The Trinity Amps

TRIWATT

Amp Builder's Guide

For the sole personal use of Trinity Amps Customers.

January 2022, Version 22.1

www.trinityamps.com

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Thank You

Thank you for purchasing your TRIWATT kit from Trinity Amps. We truly hope that you enjoy building it and that it will be enjoyed for many years. If you have any questions please do not hesitate to contact us and. Please be sure to check the package contents in case there are any missing items.

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!

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 do appreciate your business. If there is any other product we can provide to you or your associates, please get in touch and we will be happy to discuss requirements.

Sincerely,

Stephen Cohrs,
Trinity Amps

Web site: **www.trinityamps.com**
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. To view the Resources, you need to sign up so go to **www.trinityamps.com** and click on the Forum button.

Email: We can't help with every problem but if you can not 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.

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 DISCLAIM 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 TRANSFORMER!

Version Control

Version	Date	Change
21.1	12Feb21	First Issue
21.2	19Jul21	Clarified mounting of board
22.1	14Jan22	Added Managing Power Transformer leads

Custom TRIWATT Lead Description

The TRIWATT was designed by Trinity Amps to capture the classic HIWATT sound without the usual classic ear-bleeding volume levels. It is closely based on an early '70s style Hiwatt DR, but utilising either 6V6 or KT66 power tubes for more usable power output. Furthermore, it has the 3-input configuration used by David Gilmour of Pink Floyd, plus an Overdrive stage, as found in early '80's "Biacrown era" Hiwatt Lead amps.

Bright channel - perfect right out of the gate. The entire travel of gain knob yields usable tones. Bright is AMAZING from zero to dimed, with lots of subtle colours in between. This channel really cuts through the mix.

Normal channel - has usable gain from the bottom all the way to the top, and lots of subtle shades of clean and semi-clean from around 10 o'clock to 3 o'clock. This channel is important because it's where most people will probably spend most of their time. The tone, is big and more detailed.

Link - is like jumping the two channels on a 4-holer. There are infinite shades of tone possible by blending the two channels' volume controls. The actual "sound" of the link inputs is subtly more scooped-mid and sparkly, giving one set of knob settings two slightly different tones.

Tone Controls - Treble, Middle, Bass, Presence - these are less like "boost/cut" knobs and more like "real" tone controls. They do a lot to the tone in a very subtle way. With Fenders/Marshalls extreme settings can get painful. TRIWATT never gets painful. Presence in particular is very authentic - rather than boosting a high treble, it opens up or extends the top end of the tone to add "air" to the sound. TRIWATT EQ knobs are in very similar places when compared to original Hiwatt amps, dialed in to similar tones.

Master Volume - turning the master down isn't a tone killer like in some amps. The tone is not compromised when the master is under around 11 o'clock. IF you set the OD up appropriately (see below), even with the MV way down - 7 or 8 o' clock, it still sounds huge. This control sounds big, quiet, and it it sounds big loud!

Overdrive - This control may be the reason someone who owns arguably a Hylight-era Hiwatt 4-holer, would want the TRIWATT. This is where the TRIWATT "art" lives – a . Pull out the Overdrive control and you get the extra gain stage of a Biacrown era Hiwatt Lead amp (push the knob in and it's out of the circuit). This gain stage naturally gives you more gain and more distortion, as well as more compression. So, for rhythms as well as leads, it's incredible! The way it works, is that when the Overdrive stage is engaged by pulling the Overdrive knob, the stage's drive/gain level is set by the Normal and Bright volume controls, and the stage's outout level is set by means of the Overdrive knob. So it's possible to set the stage to provide a lot of extra gain but at the same volume level as when its not engaged. But there are more possibilities. If you have to play lead, bring up the bright/normal gain stage and starve the overdrive gain and the tone comes forward is more dynamic and bigger. Turning up the Overdrive, with an LP and humbuckers reveals big metal tones, yet rolling back the guitar volume and playing more gently yields delicate, transparent, sparkling cleans with the Overdrive still on. And you can imagine all the shades in between!!!

Guitars - The TRIWATT can handle many guitars with aplomb. Tele, Strat, Danos, Ric, Les Paul with P90's for the single coils, and Les Paul, SG, Seymour Duncan hot-rodded Fender Cyclone for 'buckers, PRS Mira in both 'bucker and single mode - have all been tested with this amp, and every guitar sounds GREAT. Also, Hiwatts are known for taking a lot of pedals really well. The TRIWATT does not disappoint in this area either.

Key Points about the TRIWATT Design

- Big Hiwatt DR clean tones and breakup at more ear-friendly levels
- Vintage style early '70s 103 preamp (with cathode-follower)
- Three-inputs - Normal, Bright and Link, like Dave Gilmour's 3-input amps
- Switchable 80s' "Biacrown era" high-gain OL/Lead mode, with Overdrive control and optional footswitch
- Early Hiwatt style 12AT7 phase invertor, with 12AX7 option for increased breakup
- Solid State rectified, fixed-bias, 22 Watt 6V6 power stage, based closely on Hiwatt original
- Optional 6V6 or KT66 operation with External Bias Control and Bias Test Points
- Transformers closely based on original Hiwatt Partridge transformers for definitive tone
- Preamp easily modded for Pete Townshend or Jimmy Page/SAP variants
- Compact physical format and cabinet - chassis also fits other standard cabs

Builders Guide General Theory

For a discussion on Guitar Amp Basics and Tube Amp Theory, please refer to our support page document Builders Guide General Theory

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 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 20 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.

Use 18 Gauge stranded for mains 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:
25 watt pencil tip soldering iron
60/40 rosin core solder
wire stripper
wire cutter
needle nose pliers
screwdrivers (Philips, standard)
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.

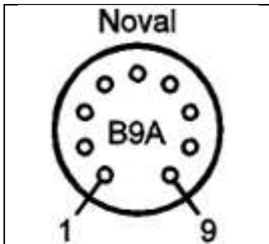
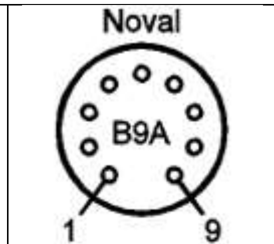
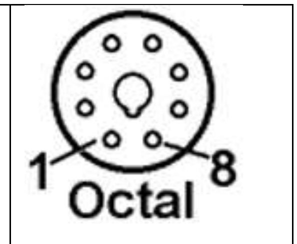
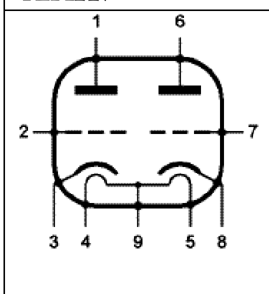
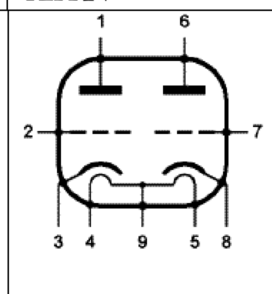
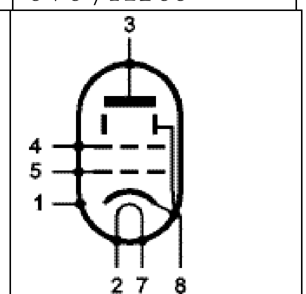
ROHS: 725-750F when soldering ROHS turret boards, the dwell time (time to heat and complete the connection) is a little longer and temperature is set a little hotter. The solder used was Lead-free solder 97/3 formula tin/copper with a Rosin Core.

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	12AT7	6V6 /KT66
		
12AX7	12AX7	6V6

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.

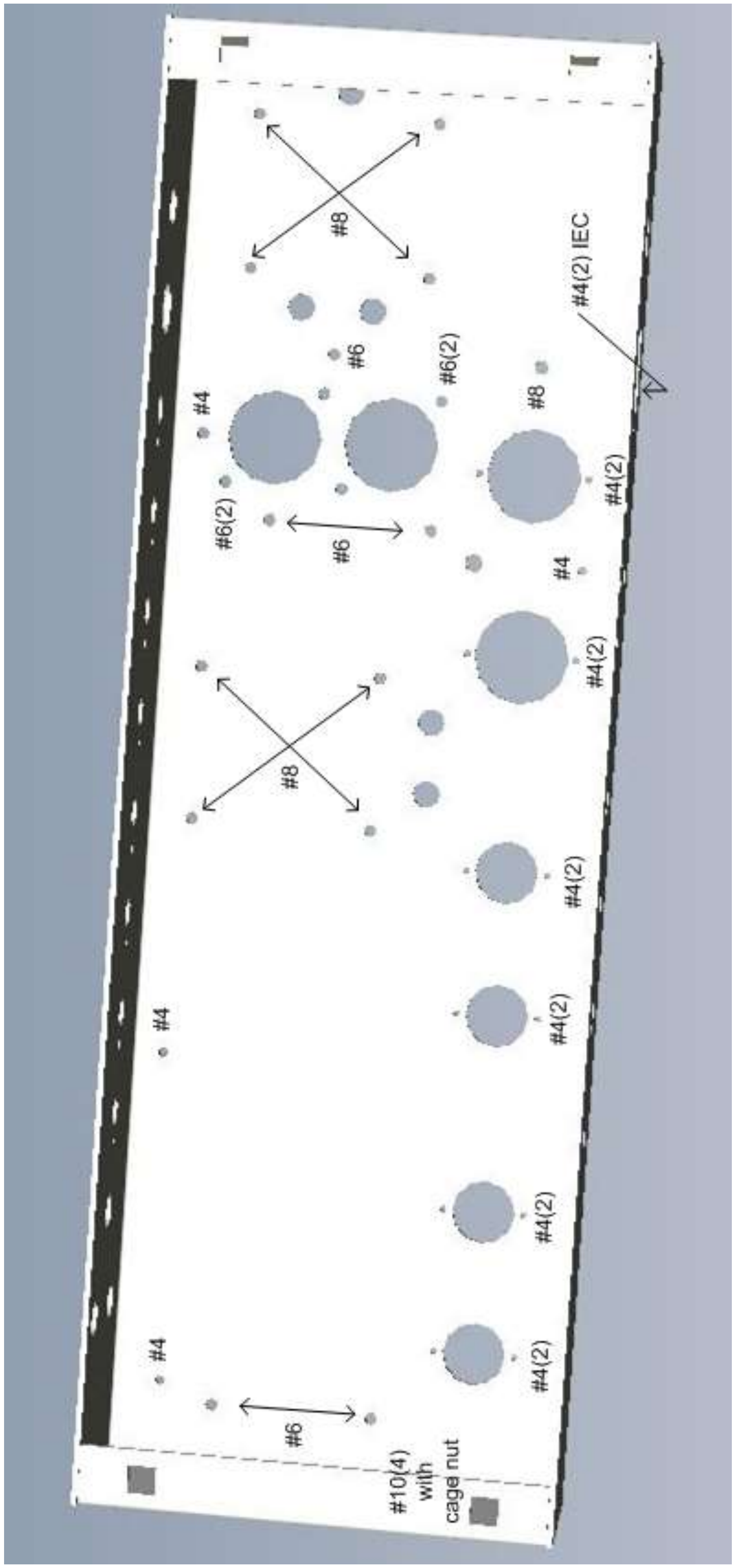
Assembly Steps Summary

1. Install Hardware on the Chassis.
2. Wire up the heater wires to the sockets.
3. Install Transformers on the chassis.
4. Wire up the power supply - Mains, Transformers, power switch and pilot light.
5. Assemble the turret board and Install on chassis.
6. Connect turret board leads to tubes installing off-board parts as you proceed.
7. Connect turret board leads to controls installing off-board parts as you proceed.
8. Remove input jacks. Wire with 1M film resistors and shielded cable. Re-install.
9. Check Wiring.
10. Follow Start-Up procedure.

1. Install the Hardware

Install all the tube sockets. The sockets with the shields are for V1 to V4. The other 8 pin sockets are for the two 6V6 or KT-66 output tubes. For KT66 tubes, you may need to install the sockets under the chassis to gain some extra clearance in the cabinet. There are many nuts bolts etc. required. Here are some guidelines.

Part	**Qty**	**Where to use**
4-40 X 5/16	16	Mount tube sockets (no nuts reqd.) and terminal strips with nuts (6)
4-40 nuts	12	Mounting terminal strips, ground point, IEC socket
4-40 X 7/16	*8*	*If supplied – to mount tube sockets with terminal strip, use nut to hold terminal strip with nut/lock washer or lock nut. Use with nuts/lock washer to mount IEC connector, 5 lug terminal strip and 1-#4 pre-amp chassis lug.* *Mount tube sockets on **non-threaded chassis** with lock nut*
6-32 X ½	5	Mount 3 power ground # 6 chassis lugs with lock nut. Mount Capacitor clamp
6-32 X 1	4	Mount turret board to chassis using stand-off. Use with lock nut.
8-32 X 3/8	1	Mount Mains ground **ONLY**. Use additional lock washers with #8 chassis lug.
8-32 X 3/8	8	Mount Output and Power trans. with lock nuts.
8-32 lock nuts	9	8 "Keps" for power transformer; 1 "Keps" for ground bolt.
10-32 X 1-½	4	Mount chassis to cabinet. Use cage nuts in square holes pressed into chassis.


#8
#4(2) IEC
#6
#6(2)
#4
#8
#4(2)
#6(2)
#6
#4
#4(2)
#8
#4(2)
#4
#4(2)
#4(2)
#4
#4(2)
#6
#10(4)
with
cage nut

Install the two dual capacitor can caps using the bracket to hold it in place.

Insert the 5 grommets for wire leads passing through the chassis from the power transformer and output transformer.

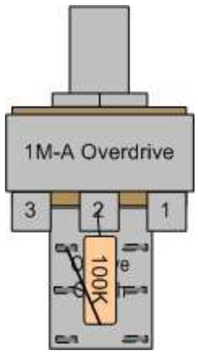
The front panel is installed and held in place by installing the pilot light, power switches, potentiometers and jacks. Ensure the potentiometers are located in the correct positions according to their values and the layout. There are locating holes cut into the chassis for the potentiometers, so they won't spin if the control ever loosens. For the jacks you probably will need only 1 fiber washer on the inside to mount them flush with the front panel.

TRIWATT Front View

If supplied, the rear panel is installed and held in place by installing the IEC mains connector, Mains strain relief, fuse holder, output jacks and possibly an impedance selector.

TRIWATT Rear

Some components are more easily installed on other components prior to installation. Use the following illustrations as a guideline.



Before installing the Overdrive switch, pre-wire the switch with a 100K resistor as shown.
Note: * This step not required when the relay board is being used for the footswitch option. Also not required if you have mounted the 100K on the tube socket pin 2 directly. This modification requires a jumper where the 100K is shown in the layout diagram.

Cut the tab of the Overdrive switch off, this is not required. You may require a small white plastic washer on the switch. This is used to center the control pot inside the 3/8" diameter chassis hole. It is a tight fit, but you can push it into place to hold the Overdrive switch in place.

Inside the chassis, install the 5 terminal strips (several solder lugs or 'terminals' attached to an insulated strip) for the power connections, the 1K 5W plate resistors to the 6V6/KT66, and the 68K input resistors to V1, and V3's 22k resistor. See the following diagrams for the areas where these are used.

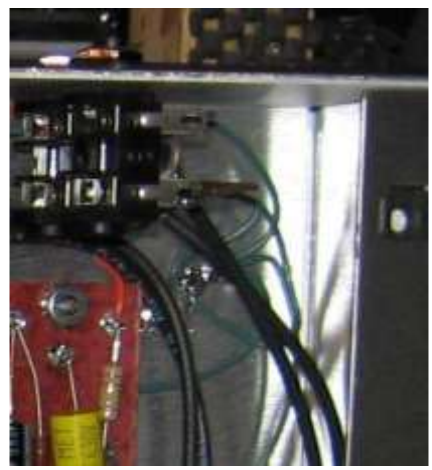
When installing the DPDT BIAS SWITCH, be careful not to break the bias selector switch on installation--clip off the vertical locator tab on the included flat washer and make sure to use it! Otherwise if you over-tighten it'll break apart. Also be careful not to overheat the terminals when soldering. Remember to insulate the lugs and wiring to prevent switch arching.

2 Wiring

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

- Use 22 gauge solid for hook up from board to tubes
- Use 22 gauge solid for hook up from board to pots/front panel
- Use 22 gauge solid with insulation stripped for turret board buss bar
- Use 22 gauge RED-BLACK solid twisted pair supplied for tube heater wiring
- Re-use cut offs from the transformers stranded, for power supply hook up - to transformers, rectifier, standby etc. It is not necessary to follow the colour layout.
- Use RG174U for inputs to V1, V2/Overdrive, Master and Presence and as indicated on layouts
- Use green wires for ground wires.

Grounding Scheme



The TRIWATT use a two point grounding scheme where the power side of the amp is connected to a single common ground point, and the preamp part is connected to another point on the chassis that is located immediately beside the input jacks.

For grounding these amps, we strongly recommend that you follow the layout provided. We don't recommend that you deviate, but if you do, use a collected one-point star grounding scheme. Everything connected together and marked with the 'earth' symbol on the schematic is connected together locally, and then that local common is connected to the star point.

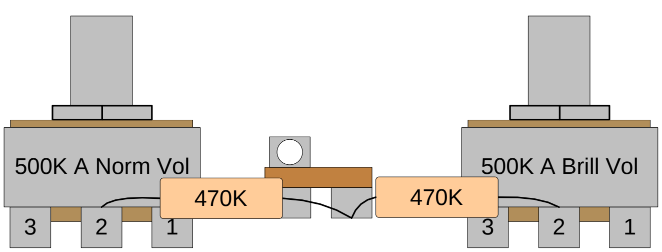
There is also a separate AC supply safety ground point near the IEC connector, which doesn't form part of the actual amplifier circuit. WARNING: THIS CONNECTION IS VITAL FOR SAFETY REASONS.

Install the pilot lamp socket if you haven't already. Tightly twist the two green 6.3 V AC heater wires from the power transformer. Connect the two 6.3V AC leads to the pilot lamp socket terminals. Connect the Green-Yellow 0V 6.3V center tapped wire to the "Power" ground made of 3 #6 lugs connected to the chassis	

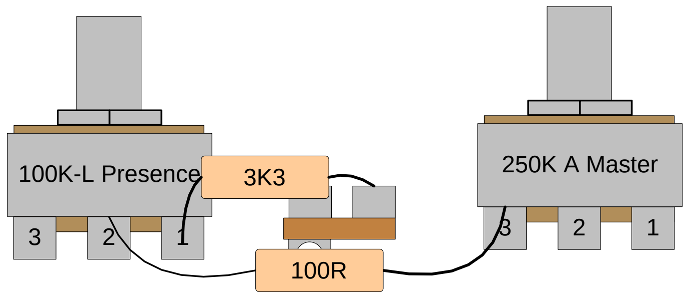
Heater Wiring
For the heater wires, the two twisted 20 gauge wires connect to the pilot lamp socket and then to the terminals of the first Power Tube to pin 2, the other wire to same Power Tube but pin 7. Then these go to pins 2 and 7 respectively of the second Power Tube. From there, the wires daisy chain across the preamp tubes, one wire to both pins 4 and 5 of each preamp tube and the other wire to pin 9. This phasing or 'polarity' on the preamp heaters needs to be maintained. The two power tube sockets also need to have their heaters wired in the same phase (using the same colours) to reduce hum.

It is important to wire the tube filaments carefully. Use the pre-twisted 20/22 gauge wire to minimize any hum. Solder each wire to the pilot light assembly. Now route the twisted pair wire around the outside perimeter of the chassis, following the layout diagram, pressing it flat against the chassis. Connect the same color heater wire to the same pin(s) as you progress from tube to tube e.g. Red on pin 2 of both Octal sockets and Black on pins 7. Do one tube socket at a time. Complete the 12AX7s using the same process. Black on pins 4 & 5 tied together and Red on pins 9. Don't switch the heater wire polarity.

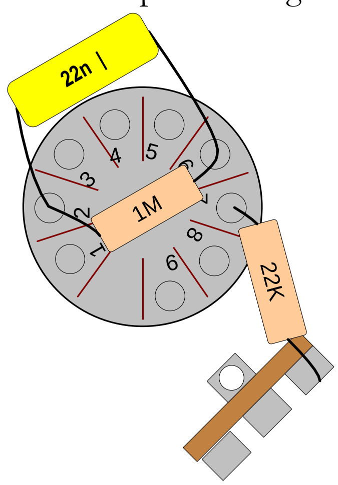
Once the heater wiring is completed, install the parts from the terminal strips to the potentiometers or tube sockets.



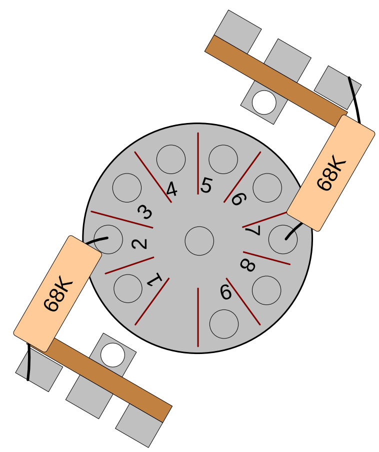
Install parts from terminal strip on chassis and parts on chassis. Connect 470K resistors from terminal strip to center lugs of Normal and Brilliant Volume.



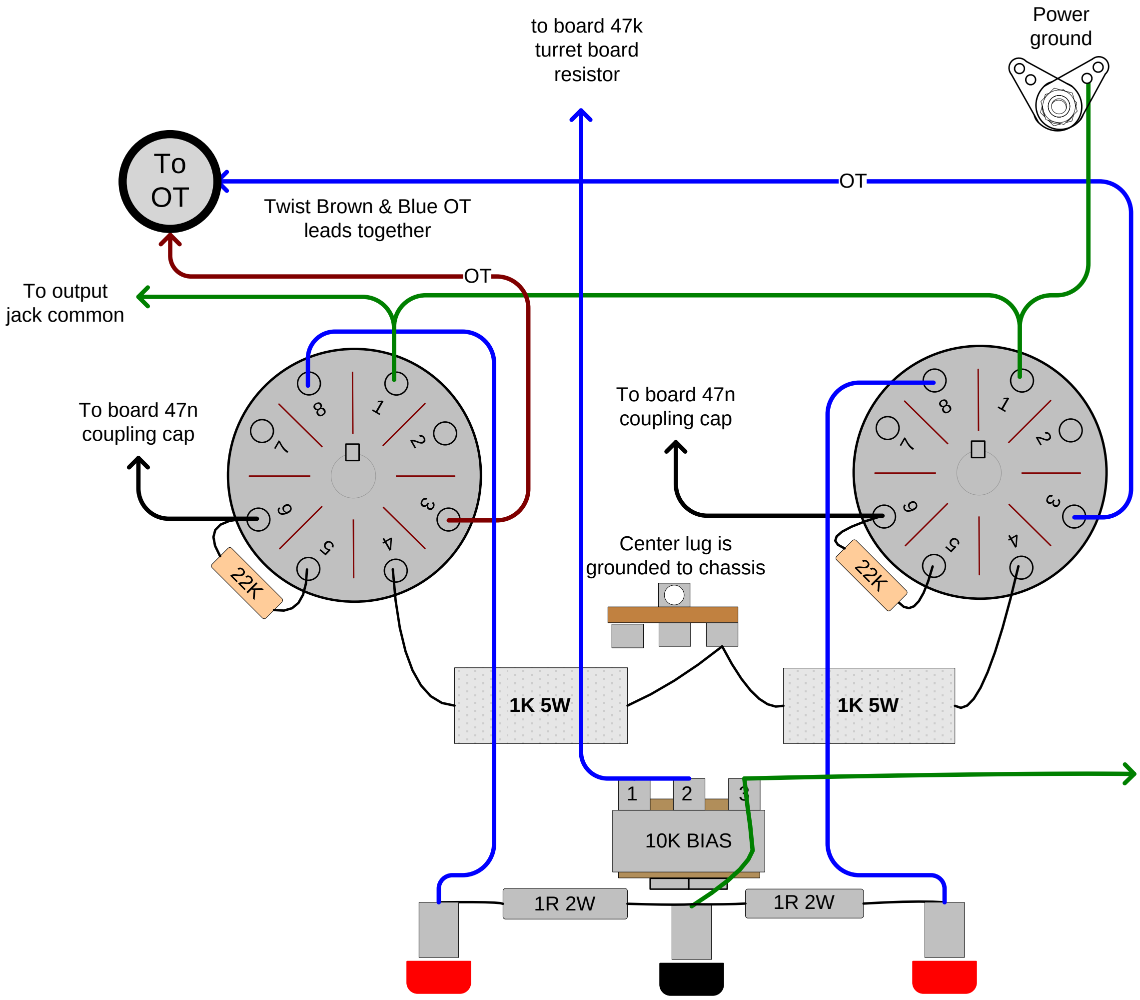
Install parts from terminal strip on chassis and parts on chassis. Connect 3K3 resistor from terminal strip to one lug of the Presence Control.



Install terminal strip on chassis and parts on V3 socket. Connect resistor from terminal strip to V3 socket

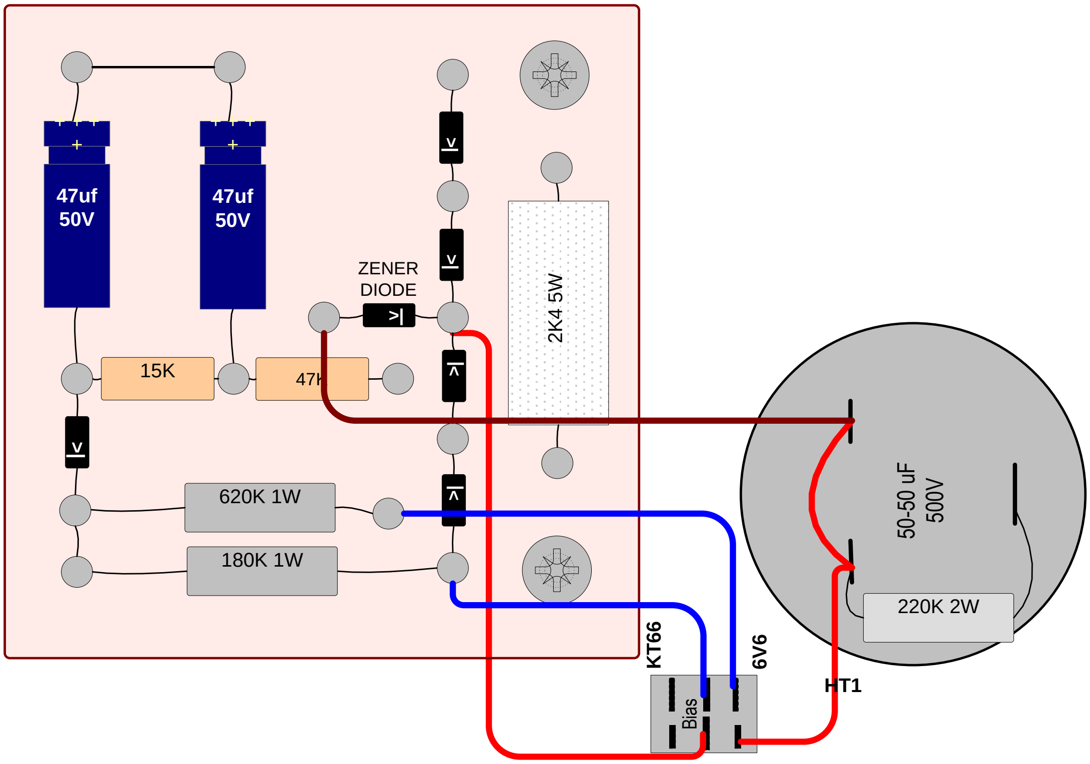


Install 2 terminal strips on the chassis. Connect 68K resistors from terminal strip to V1 2 & 7



Install terminal strip on chassis and 22K resistors on V5, V6 socket. Connect 1K5 resistor from 1 terminal strip common point (**NOT** the center lug which is connected to ground) and then on V5, V6 socket pin 4

Continue wiring up the bias terminal points (2-Red, 1-Black) with 1 ohm precision resistors soldered between them and the 10K bias pot and the connecting wires to the tube sockets. Connect the bias pot ground to power ground.



If you haven't already, install the bias switch. **NOTE**: When installing the DPDT BIAS SWITCH, be careful not to break the bias selector switch on installation--clip off the vertical locator tab on the included flat washer and make sure to use it! Otherwise if you over-tighten it'll break apart. Also be careful not to overheat the terminals when soldering and remember to insulate the lugs and wiring to prevent switch arching.
Wire the bias switch to the Zener diode so that in one position, the two resistors are connected to two terminals (center and outside) and the 18V 5W zener diode to the other two (center and outside) of the DPDT toggle switch. **This is the 6V6 Position.**
The switch puts the Zener in circuit to lower the voltage and it puts the two bias resistors in parallel to change the bias range. Make sure you orient the switch accordingly.
Note: The toggle will point AWAY or OPPPOSITE from the 2 terminals that get switched.
Remember to insulate the lugs and wiring to prevent switch arching.

3 Install Transformers

Install the power transformer. The Power transformer lies down along it's 'long axis'. Tightly twist the AC mains leads (Black/Black) together. Braid the High voltage (Red - Red/Yellow - Red) and the heater leads (Green – Green/Yellow - Green).

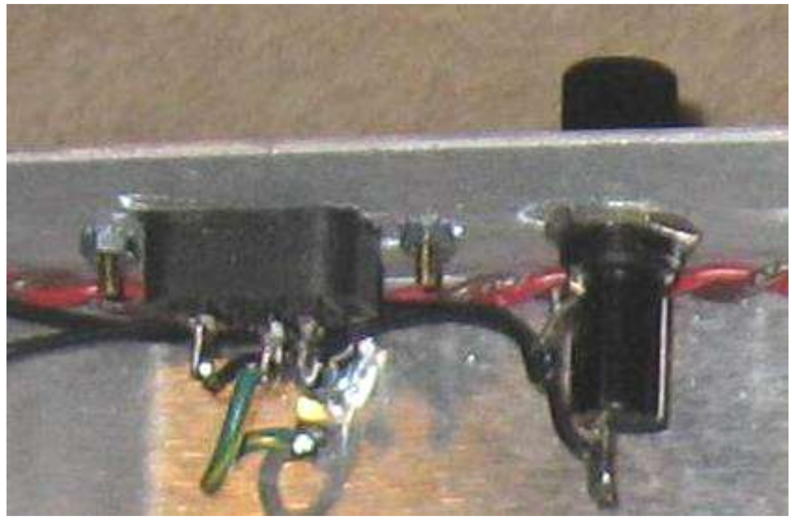
Align the AC mains leads so they face towards the outside of the chassis. The High voltage (Red - Red/Yellow - Red) and heater leads (Green – Green/Yellow - Green) face inwards. Feed the leads through the 3 grommets installed in the chassis with the High voltage and heater leads going through separate grommets. Bolt the transformer in place with the supplied 8-32 bolts & Keps nuts.

Install the Output transformer. The Output transformer lies down along it's 'short axis'. Braid the High voltage leads together (Brown – Red – Blue) and also braid the secondary winding leads (Yellow (4 ohm), Green (8), Orange (16) Black (Common).
Align the High voltage leads so they are pointing towards the Power transformer. Feed the leads through the 2 grommets installed in the chassis with the High voltage and Secondary lead going through separate grommets. Bolt the transformer in place with the supplied 8-32 bolts & Keps nuts. The secondary leads should be in-line with the impedance switch.

4 Power Supply Wiring

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

Now is the time to wire up the rest of the main power supply. Start with the IEC socket and ensure it is grounded to the bolt/lug on the chassis immediately beside the socket. Tighten the ground bolt tightly. Run a wire from the 'Hot' or 'Line' side of the IEC connector to the lug on the end of the fuse holder and from the lug on the side of the fuse holder to the power switch. Make sure the switch was installed with the desired 'On' position when the connection is 'made'. Connect the 'LINE' side wires to the power switch.

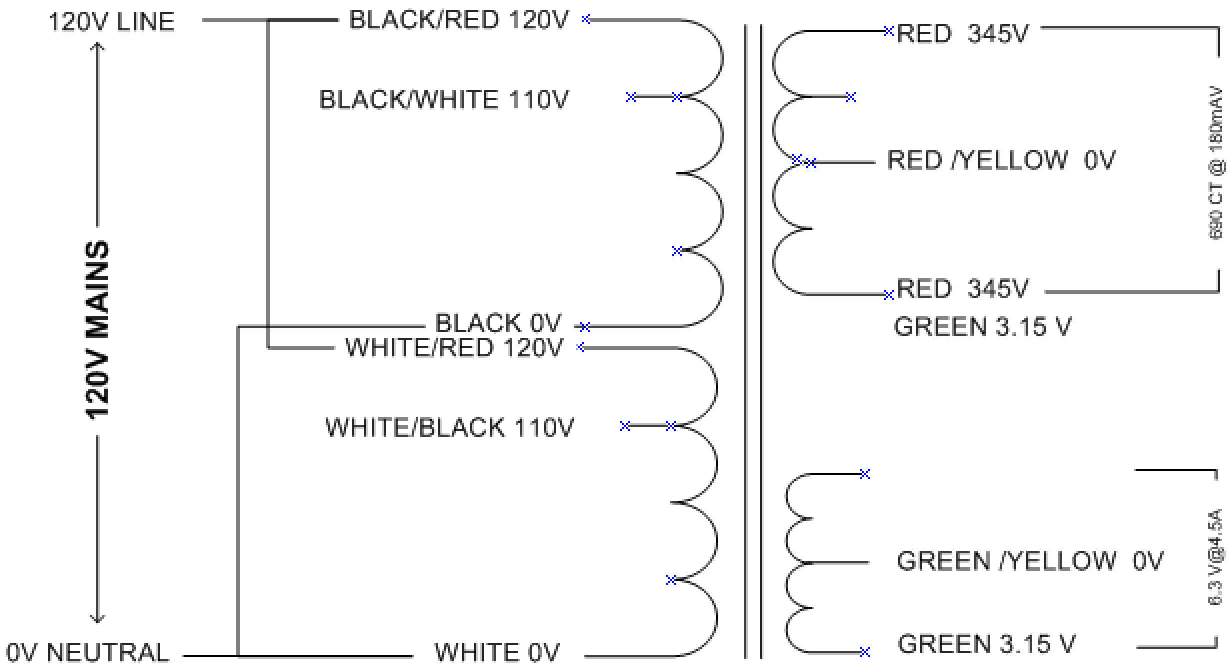


For 120V it is the BLACK/RED and WHITE/RED wires.
For 240V it is the BLACK/RED. For 240V the BLACK wire gets connected to the WHITE/RED wire.

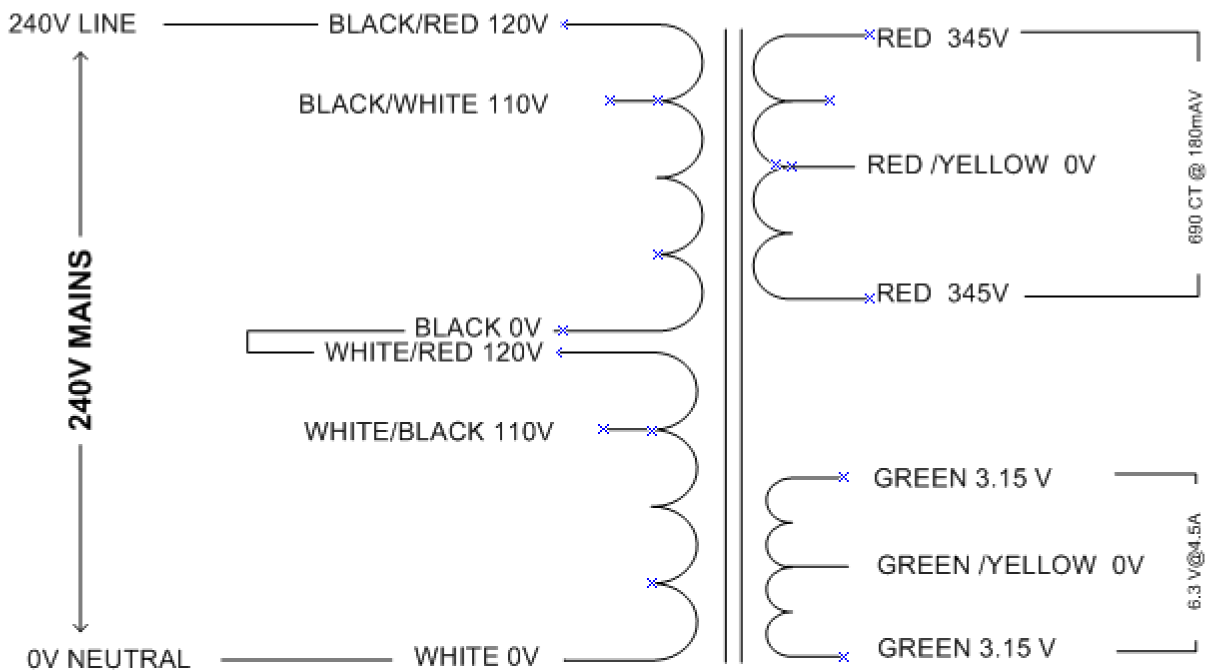
The other side of the IEC socket or 'NEUTRAL' gets connected to the 'NEUTRAL' side of the power transformer.
For 120V it is the BLACK and WHITE wires.
For 240V it is the WHITE wire.

Tie off the unused leads (110V BLACK/WHITE and WHITE/BLACK wires) that are not required for the build. Tie it off by cutting off the exposed wire and then put heat-shrink over the end and then tuck it away as it is not used. You can also connect unused wires to a terminal strip.

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 230V	Green/White or Green/Yellow	It makes no difference how the other two wires are matched.	

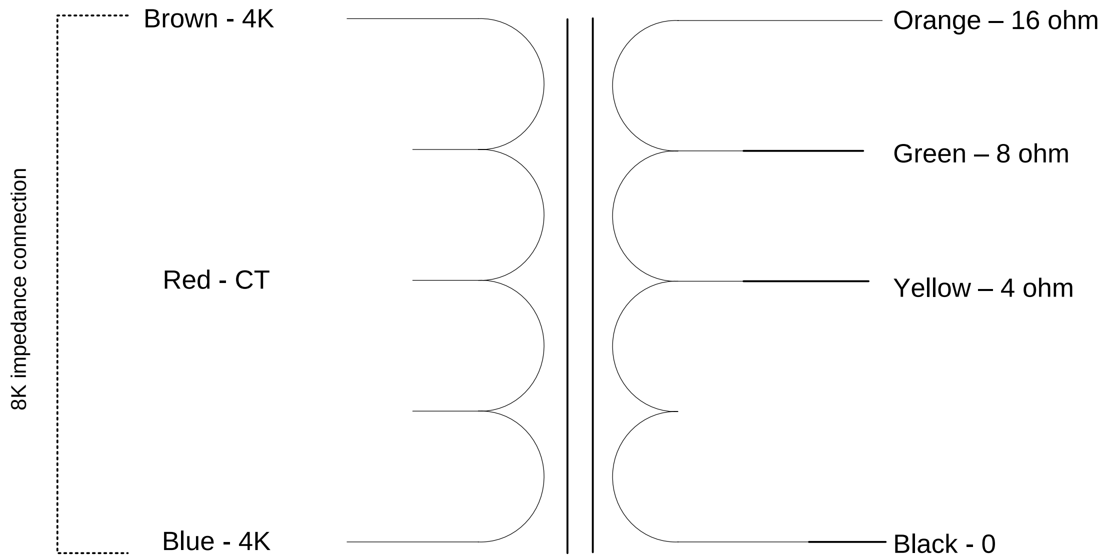


Trinity Amps 9642-EX -1 Power Transformer 120V HOOK-UP



Trinity Amps 9642-EX -1 Power Transformer 240V HOOK-UP

Trinity Amps HTS-9642-EX-1 Power Transformer

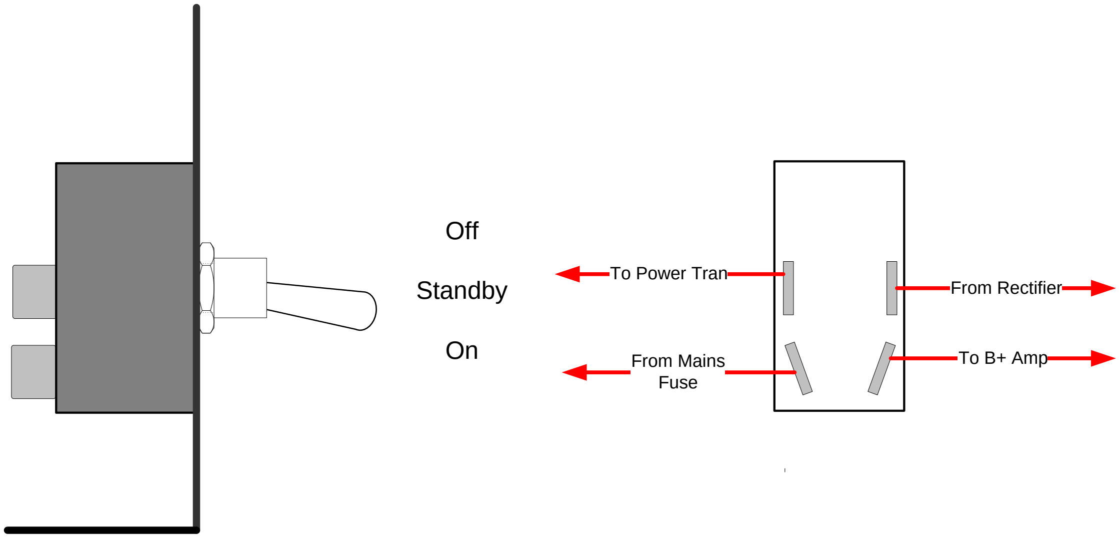


Trinity Amps HTS-9641-1 50EZ Output Transformer

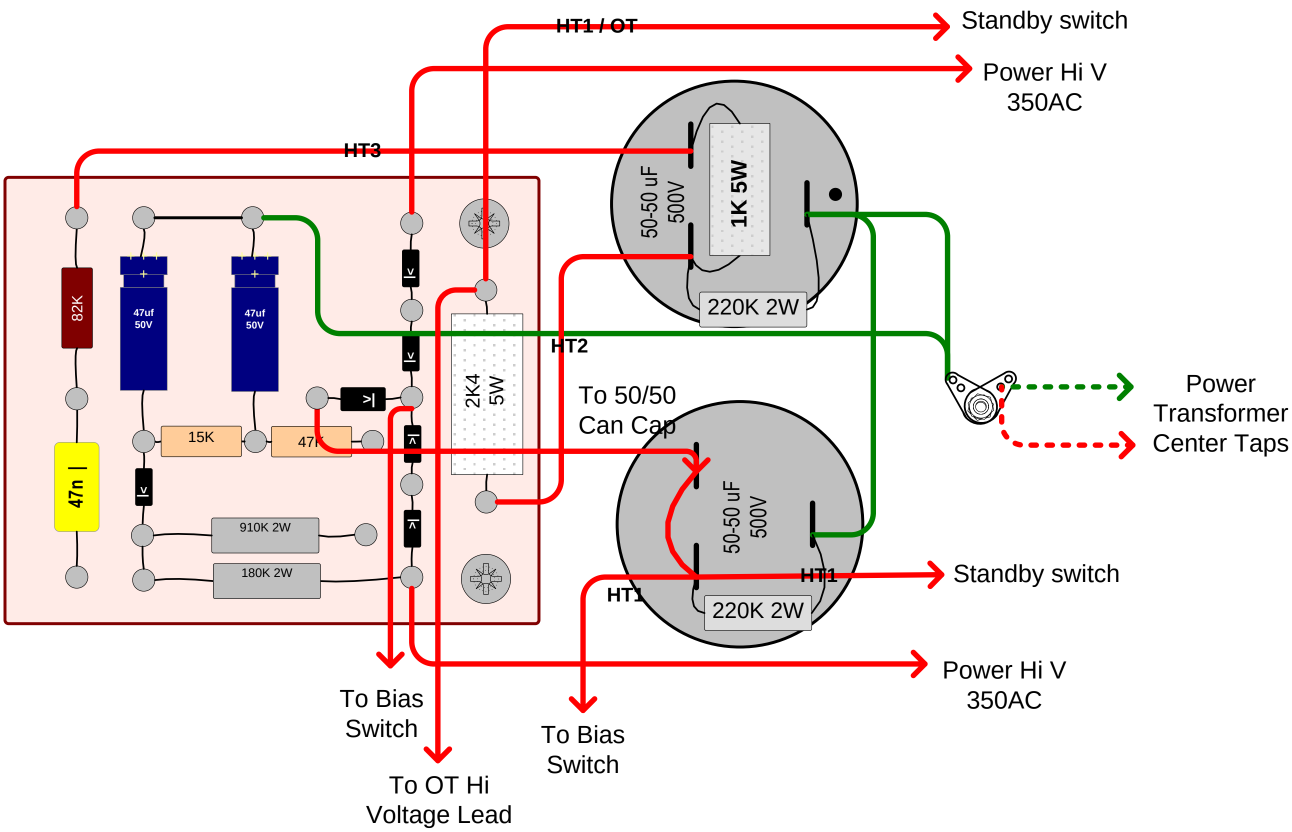
Wiring the Progressive Power Switch

This amp has a special power switch that combines both Power and Standby into one convenient switch. In one extreme position, the amp is Off, in the middle position it is on Standby and in the third position it is in the On position. This switch is **not wired up like other power switches** so follow the diagrams below and layout closely.

Make sure the switch is in the desired on position when it is on. Align according to the front panel. Connect the twisted leads to the AC side of the switch. Now connect the lead from the rectifier center position to the switch DC side, and then return to the board 2.4K resistor for the DC side.



Attach a wire to the other side of the standby contact and route that to one side of the can cap following the layout. From this point connect to the centre tap of the Output Transformer. Connect from the other side of the dual cap, and the 1K5 power resistor, to the turret board following the layout. Connect the centre of the can cap to the power amp star ground point.



Connect the center tap of the high voltage leads from the transformer to the power amp star ground point.

Test the Power Transformer

This is a good time to check your mains wiring to the power transformer and ensure all wires are safely connected or tied off.

Without tubes installed, mains supply **unplugged**, trannies **NOT** soldered to the board, get out an ohmmeter. Remove the pilot lamp from the 6.3 V assembly. Use an ohmmeter to verify that the connection points for the Power Transformer (PT) secondaries are not shorted to ground. With no tubes and no pilot lamp, each half of the 6.3VAC (Volts A C) secondary when measured to ground, should <u>not</u> read zero ohms. It will be low, but not zero. With solid-state diodes, there is continuity to the filter caps. So, you will see an initial low resistance that increases with time as the filter caps charge. Use the continuity setting on your meter for this.

If all is well, solder in your transformer's low voltage secondary leads (120 or 230 volt primary). Don't solder in the High Voltage (HV) secondary. Also solder in your Output Transformer (OT) secondary.

Install your pilot lamp and the slo-blo mains fuse. Switch to standby for 1 second just to see the pilot come on nice and bright. This checks that the 6.3VAC supply line is not shorted and is properly connected to the lamp. If the lamp did not come on, check to see if the fuse blew. If not, try another lamp and do the 1-second power thing again. If the fuse blows, there is a short on the PT or mains. If the fuse survives, then it's likely that the 6.3VAC is not properly connected to the pilot lamp. Use your AC voltmeter to check for 6.3VAC (actually more like 7VAC with no tubes installed) at the lamp and all the tube sockets.

In the following steps, B+ is going to go to full voltage. **Be extremely careful**.

Assuming you now have a bright pilot light, connect your AC voltmeter to the power transformer's High Voltage secondary (which is still not soldered into the circuit). Turn the power on just long enough to get a reading to verify it is correct. You should get a value 10 to 20% higher than the rated output voltage of 700 VAC. Measure the AC voltages to ensure they are within spec of the provided transformer schematics and specs.
If you get a value less than the rating, shut down the amp and check the fuse. If you get a proper value from the HV secondary, power down and solder the secondary to the recto tube or diodes. Hook your Volt Ohm Meter (VOM) to the HV secondary again.

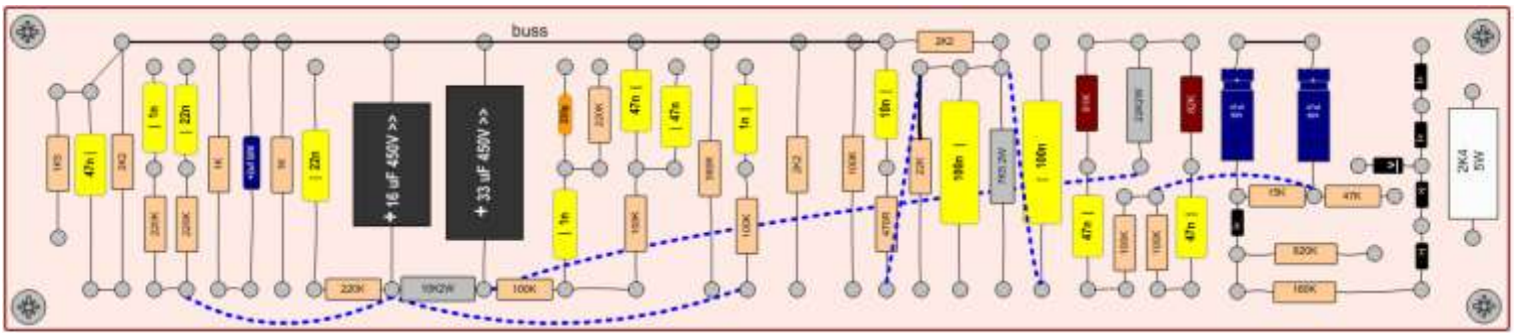
BE VERY CAREFUL at this point. Your B+ will charge up for this power up.

Connect up the Power Supply Filter Capacitors. If not already done, install the two 50+50uF can caps onto the chassis. These are held in place by a large clamp bolted to the chassis. **Take special note of the polarities of the can caps**. Identify the two positive terminals and orient the cap connectors as per the layout diagram. Attach the 1K5W filter and 220K 2W bleeder resistors to them. Connections to the ground terminals and chassis ground are now made. Also, install the jumper across the first filter cap between the two positive terminals. Wiring to the board will wait until the board is installed.

5 Turret Board Construction

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

Install the 6 jumper wires on the underside of the board. Follow the pictures below.



TRIWATT Board

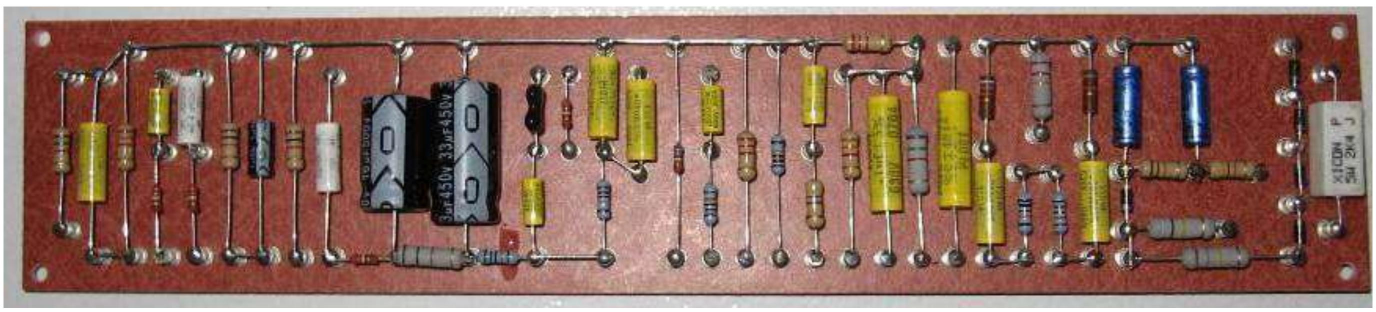
Strip a piece of the supplied 20 gauge solid core wire long enough for the buss bar. Bend it at each end and install the ground buss bar onto the board. Do not solder in place yet.

Carefully identify the board components and their values. **Measure the resistor values to confirm they are correct**. **If you can, check the capacitor values as well**. See the section on how to read Resistor and Capacitor codes. Ensure that electrolytic capacitors (power supply, bypass caps) are aligned with the correct polarity on the board. There will be a '+' sign, or indentation to identify the positive end of the capacitor.

Arrange the board according to the layout diagram and follow the diagram closely.
Capacitor Orientation: In the manufacturing of a non-polarized capacitor, Mallory, SOZO, ETR etc., one of the foils ends up on the outside while the other is wrapped on the inside. As a result, the outside foil may be used as a "shield". To minimize amp noise, we can orient the outer foil side in circuit stages to take advantage of this inherent shielding.
If a signal travels into a coupling capacitor and enters the outside foil side, this will act as a shield, minimizing induced noise interference. Ideally you would be able to connect the outer foil to the incoming signal point or to the lower impedance stage. For capacitors that are used as cathode bypass capacitors or in tone stacks, the outer foil gets connected towards ground. For coupling, the outer foil is oriented towards the previous stage.
Some manufacturers such as SOZO have this polarity marked. Others do not. In this case, if you have access to an oscilloscope, you can quickly determine which lead is the outer foil.
Set your oscilloscope to a low AC setting [10 - 20mV] and hold the capacitor between your fingers to induce noise. Connect the oscilloscope probes to the capacitor leads. One orientation of leads

will result in a lower reading. In this case, make note of the lead that is connected to the oscilloscope ground lead (usually has an alligator clip) and that identifies the outer foil. Mark the capacitor with a sharpie and install the cap as per the provided TRIWATT board layout.
Install the components on the board by following the layout – from left to right.

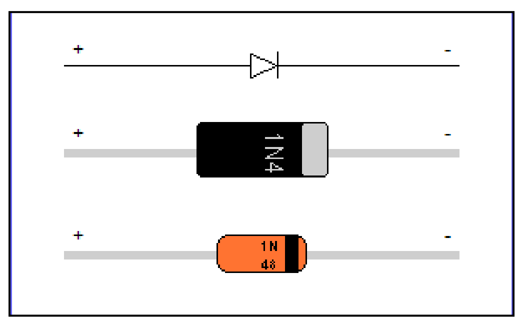
Note: For multiple component leads that must fit into one turret, insert them first and solder once when they are all in place. Bend each component lead at 90 degrees so that it fits into the turret, squarely and neatly. Solder each turret once all component leads that connect to it are in place.



TRIWATT Completed Board Top View

Diode Orientation: Pay particular attention to the orientation of the 5 diodes when they are installed. Even though Rectifier diodes are quite robust and require no special precautions for soldering them, use a minimum amount of heat.

Diodes must be connected the correct way round, and circuit diagrams may be labeled 'a' or '+' for anode and 'k' or '-' for cathode (yes, it really is 'k', not 'c', for cathode!). The cathode is marked by a line painted on the body of the diode. Diodes are labeled with their code in small print, and you may need a magnifying glass to read! The diagram below shows the orientation of the 1N4007 diode.



Testing Diodes: If you ever need to test a diode, you can test with an ohm meter, using a setting that shows a picture of a diode on it. Put it to that setting and just put the red (+ve) lead on one leg of the diode and the black lead on the other leg. If you get a resistance reading the cathode is on the side where the black lead is. If you get no reading the cathode is where the red lead is. If there is a dead short you will get a buzz tone out of the meter. Same as if you touched the leads together.

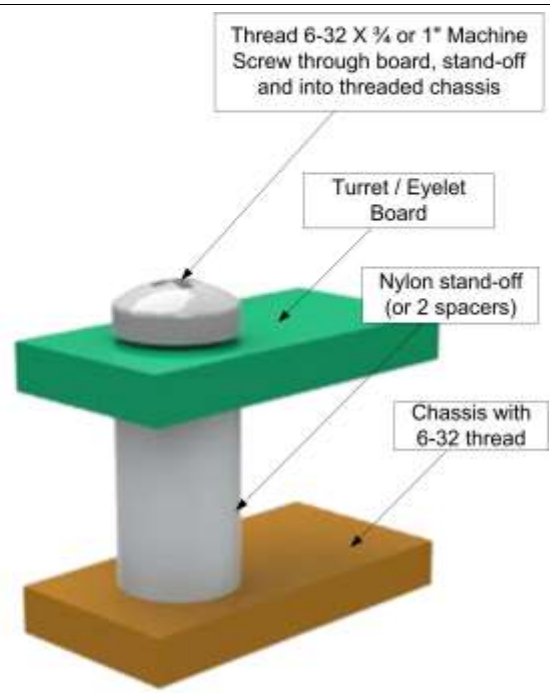
Now, cut connecting wires to the control side in various colors to about 9" to 12" long each and to about 6" long to the tube pin side. We suggest you confirm the approximate lengths before cutting.

Use 18/20 gauge stranded wire for connections to ground, power switch, B+ to output transformer and diodes. These can be cut-offs from installing the transformers or any provided wire.

Following the layout, install the connecting wires to the bottom of the board leaving plenty of extra length, wire is cheap, and it'll save aggravation later.

When the board is built, double check all components, jumpers and leads against the layout. If all is correct, carefully install the board into the amp.

Installing the board and stand-offs



The chassis is tapped to receive 6-32 machine screws. To mount the board, align the board mounting hole, stand-off and tapped hole and then thread a 6-32 X ¾ / 1" machine screw through board, stand-off and into threaded chassis. Tighten to keep it in place and repeat for each corner. Use #6 lock washers under the screw head.

.

6 Connecting the Turret Board

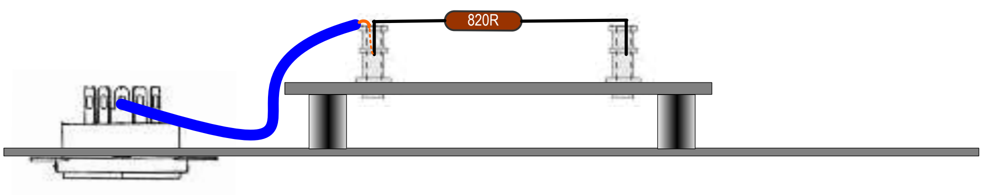
Now is the time to make the connections from the turret board to the tubes.

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

Also, some tube sockets require components or jumpers to be installed on them.. Some builders prefer to do this work out of the chassis. Pre-form these components to fit into place and you may use some heat shrink tubing make sure they do not touch other parts or pins especially the jumper on V4. Solder the parts in place following the layout provided keeping in mind what connections to the board still may need to be made.

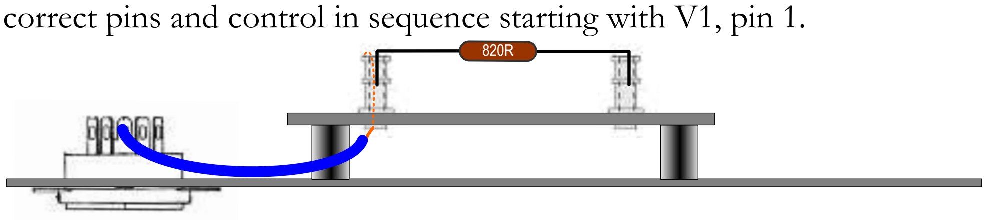
Start at the V1 end of the amp and work your way sequentially to V6 doing the point-to-point wiring. Board to tube pin; board to tube pin etc. Start at V1, pin 1 and move to the far end of the board to V6.

Identify the first turret and its destination socket pin.
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.
<u>After installing the turret board</u> 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.



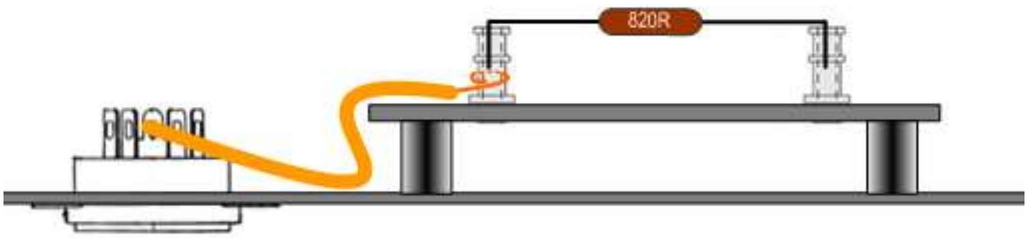
Once cool, press the wire so that it lies flat on the board and chassis with any excess tucked underneath the board.
Repeat for each turret that has a connection to a socket pin or from the turret board to a Toggle Boost switch or terminal strip for screen resistor.

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.

Do not connect the leads to the power supply or diodes yet.

7 Connecting the Turret Board to Controls

Now is the time to make the connections from the turret board to the potentiometers.

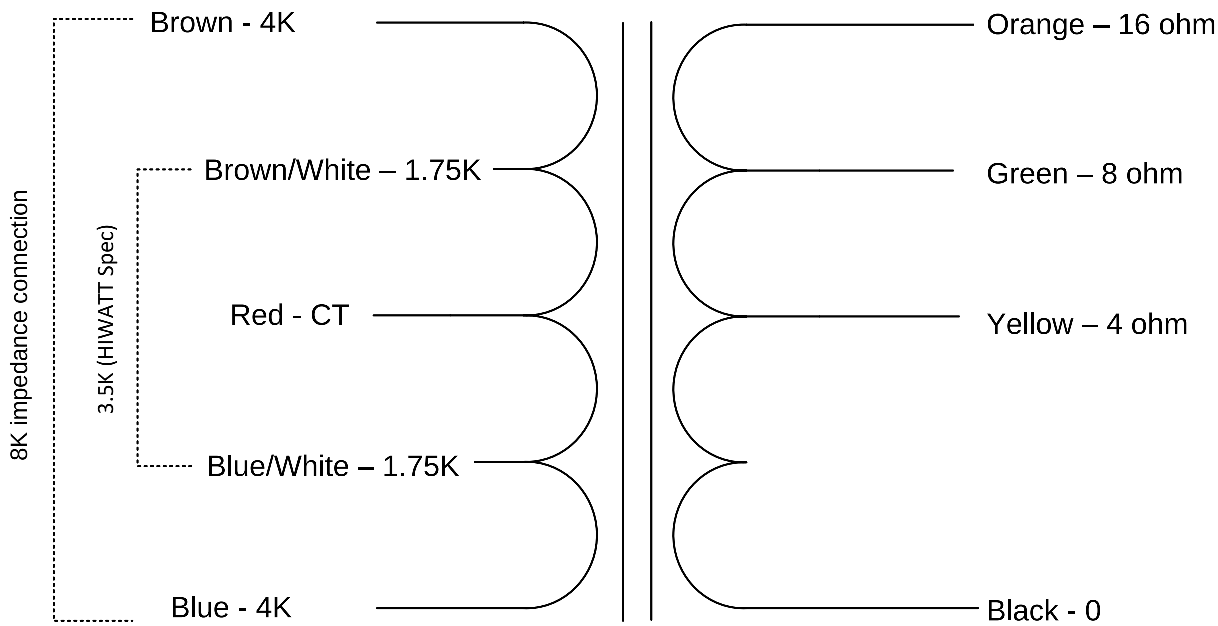
The easiest way to wire these correctly is to follow the layout, and do one terminal connection at a time. Some of these terminals require more than one wire connection, so arrange these accordingly and solder once.

Some controls may require components need to be installed for tone controls etc.. Pre-form these components to fit into place and use some heat shrink tubing ensure they do not touch other parts. Solder them in place following the layout provided.
Follow the steps above to connect wires from turrets to controls.

8 Output Transformer - Output Jacks

Refer to the Output Transformer schematic. Twist the Blue & Brown output leads from the transformer to the output tubes. Leave enough transformer lead length to reverse the leads from one 6V6/KT66 to the other if necessary to eliminate amplifier squealing.

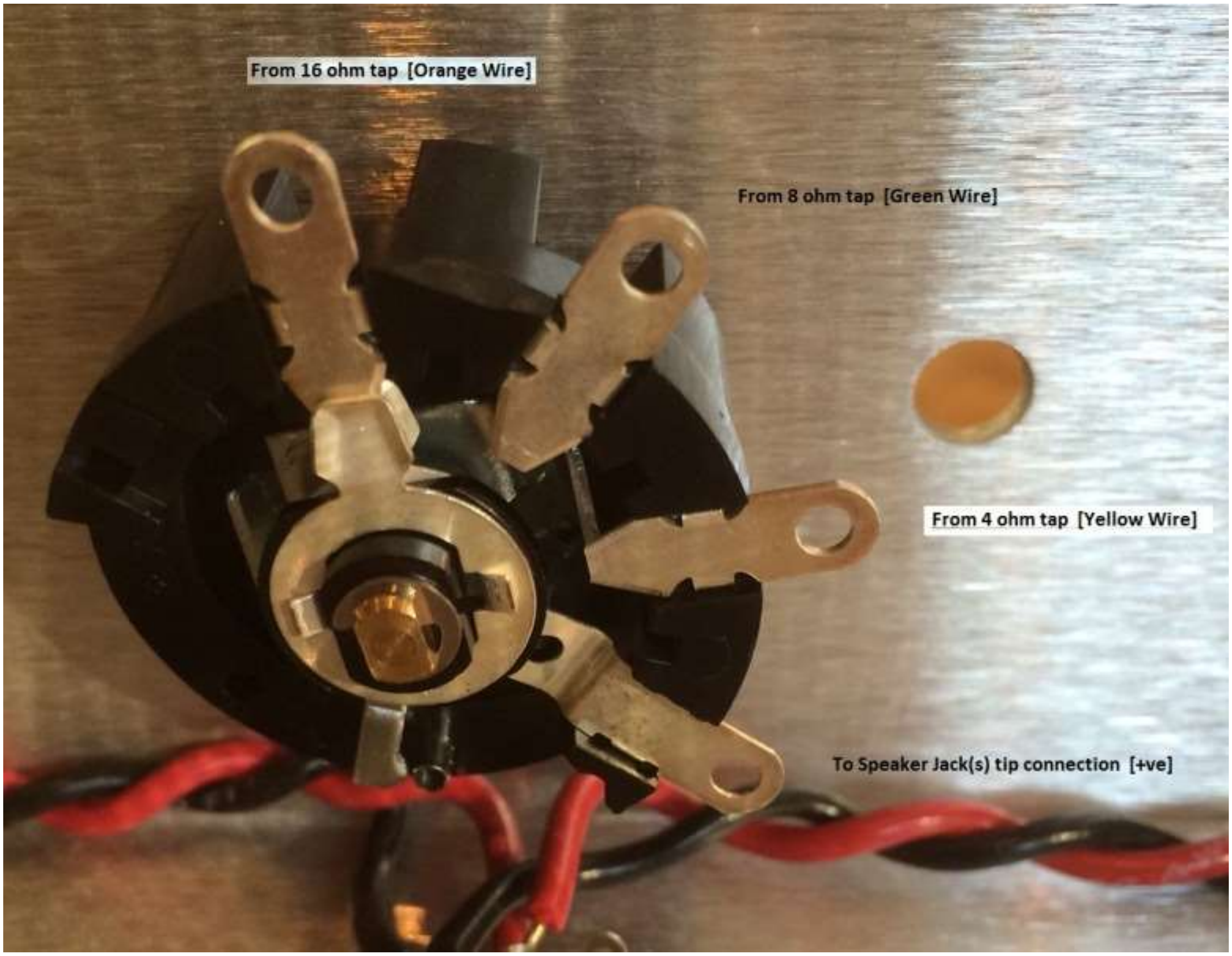
Start by soldering the Brown output lead to V5 and the Blue to V6.

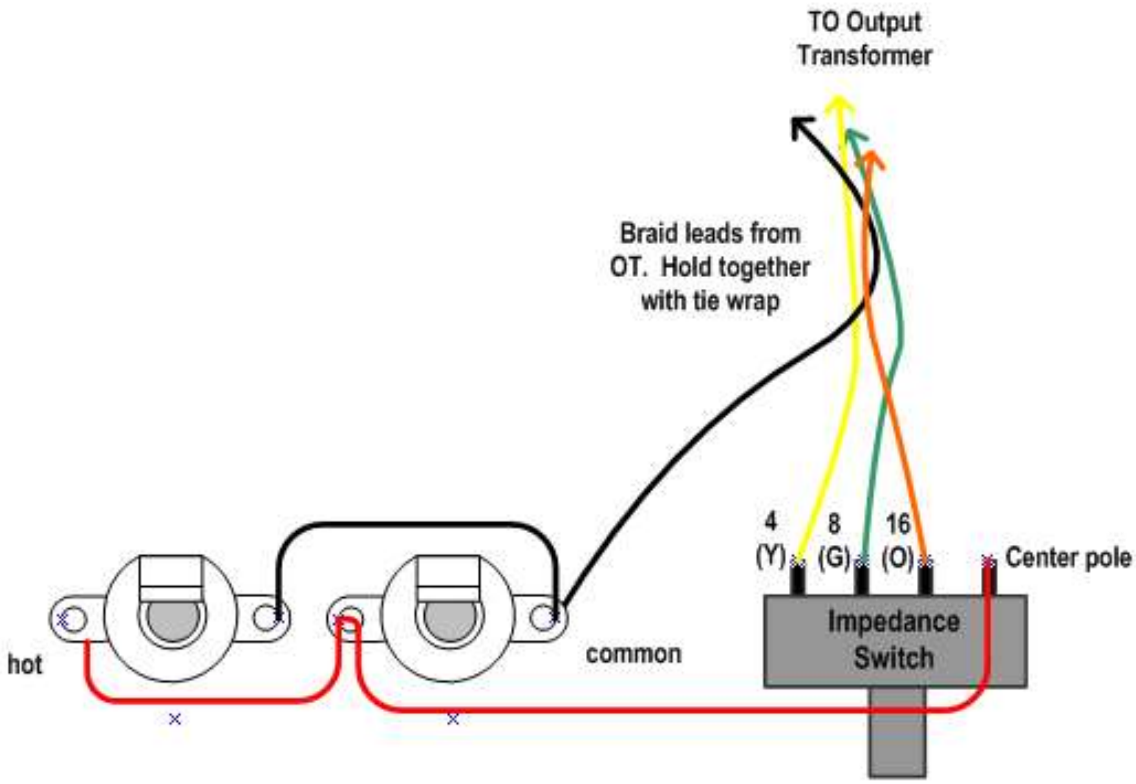


Trinity Amps TRIWATT Partridge Output Transformer

Connecting the Impedance Selector

Referring to the Output Transformer schematic above, 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.


From 16 ohm tap [Orange Wire]
From 8 ohm tap [Green Wire]
From 4 ohm tap [Yellow Wire]
To Speaker Jack(s) tip connection [+ve]



Connect from the center pole of the switch to the TIP/HOT 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/ COMMON position of the pair of output jacks. Strip enough wire to bridge between both jacks. Follow the layout above..

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

9 Input Jacks

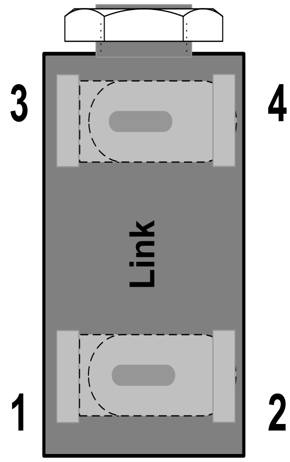
Wire up the input jacks. Use shielded wire from the input jacks to the tube and be careful when wiring switched input jacks. It is easiest to remove the jacks, wire them with the resistors and jumpers and then reinstall them. The ground wires on the input jacks go to the pre-amp ground along with the board ground at that end.

To prepare the co-axial cable for connections:

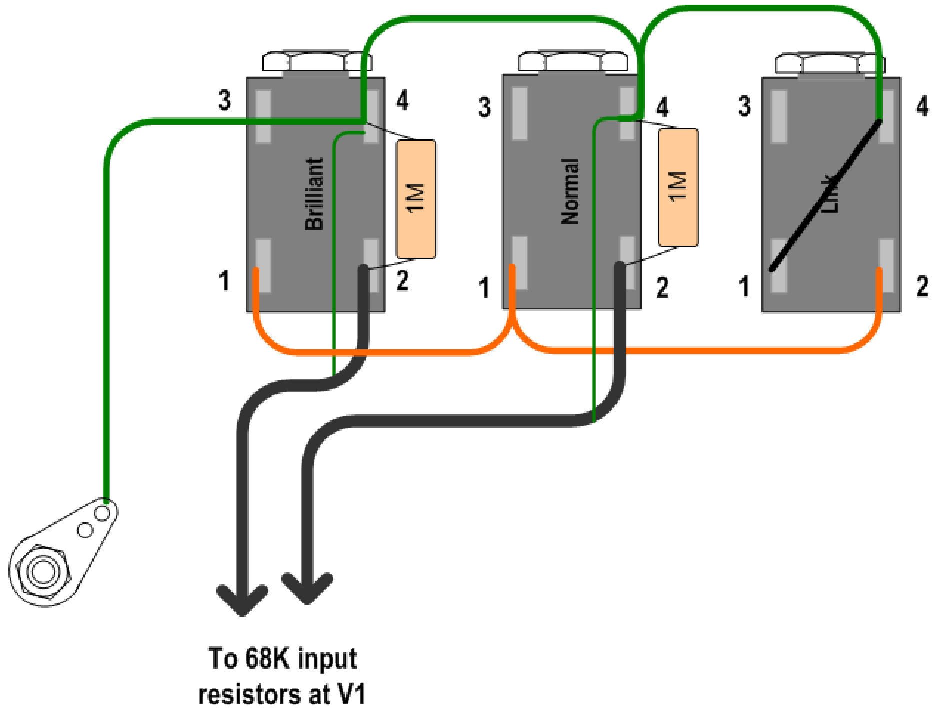
1. Cut back the outside plastic covering at both ends by about 5/8" to reveal the braided shield.
2. At on end, pull back the shield and cut it off at the 5/8" mark. Put some heat shrink around the end covering the area where it was cut off.

3. At the other end, pull back the shield but poke a very fine screwdriver or pick into the shield and work out a ‘hole’. Fish the inside conductor through this hole and pull it through.
4. Twist the braid together.
5. Finally, cut back the outside plastic covering on the inside conductor at both ends by about 1/4"

Cliff Jacks - 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’.



Bottom view of a Cliff Jack showing the hidden connections, underneath with dotted lines



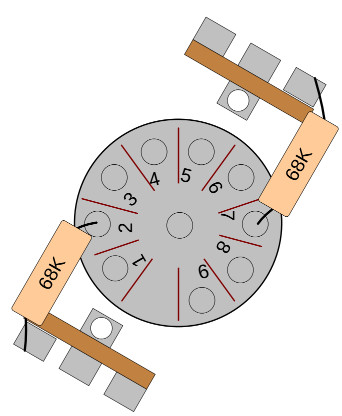
On the input jack end, connect the shields to the ground point on the jacks, which in turn go directly to the pre-amp ground. Do not connect the shields at both ends of the cable or you will induce hum.

Measure enough shielded cable to reach from the input jacks to the terminal strip, routing the cable around the end of the turret board. Prepare the shielded cable for connection and put some heat shrink over the end to ensure there is no chance the shield will connect to ground or touch the tube pins. Solder the shielded cable centre conductor to each 68K resistor on each tag.

Input to V1

If you haven't already, install 2 3-lug terminal strips at the base of V1 closest to the board. Use the tube socket mounting bolt to hold the strip in place.

Connect the two 68K input resistors from two of the tags to the input (pin 7 and pin 2) of V1. Make the end that connects to the input pin 7 as short as possible.



Input to V1

9 Final checkout

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

Test continuity for all the connections. Set your meter to continuity and follow the layout diagram to make sure all the connections are correct. Trace or highlight the connections on a copy of the layout provided with the kit to ensure the amp is wired correctly. Check everything at least once! Touch each component's lead and touch the lead at the other connection.

Measure the resistances to confirm they are correct.

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 between 1 ohm and 0.1 ohm typically.

Make sure the Mains ground at the chassis is **very** tight.

10 Power Up

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 between the plate of a preamp tube and chassis ground. 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.

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.
Wherever possible connect the meter into the circuit when the circuit is OFF, then power up the circuit without touching anything.
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.

Discharging the Power Supply

If you need to service the amp after having it on, you must "discharge" the power supply capacitors. This is done by unplugging the amp, turning the power to the on position and letting it sit for 60 seconds or so. The 150K 2W resistor will drain the supply in about 60 seconds but always use a multi-meter to check the residual B+ voltage in the large filter capacitors to make sure it is fully discharged. REMEMBER: DO NOT OPERATE YOUR AMP WITHOUT A LOAD

The following the procedure to follow for the first power up of a new amp. Don't give in into the temptation to "fire it up" as soon as the last solder joint is cold.

Complete all the basic circuit checks already mentioned before soldering the transformers into the rest of the circuit. **If you haven't performed the Power transformer test, go back and do it**

now. If you've already soldered in your trannies, take a minute to desolder the secondaries from the rest of the amp and go back and test them.

Install a 2 AMP SLO BLO fuse.

Note: If you see or smell smoke when you turn on the amp, turn it off immediately and re-check the connections. It is common for new tubes to emit an odour upon initial start-up.

Test the 6.3 AC filament voltages and ensure they are on the correct pins for all tubes. Remember this is AC voltage, not DC so set your meter.

THIS IS IMPORTANT: Before powering up **INSPECT DIODES & FILTER CAPS**. You MUST have the **diodes and cap polarities correct**. This is critical but an easy mistake. If either the diodes or caps are wired in reverse, you can destroy the caps, diodes and possibly the power transformer!

If all is OK, install solder the power transformer leads to the turret board following the layout in the above "Power Supply Wiring" section and the main layout as well.

Power up the amp and watch the following things as quickly as possible and roughly in this order:

- pilot lamp comes on brightly; and
- High Voltage secondary goes to nearly the same value as it did with the lines unsoldered

If any of these does not happen, shut off the amp immediately and find the problem by looping back to the beginning of this checklist. If these check out, power down. B+ MUST be discharged to safely continue messing with the amp guts. The included bleeder resistor will take at least a minute to bring B+ down to safe levels.

Now hook your DC voltmeter to B+ and ground. Power up again and check the B+ voltage. With no tubes installed, all the filter caps will charge up to the same voltage. The voltage should be very close to 40% higher than the raw AC. Assuming you measured, say, 700VAC across the full secondary in the above steps, then each half is delivering 350VAC. B+ will be ~40% above this, which is ~490VDC.

KEEP IN MIND that every time you power up from now on that B+ will be high. In all the following, allowing B+ to bleed at each power down is implied.

If all is well, check that B+ is at the OT on all the primary taps. Without the power tubes installed, the OT primary should be at B+. If not, something is wrong at the OT. Power down immediately and check for shorts of the OT primary. This should not be the case, however. An OT short should have been caught by now by checking B+ levels in the previous steps. This is really just a final sanity check to really make sure the trannies aren't going to be killed by any mistakes. Leave the amp on for a few minutes and make sure neither tranny is getting warm. The OT should stay dead cold and the PT should get just a little warm supplying the pilot lamp and heaters. Make sure the negative voltage is being generated and check that it gets to the power tube grids and is adjustable with the bias pot.

Now we're ready to put some tubes in. Power down and install all the signal tubes. You also need to hook up a speaker or dummy load for the OT. Use an old or less valuable speaker to get started. Turn volume and gain pots all the way down and tone controls to center. Turn the 10K bias control pot all the way down (fully anti-clockwise) to start (most negative grid voltage possible). Power up and, again, watch for the following signs:

- pilot lamp comes on brightly;
- all tube filaments light up right away;
- tube plates do NOT glow red (overheat) paying attention to power tubes.

Bias Setting: Check power tube current and bias appropriately soon after power up to make sure all is well.

Set the tube selector toggle switch to select your type of power tubes - 6V6 or KT66.

Set your meter to the mV scale. With the 10K bias control pot all the way down (fully anti-clockwise), insert the black (negative) test probe into the Black bias test point jack. Put the other into the Red bias test point jack.

Turn on the amp. You should have a small reading in mv. Since you are measuring across a 1 ohm resistor, then this is the equivalent ma bias. i.e. 10mv on your meter is reading 10 ma bias.

Slowly move the pot with a small screwdriver until the readings are as follows:

6V6 Bias	15 ma min	23 ma max
KT-66 bias	30 ma min	40 ma max

You should be able to hear a little hiss or hum from the speaker. Of course, hopefully this is at a low level, requiring your ear up next to the speaker to tell (make sure the Overdrive control is pushed in -ie Off). If hiss and hum is loud at this point, there are problems. If there is dead silence, something is likely wrong, too.

With the bias set correctly, you can now 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. If you have a cathode follower in the signal path, the grid should be at the plate voltage of the previous stage and the cathode should be about a volt higher.

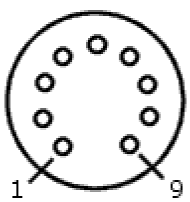
If all seems in order, and the fuse has not blown, turn the volume up a bit. Plug in a guitar input cable, and touch one end. You should get a louder hum, this is a good sign. If you get this far, it's time to plug in your guitar and take the amp for a test run.

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.

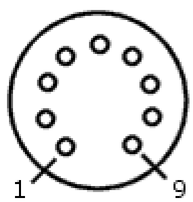
Trinity TRIWATT 6V6 Voltage Chart

AC Mains Voltage 122VAC;B+ 460 VDC no tubes installed;442 VDC with tubes

6V6 Bias	15 ma min	23 ma max
KT-66 bias	30 ma min	40 ma max



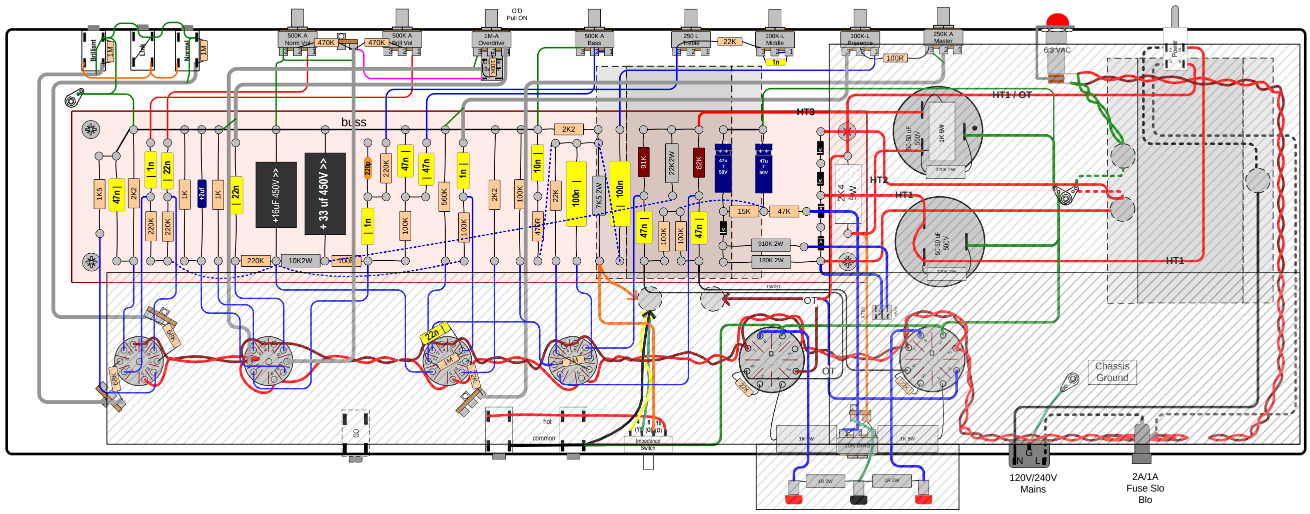
12AX7/12AT7



6V6

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 (12AX7/ECC83)	150	0	1.2	--	--	120	0	1.0	--
V2 (12AX7/ECC83)	179	0	1.2	--	--	106	0	0.7	--
V3 (12AX7/ECC83)	269	67	71	--	--	188	0	1.5	--
V4 (PI) (12AT7/ECC)	274	71	74	--	--	236	64.4	74	

* Varies with bias pot setting



The shaded area in the above layout above indicates areas of the TRIWATT where you should take extreme caution. There are voltages in this area in excess of 450 VDC.

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, **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 DISCLAIM 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 support page document Builders Guide General Troubleshooting

Triwatt Tone Tweaking

Below are some modifications you might try in order to change the tone and response of your TRIWATT.

V1 Pin 8 - Townshend/Who CP103 1k5 + 64uF
V1 Pin 8 - Jimmy Page amp 2k2 + 100uF with additional parallel 1k5 resistor
V1 Pin 8 - SAP DR 103 2k2 + 100uF (no additional resistor)
V1 Pin 8 - Late '70s, Late '80s and OL/Lead 1k5 + 150uF

V2 Pin 3 - Townshend /Who CP103 2k2 + 47nF (47nF = .047uf)
V2 Pin 3 - Page/SAP DR103 1k5 + 47nF

If you want to mod your TRIWATT to any of these versions, solder the extra components onto the existing turrets.

Normal channel gain can be reduced a little more by changing the cathode resistor on V1 Pin 8 from 1k5 to 2k2, like in early '70s models. Just another small tweak you may want to consider.

To get a bit more clean put a 5751 in the V3 position, with a 12AT7 in the PI V4 will provide more clean on the MV control. Optionally remove the 47n bypass cap on V3 pin 8. Removing the cap would reduce a fair bit of post-MV gain, as well as increase bass, but may not be to the liking of those folks who would want a Triwatt for its earlier breakup compared to a DR.

More Tips for fine tuning your amp

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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 (and resistors of 100k or above) with metal film types. This can help reduce hiss..

Running EL34 Tubes in the TRIWATT

THIS MODIFICATION IS EXPERIMENTAL & AND DONE AT YOUR OWN RISK.

The EL34 can work in a TRIWATT but you have to make a couple of changes. This will definitely have similar headroom to a 4 holer and a bit more volume than the standard TRIWATT.

The variable bias switch works by putting a second resistor in parallel with the 180K (6V6) . Default is 180K in parallel with 620K = 140K (for KT66 setting). You may not have enough adjustment in the bias pot to get EL34 in range. So you can try a 1M resistor in place of the 620K KT66 resistor. In parallel with the 180K 6V6 resistor = 152K.

Plug the EL34 in and put the switch to the KT66 setting which is a higher voltage by about 15V-18V or so than the 6V6

Carefully set bias of the KT66 setting to get around 33 mA/mV max. on the power tubes, at 450v. You may still have to play with the bias resistor to get into range.

When you use them, **set the output impedance to 4 ohms and plug into an 8 ohm cabinet**.

.

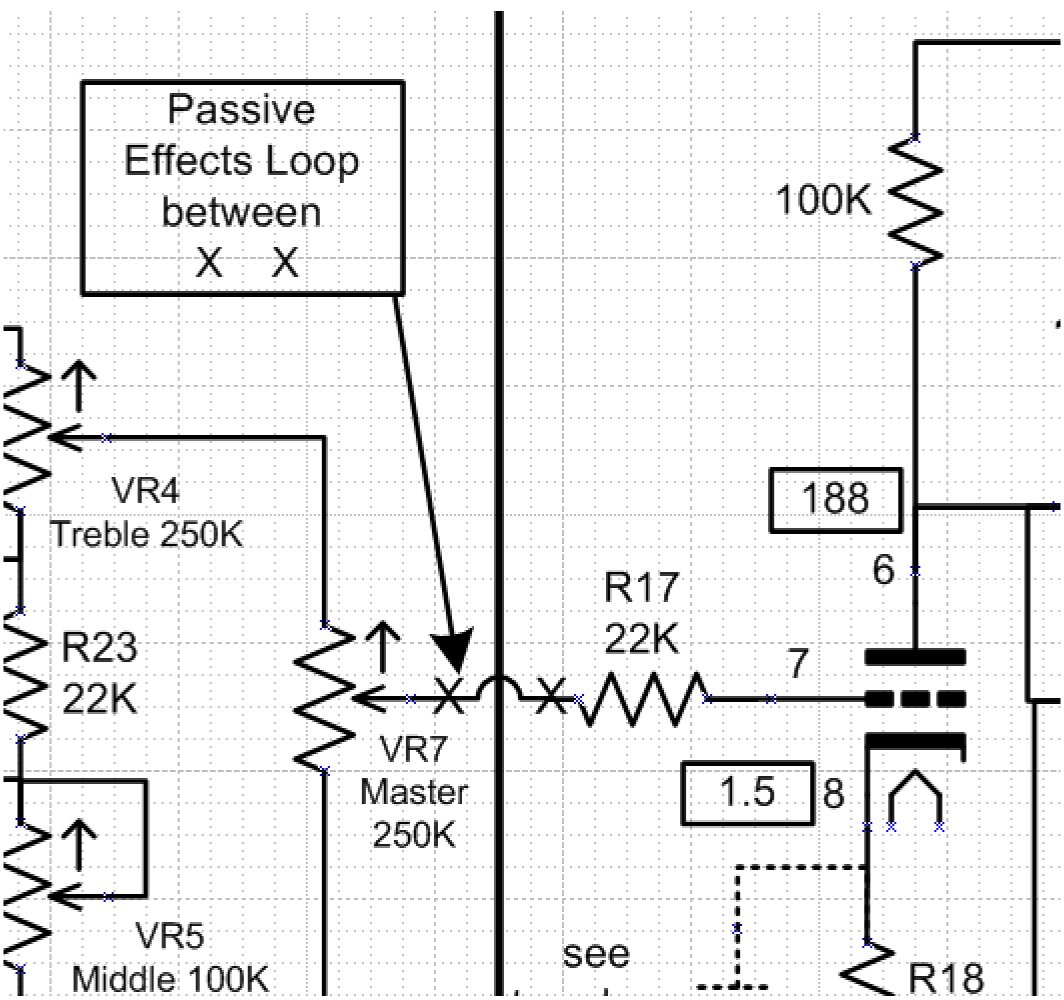
Installing a Passive Effects Loop

Note: This is for experienced builders.

To add a passive effects loop, all it needed was an interrupt between the Master Volume wiper and the 22k resistor that goes into V3 pin 7. It does not need a 1M to ground at the return to balance any potential impedance mismatch. Also it does not need a coupling cap. Very simple mod and the amp still sounds great.

Wire the switched send & return jacks so that when there is nothing plugged in them, the loop is bypassed.

To accommodate the send & return jacks in the chassis drill two new holes between the Output Jack and OD Footswitch jack. This works well, and places the send and return jacks in exactly the right place to have the shortest cable runs possible.



Appendix 1 - Tube Substitutions

12AX7 - High-Mu Twin Triode
Close or identical : 12AX7R, CV10319, CV492, ECC83
Different rating or performance : 12AX7A, 12AX7S, 12AX7WA, 5751, 5751WA, 6057, 6681, 6L13, 7025, 7382, 7494, 7729, B339, CK5751, CV4004, CV4017, CV8156, CV8222, CV8312, E2164, E83CC, ECC803, ECC803S, ECC863, M8137, QB339

12AT7 - Medium-Mu Twin Triode
Close or identical: CV10662, CV455, CV8154, CV9859, ECC81
Different rating or performance: 12AT7WA, 12AT7WC, 6060, 6201, 6679, 7492, 7728, A2900, B152, B309, B739, CC81E, CK6201, CV4024, E2157, E81CC, ECC801, ECC801S, M8162, QA2406, QA2407, QS2406

6V6GT – Audio Beam Tetrode Power Tube
Close or Identical: 5871, 6AY5, 6P6C*, 6V6, 6V6G, 6V6GTA, 6V6GTY, 6V6Y, 7184, CV509, CV510, CV511, OSW3106, VT107, VT227, WT2100082, WTT123, 6Pi6

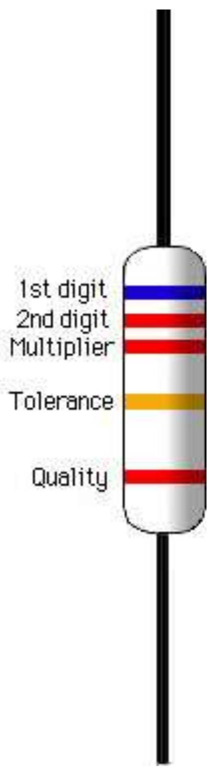
KT66 - Audio Beam Tetrode Power Tube
Close or identical CV1075, CV321, VT75(RAF)

Appendix 2 - 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.

Appendix 3 - 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
473	47000	47	.047
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%
M +/	20%
N +/	0.05%
P +100%	0%
Z +80%	20%

Appendix 4 - 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 TRIWATT, Lightning Strikes or, 18 Watt forums.

NOTE: B+ stands 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 TRIWATT, it is measured between the joined lugs of the 50+50 cap and chassis ground. It should be about 450 VDC with tubes, with 120 VAC mains.

Q: Does it make a difference as to what orientation I choose to make sure the power switch operates 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 the side. "ON" is where resistance is zero. Then rotate the switch so that DOWN is ON (UK style).

Q: The picture and layout show a grounding screw next to the IEC plug, the chassis is not drilled for one. Can I run the ground to the common star ground that the power transformer.
A: To meet electrical safety code, the mains ground must be connect by itself to the chassis. It is best to drill a hole to connect the 120 V ground to a bolt that fastens to the chassis.
Don't run the 120 V ground to the common star ground.

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 20 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,

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 black 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 do you wire up the impedance switch? The layout shows 4 lugs on the switch while the actual switch has two concentric rings of lugs, 4 inner and 12 outer.
A: The impedance switch inner & outer lugs are in pairs - 4 inside & 3 each for the outside. Connect the output jack to one of the inner lugs, and then connect each output tap from the transformer to the outside lugs that are 'paired' with that inner lug. You can confirm the 'pairs' by checking the resistance between the inner lug and outer lug at different switch positions.

Q: How are the three terminal tag strips next to V1 were supposed to be mounted, looked at the pictures on line and found they go under the V1 socket mounting nuts.
A: Yes. They are part of the socket mounting. Use the 4-40 nuts supplied to fasten them down.

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 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 – Resources Section. Right click on them to download if you want print in large, colour format.

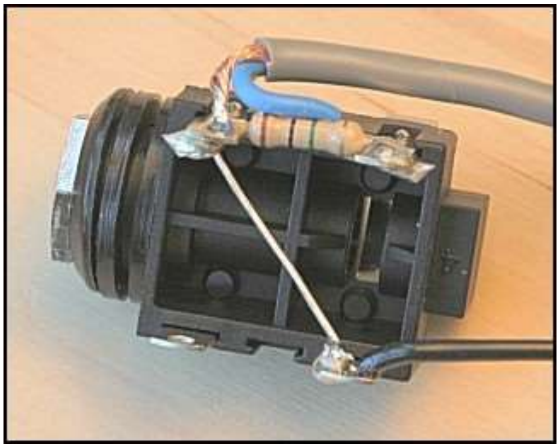
TIP: Sometimes it is hard to decode the resistors colours. It is a good idea to check the resistances of these parts before assembly.

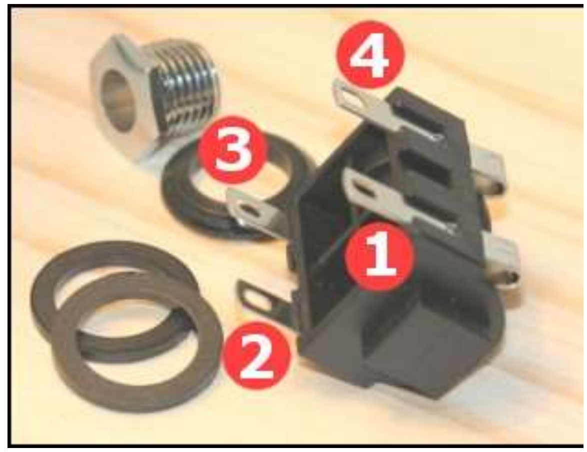
TIP: Use insulation tubes from the wiring on the resistor / cap leads around the tubes and pots by using longer pieces of insulation stripped from the supplied 20 ga wire.

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. Use 20 ga solid for heaters. It is rated for more than 5A/600Volts.

Appendix 5 - 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

Appendix 6- TRIWATT Bill of Materials

DESCRIPTION	QTY	CHECK
TRIWATT CUSTOM LEAD KIT WITH TRANSFORMER SET, CHASSIS, PANEL		
TRIWATT RESISTORS	1	
METAL FILM RESISTORS - THROUGH HOLE 1WATT 1 OHMS 1%	2	
CARBON FILM RESISTORS - THROUGH HOLE 100 OHMS 5%	1	
CARBON FILM RESISTORS- THROUGH HOLE 470 OHMS 5%	1	
WIREWOUND RESISTORS - THROUGH HOLE 1.0K OHMS 5% TOL	3	
CARBON FILM RESISTORS- THROUGH HOLE 1K OHMS 0.05	2	
CARBON FILM RESISTORS- THROUGH HOLE 1.5K OHMS 0.05	1	
CARBON FILM RESISTORS - THROUGH HOLE 2.2K OHMS 5%	3	
WIREWOUND RESISTORS - THROUGH HOLE 2.4K OHMS 5W	1	
CARBON FILM RESISTORS- THROUGH HOLE 3.3K OHMS 0.05	1	
METAL OXIDE RESISTORS 7.5K OHMS 5% TOL	1	
METAL OXIDE RESISTORS 10K OHMS 5% TOL	1	
CARBON FILM RESISTORS - THROUGH HOLE 15K OHMS 5%	1	
CARBON FILM RESISTORS- THROUGH HOLE 22K OHMS 5%	5	
METAL OXIDE RESISTORS 22K OHMS 5% TOL	1	
CARBON FILM RESISTORS- THROUGH HOLE 47K OHMS 5%	1	
CARBON FILM RESISTORS- THROUGH HOLE 68K OHMS 0.05	2	
CARBON COMPOSITION RESISTORS 82K OHMS 5%	1	
CARBON COMPOSITION RESISTORS 91K OHMS 5%	1	
METAL FILM RESISTORS - THROUGH HOLE 100K OHMS 1% 50PPM	7	
CARBON FILM RESISTORS- THROUGH HOLE 180K OHMS 5%	1	
CARBON FILM RESISTORS- THROUGH HOLE 220K OHMS 0.05	4	
METAL OXIDE RESISTORS 220K OHMS 05% TOL	3	
METAL FILM RESISTORS - THROUGH HOLE 470K OHMS 1% 50PPM	2	
METAL FILM RESISTORS - THROUGH HOLE 1WATT 560K OHMS 5%	1	
METAL OXIDE RESISTORS 620K OHM 5% 2W METAL OXIDE FILM	1	
CARBON FILM RESISTORS- THROUGH HOLE 1M OHMS 5%	4	
TRIWATT CAPACITORS	1	
CAPACITOR - 500V SILVER MICA ± 5% 220 PF	1	
CAPACITOR - MALLORY 630V 150S AXIAL LEAD CAPACITANCE: .001 UF	4	
CAPACITOR - MALLORY 630V 150S AXIAL LEAD CAPACITANCE: .01 UF	1	
CAPACITOR - MALLORY 630V 150S AXIAL LEAD CAPACITANCE: .022 UF	3	
CAPACITOR - MALLORY 630V 150S AXIAL LEAD CAPACITANCE: .047 UF	5	
CAPACITOR - MALLORY 630V 150S AXIAL LEAD CAPACITANCE: .1 UF	2	
ALUMINUM ELECTROLYTIC CAPACITORS - AXIAL LEADED 2.2UF 63V -10%+50% AXIAL	1	
CAPACITOR - 475V AXIAL LEAD ELECTROLYTIC CAPACITANCE: 16 UF	1	
CAPACITOR - 450V AXIAL LEAD ELECTROLYTIC CAPACITANCE: 33 UF	1	

CAPACITOR - JJ ELECTRONICS 500V 50/50UF ELECTROLYTIC	2	
ALUMINUM ELECTROLYTIC CAPACITORS - AXIAL LEADED 47UF 63VOLTS 20%	2	
RECTIFIERS 1000V 1A RECTIFIER GLASS PASSIVATED	5	
ZENER DIODE 18V 5W	1	
CAPACITOR CLAMP - 1.375" DIAMETER	2	
TRIWATT POTENTIOMETERS	1	
POTENTIOMETER - FENDER 10K LINEAR BIAS SCREW	1	
POTENTIOMETER - ALPHA LINEAR 3/8" BUSHING RESISTANCE: 100 KOHM	2	
POTENTIOMETER - ALPHA LINEAR 3/8" BUSHING RESISTANCE: 250 KOHM	1	
POTENTIOMETER - ALPHA AUDIO 3/8" BUSHING RESISTANCE: 250K A	1	
POTENTIOMETER - ALPHA AUDIO 3/8" BUSHING RESISTANCE: 500 KOHM	3	
POTENTIOMETER 1M OHMS PLAIN SOLDER LUGS	1	
TRIWATT SOCKET	1	
SOCKET - BELTON 9 PIN MINIATURE TOP MOUNT	4	
TUBE SHIELD - FOR 9-PIN MINIATURE ALUMINUM MULTIPLE COLORS COLOR: ALUMINUM	4	
SOCKET - BELTON MICALEX 8 PIN OCTAL MIP	2	
TUBE CLIP - BELTON FOR OCTAL SOLD INDIVIDUALLY	2	
TRIWATT JACKS	1	
JACK - CLIFF 1/4" MONO SOLDER LUG	3	
JACK - SWITCHCRAFT ¼" MONO 2-CONDUCTOR OPEN CIRCUIT	2	
TRIWATT CHASSIS HARDWARE	1	
SWITCH - CARLING TOGGLE DPST 3 POSITION PLAY-STDBY-OFF	1	
SWITCH - ROTARY 1 POLE 3 POSITION	1	
SWITCH - CARLING MINI TOGGLE DPDT 2 POSITION	1	
KNOB - LARGE, INDICATOR LINE, SET SCREW, COLOR: BLACK	1	
FUSE HOLDER - SCREW TYPE 3AG-TYPE	1	
FUSE - SLOW-BLOW 250V 3AG 0.25" X 1.25" AMPERAGE: 2 AMPS	1	
TERMINAL STRIP - 3 LUG 2ND LUG COMMON HORIZONTAL	5	
JEWEL - FENDER STYLE COLOR: RED	1	
LAMP - FENDER STYLE PREMIUM PILOT ASSEMBLY	1	
DIAL LAMP - #47 T-3-1/4 6.3V 0.15A BAYONET BASE	1	
IEC RECEPTACLE - FOR POWER CORD	1	
TEST PLUGS & TEST JACKS BANANA JACK RED	2	
TEST PLUGS & TEST JACKS BANANA JACK BLACK BU-31602-0	1	
GROMMETS & BUSHINGS GROMMETS & BUSHINGS SB 500-4 BLACK	5	
TRIWATT FASTENERS	1	
MACHINE SCREW PHILLIPS PAN HEAD 4-40X5/16 L	20	
HEX NUT EXT TOOTH LOCKWASHER 4-40	6	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#4	1	
MACHINE SCREW PHILLIPS PAN HEAD 6-32X3/8 L	5	
MACHINE SCREW PHILLIPS PAN HEAD 6-32X3/4 L	4	

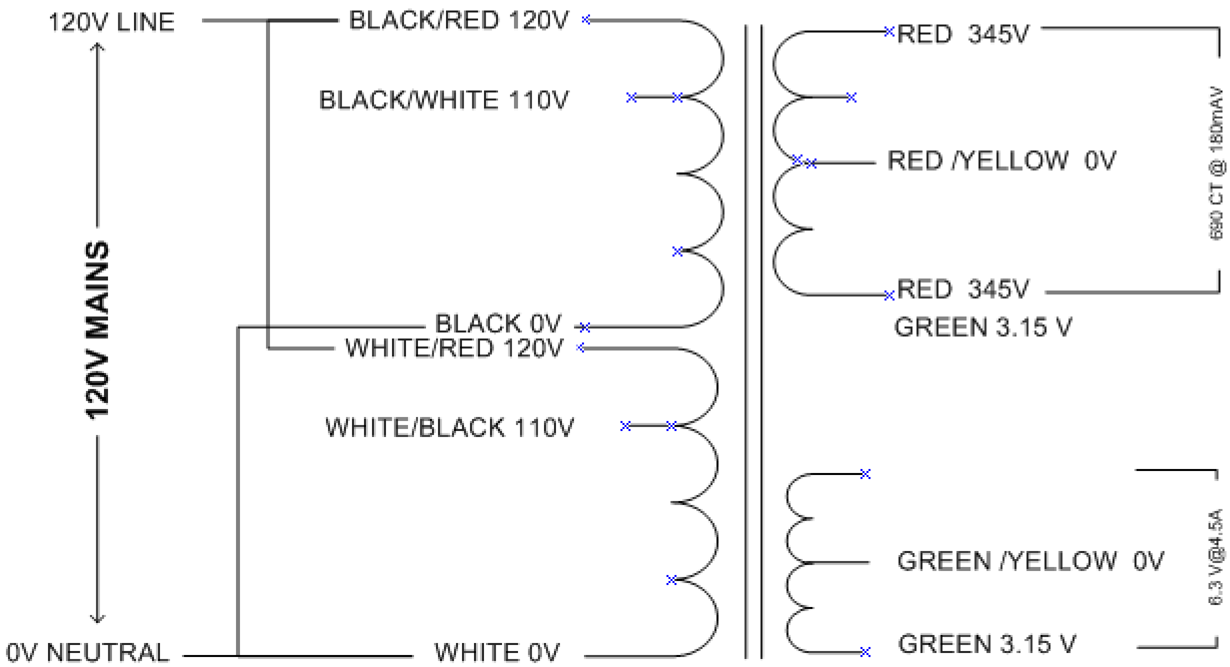
INTERNAL TOOTH LOCK WASHER #6 CHROME	4	
HEX NUT EXT TOOTH LOCKWASHER 6-32	1	
TERMINALS LUG LOCKING MATTE TINNED#6	3	
STANDOFFS & SPACERS .500 STD SPACER	4	
MACHINE SCREW PHILLIPS PAN HEAD 8-32X3/8 L	9	
HEX NUT EXT TOOTH LOCKWASHER 8-32	9	
TERMINALS LUG LOCKING MATTE TINNED#8	1	
MACHINE SCREW PHILLIPS PAN HEAD 10-32X1-3/4 L	4	
ANCHOR (CAGE) NUT 10-32	4	
TRIWATT WIRE	1	
22 GUAGE SOLID CORE WIRE (VARIOUS COLOURS)	15	
22 GAUGE TWISTED PAIR RED/BLACK	4	
BELDEN RG174/U COAXIAL CABLE	72	
18 GUAGE STRANDED WIRE BLACK	18	
18 GUAGE STRANDED WIRE WHITE	18	
HEAT SHRINK TUBING 1MM	4	
HEAT SHRINK TUBING 3MM	8	
HEAT SHRINK TUBING 6MM	4	
CABLE TIE 4 IN BLACK 18 LBS	10	
TRIWATT TURRET BOARD	1	
CHASSIS TRIW ALUM HEAD	1	
PANEL BLACK TRIWATT	1	
CORD - POWER 18 AWG 3 CONDUCTOR DETACHABLE BLACK IEC LENGTH: 8 FEET	1	
TRIWATT POWER TRANSFORMER	1	
TRIWATT OUTPUT TRANSFORMER 3.5/8K	1	
TRIWATT OVERDRIVE RELAY BOARD (IF PURCHASED)	0	
TWO RELAY PCB WITH PSU	1	
LINEAR VOLTAGE REGULATORS 1A POS VOL REG	1	
ALUMINUM ELECTROLYTIC CAPACITORS - RADIAL LEADED 3300UF 10V ELECT NHG RADIAL	2	
MULTILAYER CERAMIC CAPACITORS MLCC - LEADED 0.1UF 50VOLTS Y5V +80/-20% 2.5MM LS	1	
STANDARD LEDS - THROUGH HOLE STANDARD LEDS - THROUGH HOLE RED DIFFUSED	2	
LOW SIGNAL RELAYS- PCB THRUHOLE HI-SENS DPDT 5VDC 150MW SEAL	1	
BRIDGE RECTIFIERS BDGE RECT 1.5A50V	1	
CARBON FILM RESISTORS- THROUGH HOLE 510 OHMS 1/4 WATT	1	
RECTIFIERS 1000V 1A RECTIFIER GLASS PASSIVATED	1	
TERMINALS TERMINALS LUG LOCKING MATTE TINNED#6	1	
FOOTSWITCH - FOR MARSHALL ONE BUTTON	1	
JACK - CLIFF 1/4" MONO SOLDER LUG	1	
ZETTLER MAGNETICS POWER TRANSFORMER PRI 115VAC SEC 6.3/12.6VAC PC 50/60HZ	1	

RELAY PSU TRANSFORMER EYELET BOARD	1	
BELDEN RG174/U COAXIAL CABLE	24	
22 GUAGE SOLID CORE WIRE (VARIOUS COLOURS)	2	

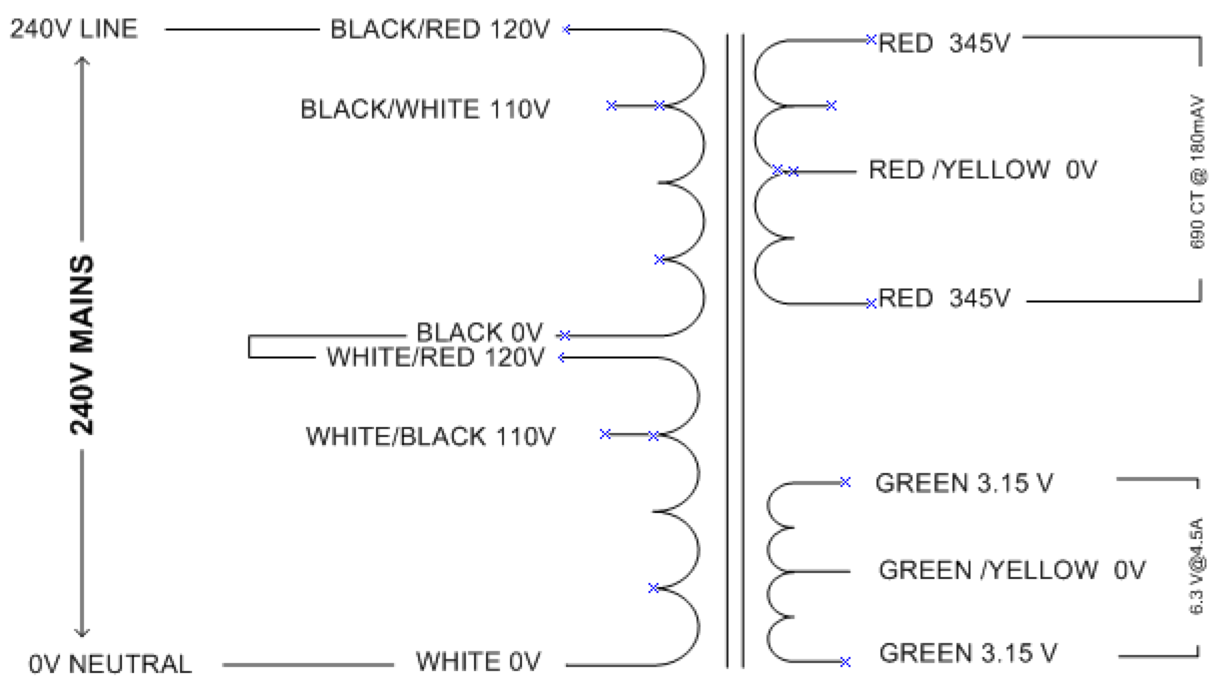
Appendix 7- TRIWATT Overdrive Footswitch

See separate "**TRIWATT OD Footswitch Builder's Guide**"

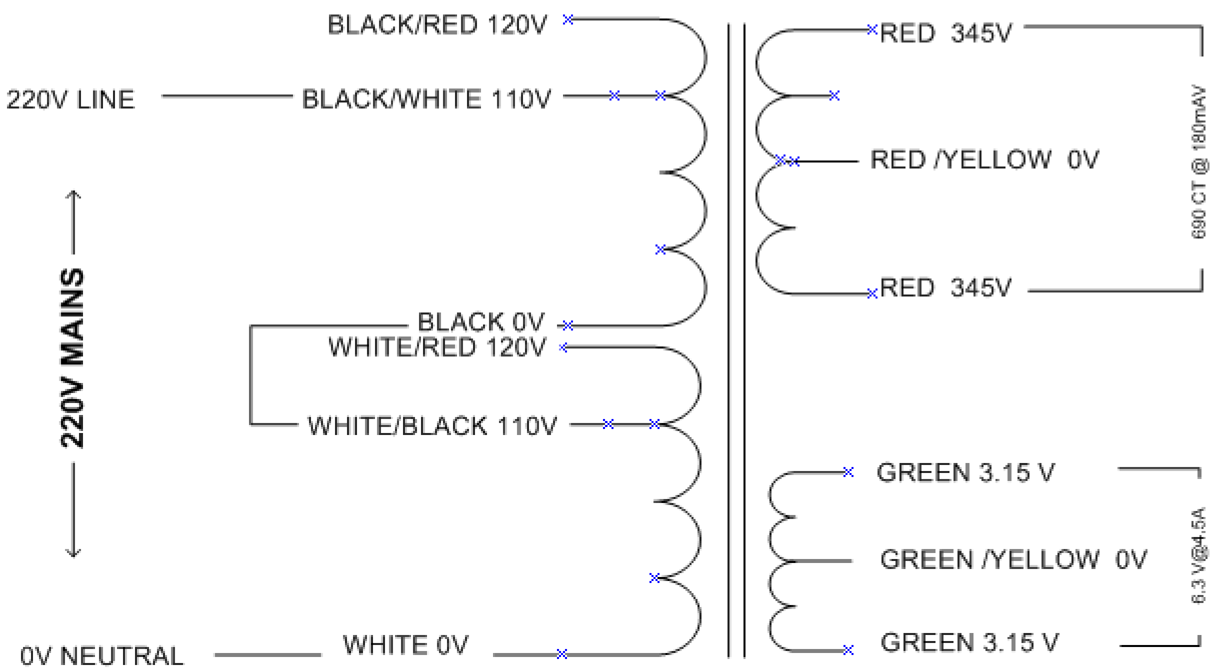
Trinity Amps 9642-EX-1 Transformer Schematics



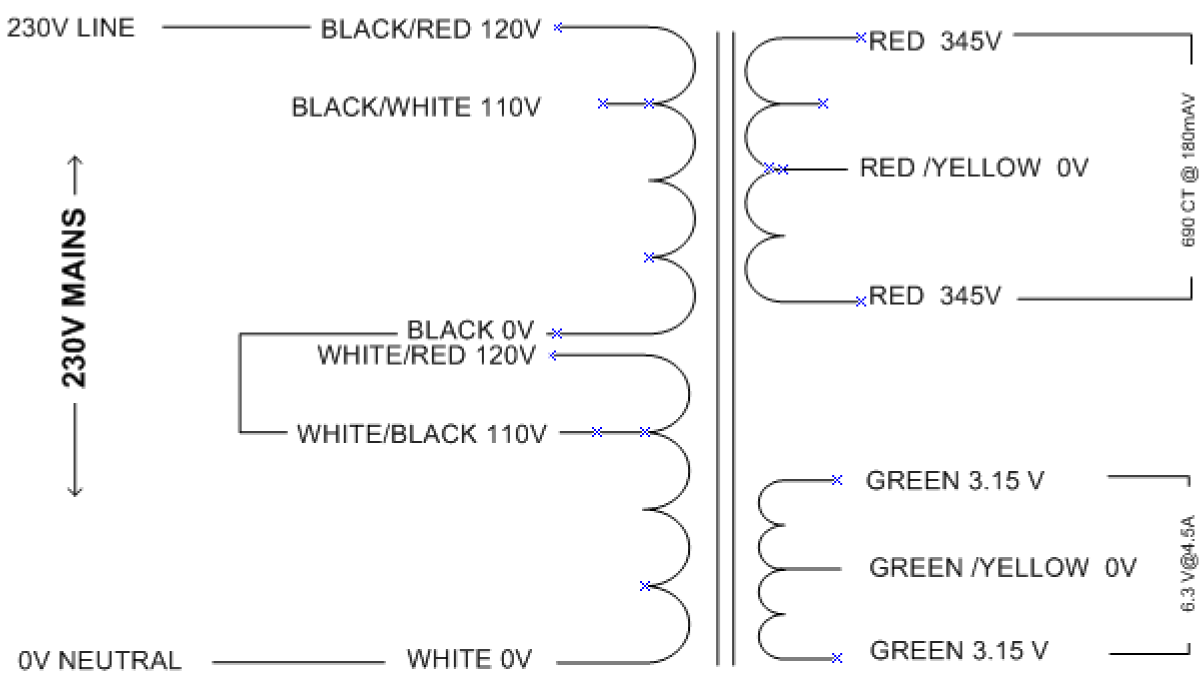
Trinity Amps 9642-EX -1 Power Transformer 120V HOOK-UP



Trinity Amps 9642-EX -1 Power Transformer 240V HOOK-UP



Trinity Amps 9642-EX -1 Power Transformer 220V HOOK-UP



Trinity Amps 9642-EX -1 Power Transformer 230V HOOK-UP

Trinity Amps Schematics and Layouts