gap between pins 1 and 9. The pins on an 8-pin tube socket are numbered 1 to 8 in a clockwise direction when viewed from the bottom. Note that there is a gap between pins 1 and 8.



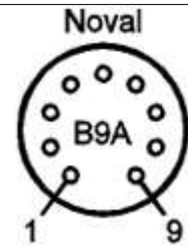
12AX7



EL84

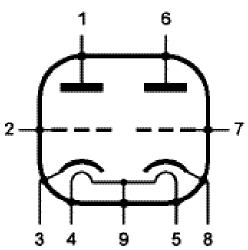


6CA4

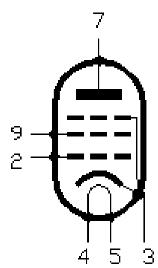


EF86

GZ34/6V6



12AX7



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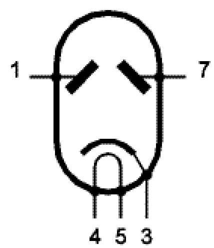
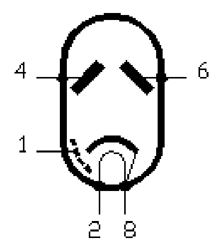
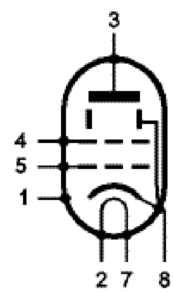


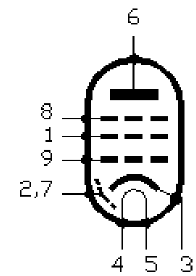
6CA4



GZ34



6V6



EF86

The pins on the potentiometers are numbered 1 to 3 from left to right when the shaft is facing towards you and the pins are at the top.

Tube Designations

There are several different tube numbering systems that you may see on tubes, which generally are a result of where they were built. Most commonly the numbers contain digits only (e.g. 5751), or are some combination of numbers and letters (12AX7, ECC83, CV4004). These different numbering systems may be from the American or British military, or from American or European industrial or consumer use, and then of course there are many strange exceptions. But to use the notation commonly seen in the United States, here is the meaning of "12AX7":

12 - the filament voltage

AX - an arbitrary model number

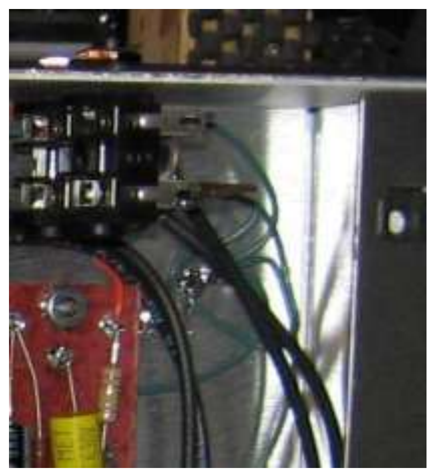
7 - the number of internal elements, including the filament

To make things more complicated, many tubes have letters after the name, such as 6L6WGB, 6L6GC. Sometimes these letters mean functionally nothing (design revisions) and sometimes they refer to different voltage capabilities of a given type.

NORTH AMERICA	*EUROPE*
12AX7	ECC83
6BQ5	EL84
6CA4	EZ81
5AR4	GZ34
6CA7	EL34
6L6GC	KT66
12AT7	ECC81
12AU7	ECC82

Grounding Scheme

To keep noise to a minimum, the Trinity Amps THOR layout uses a two point grounding scheme where the power side of the amp is connected to a single common ground point (Power Ground), and the pre-amp is connected to another point on the chassis that is located immediately beside the input jacks (Pre-Amp Ground).



For grounding these amps, we strongly recommend that you follow the layout provided. We don't recommend that you deviate.

For safety, we use a single Mains Ground point. No other components may be connected to this point.

Assembly Steps Summary

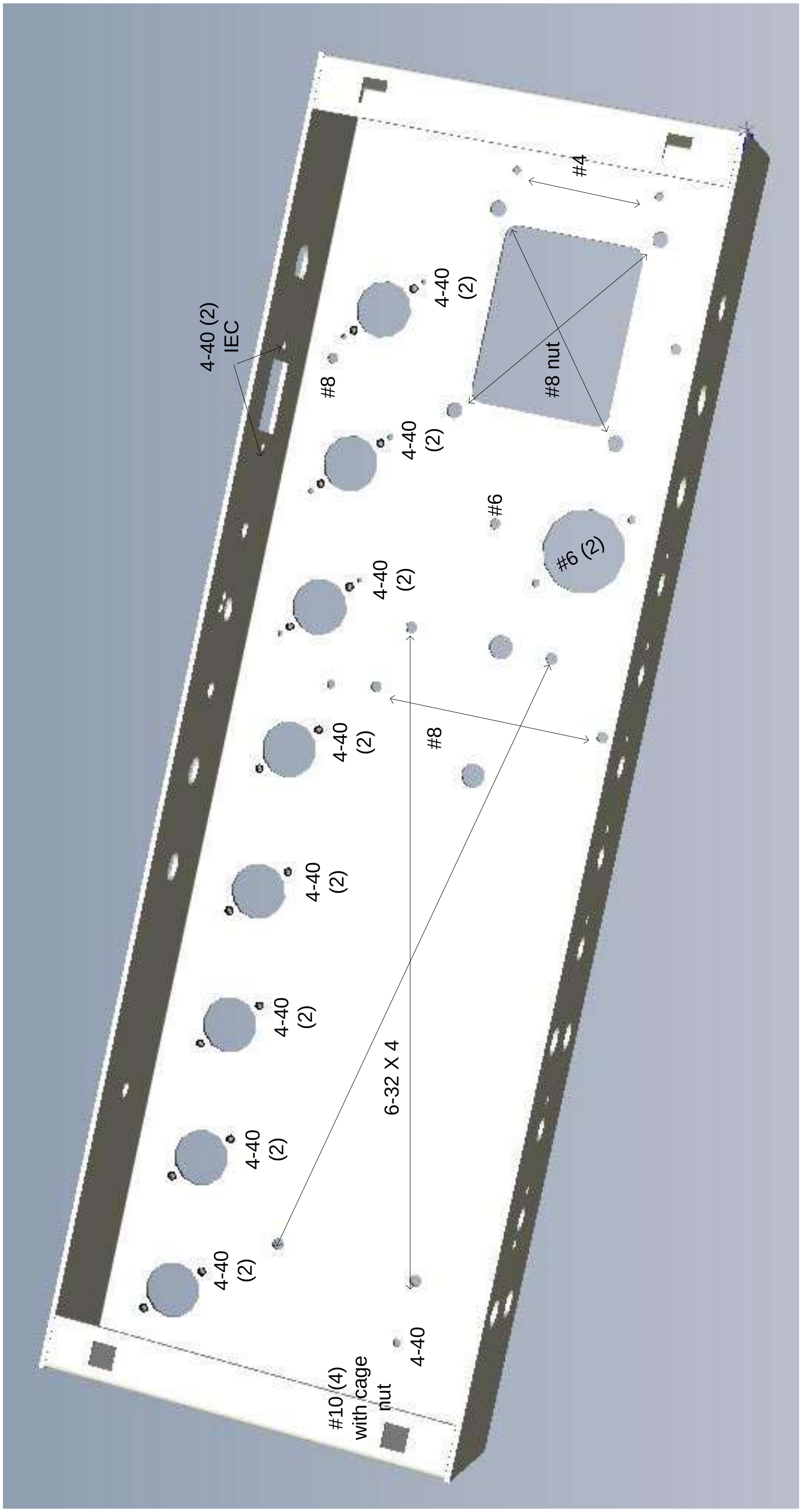
1. Install Hardware on the Chassis.
2. Wire up the heater wires to the sockets.
3. Install Transformers onto chassis.
4. Wire Power Supply - Mains, Transformer, Rectifier socket, Switches, Pilot light.
5. Assemble the turret board and install on chassis.
6. Connect turret board leads installing off-board parts as you proceed.
7. Wire up Impedance Switch and Output Jacks
8. Wire input jacks and shielded cable.
9. Check Wiring.
10. Follow Start-Up procedure.

Follow Pictorial on Forum – Resource Section – Topic: "THOR Plexi Pictorial Build"

1. Install the Hardware

There are many nuts bolts etc. required. Here are some guidelines.

Part	**Qty**	**Where to use**
4-40 X 5/16”	20-25	Holes are tapped so nuts are not required for tube sockets and IEC connector. Use KEPS nuts to hold terminal strip at tube locations. Use with nuts/lock washer to mount the 5 lug terminal strip and 1-#4 power amp screen resistor terminal strip.
6-32 X 3/8”	3	Mount 3 power ground # 6 chassis lugs with KEPS nut. Mount Capacitor clamp
6-32 X 3/4”	4	Mount turret board to chassis using stand-offs. Screw though board – spacer and into chassis tapped hole. Use a #6 lock-washer between the board and screw head.
8-32 X 3/8”	1	Mount Mains ground **ONLY**. Use any additional lock washers with #8 chassis lug.
8-32 X 3/8”	2	Mount Output trans. With KEPS lock nuts.
8-32 KEPS nuts	7	4 for power transformer (optionally remove Heyboer PT nuts as supplied); 2 for Output transformer; and 1 for mains ground bolt.
10-32 X 1-1/4”	4	Mount chassis to cabinet. Use cage nuts in square holes pressed into chassis.


4-40 (2)
IEC
#8
4-40 (2)
4-40 (2)
4-40 (2)
4-40 (2)
4-40 (2)
4-40 (2)
4-40 (2)
4-40 (2)
#4
#8 nut
#6
#6 (2)
#8
6-32 X 4
4-40
#10 (4) with cage nut

Tube Sockets - Install all the tube sockets. The chassis is tapped for #4 screws so that nuts are not required.

Align the #1 pins according to the layout to minimize lead length. RF shield's are supplied for pre-amp tubes, V1 to V3. These are mounted on top of the socket and held in place by the #4 screw that holds the socket in place.

Spring retainers are provided for power and rectifier tubes. These are mounted on top of the socket and are held in place by the #4 screw that holds the socket in place.

Can Capacitor - Install the dual capacitor can cap clamp with #6 X 3/8" bolt and KEPS nut. Loosen of the clamp screw and insert the dual capacitor JJ 50uF X 50uF can cap into the clamp. Align it so the 2 lugs are parallel to the chassis front. Tighten the clamp screw.

Grommets - Insert 2 - ½" grommets for wire leads passing through the chassis from the output transformer.

Front Panel - The front panel is installed and held in place by installing the pilot light, power switches, potentiometers and jacks. Ensure the potentiometers are located in the correct positions according their values and the layout. The locating tabs on the potentiometers are used to stop them from rotating and fit into the chassis.

For the input Cliff jacks you will probably need only 1 fibre washer to mount them flush.

Install all parts only finger tight until all parts are fitted, then tighten.

Trinity THOR Combo Front View

Terminal Strips - Inside the chassis, install the terminal strips (several solder lugs or 'tags' attached to an insulated strip).

5 tag terminal strip (not including 2 ground tags) is used for the power connections;

2 tag terminal strip (not including 1 ground tag) for 100R screen resistor to the EL84s;

2 tag terminal strip (not including 1 ground tag) for the two 68K grid stopper input resistors;

2 tag terminal strip (not including 1 ground tag)for the 470K TMB grid stopper resistor.

The terminal strip for the input to V1 is optional, but highly recommended.

The terminal strip for the TMB 470K grid stopper resistor is necessary to prevent excessive feedback squealing in the TMB channel. It is not required on the sIII or Plexi design.

Terminal strips are mounted using a nut over the socket mounting screw.
NOTE: DO NOT SOLDER COMPOMEMTS TO THE GROUND CONNECTED LUGS UNLESS DIRECTED TO DO SO!!

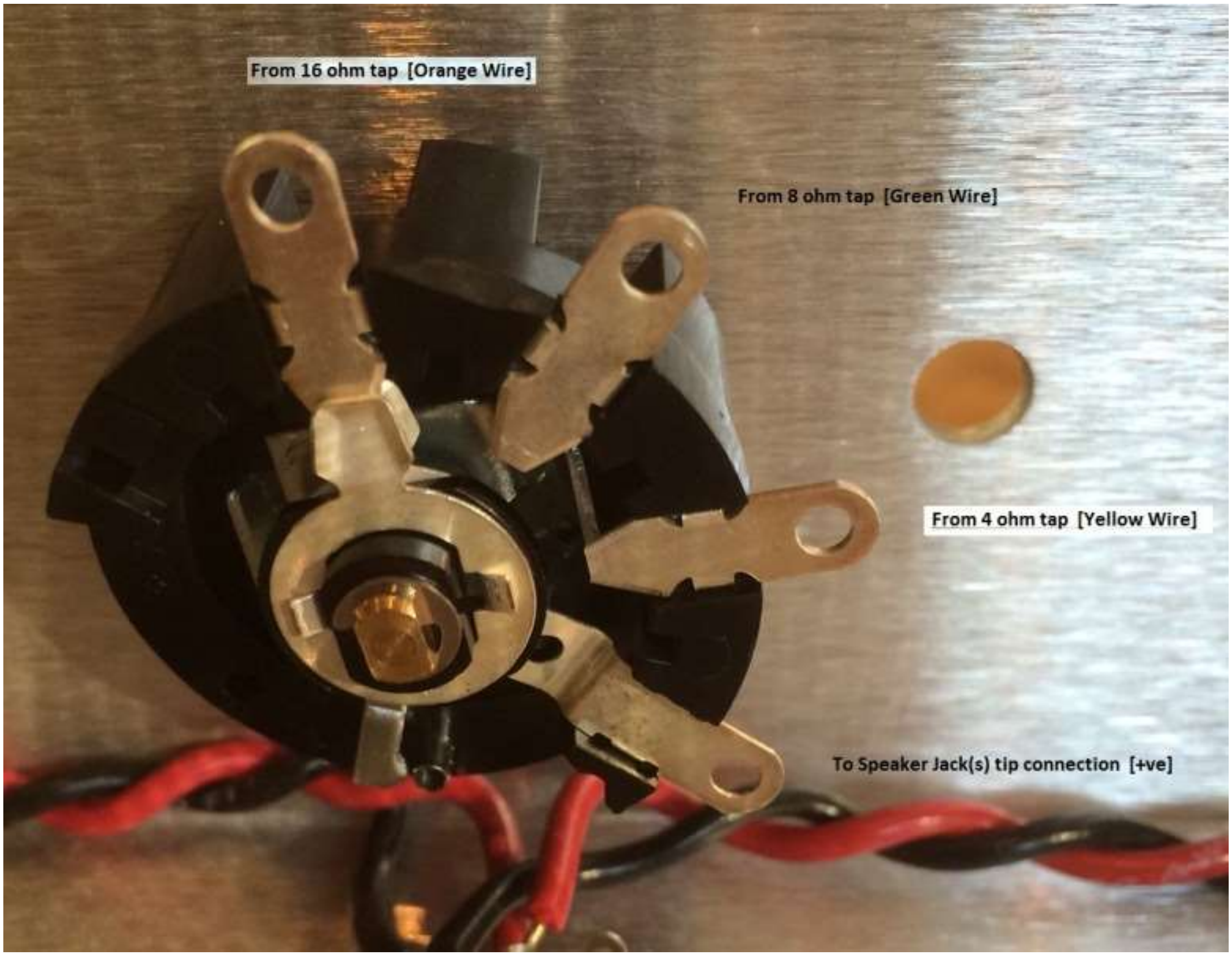
Ground Lugs - Install the ground lugs:

1 - #8 Mains chassis ground lug using 1 #8 bolt & KEPS nut;

3 - #6 Power chassis ground lugs using 1 #6 bolt & KEPS nut; and

2 - #4 preamp chassis ground lugs using 1 #4 bolt & KEPS nut

Impedance Switch – Install the Impedance Selector paying particular attention to the leads orientation for the correct impedance selection. Refer to the diagram below for the connections.



Output Jacks - You can install the output jacks, but they may need to be removed to provide good access to the tube sockets for wiring. You will probably need to use both spacers to ensure a flush mount of the jack on the chassis.

IEC Mains Socket - Orient the IEC socket so that the center ground lug points toward the top of the chassis. Install the IEC socket using 2 - #4 screws , screwed into the chassis which is tapped to accept them. Nuts are not required.

Fuse Holder - Orient the Fuse holder socket so that the center lug points away from the IEC socket. Fasten in place with the nut and washer provided.

1. Install Transformers

Install the power transformer and output transformer.

Orient the power transformer so that the 6.3 VAC heater wires are facing the rectifier. When mounting the transformers, use the supplied #8 KEPS lock nuts to hold transformers in place.

Orient the output transformer such that the leads to the B+ are closest to the filter capacitors. The Primaries (Brown, Blue, Red) wires should face the power transformer. Braid the Yellow, Green, Orange and Black secondaries together and feed them through the chassis grommets. Twist the Blue & Brown together and feed them through the other grommet along with the Red lead.

Note: On the outside of the Chassis, tie off the unused 5K Blue-White & Brown-White primary that is not required for the THOR build. Tie it off by cutting off any pre-stripped, exposed wire and then put heat-shrink over the end and tuck it away as it is not used.

Install the 4H choke on the outside of the chassis between the power transformer and Output transformer and feed the two wires through the chassis grommets into the inside of the chassis. Use the supplied #8 KEPS lock nuts and 3/8"screws to hold transformers in place.

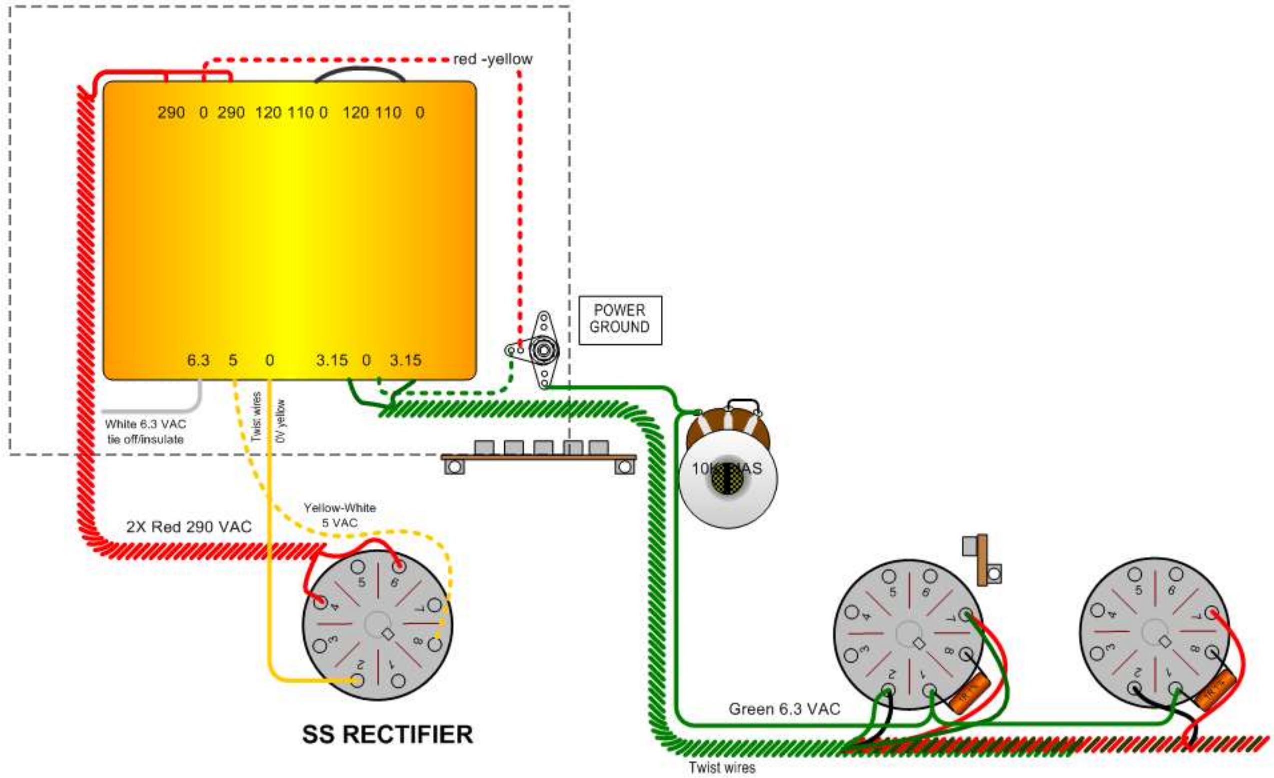
2. Heater Wiring

Here is a guideline for wiring the kits with the supplied wire:

- 22 gauge 600V solid for hook up from board to tubes
- 22 gauge 600V solid for hook up from board to pots/front panel
- 20/22 Gauge pre-twisted for tube heater wiring
- 20/18 Gauge, stranded, or solid 600V for power supply hook up to transformers, rectifier, standby etc. TIP: Re-use cut offs from transformers.
- shielded wire RG174U for inputs to V1 and some controls
- green wires for ground wires.

Heater Wires

It is important to wire the tube filaments carefully. A long length of pre-twisted 1 pair (Red-Black) wire is supplied. This will help to minimize any hum. Twist and Route the Green pair to the first 6V6 power tube and solder it to pins 2 and 7. Carry on with the Red-Black twisted wire to the next 6V6 pin 2 and 7.



From there, the wires daisy chain across the preamp tubes, with the Red wire to both pins 4 and 5 of each preamp tube and the Black wire to pin 9.

This 'Polarity' on the preamp tubes and heater tubes must be maintained to keep hum to a minimum. You must connect the same color heater wire to the same pin(s) as you progress from tube to tube e.g. black on pin 2 of both 6V6 and red on pins 7. Do one tube socket at a time. Complete the 12AX7s using the same process. Red on pins 4 & 5 tied together and black on pins 9. Don't switch the heater wire polarity.

3. Install Transformers

Install the power transformer and output transformer.

Orient the power transformer so that the 6.3 VAC heater wires are facing the rectifier. You may prefer to remove the existing 4 nuts on the transformer and mount the transformer flush on the chassis surface. Either way, when mounting the transformers, use the supplied #8 KEPS lock nuts to hold transformers in place.

Orient the output transformer such that the leads to the B+ are closest to the filter capacitors. The Primaries (Brown, Blue, Red) wires should face the power transformer. Braid the Yellow, Green, Orange and Black secondaries together and feed them through the chassis grommets. Twist the Blue & Brown together and feed them through the other grommet along with the Red lead.

Note: On the outside of the Chassis, tie off the unused 5K Blue-White & Brown-White primary that is not required for the 18 watt build. Tie it off by cutting off any pre-stripped, exposed wire and then put heat-shrink over the end and tuck it away as it is not used.

4. Wire the Power Supply

Note: Managing Power Transformer extra leads.

When you go to wire up your amp transformer you are going to have some leftover leads which need to be insulated and tucked out of the way – i.e. Tied Off:

First, separate all of the primary leads from the secondary leads and put them into their respective bundles. To determine what's what, reference the wiring diagram that came with your kit. The primary leads will all be notated on the left side of the wiring diagram, and the secondary leads will be notated on the right. If you have already wired up all of the secondary leads, they would be permanently trimmed to length and out of the way.

Once you've determined the length of wire you need for all your primaries, trim off the excess. Using a set of wire cutters, trim the excess wire not only from the primary leads you'll be using, but from ALL primary leads.

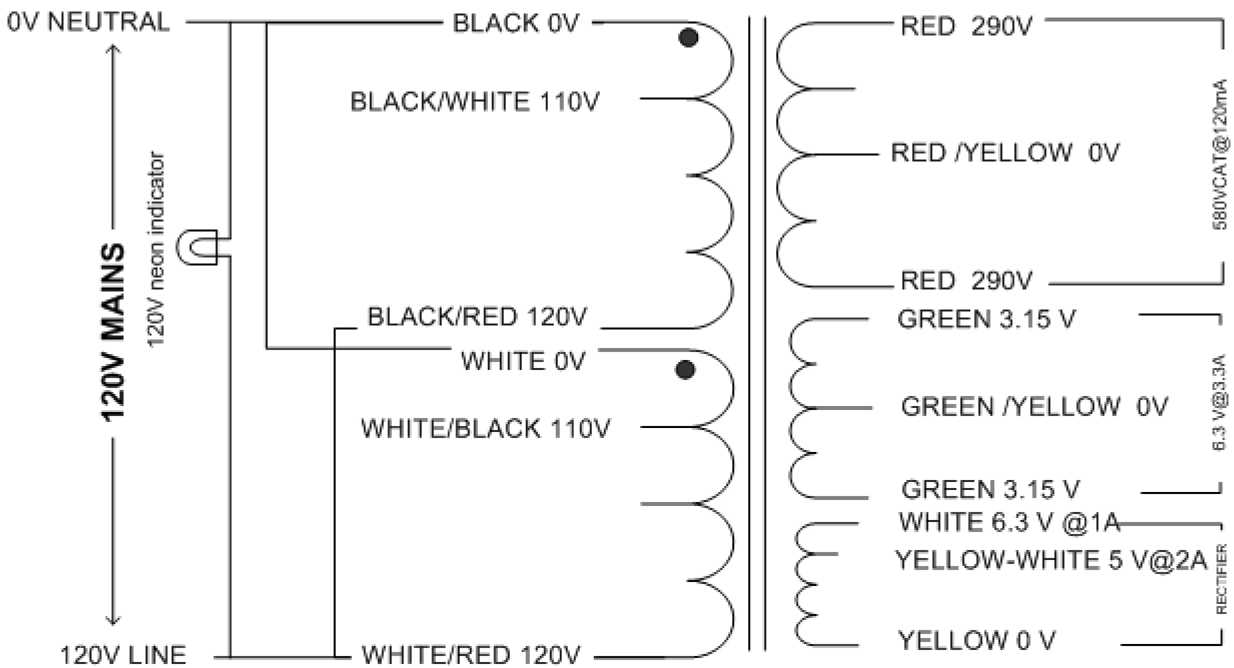
Why not just trim the full excess of the unused leads all the way down to the transformer itself? There is plenty of room to store the excess leads in the chassis without messing anything up, and what if you move to a place where the power isn't 120V? It's best to leave yourself the option to rewire the primary leads for that country's power.

When the leads are trimmed to length, insulate the exposed ends of the unused wires. Insulate with shrink tubing, but this can also be done by wrapping electrical tape around the wires and over the top exposed side of them. Prevent those conductors from touching each other or anything else inside the chassis.

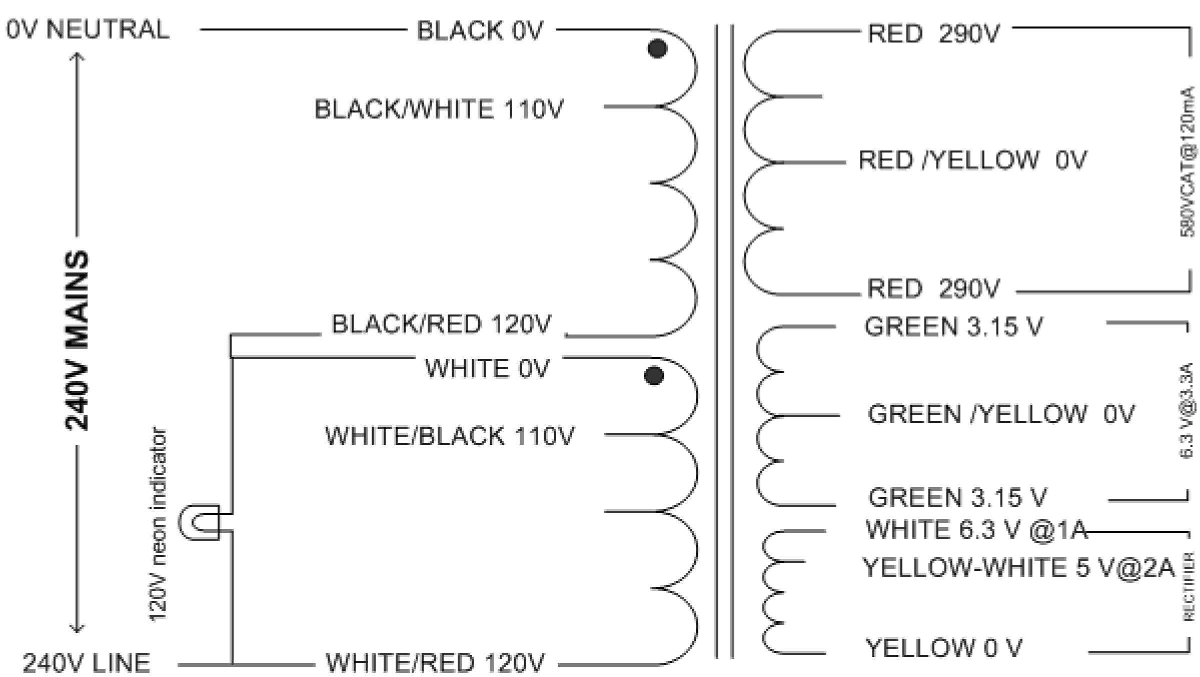
Finally, twist all of the wires together and tuck them down into the chassis next to the transformer. This little loom of wires is secure and will easily stay put on its own forever; you won't have to worry about them getting loose and messing things up or rattling around and making noise

Start with the IEC socket. Run a GREEN wire from the bolt/lug on the chassis immediately beside the socket to the GROUND LUG on the IEC socket. Solder both ends on place. Make sure to <u>tighten the ground bolt / lug very tightly</u>.

The Power Transformer utilizes two 120 VAC nominal primaries. These are ***connected in Parallel for North American*** mains voltages and ***in Series*** for 240 mains. 110, 220, 230 mains voltages are also supported. See Appendix for connection diagrams.



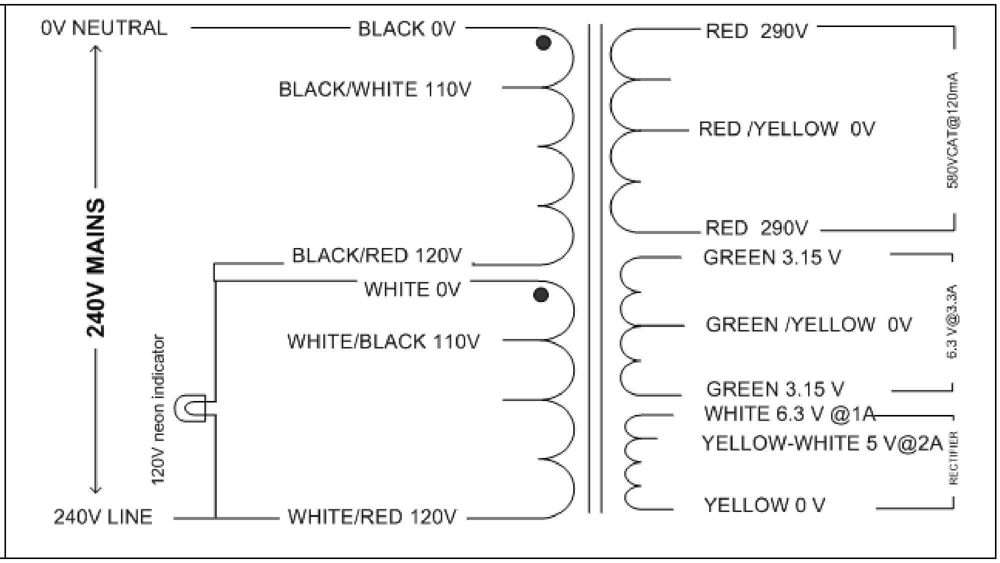
Trinity Amps Power Transformer 120 VAC Connection



Trinity Amps Power Transformer 240 VAC Connection

Wiring of Mains circuits: European vs North America			
	Ground	Hot (L)	Neutral (N)
Europe	Green/White or Green/Yellow	Brown	Blue
North America	Green [USA-plug round prong]	Black [Small flat prong]	White [Large flat prong]
European 240V	Green/White or Green/Yellow	It makes no difference how the other two wires are matched.	

Diagram for proper hook-up of 120V Neon indicator when using 220-240 VAC primary.



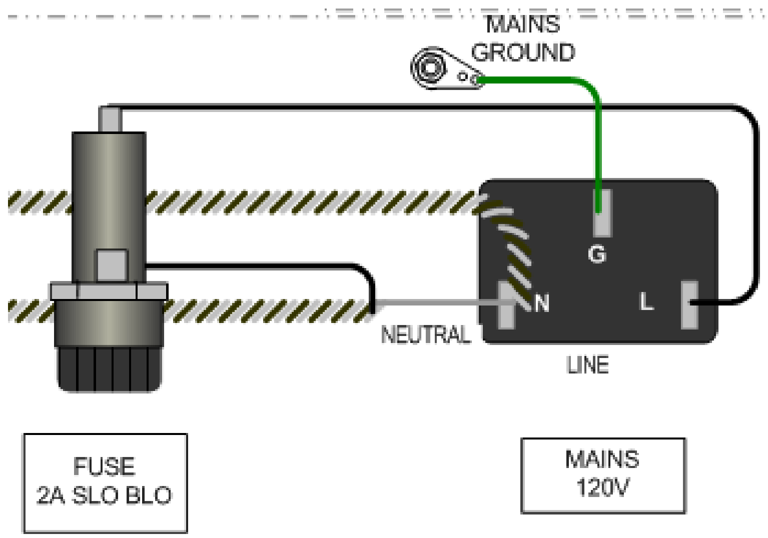
Connect the heater center tap ground to the #6 ‘Power’ star ground point located between the power transformer and turret board.

Wire Up The Transformer Mains Power Supply.

Start with the IEC connector and ensure it is grounded to the #8 bolt/lug on the chassis immediately beside the socket. Liberally use star washers to lock this well into place.

Run a wire from the 'Line (L)' or 'Hot' side of the IEC connector to the lug on the END of the fuse holder and from the SIDE of the fuse holder to one of the Power switch terminals.

The other side of the IEC connector or 'Neutral (N)' connects to the 'Neutral point of the power transformer wires (Black and White), plus another wire goes to the indicator lamp twisted together with the Line Black wire.



120V MAINS

Connect the Black and White transformer leads to the IEC socket where the Line Neutral (N) is connected.

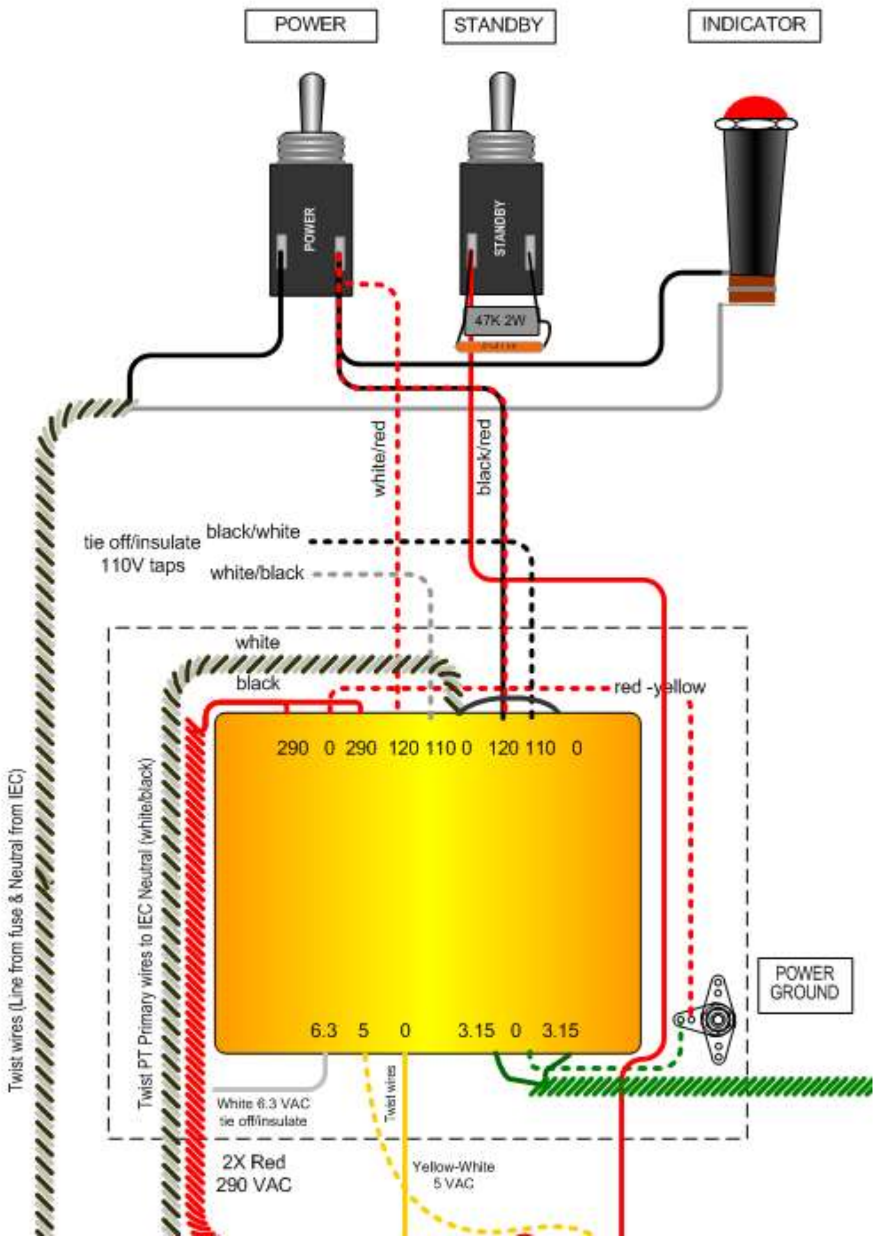
Make sure the switch is in the desired on position when the connection is 'made' (0 ohms resistance). The switch can be oriented so that it is 'On' in either 'Up' or 'Down' position.

Connect to the Line Lead from the IEC socket Line tab to one side of the switch.

Connect the power transformer Black-Red & White-Red transformer leads to the other lug. A second wire is attached to this same lug and runs to the 120V neon indicator light.

The other side of the indicator light goes to the 'Common' Neutral wire from the IEC socket

Twist all wires together and then solder the wires in place on the power switch lugs, indicator and terminal strip tags.



240V MAINS

All AC wires are twisted together to reduce hum.

Connect the Black transformer leads to the IEC socket where the Line Neutral (N) is connected.

Make sure the switch is in the desired on position when the connection is 'made' (0 ohms resistance). The switch can be oriented so that it is 'On' in either 'Up' or 'Down' position.

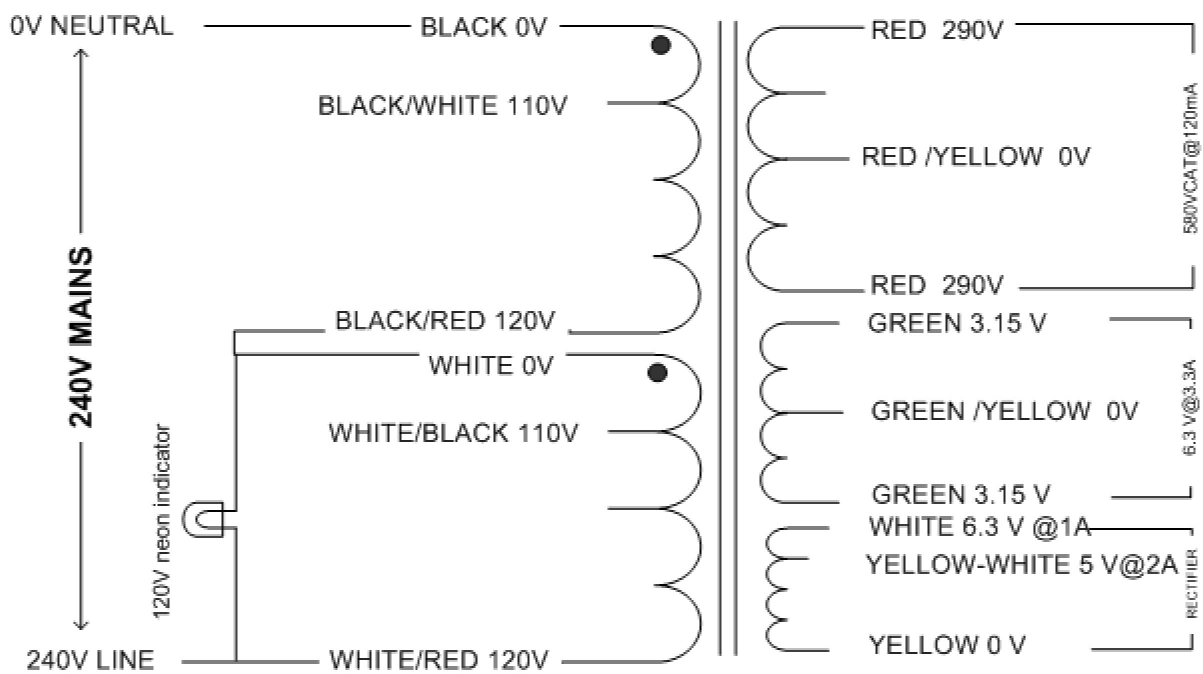
Connect a White lead from the IEC socket Line tab to one side of the switch.

Connect the power transformer White-Red Transformer (L) Lead transformer leads to the other lug. A second wire is attached to this same lug and runs to the 120V neon indicator light.

Connect the Transformer Black-Red and White together at the terminal strip or solder together and insulate well with heat shrink tubing.

The other side of the indicator light goes to the 'Common' Neutral wire from the IEC socket.

Twist all wires together and then solder the wires in place on the power switch lugs, indicator and terminal strip tags.



RECTIFIER WIRING (SS/5AR4)

The Rectifier heater wires are identifed by colour and by the fact that there is no center tp. They are labelled 6.3, 5, 0

Twist and connect the two 5 VAC Rectifier (Yellow-White and Yellow) heater wires to pins 2 and 8 of the 8-pin rectifier socket.

Connect the unused 6.3VAC White lead to an unused terminal on the 5-lug terminal strip or tie it off.

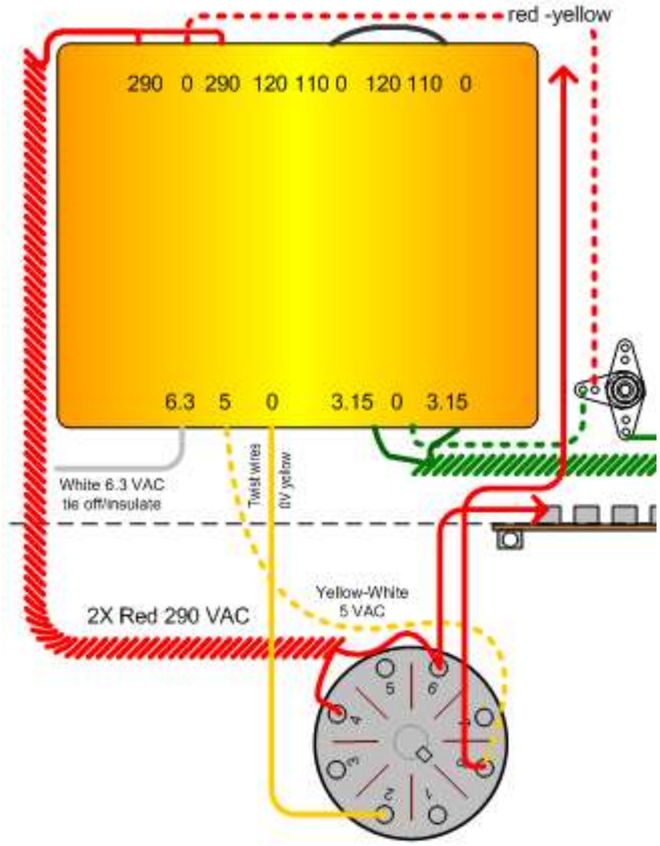
HV WIRING

Twist and connect the two Red, HV (high voltage) - 290VAC) wires to pins 4 and 6 of the rectifier socket.

Route and connect the Red-Yellow center tap of the high HV leads from the transformer to the single star Power Ground point.

Route the wire from pin 8 back to the standby switch. Make sure the switch is in the desired on position, i.e. where the connection is 'made' . The switch can be ON in either 'Up' or 'Down' position.

Attach a wire to the other side of the standby switch and route it to the closest side of the 50uF/50uF can cap.



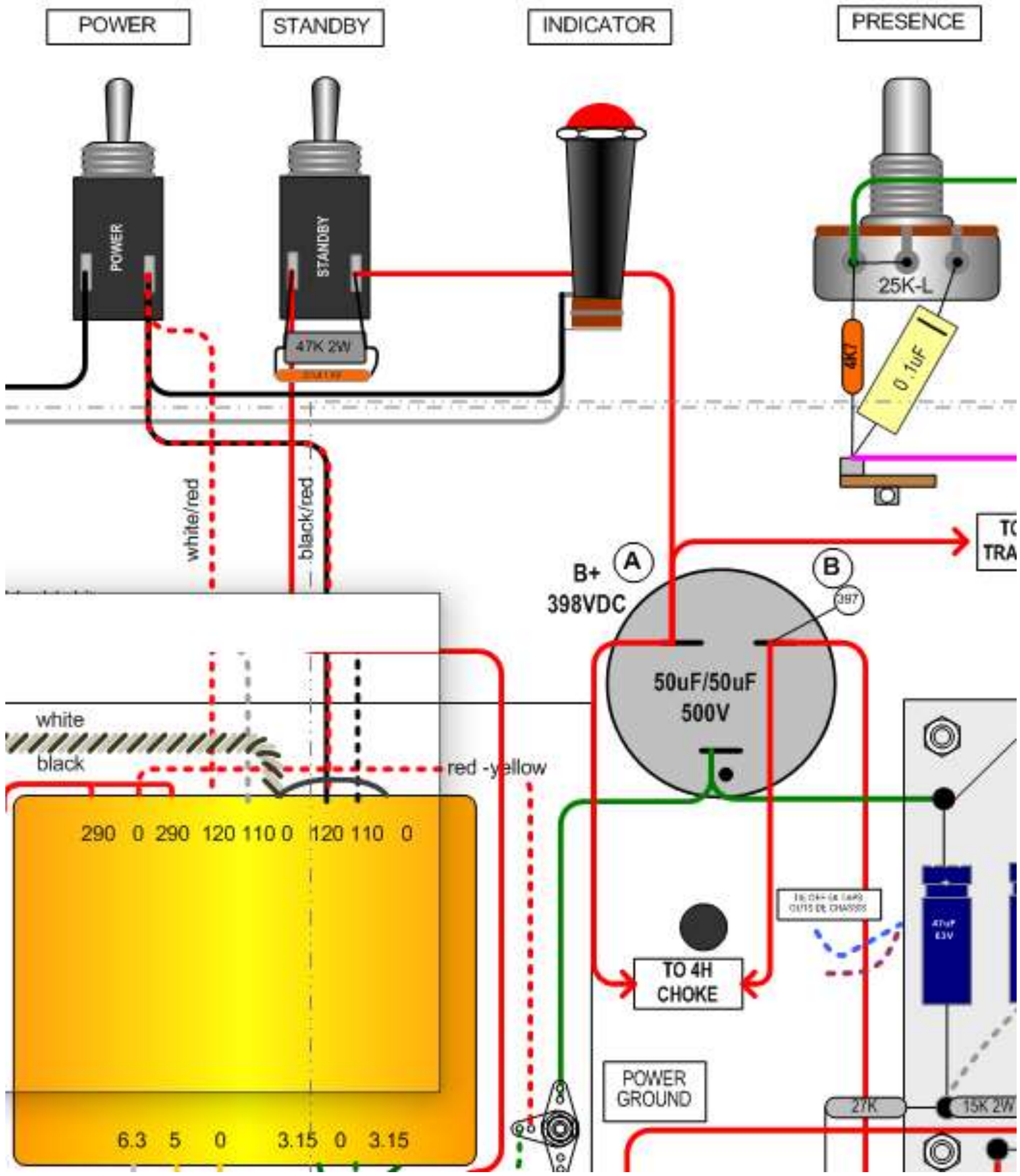
SS RECTIFIER

Route the Output Transformer Center tap lead along the chassis inside corners and connect this lead to the same lug the Stand-By switch is connected to. This is B+.

Connect a lead from the 4 H choke to the B+ lug and solder it. Connect the other choke lead to the second lug. Run a lead from the second lug to the turret board following the layout.

From the negative 50/50 uF Can Capacitor terminal, run a green wire to the #6 Power Ground point.

Solder all the Can Capacitor terminals.



The layout drawing shows dotted green and dotted red wires from PT as well as the ground wire from the capacitor bank on the board being grounded together. This is this same as the star ground on the PT nut.

Test the Power Supply

Check your mains wiring to the power transformer and ensure all wires are correctly and safely connected or tied off. Make sure there are no loose ends.

First read the section on "***Making a Voltage Measurement***" later in this manual.

Install a fuse (2A if 120 Volts Mains, 1A if 220/240 Mains)

Do not install a rectifier or rectifier tube.

Turn on the power.

Look for a glowing Indicator light and then prepare to measure the AC voltages to ensure they are within spec of the provided transformer schematics. Remember these are not under load (no tubes installed), so they will all be higher than expected.

Very carefully Measure AC Voltage as follows. There are lethal voltages in this Chassis.

Set your Meter to AC Volts:

Mains Voltage 120 or 220/240 VAC between lug N and L on the IEC socket

120 VAC across the 2 indicator terminals

5.0 VAC across pins 2 – 8 of the Rectifier socket (V6)

580 VAC minimum across pins 1 – 7 of the Rectifier socket (V6)

6.3 VAC across pins 4 – 5 of the EL84 sockets (V4, V5)

6.3 VAC across pins 4,5 – 9 of the 12AX7 sockets (V1, V2, V3)

These should all correspond approximately to the label on the Transformer.

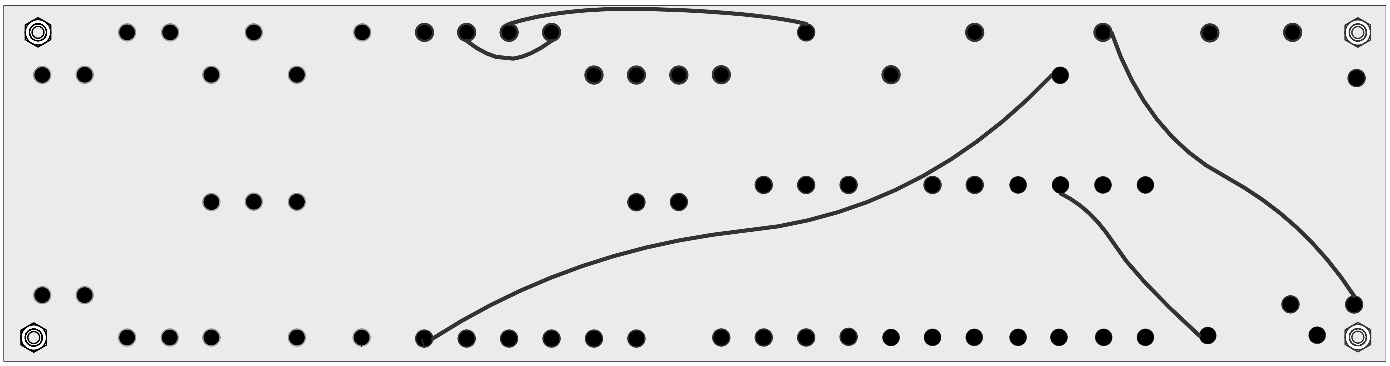
5. Assemble the Turret Board

If you do not have a pre-built Trinity amps turret board, now is the time to build it.

Identify if it is labeled as an ROHS board or not.

First, install jumper wires on the underside of the board. Follow the pictures below.

Note: Some builders prefer to install jumpers on the 'Top Side', to do that, just use the large, colour layout diagram provided and make the connections above board.



Trinity Thor Showing *Underside* Jumpers

Install Components on Turret Board

Carefully identify all the board components, their values and their orientation. See the section on how to read Resistor and Capacitor codes if you need help. It is very good practice to measure each part to confirm its value. At a minimum, confirm the resistor values.

For the electrolytic capacitors (used for power supply, bypass caps) identify the Positive and Negative ends. These must be installed using the correct polarity. There will be a '+' sign, or indentation to identify the positive end of an electrolytic capacitor.

SOZO non-polarized capacitors have a line identifying the 'outer foil'. Feeding the signal via the outer foil creates a bit of a shield, minimizing any possible induced noise interference such as the 60Hz (or 50Hz) to it. As a rule of thumb it would be best to connect the outer capacitor foil to the incoming signal. For tone stack capacitors or bypass capacitors, connect the outer foil to ground.

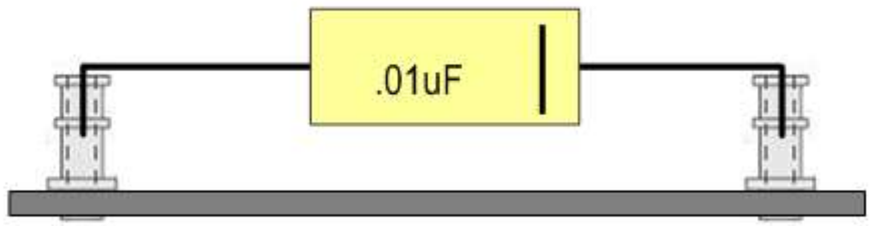
The polarity of the capacitor is therefore to be aligned according to the layout. Other non-polarized capacitors (Mallory, ETR) do not have this marking.

Resistors do not have a polarity, but it is good practice to align them so the colours can be read in a consistent direction e.g. Left to Right.

Align the board according to the layout diagram and follow the diagram that corresponds to your design exactly.

Prepare and place each component on the board by following the layout – from left to right.

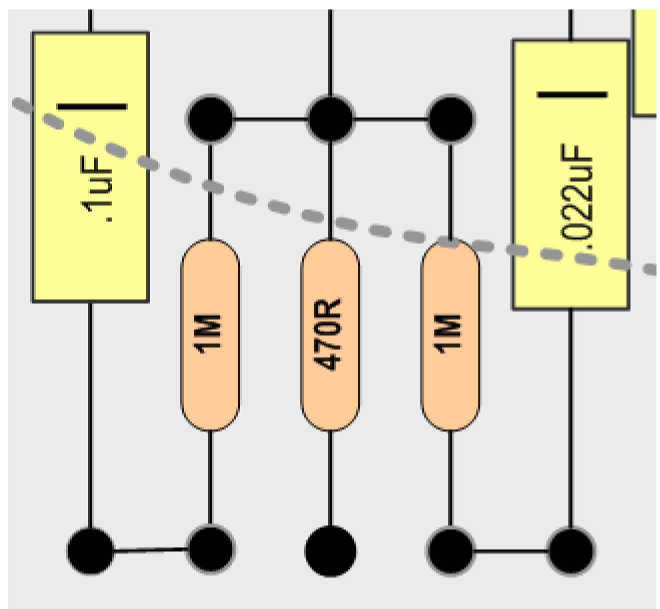
To prepare and place a component, center each component between the two turrets in the location it will be installed. Bend each component lead at 90 degrees so that it fits perfectly into the turret holes, squarely and neatly. Solder in place on the turret once all component leads and jumpers that connect in the one turret are in place.



For multiple component leads that must fit into one eyelet or turret, insert them all first and solder once when they are all in place.

It is good practice to work from one side to the other. Begin at the power supply end and start by installing two 47/63V bias supply caps . Pay attention to the orientation of the two bas filter capacitors. Then install the 15K resistor, the connecting jumpers and continue to work from left to right.

Next install 4K7 and 22uF capacitor, etc.



There are places where short jumpers are required to connect components together. To do this, strip bare, a short piece of 22 gauge wire, bend each end about ¼" or 5 mm at 90 degrees and insert into the turret and solder in place.

For example, around the Phase invertor components, notice the short pieces required to connect parts together.

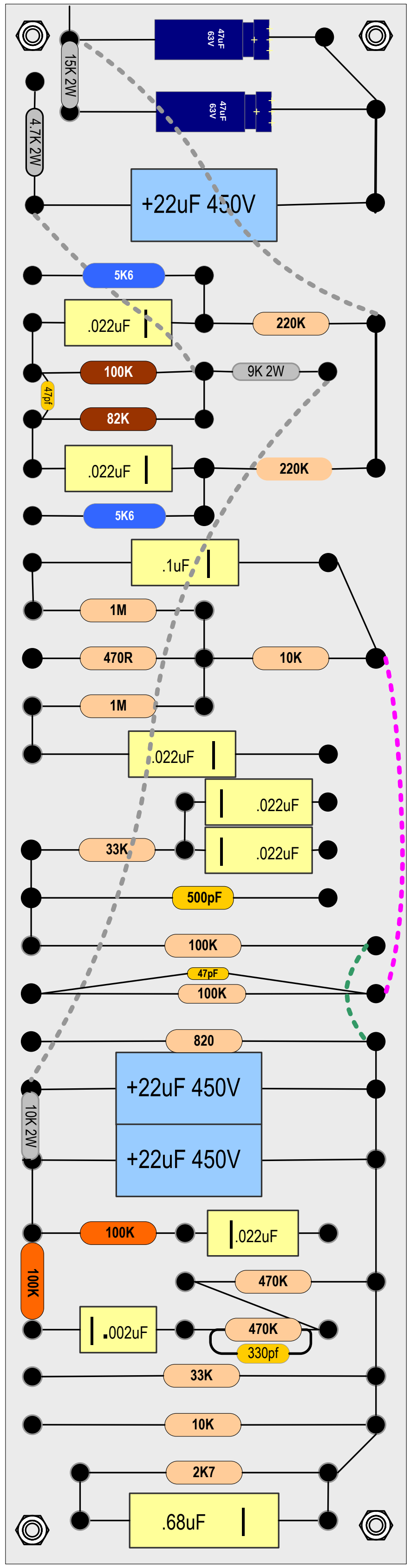
Note: Missing a jumper anywhere will cause the amp not to work correctly, so take your time.

There is also some very long ground buss connections. To install this buss, strip a long 22 gauge wire, bend one end over at 90 degrees and solder it in place in the last turret. Then, using a pair of needle nose pliers, pull the buss tight and align it over top and in-line with the turrets. Then solder the second last turret and finish of the last turret with a small 90 degree bend into it and solder it in place. Now go back and solder all the turrets that the buss is supposed to touch. Cut away any that it is not supposed to touch.

Continue to build the board from Left to Right until all the parts are installed.

Continuously check the location, the part, orientation and value of each component as you install it.

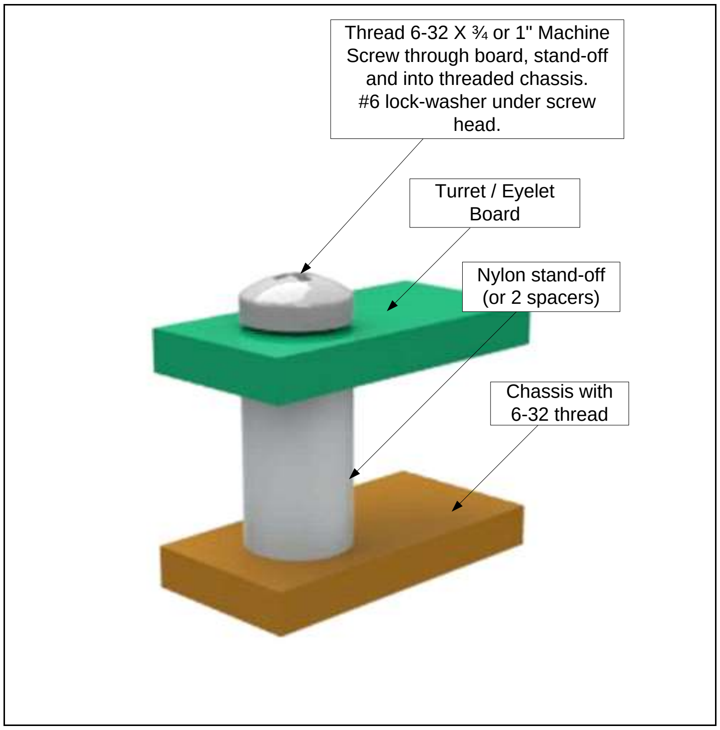
When completed, check against the layout, and then check continuity between parts and jumpers.


15K 2W
4.7K 2W
47uF 63V
47uF 63V
+22uF 450V
5K6
.022uF
220K
100K
9K 2W
47pf
82K
.022uF
220K
5K6
.1uF
1M
470R
10K
1M
.022uF
.022uF
33K
.022uF
500pF
100K
47pF
100K
820
+22uF 450V
10K 2W
+22uF 450V
100K
.022uF
100K
470K
.002uF
470K
330pf
33K
10K
2K7
.68uF

Install the Turret Board

The chassis is tapped to receive 4 - #6 machine screws. To mount the board, align the board mounting holes, stand-offs and tapped holes and then thread a #6 X 1" machine screw through board, stand-off and into the threaded chassis. Tighten to keep it in place and repeat for each corner.

Use a #6 lock washer under the head of the machine screw.

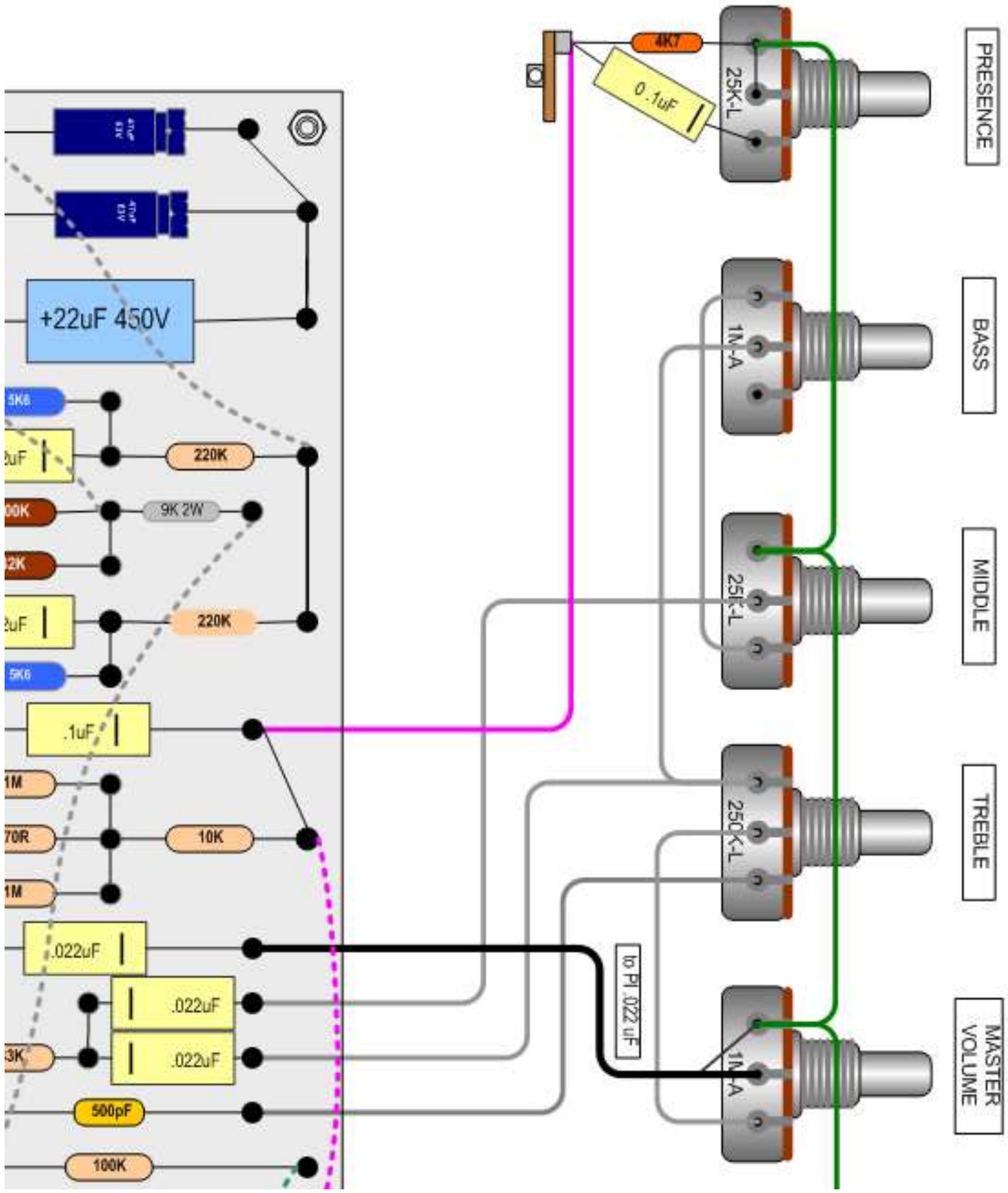


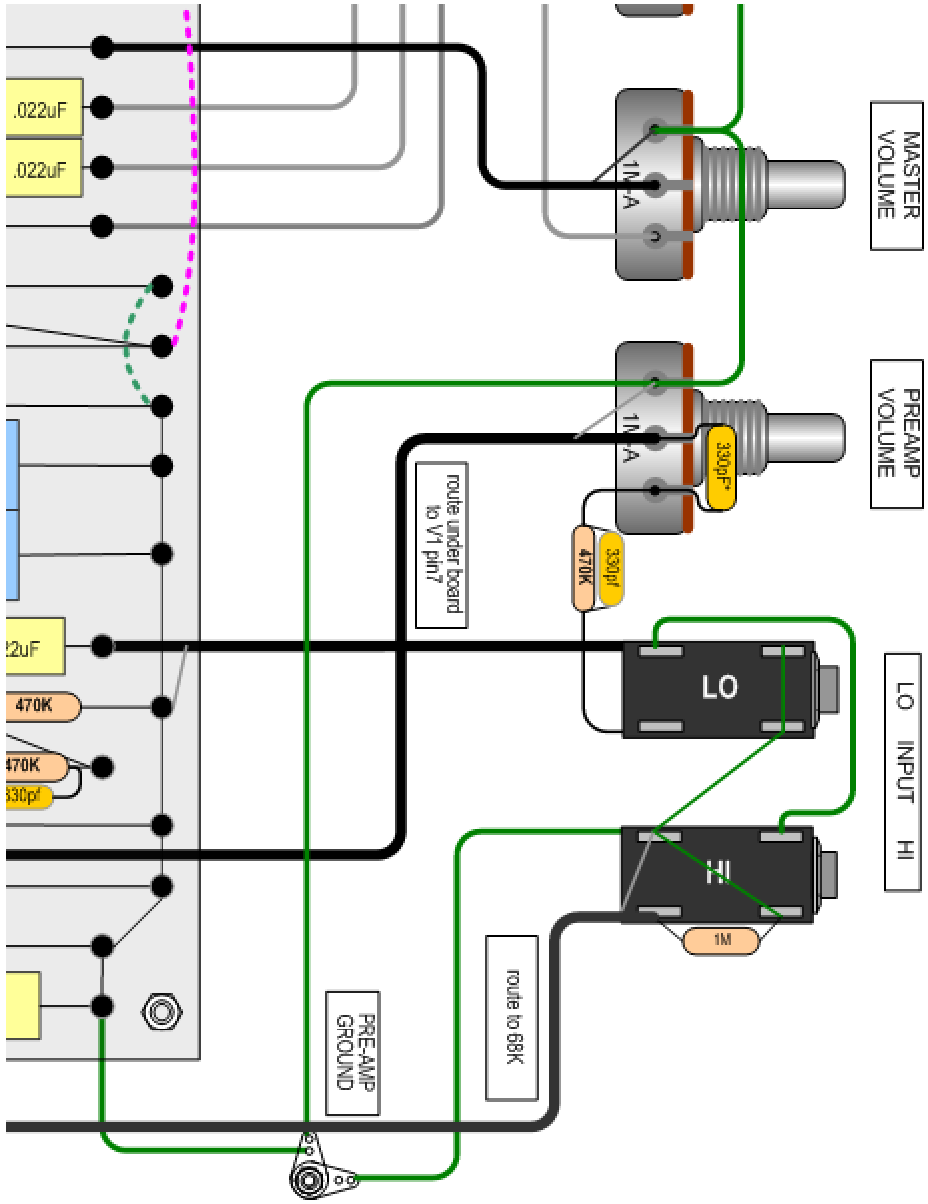
Alternative: You may be able to install the board using an alternate method: The #6 X 1" stand-off bolts are screwed into the chassis to hold them in place. Then the ½" nylon stand-offs are installed over them and finally the board over top held in place with #6 lock nuts. Install the turret board on the spacers and tighten in place with #6 KEPS nuts.

6. Connecting the Turret Board

Now is the time to make the connections from the turret board to the tube sockets and control pots. Again, you will start at one end of the board and work your way around the board doing the point-to-point wiring going from board to tube pin. Start at the first turret at the pre-amp end of the board and locate the destination point. That will be your first connection.

Tip: On a copy of the layout, highlight the connections as you complete them to make sure they are done correctly.




.022uF
.022uF
1M-A
MASTER VOLUME
1M-A
330pF*
PREAMP VOLUME
470K
330pf
route under board to V1 pin7
LO
HI
LO INPUT HI
1M
470K
470K
330pf
route to 68K
PRE-AMP GROUND

Bias and Power Supply

Connect the 100K 2W and the 1N4007 diode in series on the 5-lug terminal strip. Pay attention to the orientation of the diode.

NOTE: DO NOT CONNECT COMPONENTS TO THE GROUND LUGS!!

Connect a 27K 2W resistor from the Bias Pot to the closest end of the 15K 2W on the turret board.

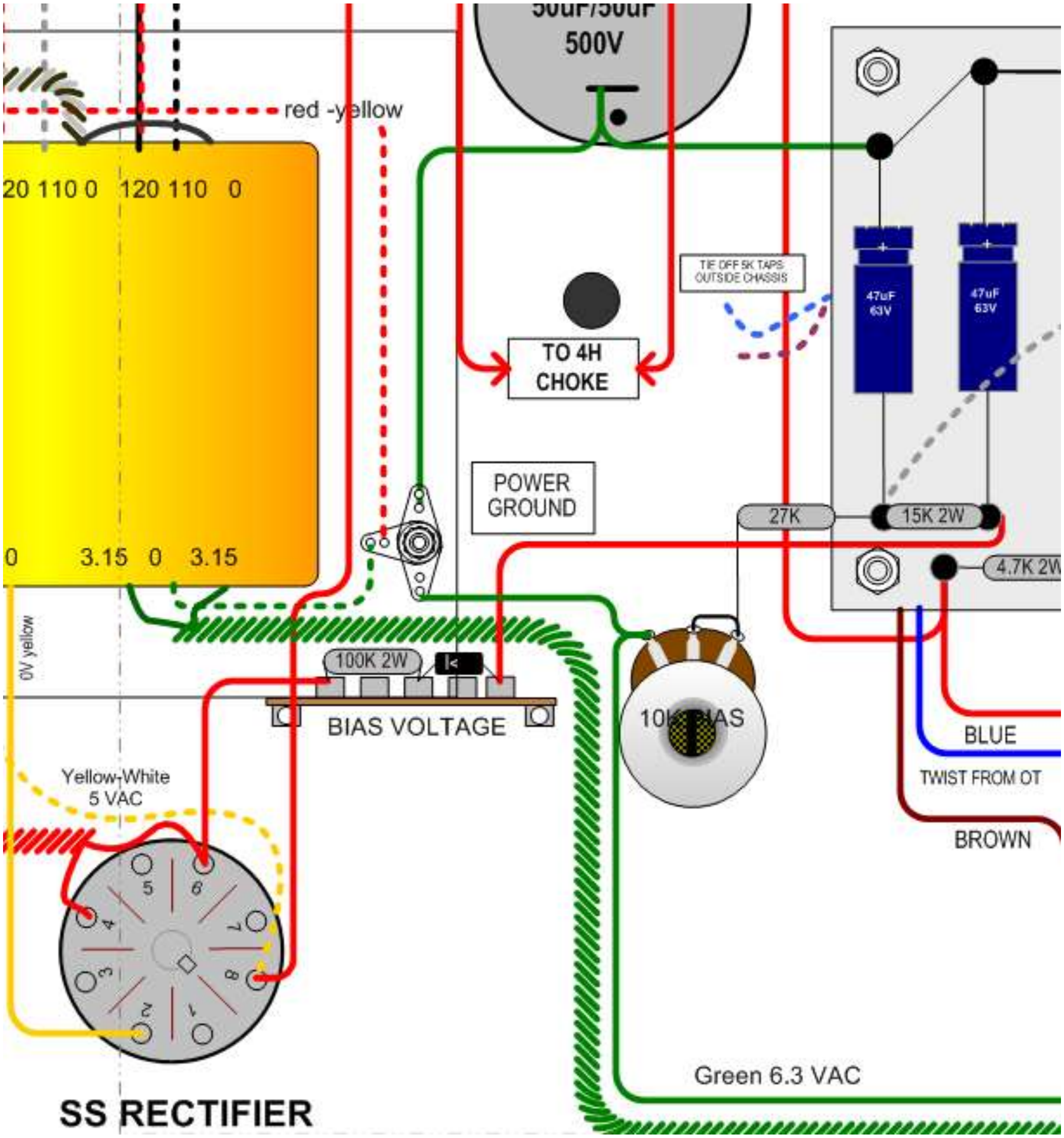
Put a jumper on the Bias Pot between the two lugs per layout

Run a wire from the diode on the terminal strip to the other end of the on board 15K 2W resistor

Run a wire from the 100K 2W to pin 6 of the rectifier socket.

Run a wire from the bias pot to the Power Ground lugs and run another wire to both 6V6 pins 1.

Run a wire from Pin 8 of the rectifier socket to a stand-by switch lug



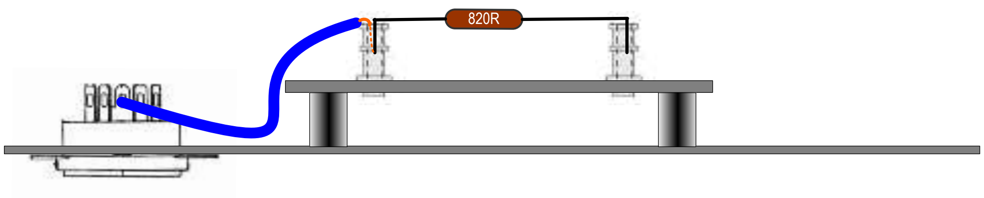
Pay attention to the orientation of the diode and bas filter capacitors.

Tube Sockets

Identify the first turret and its destination socket pin. In this figure above, it is V1, pin 3.

Cut a length of the supplied solid core wire so it will easily reach (with some extra) from the turret to the correct tube socket pin while laying flat to the turret board and against the chassis.

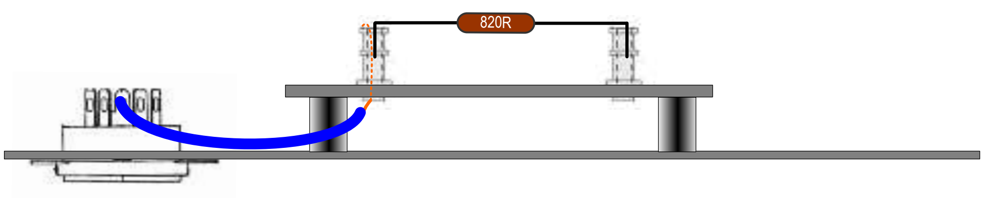
After installing the turret board on it mounting stand-offs, strip about 1/2" / 10 mm off one end and push it into the top of the turret so it touches the component lead. Then solder it well in place at the turret end only.



Once cool, press the wire so that it lies flat on the board and chassis with any excess tucked underneath the board.

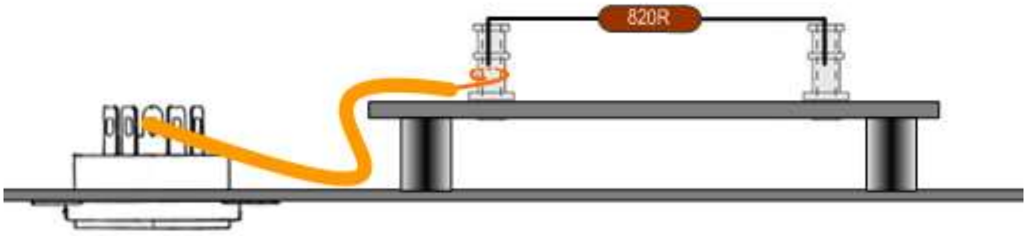
Repeat for each turret that has a connection to a socket pin or from the turret board to a Toggle Boost switch or terminal strip for screen resistor.

Alternative: Instead of connecting the leads to the top of the turret board, you may choose to install the leads before the board is installed, connecting the lead to the turret below the board and then to the tube pin or control. In this case, cut connecting wires to the control side in various colors to about 9" long each and to about 6" long to the tube pin side. Then, following the layout, install the connecting wires through the bottom, as described below, of the board leaving plenty of extra length, wire is cheap, and it'll save aggravation later. Then install the board and connect to the correct pins and control in sequence starting with V1, pin 1.



Strip about 3/4" / 15 mm off one end push it into the bottom of the turret so it touches the component lead and bend it over. Then solder it well in place at the turret top end only.

Alternative: Some people like to run the wire from the turret to the socket pin while laying flat to the turret board and against the chassis. Cut the wire about ½" / 10 mm longer and strip the end. Then make a hook at the end and put it through the socket pin. Squeeze the hook with a pair of needle nose pliers so that it is mechanically tight to the turret.

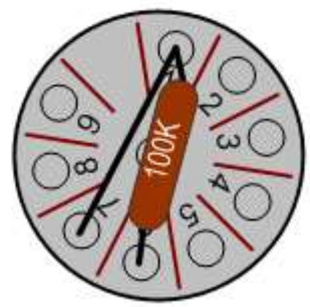


Solder it well in place. Trim off any excess wire.

Note: This procedure requires more soldering skill and may be more difficult to achieve than the previous methods.

Socket Mounted Parts

Sometimes it is necessary to mount a resistor on a socket such as on V2 100K plate resistor annnnnn270pf on V1. These should be done before connecting to the turret board.



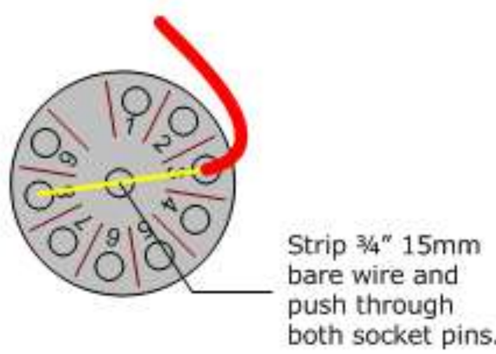
Take the correct resistor and bend one lead back towards the other. Now, slip the bent lead through the socket pin (1 in this case) while feeding the other two leads through the other pins (6 & 7 in this case.). Trim leads to within about ½" / 10 mm of the tube pin. Solder the apex of the bend (pin 1) to the socket and then solder the resistor lead that has no turret board connection (pin 7 in this case). Trim off excess.

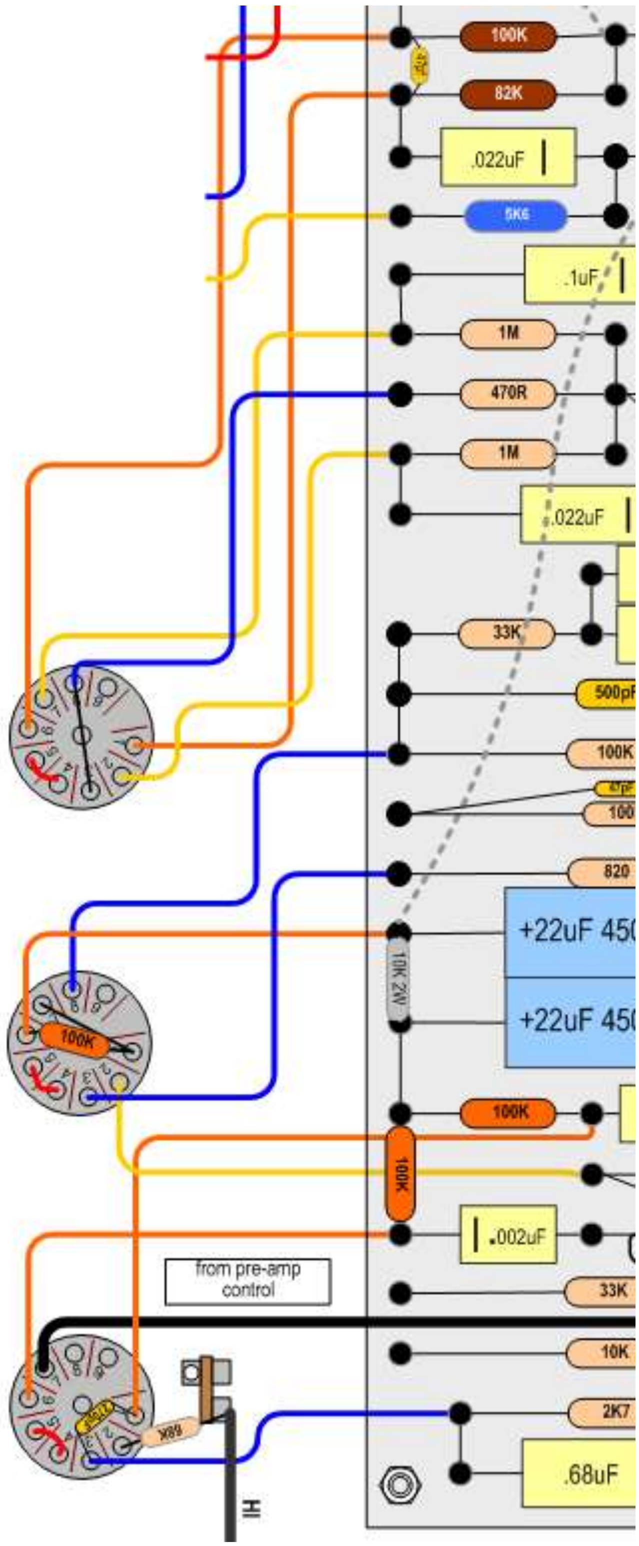
Now, route and wire from the turret board to pin 6 and solder in place. Trim off excess.

Repeat a similar process for 270pf on V1.

Phase Inverter Socket

The PI requires the cathodes to be connected together. When connecting from the turret, strip an extra ¾" 15mm bare wire and push through both socket pins and then solder in place.

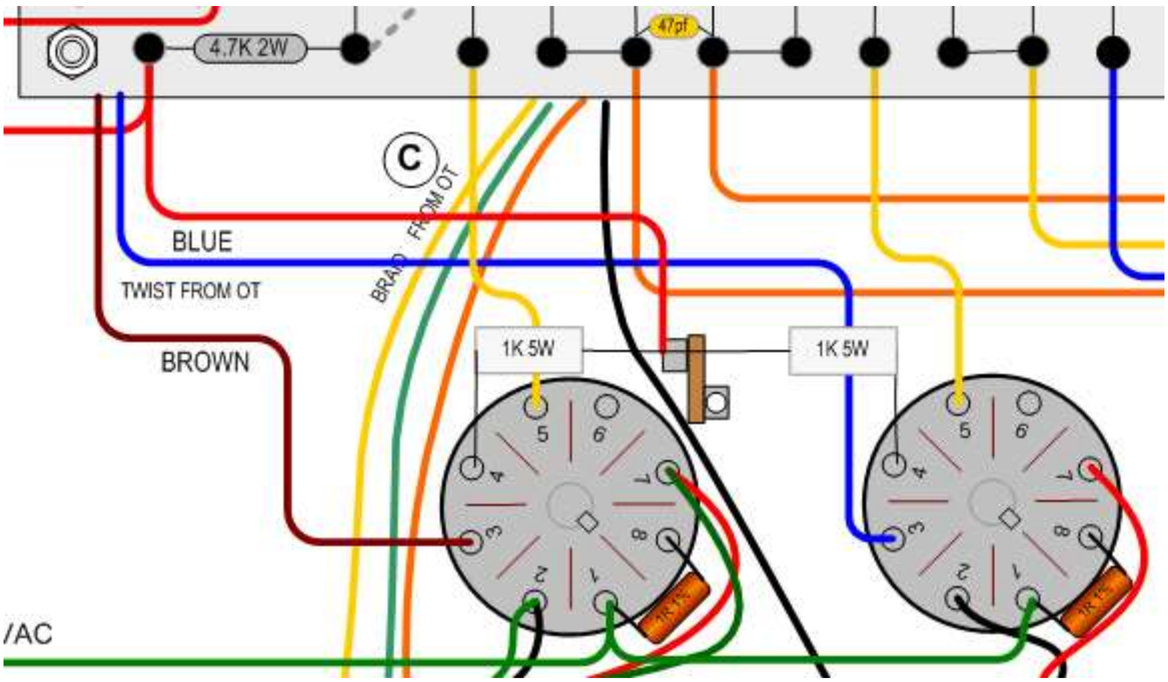



100K
82K
.022uF
5K6
.1uF
1M
470R
1M
.022uF
33K
500pF
100K
820
+22uF 450
+22uF 450
10K 2W
100K
100K
100K
.002uF
from pre-amp control
33K
10K
2K7
68K
.68uF
HI

6V6 Power Tube Wiring – Bias Resistor, Screen Resistor

Before connecting the power tubes to the turret board, some wiring is required. The tubes are connected as Fixed-Bias, Push-Pull. There are 2- 1 ohm resistors in place between pin 8 and ground to measure t bias current across the 6V6. These should all be done before connecting to the turret board.

There are two 1K screen resistors between the installed terminal strip and pin 4 of one of the octal power tube sockets. Wrap the lead around the tag and pin 4 of the socket. Repeat for the other octal socket. Solder in place



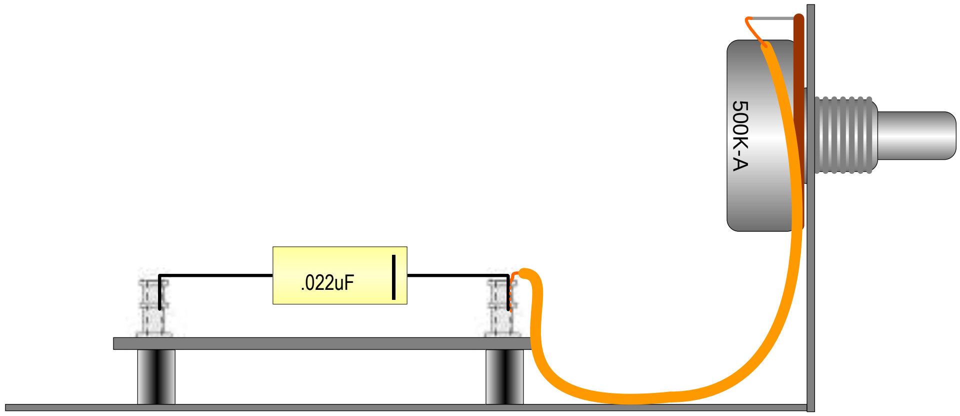
Connecting Controls - Potentiometers

The easiest way to connect these correctly is to follow the layout, and do one terminal connection at a time. Some of these terminals require more than one wire connection, so arrange them accordingly and solder only once.

Complete the ground control inter-connections and grounds first. Use Green wire as depicted in the provided colour layout.

Complete the control inter-connections next. Where such connection is also connected to the turret board, go ahead and make the connection using the following technique.

Review the diagram below showing a connection from a control terminal to the turret board.



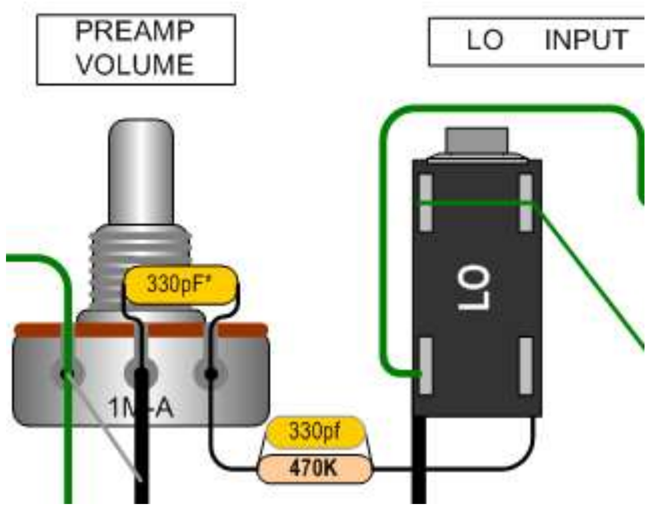
Strip about 3/4" / 15 mm off one end and wrap it around the turret. Then solder it well in place at the turret end , then run the lead to the control terminal.

Run the wire from the turret to the control terminal while laying flat to the turret board and against the chassis. Cut the wire about ½" / 10 mm longer and strip the end. Make a hook at the end and put it through the terminal pin. Squeeze the hook with a pair of needle nose pliers so that it is mechanically tight to the pin and solder it well in place. Trim off any excess wire.

Once the joint has cooled, press the wire so that it lies flat on the board and chassis with any excess tucked underneath the board.

Some controls require components that need to be installed for tone controls etc.. Pre-form these components to fit into place and use some heat shrink tubing to ensure they do not touch other parts.

Solder them in place following the layout provided once any lead to the turret board is also connected.



Finish off the remaining connections from the turret board to the controls using the same technique. Once a solder joint is cool, press the wire so that it lies flat on the board and chassis with any excess tucked neatly underneath the board.

7. Output – Transformer, Impedance Switch, Jacks

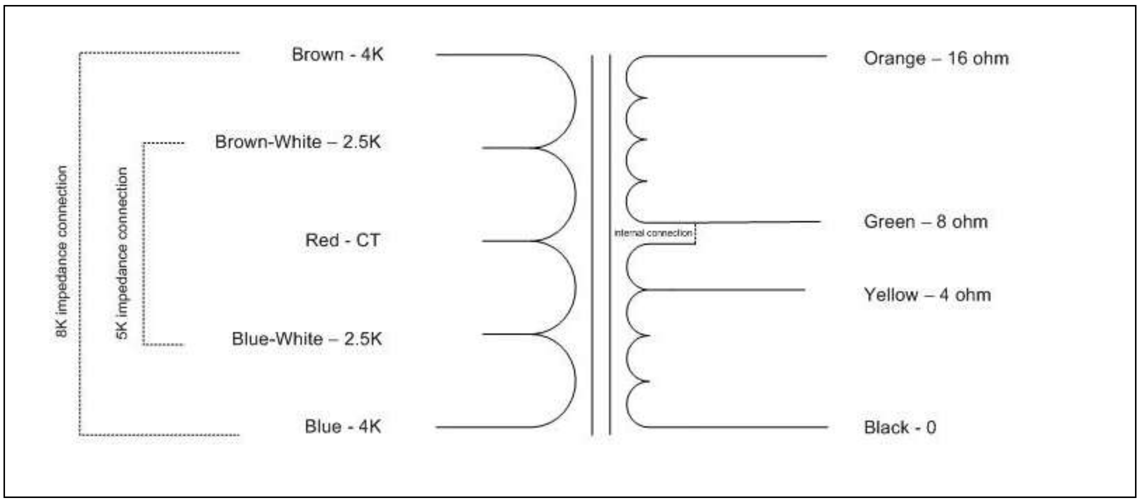
Refer to the Output Transformer schematic below.

The Primary 8K Impedance leads from the transformer should be twisted together and the secondaries braided and both fed through the two chassis grommets already.

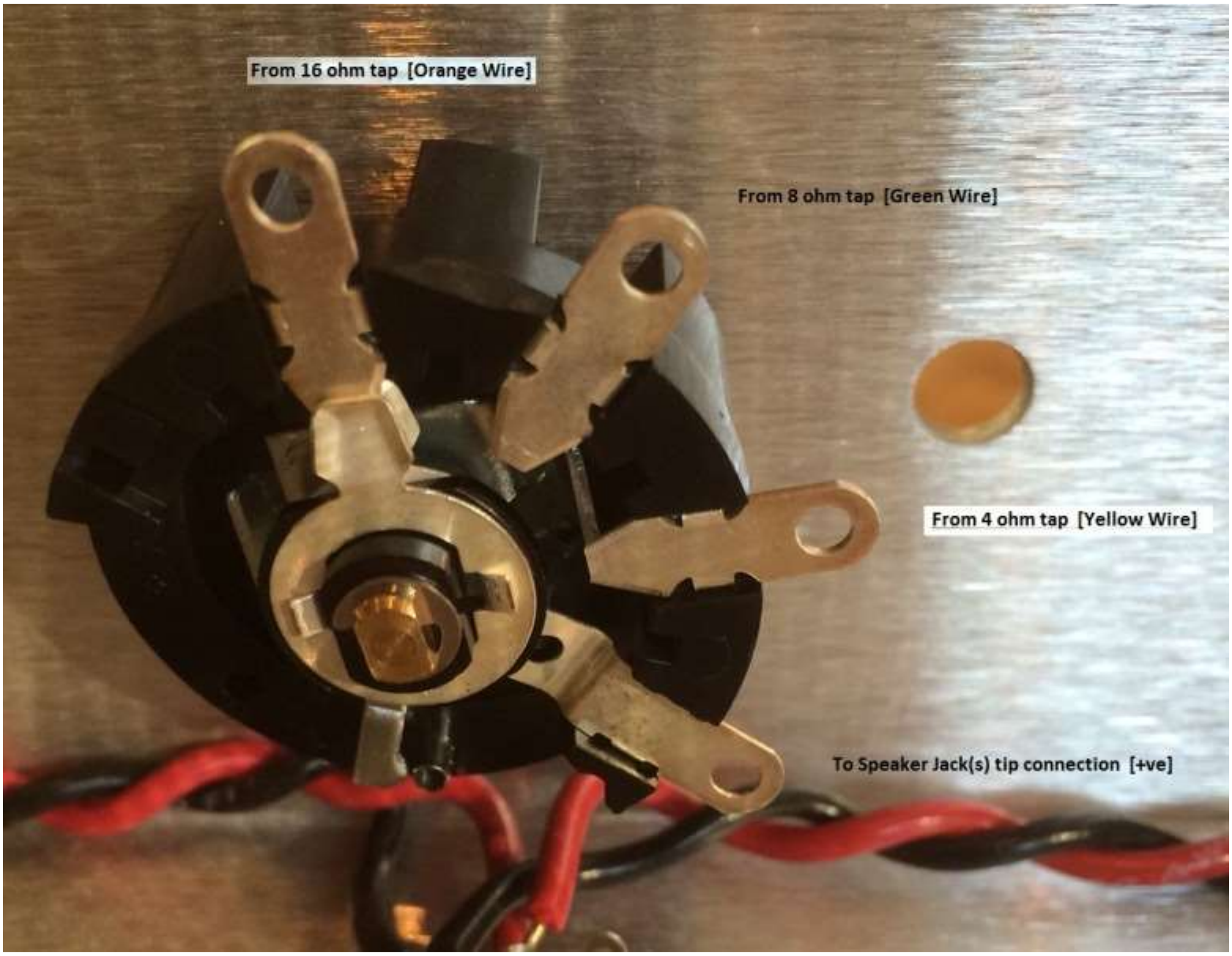
Route the 8K Impedance leads (Blue & Brown) to pins 7 of each Power tube. Blue goes to V4 and Brown to V5. It is good practice to leave enough lead length to reverse the leads to power tubes if necessary to eliminate amplifier squealing.

Solder the Blue output lead to V4 and the Brown to V5.

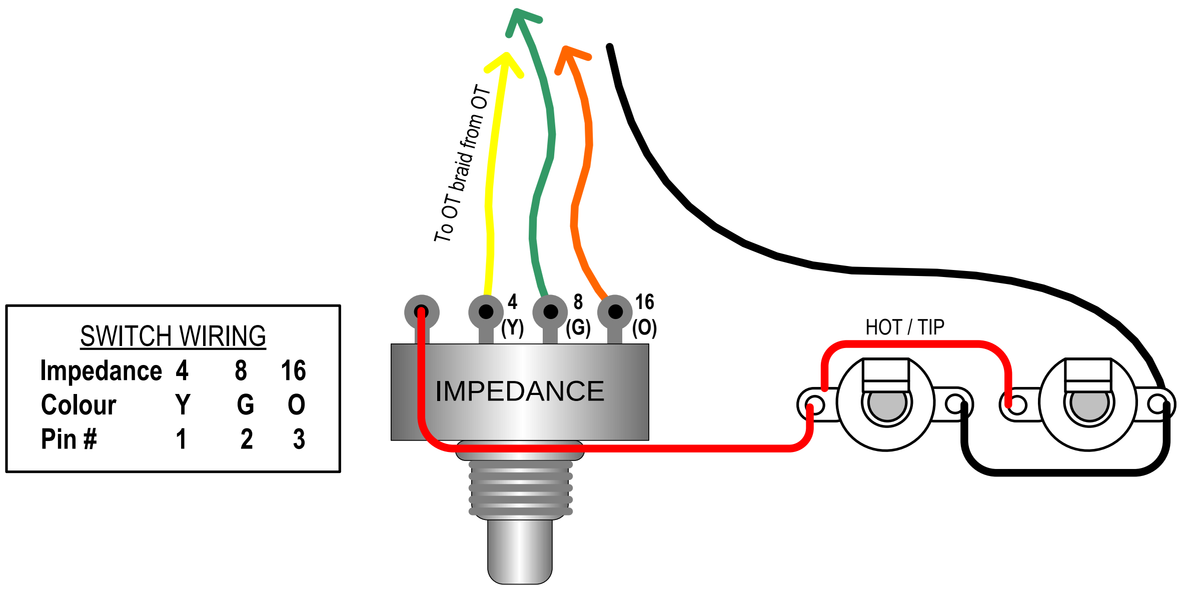
Refer to the Output Transformer schematic below and wire up the output impedance selector paying particular attention to the leads for the correct impedance.



Connecting the Impedance Selector **Referring to the Output Transformer schematic, wire up the Impedance Selector to the transformers and output jacks paying particular attention to the leads for the correct impedance. Refer**



to the diagram below for the connections.



Connect from the center pole of the switch to the Tip position of the pair of output jacks. Use some cut-off stranded wire and strip enough wire to bridge between both jacks. Connect from the output transformer's Common / Black lead to the Ring position of the pair of output jacks. Strip enough wire to bridge between both jacks. Follow the layout and remember the speaker jacks common are mechanically and electrically connected to the chassis ground.

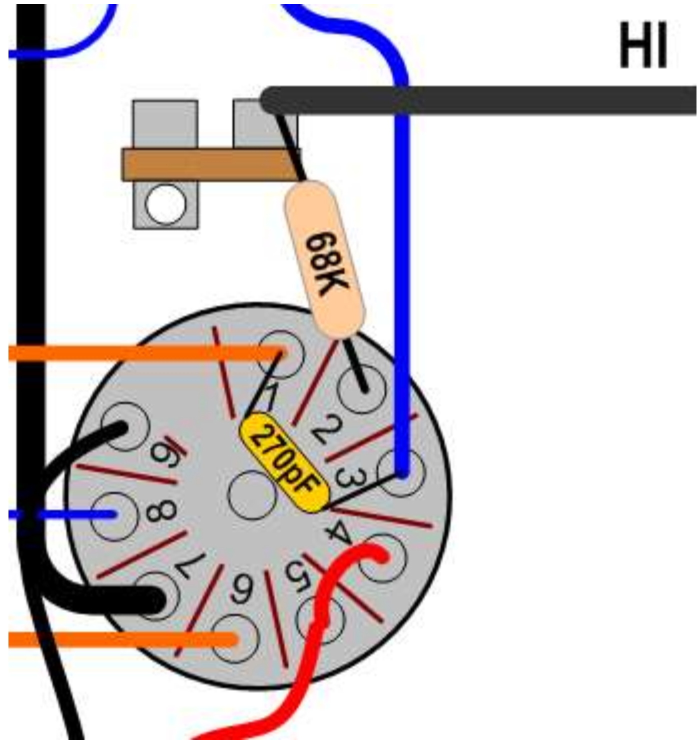
Check your speaker jack with and without a speaker plugged in to make sure it isn't shorted.

Output Jacks

The Switchcraft Output Jacks have 2 terminals. The contacts open when a ¼" plug is inserted into the jack. The Tip connection is at the very end of the plug and is normally 'positive' polarity. This is sometimes referred to as the 'Hot' side. The other part of the plug is typically ground or 'common'.

8. Input - Jacks and Input Grid Resistors

Input Grid Resistors



In step 1, a 3-lug terminal strips was installed using the socket mounting screws and #4 KEPS nuts. These terminal strips will hold the 68K HI Input Grid resistor.

Connect a 68K Carbon film resistor between the two terminal strip tags and the Grid / input pin 2 of V1. Make the ends that connect to the pin 2 as short as possible. Solder pin 2 well. Do not solder at the terminal strip end yet.

The terminal strip also provides an excellent mounting place for the co-axial cable coming from the input jacks in the next step.

Input Jacks

To wire up the input Cliff Jacks, it is easiest to remove the jacks, wire them with the resistors, jumpers and co-axial cables and then reinstall them. For reference, in the figure below, they are shown in position in the chassis.

Cliff Jacks have 2 normally closed contacts and 4 terminals. The contacts open when a ¼" plug is inserted into the jack. The Tip connection is at the very end of the plug and is normally 'positive' polarity. This is sometimes referred to as the 'Hot' side. The other part of the plug is typically ground or 'common'.

Set the spacing of two input jacks to be approximately equal to the spacing on the chassis and orient the two jacks so that the terminals face towards you.

Strip a 3" / 75mm solid wire and then bend 1" / 20mm at about 45 degrees. Install it through all 4 ground terminals closest to the front while feeding it into the lower, top- tip terminal. This is the Input Ground buss.

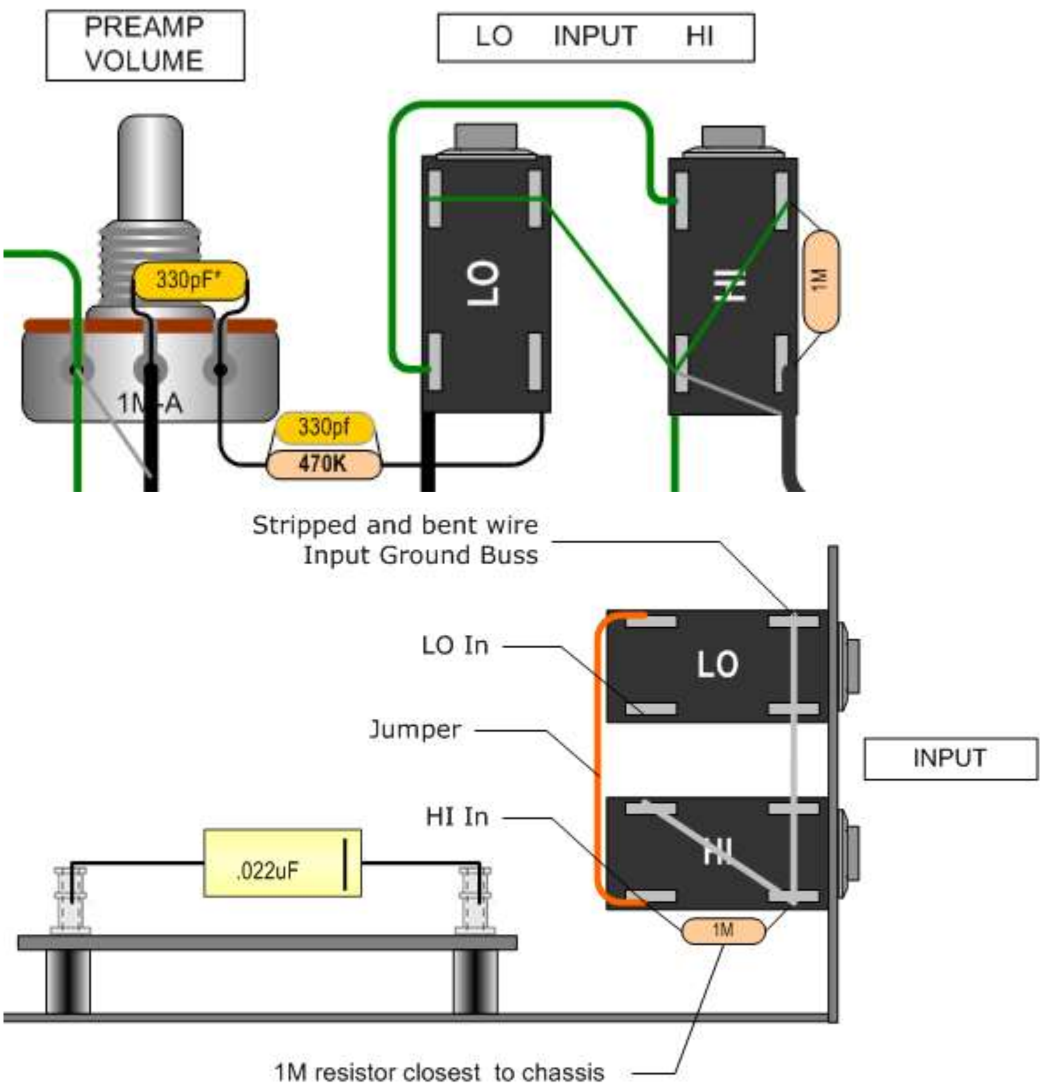
Install a 1M Carbon film resistor across the lower Tip and Sleeve terminals of the HI input jack.

Take a length of Green wire , long enough to reach the Pre-Amp ground or Ground buss on the turret board and strip one end, hook it into the point where the 1M and Input Ground buss connect on the HI input jack. Solder this joint well.

Cut another piece of Jumper wire long enough to reach the other terminals of both jacks as per the layout. Solder in place. Run a jumper from the LO input jack Tip to the HI input jack Sleeve asper layout diagram.

Use the pre-prepared piece of co-axial wire (follow Preparing Co-Axial Wire instructions below) and hook and solder the center core wire to the HI jack where the 1M and Jumper connect. Solder the outer shield to the Input Ground buss at a convenient ground buss location. Be very careful not to apply too much heat and melt the core insulation causing a short.

Use the other pre-prepared piece of co-axial wire and hook then solder the center core wire to the LO jack, Tip terminal. Solder the outer shield to the Input Ground buss at a convenient location.



Ensure all joints on the input jacks are well soldered and shiny.

Align and install the input jacks into the chassis in the correct locations. Only one spacer ring will probably be required to mount the jack flush with the panel, then insert the plastic grommet followed by the chrome nut.

Securely tighten the chrome nuts so the jacks will not come loose.

Connect a 330pf cap and 470K pair from the LO input sleeve to the Preamp Volume Pot following the layout.

Do not connect the shields at both ends of the cable or you will induce hum.

Route the co-axial cable around the end of the turret board as per layout provided, and then hook the center core wire and solder the correct input cable to the 68K Grid resistor.

Preparing Co-Axial Wire

Use RG-174U shielded wire from the input jacks to the tube.

The co-axial shield / ground wires on the input jacks go to the pre-amp ground along with the turret board ground at the pre-amp end.

To prepare the co-axial cable for connections:

1. Very carefully cut back the outside plastic covering at both ends by about 5/8" to reveal the braided shield.
2. At one end, pull back the shield and cut it off at the 5/8" mark. Put some heat shrink around the end covering the area where it was cut off so no shield ‘whiskers’ can short out the input signal.
3. At the other end, pull back the shield but poke a very fine screwdriver or a pick, into the braided shield and work out a ‘hole’. Fish the inside conductor through this hole and pull it through.
4. Twist the braided shield together.
5. Take the Inside /Core and strip the plastic covering at both ends by about 1/4"
6. Apply some heat and solder to the core wires & braid just to stop them from fraying.
7. Put some 1/8” diameter shrink tubing over the jacket and core.



Final checkout

When you finish assembling the amp, double-check the wiring and the components.

Trace or highlight the connections and wires on a copy of the layout provided with the amp to ensure the amp is wired correctly. Check everything at least once!

Measure the resistance from each part that has a ground connection to the chassis. Put your probe on the parts lead. All readings should be less than 1 ohm, typically 0.5 ohms. Grounding is very important and often one connection is missed. Check thoroughly.

Make sure the #8 Mains Ground at the chassis and #6 Power Ground are **very** tight.

Power Up

****** RE-READ SAFETY WARNING AGAIN! ******

Working Inside A Tube Amplifier Safely

Working inside a tube amplifier can be dangerous if you don't know the basic safety practices. If you aren't prepared to take the time to learn and apply the right precautions to keep yourself safe, don't work on your own amp. You can seriously injure yourself or get yourself killed.

Unplug Pretty self explanatory. Do not, ever, ever, leave the equipment plugged in and start work on it. Leaving it plugged in guarantees that you will have hazardous voltages inside the chassis where you are about to work.

Sit If the amp has been turned on recently, the caps will still have some high voltage left in them after the switch is turned off. Let it sit for five minutes after you turn it off.

Drain When you open up an amp, you need to find a way to drain off any residual high voltage. A handy way to do this is to connect a shorting jumper <u>between the plate of a preamp tube and chassis ground</u>. This jumper will drain any high voltage to ground through the 50k to 100K 2W plate resistor on the tube. To do this successfully, you will need to know which pins are the plate pins. Look it up for the amp you're going to be working on. You'll need to know this for the work anyway. Leave the jumper in place while you do your work. Remember to remove it when you finish your work. You can also permanently install a 220K 2W resistor on the B+ line to chassis ground to do this.

Test Take your multimeter and ground the negative, black lead to the chassis. With the positive, red lead, probe the high voltage cap terminals or leads and be sure the voltage across them is low. Preferably to less than 10V.

Close First take the shorting jumper out. Put the chassis back in the cabinet, making sure all of your tools, stray bits of solder, wire, etc. are out of it. You don't have to actually put all the screws and so forth back in if you believe more work might be needed, but make sure that the chassis is sitting stably in the cabinet and won't fall out.

First note that most meters have three input jacks (some have four) one is marked COM, the BLACK lead goes there. Another jack is marked V, ohm, mA, the RED lead goes there for most measurements. The third jack is a high current jack usually marked 10ADC (sometimes it is 20 or some other number). This jack is used only for high current measurements. The four jack models use separate jacks for current measurements, this makes accidentally setting the meter to a current mode harder, but it still can be set to resistance. For vacuum tube electronics we can usually ignore the high current mode. Put your test leads into the COM and V(ohm)mA jacks and leave them there.

Making a Voltage Measurement

Before attempting to make a voltage measurement, think about the anticipated result.

- Is this a DC or AC voltage?
- How much voltage will be present?
- If things are not working correctly what is the highest voltage that I might find?

A voltage is ALWAYS measured between TWO points. Is one of those points CHASSIS GROUND? This is the most common case. If not, can you make a different measurement such that one of the measurement points IS GROUND? If your measurements are all referenced to CHASSIS GROUND, you can then connect the black lead (Negative or Common) to the CHASSIS with a clip and probe the other test point with the RED (Positive) lead.

1. Set the selector switch on the meter to the range that is higher than the maximum anticipated voltage of the appropriate type (DC or AC). If the maximum anticipated voltage is not known, set the meter to the highest range available.
2. Wherever possible connect the meter into the circuit when the circuit is OFF, then power up the circuit without touching anything.
3. Read the meter. If the reading is lower than the next available lower range on the meter you may set the meter to a lower range while the circuit is on. When doing this touch ONLY the meter with ONE hand, and be careful to only lower the meter one range, allow the readings to stabilize (2 or 3 seconds) before proceeding further.

Note: Accidentally setting the meter to a current or resistance range can damage the meter, and the circuit it is connected to. If the circuit has sufficient power the meter can explode or burst into flames. I know from experience that this will happen if you try to measure the resistance of the wall outlet. Most modern meters are "fuse and diode protected" this is to prevent fireworks, but will not usually save the meter from an overload of this magnitude.

REMEMBER: DO NOT OPERATE YOUR AMP WITHOUT A LOAD

Install a 2 AMP SLO BLO fuse. Use 1 AMP SLO BLO if operating at 220-240 VAC

Note: If you see or smell smoke when you turn on the amp, turn it off immediately and re-check the connections.

You should have previously tested the Power Supply AC voltages, so this step is included for completeness.

1. With no rectifier in place, apply power and test the High voltage AC and ensure that it is on the correct pins of the rectifier and in the correct voltage range (290 VAC). Test ALL the filament voltages (rectifier, power and pre-amp tubes) and ensure they correct are on the correct pins for all tubes.
2. If all is OK, then shut off, install the rectifier and apply power without the preamp or power tubes installed. Wait 10 seconds and turn on the Stand-By switch.

Check the B+ voltage at the first filter cap terminal before the 1.5K 5W filter resistor. Measure from the filter cap terminal with the positive or Red lead, to Chassis ground with negative or Black lead.

Check the plate voltages on the tube sockets. Measure from pin to Chassis ground.

12AX7, AY7, AT7 etc plates are pins 1 and 6 and 6V6, 6L6, KT66, EL34 etc plate is pin 8. **The plate voltages will be higher than the voltages listed on the schematic because there is no load provided by the tubes**.

Leave the amp on for a few minutes and make sure the negative Bias voltage is being generated and check that it gets to the power tube grids and is adjustable with the bias pot in the - 40V range. **Set it to the most negative grid voltage possible.**

3. If everything is okay, power off the amp.
4. **Connect a speaker** or 8 ohm load. Install the three preamp (12AX7) and two power tubes (6V6) and power on again.
5. Using a DMM set to DC mV, clip the BLACK (negative) test probe onto chassis ground. VERY carefully clip the RED (positive) other onto pin 8 of a 6V6 power tube. Check and slowly move the pot with a small screwdriver until bias current is 18-22mA. (The bias taps convert mA to mV so you'll be reading on the millivolt scale. The readings are as follows:

6V6 Bias	15 ma min	23 ma max

6. With the bias set correctly, you can test all the voltages and compare them with the voltage chart. Measure and write down the B+ levels at each filter cap. Also write down cathode and plate voltages at all stages and also the screen grid voltage at the power tubes. Compare all the DC voltages to those on the supplied Voltage Chart. As a rule of thumb, the triode gain stages should have ~1V on the cathode, 0V on the grids and ~1/2 to 1/3 B+ on the plates. If the DC voltages are not in the ballpark (within 50% of the general rule just stated), take some time to check the circuitry of the offending stage.
7. With all tubes installed, and **speaker connected**, volume setting at minimum and NO instrument plugged in, power up again. Listen for sounds that may indicate a problem. Loud transformer vibrations or humming or other crackling sounds. Observe if any of the components besides the tubes are getting hot – check the power resistors. Carefully check and make note of the voltages on all the tubes.

   This is the time to carefully check and make notes of the voltages on all the tubes.

8. If all seems in order, and the fuse has not blown, turn the volume up a bit. Plug in a guitar cable. Touch the input with your hand to see if you can induce some hum, or static sound. If everything seems fine, it's time to plug in your guitar and take the amp for a test run.

Hopefully, there are no problems but if you think there are e.g. hum, squeal etc., then move on to the troubleshooting section of this manual.

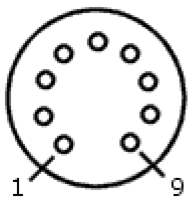
Trinity Thor Voltages

TRINITY THOR, FIXED BIAS, S.S. RECTIFIER, CHOKE FILTER										
	1	2	3	4	5	6	7	8	9	DISS
V1	226		1.9			287		3.2		
V2	170		1.2			308	170	171		
V3	225	24	39			219	27	39		12V @ 10K
V4			392	396						JJ 6V6S
V5			390	396						-35V bias voltage
V6										solid state rectifier
KEY VOLTAGES	A=398	B=397	C=344	D=308	E=299					120V AC MAINS

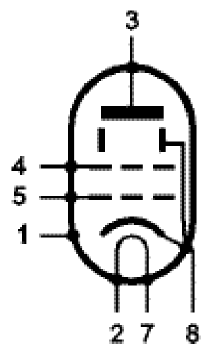
Trinity Thor Voltage Chart

Use this to record your measured voltages.

AC Mains Voltage	VAC
B+ No tubes installed	VDC
B+ All tubes installed	VDC



12AX7/ECC83



6V6

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 (12AX7/ECC83)									
V2 (12AX7/ECC83)									
V3 (PI) (12AX7/ECC83)									
V4 (6V6)									
V5 (6V6)									
Rectifier									

WARNING

Read this Information Carefully

The projects described in these pages utilize **POTENTIALLY FATAL HIGH VOLTAGES.** If you are in any way unfamiliar with high voltage circuits or are uncomfortable working around high voltages, **DO NOT RISK YOUR LIFE BY BUILDING THEM.** Seek help from a competent technician before building any unfamiliar electronics circuit. While efforts are made to ensure accuracy of these circuits, no guarantee is provided, of any kind!

USE AT YOUR OWN RISK: TRINITY AMPS EXPRESSLY DISCLAIMS ALL LIABILITY FOR INJURY OR PROPERTY DAMAGE RESULTING FROM THIS INFORMATION! ALL INFORMATION IS PROVIDED 'AS-IS' AND WITHOUT WARRANTY OF ANY KIND.

Builders Guide General Troubleshooting

For a discussion on Guitar Amp Troubleshooting, please refer to our Web-Site Support Page document **Builders Guide General Troubleshooting**

Tweaking the Thor Overdrive Intensity and Tone

with parts from Rob Robinette

It's easy to adjust the JCM800 preamp overdrive and tone by changing the value of a few components.

The two 470k Attenuator resistors R29, R30, can be reduced to increase preamp gain and increased to reduce gain. The first Attenuator resistor and 1M volume pot form a voltage divider so increasing the Attenuator resistor will cut gain. Common values are 330k (for added gain), 470k (factory value) and 560k (for less gain). If 560k doesn't cut the gain enough then I recommend also adjusting the second Attenuator resistor located just before the 3rd preamp stage at the top of the circuit board (highlighted in magenta in the layout below). Try anything up to 1M to reduce preamp gain.

Increasing gain is more difficult in the JCM800 because the preamp is already pushed near the limit of stability. That's why we added a stability or "snubber" cap on the V1 tube socket.

Reducing either Attenuator resistor from 470k to 330k will add gain. If you alligator clip a 1M resistor in parallel with the 470k you'll get 320k to see if you like the mod. 270k will probably be too much gain but you can give it a try by clipping in a 680k in parallel.

If you need to tame the JCM800 high end start with reducing or removing the <u>second</u> 470pF Treble Peaker cap C22. Making the peaker cap smaller will raise the frequency cutoff of the high frequency bypass making the highs less prominent. Another option is to put a resistor in series with the peaker cap to lower the "volume" of the high frequency bypass. Try a 120k 1/2 watt and tune to taste from there. If you need even less highs you can remove or reduce the first Treble Peaker cap located between the Preamp Volume pot and Input jack from 470pF to 330pf or 270pF. The Bright cap on the Volume pot, C22, can also be reduced but keep in mind that cap only comes into play at lower volumes. It's there to keep the tone from getting too dark at lower preamp volume. Marshall used a .001uF Bright cap so common values used are 330pF and 270pF. You can also put a resistor in series with the Bright cap to lower the "volume" of the high frequency bypass.

If you just need to reduce a little ice pick then an Ice Pick cap around the NFB resistor can do that without too much side effect on the overdrive tone. Its value can range from 47pF (stock in Thor) to 470pF, a higher value will dip lower into the mid-highs for more high frequency reduction. You can alligator clip the cap in temporarily to find what you like.

If you are a very high gain player you can cut some low end by reducing the V1A bypass cap (C1) from .68uF to .47uF. This is actually a fairly common JCM800 mod. You can also decrease the value of the second Coupling cap (C8) from .022uF to .0022uF. This lower value was used by Marshall in many factory Plexi, Master Volume and JCM800 preamps.

To simplify tuning preamp brightness consider building the amp without the Bright cap and Treble Peaker caps then add brightness in steps. Start by tuning the high gain tone by adding the second Treble Peaker cap, then if needed add the first Treble Peaker and find the right value for your taste. To trim ice pick add an Ice Pick cap around the NFB resistor. Then if the low volume tone is too dark add the Bright cap to the Volume pot and verify the high gain tone is still good.

These are very simplistic modifications you can do to your amp, let your ears be your guide:

- Change coupling caps; changing to smaller values reduces bass, changing to larger values adds more bass. Reducing the value of coupling caps can help eliminate "flabby" bass syndrome.
- Change cathode bypass caps. Adding a cathode bypass cap to a stage that doesn't have one will let the stage have more gain. Just like coupling caps, making the value larger adds bass - generally 25uF allows almost all bass through, .68uF are used in some Marshalls for a more midrange boost and 1uF and 5uF are used in some high end fusion type amps. Again, smaller values can help reduce "flabby" bass.
- Change cathode resistors - larger values reduce gain, smaller values give more gain. A "trick" is to connect a 5K+pot wired as a variable resistor instead of the standard cathode resistor - now you can turn the pot and dial in the perfect tone. After dialing the sound, remove the resistor and pot and measure it. Substitute the nearest standard value resistor in place of the pot plus a resistor.
- Add grid stopping resistors to help tame oscillation. If you have oscillation with your amp, you can sometimes help it by installing grid stopping resistors. The grid stoppers can also subtly roll off high end as well.
- Add high frequency roll off caps in parallel with the plate resistor. This is sometimes used to "mellow" out a stage (reduces highs).
- Adjust the grid leak resistor. Reduce the value to attenuate the signal into the stage to control the gain.
- Use a shielded cable from your input jack to the first gain stage. This can reduce RF, buzz and general reduce noise.
- Replace all plate resistors with metal film types. This can help reduce hiss..

How to read Resistor Color Codes

First the code

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

How to read the Color Code

First find the tolerance band, it will typically be gold (5%) and sometimes silver (10%).

Starting from the other end, identify the first band - write down the number associated with that color; in this case Blue is 6.

Now 'read' the next color, here it is red so write down a '2' next to the six. (you should have '62' so far.)

Now read the third or 'multiplier' band and write down that number of zeros.

In this example it is two so we get '6200' or '6,200'. If the 'multiplier' band is Black (for zero) don't write any zeros down.

If the 'multiplier' band is Gold move the decimal point one to the left. If the 'multiplier' band is Silver move the decimal point two places to the left. If the resistor has one more band past the tolerance band it is a quality band.

Read the number as the '% Failure rate per 1000 hour'. This is rated assuming full wattage being applied to the resistors. (To get better failure rates, resistors are typically specified to have twice the needed wattage dissipation that the circuit produces.) 1% resistors have three bands to read digits to the left of the multiplier. They have a different temperature coefficient in order to provide the 1% tolerance. At 1%, most error is in the temperature coefficient - i.e. 20ppm.

How to Read Capacitor Codes

Large capacitor have the value printed plainly on them, such as 10.uF (Ten Micro Farads) but smaller disk types along with plastic film types often have just 2 or three numbers on them?

First, most will have three numbers, but sometimes there are just two numbers. These are read as Pico-Farads. An example: 47 printed on a small disk can be assumed to be 47 Pico-Farads (or 47 puff as some like to say)

Now, what about the three numbers? It is somewhat similar to the resistor code. The first two are the 1st and 2nd significant digits and the third is a multiplier code. Most of the time the last digit tells you how many zeros to write after the first two digits, but the standard (EIA standard RS-198) has a couple of curves that you probably will never see. But just to be complete here it is in a table.

milli, micro, nano, pico

1 mili Farad (or any other unit) is 1/1,000th or .001 times the unit. (10^{-3})

1 micro = 1/1,000,000 or 0.000 001 times the unit (10^{-6})

1 nano = 1/1,000,000,000 or 0.000 000 001 times the unit (10^{-9})

1 pico = 1/1,000,000,000,000 or 0.000 000 000 001 times the unit (10^{-12})

Table 1 Digit multipliers	
Third digit	Multiplier (this times the first two digits gives you the value in Pico-Farads)
0	1
1	10
2	100
3	1,000
4	10,000
5	100,000
6 not used	
7 not used	
8	.01
9	.1

Now for an example: A capacitor marked 104 is 10 with 4 more zeros or 100,000pF which is otherwise referred to as a 0.1 µF capacitor.

Most kit builders don't need to go further but there is sometimes a tolerance code given by a single letter.

So a 102K is a 1,000 pF with +/-10% tolerance

Typical Capacitor Markings			
Code	pf	nf	uF
510	51	0.051	.0000510
181	180	0.18	.00018
501	500	0.5	.0005
102	1000	1.0	.001
122	1200	1.2	.0012
152	1500	1.5	.0015
202	2000	2.0	.002
222	2200	2.2	.0022
472	4700	4.7	.0047
502	5000	5.0	.005
103	10000	10	.01
123	12000	12	.012
203	20000	20	.02
223	22000	22	.022
104	100000	100	.1
684	680000	680	.68

Table 2 Letter tolerance code	
Letter symbol	Tolerance of capacitor
B +/	0.10%
C +/	0.25%
D +/	0.5%
E +/	0.5%
F +/	1%
G +/	2%
H +/	3%
J +/	5%
K +/	10%

FAQ

Q: Where can I find more help and support?

A: Sign up at the Trinity Amps Forum and check the “Resources” section or post a question in the Lightning Strikes, THOR forums.

Q: What does B+ stand for

A: B+ stands for Battery Plus == B+ and came from the old days of tubes. B+ is measured at the intersection of the rectifier DC output and the first filter cap.

On a Trinity 18, it is measured between the lower left lug of the 32/32 cap and chassis ground. It should be about 440 VDC w/o tubes, 350 VDC with tubes with 120 VAC mains.

On a Trinity 15, it is measured at the first 32 uf capacitor. It should also be about 440 VDC w/o tubes, 360 VDC with tubes with 120 VAC mains.

Q: The pictures show the power and standby switches as "top and bottom" on the back of the switch, the layout shows them as "front and back" and I have back mounted "left and right". Does it make a difference as to what orientation I choose to make sure the switch operate correctly, i.e. on is on and off is off?

A: It does it make a difference as to what orientation you choose to make sure the switches operate correctly. Put a switch in any position and measure the resistance across two terminals. "ON" is where resistance is zero. Then rotate the switch so that DOWN is ON (UK style).

Q: Can I run the ground to the common star ground that the power transformer, 32/32 cap can and the 125 Ohm 5 watt resistor turret

A: No. Connect the 120 V ground to a bolt that fastens the Chassis. This is next to the IEC plug. **Don't run the 120 V ground to the common star ground**.

Q: A picture showing the TMB pots shows shielded wire from the 500k TMB volume pot to V2. It looks like the core wire goes to the center pot lug and the shield wire goes to the (left on layout, right as shown on picture) lug, correct?

A: Yes

Q: I assume that the shield is only attached to the pot; it is NOT connected to the tube socket?

A: Yes. Do not connect shield at both ends on the TMB volume pot OR input cables.

Q: For the impedance switch, do I use the 5 amp or 20 amp wiring? From the layout I would guess the 5 Amp.

A: Use 5 A for the impedance switch. The amp is fused at 2A anyway, so 5 is plenty.

Q: The wire looks to be two basic sizes, "thin" and "thick". From the pictures, it looks like the "thin" is used for the pot wiring and the "thick" is for the tube sockets. Is this correct?

A:

Use 22 Gauge solid for hook up to tubes;

Use 20 Gauge, twisted tightly for tube heater wiring;

Use 20 Gauge solid/stranded for hook up to pots/front panel; and

Use 18 gauge, stranded, 600v for power supply hook up - to transformers, rectifier, standby etc.

Tip: Re-use cut-offs from the transformers for power supply hook up.

Q: What should I use for the jumper wires on the back of the turret board?

A: Use the provided solid 20 ga or the stranded supplied for jumpers, it is not critical.

Q: For the input jacks:

a): I should be using the shielded wire which is the thick gray/black wire that you supplied about 3' of. Does the shield braid from both lines go to the common tip lug on the lower jack while the core line goes to the individual tip lugs on both jacks? I want to make sure I am interpreting the drawing correctly.

b). The other end of the shield does NOT get connected to the tag strip at V1, correct?

c). Each pair of input jacks gets only one resistor, correct? Can I lace one lead of the resistor through both jacks for the connection?

A: Take a look at the drawing of the input jacks. That should help you out. Use the shielded wire which is the heavy grey wire. The core goes to the hot. At the other end, the shield does NOT get connected to the tag strip at V1.

Q: How are the three terminal tag strips next to V1 supposed to be mounted, looked at the pictures on line and found they go under the V1 socket mounting nuts.

A: Tag strips are held in place by the socket mounting nuts.

Q: I assume you don't have to use both of the fiber/rubber washers when mounting the cliff jacks; I can get only one on, is this normal?

A: Yes

Q: Is there hardware provided for the grounding? Screws, star washers, nuts, etc.?

A: Yes, these should be in the kit.

Note: The power grounds should go to the separate hole to mount the grounding points.

Q: Is the voltage chart for the TMB the same as the SIII? I would think so, but just checking.

A: Yes. These are posted on the Trinity Forum as well.

Q: Is it easier to wire the pots up outside of the chassis on a cardboard with the pots spaced correctly, or can it be done easily in the chassis?

A: You can wire them in place, it's not too difficult. It is recommended that you wire the input jacks outside of the chassis with the approximate spacing to fit the panel.

TIP: It is easy to solder up the input jacks by putting them "inside out". Use a set of jack locations to the right of the normal channel and mount the jacks in their final orientation, but mounted outside of the chassis with the mounting screw inside the chassis. This keeps the orientation and spacing correct and provides a lot of room to solder the resistor, jumpers grounding wire and shielded wires. Then, when done, remove the completed jacks, mount them correctly inside the chassis and tighten up the mounting screws and solder up the other end of the shielded wires to the tag strips at V1.

TIP: More, larger format, colour pictures and the schematic & layout that are helpful in the build are posted on the Trinity Forum & THOR forum. Right click on them to download if you want print in large, colour format.

TIP: Sometimes carbon comp resistors are hard to decode the colours. It is a good idea to check the resistances of these parts before assembly.

TIP: Use insulation tubes from the wiring on the resistor / cap leads around the tubes and pots by using longer pieces of insulation stripped from the supplied 22 or 20 ga wire.

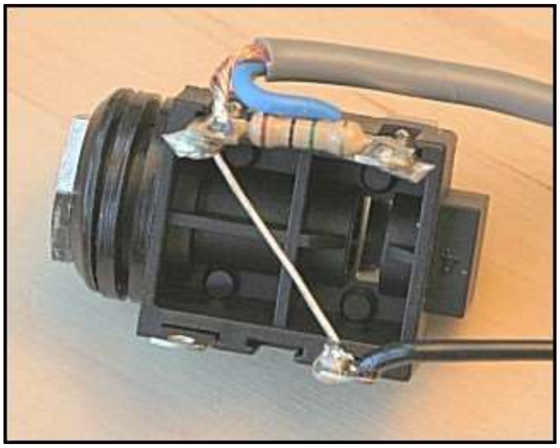
TIP: There is no bleed resistor in the sIII. You don't need to worry about this unless you are going to poke around inside after it's shutdown.

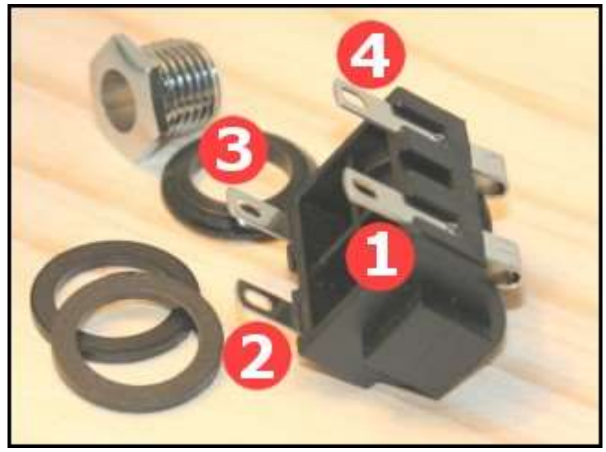
For safety, unplug the amp, then turn on the stand-by switch for a minute to help drain the caps. If you want to check them, measure B+ after you've done that. If there is still high voltage there, drain it again.

TIP: Heater Wires: Stranded wire is very hard to twist tightly. Stranded or solid doesn't make much difference. Solid wire stays in place better once it's positioned and a bit easier to feed through holes. If they aren't well twisted make sure they are tight against the chassis. You can use 22 ga solid for heaters. It is rated for more than 5A anyway.

Cliff Jacks Explained

Here's a Cliff-style jack wired for a single input.





With no guitar plugged in, there's continuity to ground for lugs 2 and 4 (a direct connection) and also for lug 1 (it's not switched and therefore mechanically connected to lug 2 with the crossover wire). With a guitar plugged in, the switching breaks, and now there's only continuity between lugs 2 and 4 and ground. Of course, with a guitar plugged in, you'll read a resistance of 6-12K for lug 1 to ground - depending on your pickups. If your guitar's Volume pot is at zero, you'll find continuity to ground instead.

You should get continuity between the tip and chassis with nothing plugged in because of the shorting jack and the cross over wire. From 18W Forum – loverocker & ebe

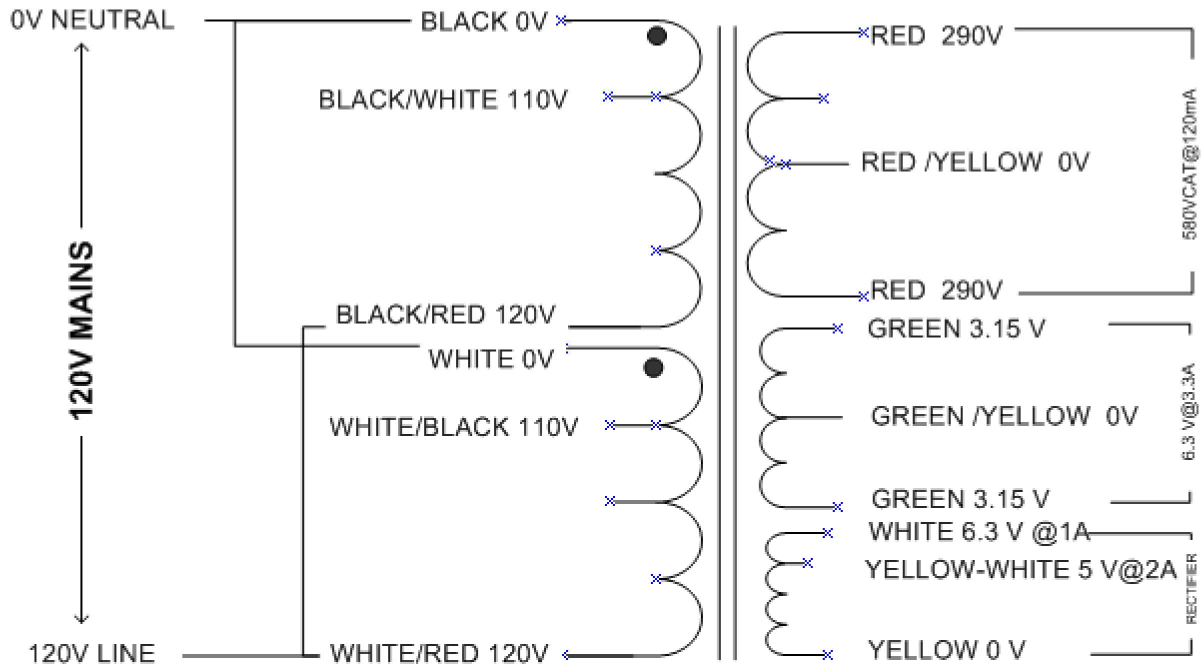
THOR Bill of Material (BOM)

Description	Qty Per	Check
THOR KIT WITH TRANSFORMER SET, CHASSIS, PANEL		
18W 6V6 THOR RESISTORS	1	
METAL FILM RESISTORS - THROUGH HOLE 1WATT 1 OHMS 1%	2	
CARBON FILM RESISTORS- THROUGH HOLE 470 OHMS 5%	1	
CARBON FILM RESISTORS- THROUGH HOLE 820 OHMS 5%	1	
RESISTORS - 5 WATT, WIREWOUND, POWER, 5% TOLERANCE, RESISTANCE: 1 KOHM	2	
CARBON FILM RESISTORS- THROUGH HOLE 2.7K OHMS 5%	1	
METAL FILM RESISTORS - THROUGH HOLE 3WATTS 4.7K OHMS 5%	1	
METAL OXIDE RESISTORS 4.7KOHMS 05% TOL	1	
CARBON FILM RESISTORS - THROUGH HOLE 5.6KOHMS 5%	2	
RESISTORS - 2 WATT, METAL OXIDE, POWER, RESISTANCE: 9.1 KOHM	1	
CARBON FILM RESISTORS- THROUGH HOLE 10K OHMS 0.05	2	
METAL OXIDE RESISTORS 10K OHMS 5% TOL	1	
METAL OXIDE RESISTORS 15K OHMS 5% TOL	1	
RESISTORS - 2 WATT, METAL OXIDE, POWER, RESISTANCE: 27 KOHM	1	
CARBON FILM RESISTORS- THROUGH HOLE 33K OHMS 5%	2	
METAL OXIDE RESISTORS 47KOHMS 5% TOL	1	
CARBON FILM RESISTORS- THROUGH HOLE 68K OHMS 0.05	1	
CARBON COMPOSITION RESISTORS 82K OHM 5%	1	
CARBON FILM RESISTORS- THROUGH HOLE 100K OHMS 0.05	2	
CARBON COMPOSITION RESISTORS 100K OHM 5%	1	
METAL FILM RESISTORS - THROUGH HOLE 1/2WATT 100K OHMS 1% 100PPM	3	
RESISTORS - 2 WATT METAL OXIDE POWER 100 K	1	
CARBON FILM RESISTORS- THROUGH HOLE 220K OHMS 0.05	2	
METAL OXIDE RESISTORS 220K OHMS 05% TOL	1	
CARBON FILM RESISTORS- THROUGH HOLE 470K OHMS 0.05	4	
CARBON FILM RESISTORS- THROUGH HOLE 1M OHMS 5%	3	
18W 6V6 THOR CAP	1	
CAPACITOR - 500V SILVER MICA ± 5% 47 PF	2	
CERAMIC DISC CAPACITORS .25LS 270PF 1KV 10% 271K	1	
330 PF 500V SILVER MICA	3	
CAPACITOR - 500V, SILVER MICA, ± 5%, CAPACITANCE: 500 PF	1	
CAPACITOR - MALLORY, 630V, 150S, AXIAL LEAD, CAPACITANCE: .0022 UF	1	
CAPACITOR - MALLORY, 630V, 150S, AXIAL LEAD, CAPACITANCE: .01 UF	1	
CERAMIC DISC CAPACITORS .375LS .01UF 1KVDC 10% 8MM LEAD DIA	1	
CAPACITOR - MALLORY, 630V, 150S, AXIAL LEAD, CAPACITANCE: .022 UF	6	

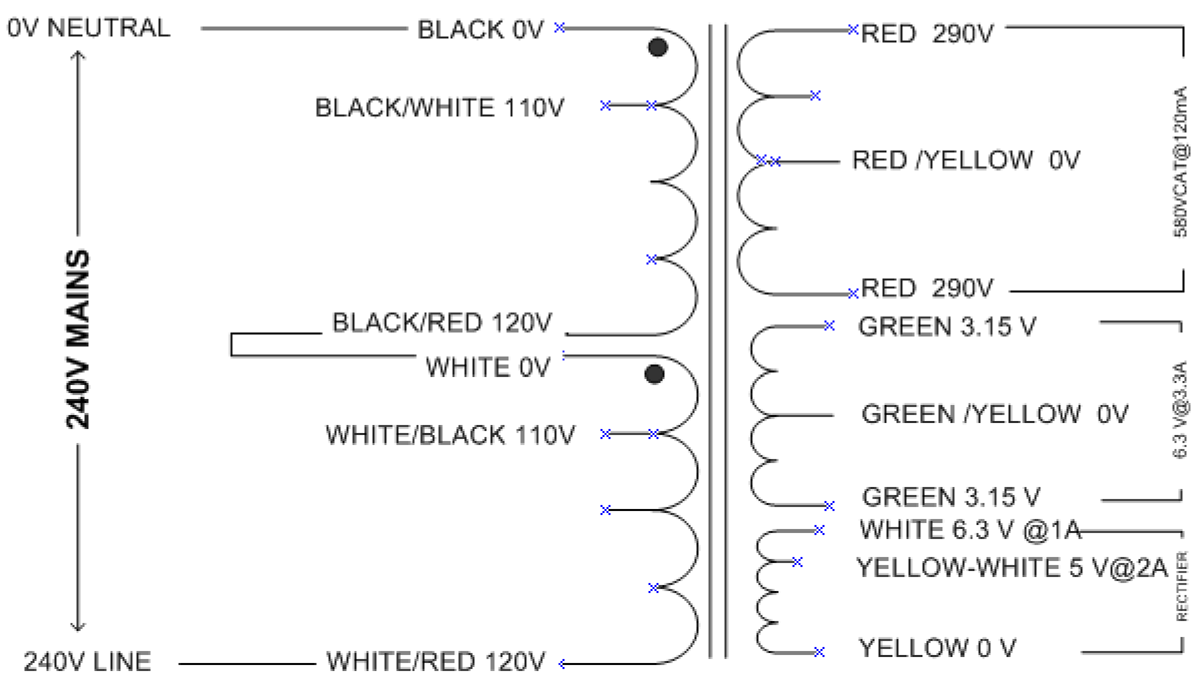
FILM CAPACITORS 100V .68UF 5%	1	
CAPACITOR - MALLORY, 630V, 150S, AXIAL LEAD, CAPACITANCE: .1 UF	2	
ALUMINUM ELECTROLYTIC CAPACITORS - AXIAL LEADED 47UF 63VOLTS 20%	2	
CAPACITOR - 450V, AXIAL LEAD ELECTROLYTIC, CAPACITANCE: 22 UF	3	
CAPACITOR - JJ ELECTRONICS, 500V, 50/50UF, ELECTROLYTIC	1	
CAPACITOR CLAMP - 1.375" DIAMETER, FOR VERTICAL MOUNTING	1	
18W 6V6 THOR POT	1	
POTENTIOMETER - CTS, 10K, LINEAR, BIAS TRIMMER, SCREW	1	
POTENTIOMETER - ALPHA LINEAR 3/8" BUSHING 25 KO	2	
POTENTIOMETER - ALPHA, LINEAR, 3/8" BUSHING, RESISTANCE: 250 KOHM	1	
POTENTIOMETER - ALPHA, AUDIO, 3/8" BUSHING, RESISTANCE: 1 MOHM	3	
MARSHALL STYLE GOLD KNOBS	6	
KNOB - LARGE, INDICATOR LINE, SET SCREW, COLOR: BLACK	1	
THOR 6V6 SOCKET	1	
SOCKET - BELTON, 9 PIN, MINIATURE, TOP MOUNT	3	
TUBE SHIELD - FOR 9-PIN MINIATURE, ALUMINUM, MULTIPLE COLORS, COLOR: ALUMINUM	3	
SOCKET - BELTON, MICALEX, 8 PIN OCTAL, MIP	3	
TUBE CLIP - BELTON, FOR OCTAL, SOLD INDIVIDUALLY	3	
THOR JACKS	1	
1/4" JACK - CLIFF, SOLDER LUG, FOR MARSHALL, METAL NUT, CHANNEL: MONO	2	
1/4" JACK - SWITCHCRAFT, MONO, OPEN CIRCUIT	2	
COMMON HARDWARE	1	
SWITCH - ROTARY, 1 POLE, 3 POSITION	1	
RECEPTACLE - IEC C14, FOR POWER CORD, 3 PRONG	1	
SCREW TYPE FUSE HOLDER 10A 250VAC CSA	1	
FUSE - SLOW-BLOW 250V MINIATURE 5MM X 20MM 2 AMPS	1	
NEON INDICATOR 120VAC RED	1	
SWITCH - CARLING, TOGGLE, SPST, ON-OFF, SIDE SOLDER LUGS	2	
RF CONNECTOR ACCESSORIES LOCKWASHER	2	
SWITCH - CARLING, MINI TOGGLE, SPDT, 2 POSITION, SOLDER LUGS	1	
GROMMETS & BUSHINGS GROMMETS & BUSHINGS SB 500-6 BLK	2	
TERMINAL STRIP - 3 LUG, 2ND LUG COMMON, HORIZONTAL	4	
TERMINAL STRIP - 5 LUG, 0 COMMON, HORIZONTAL	1	
CONDUIT FITTINGS & ACCESSORIES DP 875 BLK DOME PLUG	1	
THOR FASTENERS	1	
MACHINE SCREW PHILLIPS PAN HEAD 4-40X5/16 L	25	
HEX NUT EXT TOOTH LOCKWASHER 4-40	7	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#4	2	
MACHINE SCREW PHILLIPS PAN HEAD 6-32X3/4 L	4	

MACHINE SCREW PHILLIPS PAN HEAD 6-32X3/8 L	3	
HEX NUT EXT TOOTH LOCKWASHER 6-32	1	
INTERNAL TOOTH LOCK WASHER #6 CHROME	4	
STANDOFFS & SPACERS .500 STD SPACER	4	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#6	3	
MACHINE SCREW PHILLIPS PAN HEAD 8-32X3/8 L	5	
HEX NUT EXT TOOTH LOCKWASHER 8-32	9	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#8	1	
MACHINE SCREW PHILLIPS TRUSS HEAD 10-32X1-1/4 L	4	
ANCHOR (CAGE) NUT 10-32	4	
COMMON WIRE	1	
22 GUAGE SOLID CORE WIRE (VARIOUS COLOURS)	10	
22 GAUGE TWISTED PAIR RED/BLACK	4	
BELDEN RG174/U COAXIAL CABLE	6	
18 GUAGE STRANDED WIRE BLACK	1.5	
18 GUAGE STRANDED WIRE WHITE	1.5	
HEAT SHRINK TUBING 1MM	4	
HEAT SHRINK TUBING 3MM	4	
HEAT SHRINK TUBING 6MM	4	
CABLE TIE 4 IN BLACK 18 LBS	6	
18 WATT TURRET BOARD	1	
CHASSIS 20 IN ALUM HEAD	1	
PANEL GOLD THOR (FRONT)	1	
CORD - POWER, 18 AWG, 3 CONDUCTOR, DETACHABLE, BLACK, IEC, LENGTH: 8 FEET	1	
CHOKE 4H 90 mA	1	
TRANSFORMER POWER 290-PT	1	
TRANSFORMER OUTPUT 8K/5K	1	

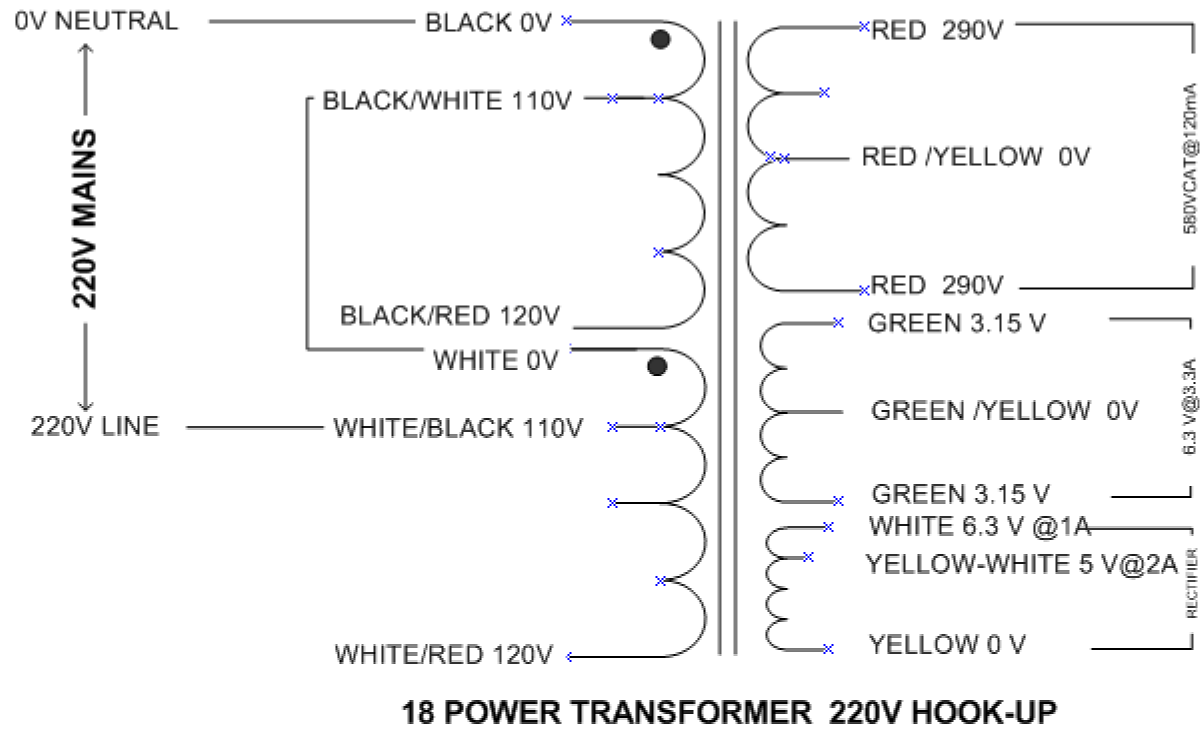
THOR Transformer Hook Up Schematics



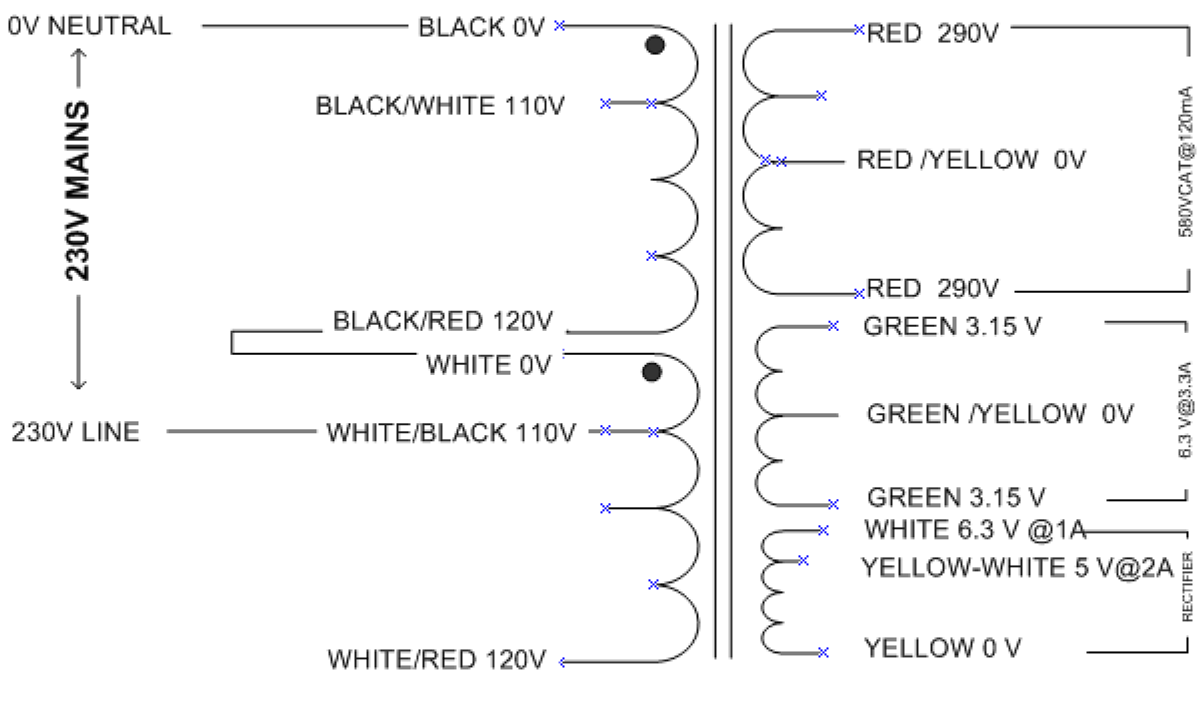
18 POWER TRANSFORMER 120V HOOK-UP



18 POWER TRANSFORMER 240V HOOK-UP



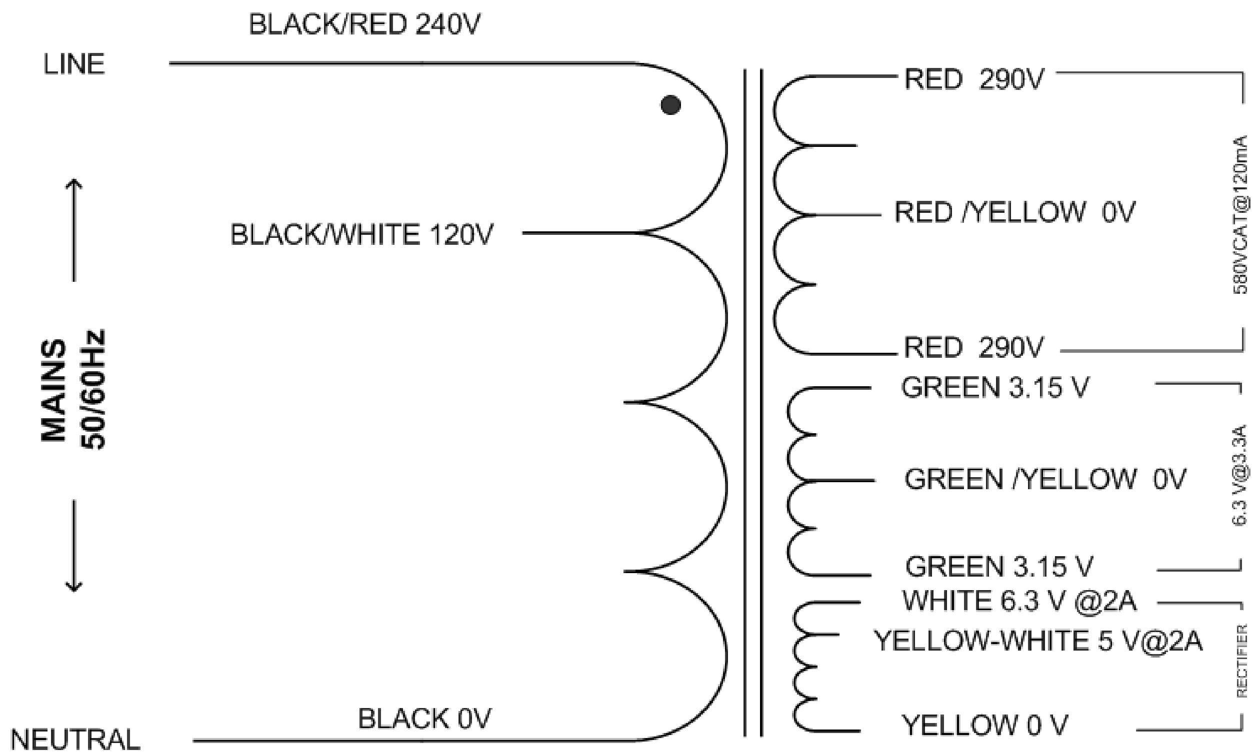
18 POWER TRANSFORMER 220V HOOK-UP

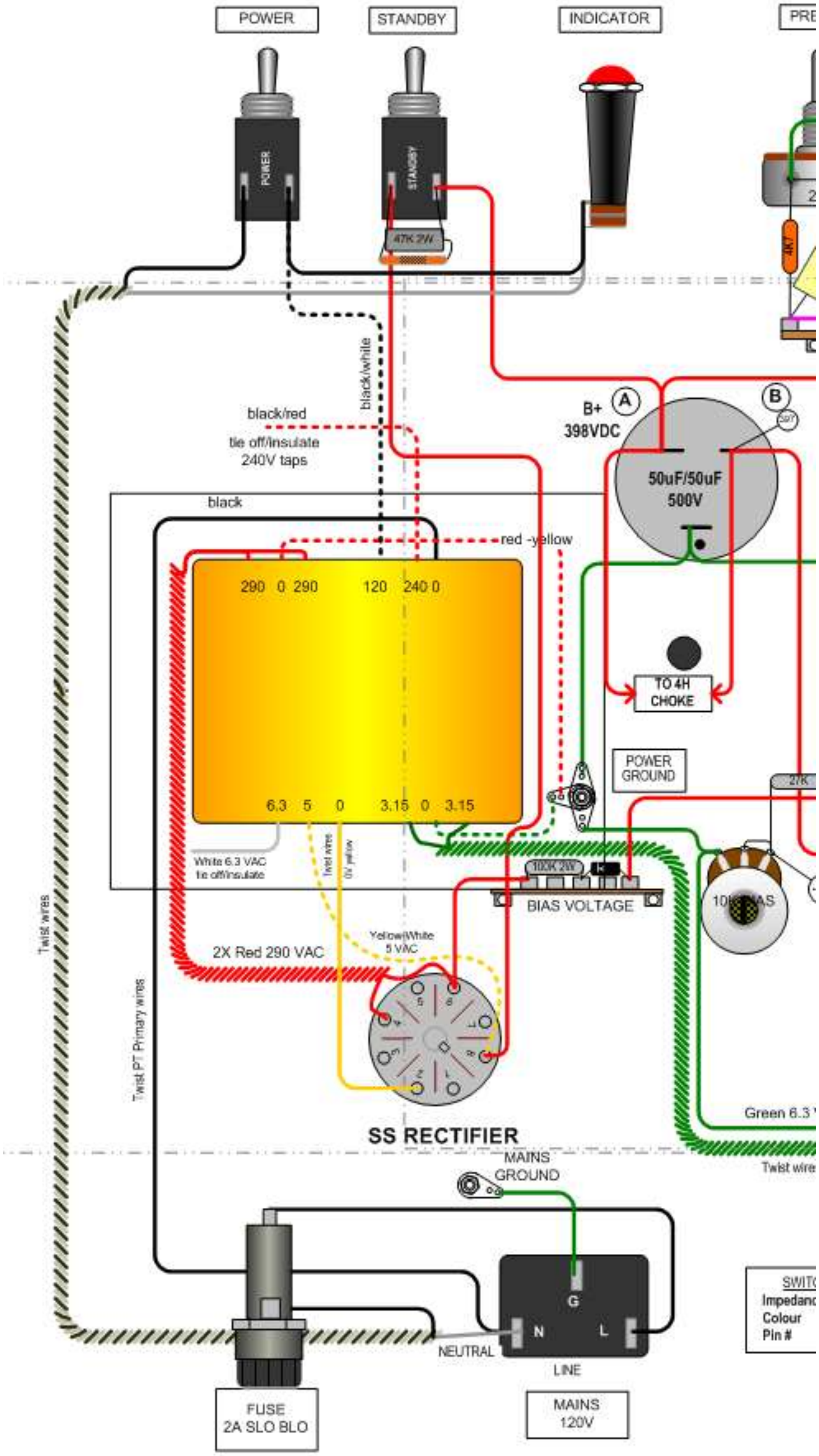


18 POWER TRANSFORMER 230V HOOK-UP

ADDENDUM 1 - DUAL PRIMARY POWER TRANSFORMER

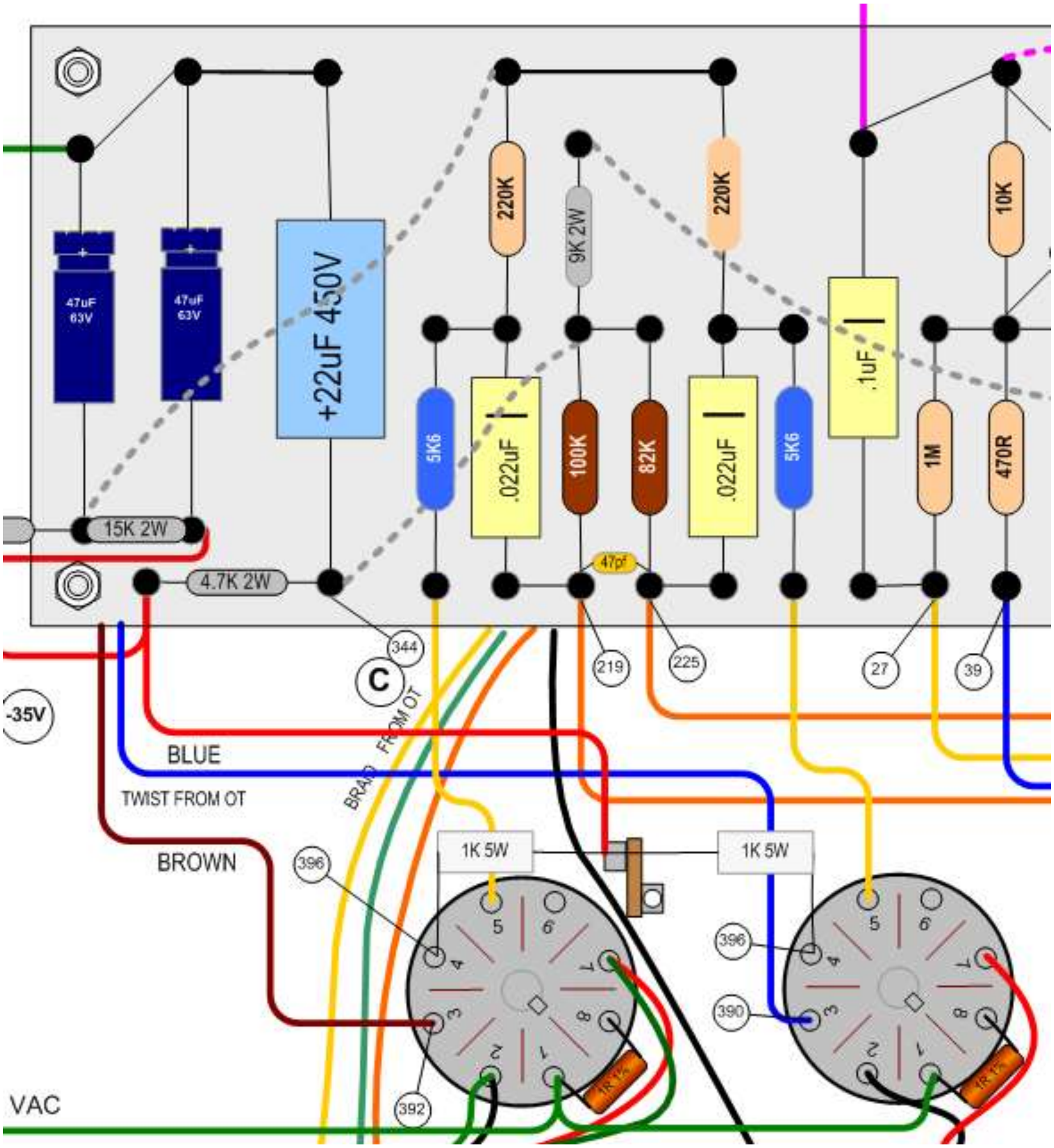
The Heyboer Power transformer with a dual primary may be supplied in which case the primary wiring is somewhat simplified. Use the Schematic and Dual Voltage Layout below.




POWER
STANDBY
INDICATOR
47K 2W
black/white
black/red
tie off/insulate
240V taps
B+
398VDC
A
B
50uF/50uF
500V
black
red -yellow
290 0 290
120 240 0
TO 4H
CHOKE
POWER
GROUND
6.3 5 0
3.15 0 3.15
White 6.3 VAC
tie off/insulate
100K 2W
BIAS VOLTAGE
Twist wires
Twist PT Primary wires
2X Red 290 VAC
Yellow/White
5 VAC
SS RECTIFIER
Green 6.3 V
MAINS
GROUND
G
N
L
NEUTRAL
LINE
FUSE
2A SLO BLO
MAINS
120V
Impedanc
Colour
Pin #

ADDENDUM 2 - 5K TAP REMOVED

The Heyboer Output transformer with a single 8K primary may be supplied so the 5K taps do not need to be tied off.



Trinity Amps Schematics and Layouts