The Amp Builder's Guide

February 2009, Version 3.921

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www.trinityamps.com

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Thank You

Thank you for purchasing your Trinity 18 / TC-15 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.

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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.

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.

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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

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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.**

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

Guitar Amplifier Basics

Electric guitarists can be fairly criticized for their reluctance to change to new ideas and technologies; however, there is no doubt that a classic 1950's guitar and tube amplifier in good condition still sounds great in modern recordings. This is a testament to good design from the start. What has improved today is consistency, and the cost benefits of production line manufacturing. This is offset by the rarity of good guitar wood (it makes a huge difference, even on an electric guitar), increased labour costs for both guitars and amplification equipment, and the availability of good and consistent quality tubes.

There is also an element of nostalgia, with memories of many of the great players of years gone by, and the desire to use the same types of instruments and equipment to recapture the magic. Vintage instruments and equipment have also become valuable collectors items (some with very inflated prices) which adds further to the desirability of older tools of the trade. There has been a recent trend by many companies to re-market their original instruments and equipment; new guitars can even be bought now 'pre-aged'!

This desire for vintage equipment is also related to guitarists' reluctance to part with tube amplification, and there are many reasons why tube and solid state amplifiers behave differently. Quite simply, if players prefer the sound of tubes, they will continue to buy and use them. Below are some fundamentals.

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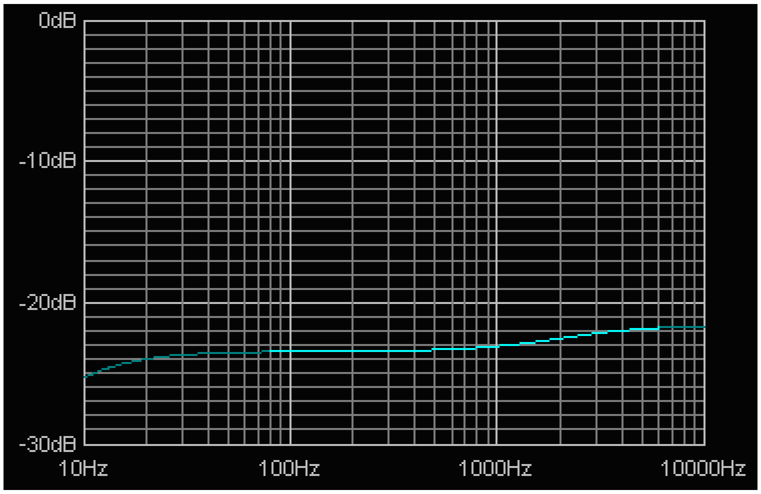
Input Impedance Typically 1M, 500K minimum (humbucking pickup guitars have volume pots up to 500K, single coil pickup guitars typically of 250K) .

Tone Controls Magnetic guitar pickups are inductive, and require compensation, although this opportunity is also used for tone enhancement, not just correction. Without compensation, they have a strong low middle emphasis and little high frequency response - overall a very muddy and muffled sound. This is why typical hi-fi Baxandall treble & bass controls are unsuitable.

To hear the natural sound of a pickup, use a typical guitar amp with the middle set to full, and bass and treble on 0. This is actually sets a flat response in the amp (see below). Expect to hear a muffled and muddy sound. And that's the whole point of these tone controls providing compensation for the natural sound of a pickup - the middle control simply boosts the pickup's normal 'middley' sound. The treble and bass controls do the opposite - they boost higher and lower frequency levels, leaving a notch in-between for middle cut (see the Fender/Marshall comparison below). So with typical settings of a bit of bass, middle and treble, the overall tone equalization complements the natural pickup sound for a balanced response of lows, mids and highs.



Full middle boost with no bass or treble actually gives a near-flat frequency response, allowing you to hear the natural sound of your pickups.

Fender and Marshall tone controls

Here are circuit diagrams of typical Fender and Marshall tone controls. They both meet the criteria of compensating for pickups' low-middle emphasis, as well as providing a useful range of tone adjustment.

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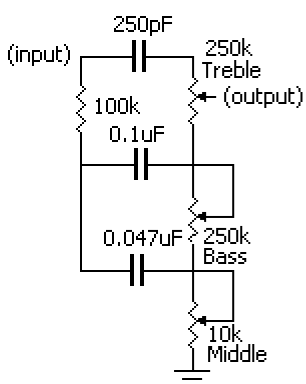
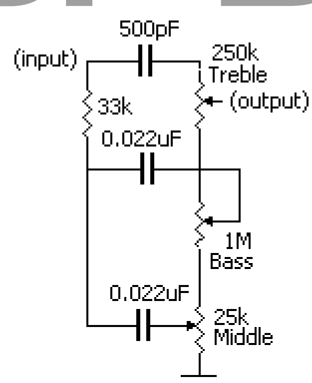


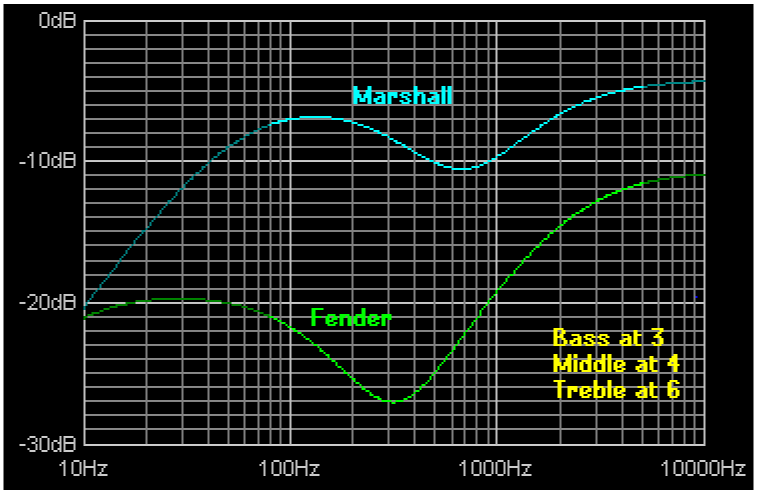
Fender Tone Controls



Marshall Tone Controls

The Fender and Marshall circuits are each tailored to suit their own styles, which are quite different. Although a generalization, Fender's market and consequently the power output stage are geared towards provided clean and chunky tones at clean and early-overdrive levels. Marshall amps are best at low-middley and crunchy rock tones, played at medium to high overdrive levels.

Here is a simple comparison of Marshall and Fender response with what might loosely be called 'typical settings' of Bass on 3, Middle on 4, and Treble on 6. The most obvious difference is that the Marshall lets more level through, and their tone controls have less range of adjustment. The higher level means that by using the same number of preamp tube stages, a Marshall can overdrive the output stage more.



Bearing in mind that typical 6-string guitar notes don't go below 80Hz, and typical guitar speakers cut above about 5KHz, these responses are similar. Both have a middle dip that is primarily compensation for typical pickups' middle emphasis, rather than an obvious dip in middle response. The Marshall circuit has this cut about an octave higher than the Fender, leaving the low mids and bass intact for that full Marshall sound. On the other hand, Fender's tone controls allow high-mids to pass with the treble response, and add little bass boost for the sparkling and tight sounds they're famous for.

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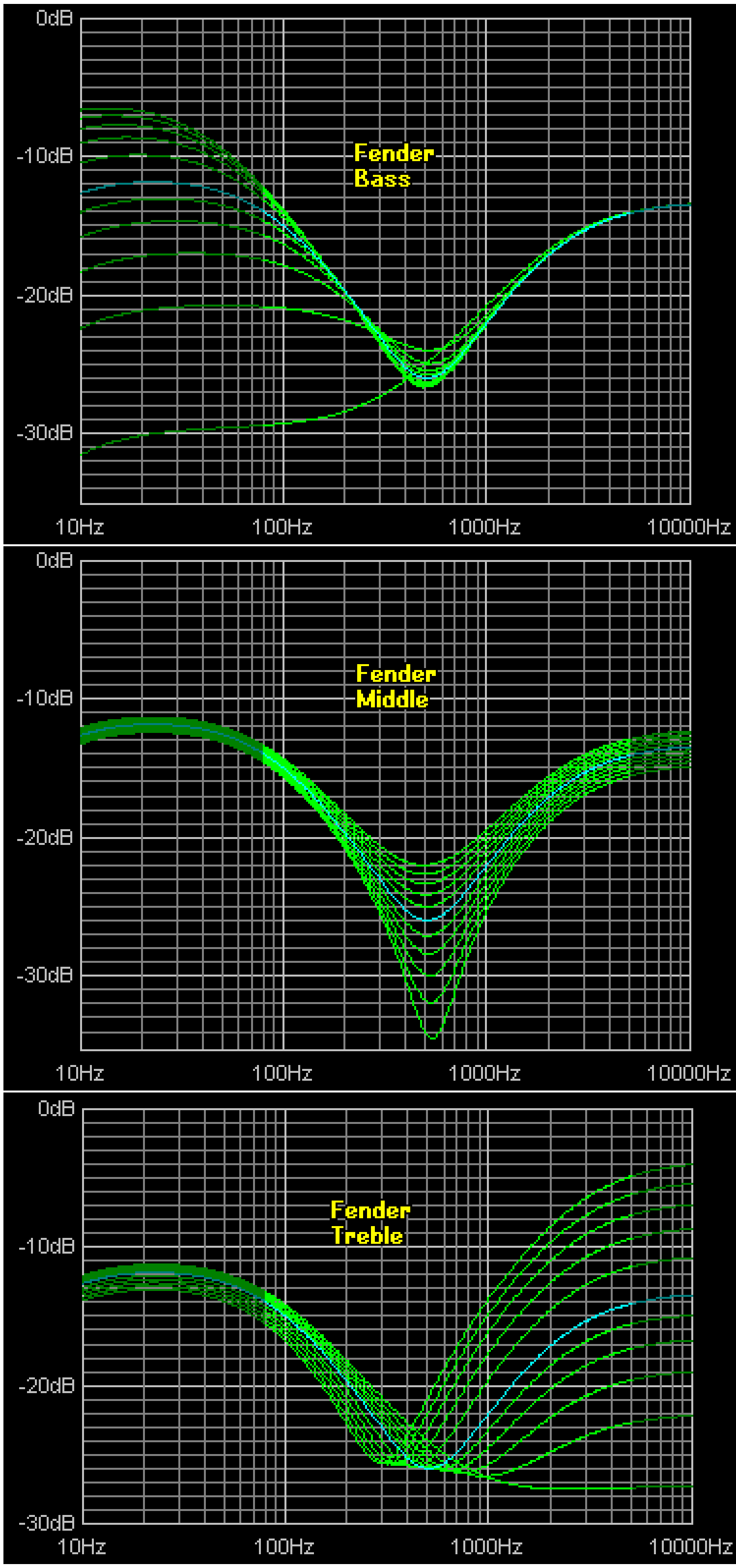
Here are charts each of the Fender controls. In all cases, the other two controls are left at 5. For example, the treble chart shows the effect of varying Treble from 0 to 10, with Bass and Middle both at 5. Notice that all controls have a wide range of adjustment, and that the bass control has most effect from 0 to about 3. Anyone's who has used a Fender will know this, and this control could easily be replaced by a control with a stronger logarithmic taper to smooth this out without changing the range of available tones.


0dB
-10dB
-20dB
-30dB
10Hz
100Hz
1000Hz
10000Hz
Fender
Bass
0dB
-10dB
-20dB
-30dB
10Hz
100Hz
1000Hz
10000Hz
Fender
Middle
0dB
-10dB
-20dB
-30dB
10Hz
100Hz
1000Hz
10000Hz
Fender
Treble

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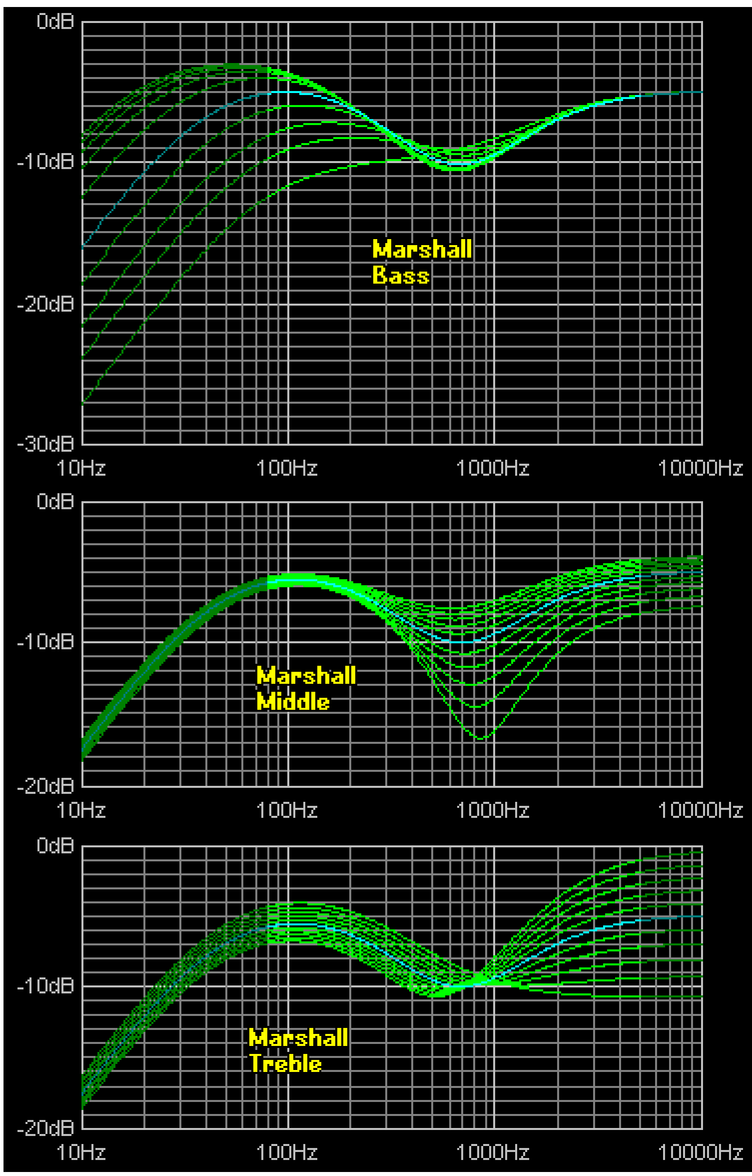
The Fender circuit also has the unusual side effect that if all controls are set to 0, then no sound is produced at all. The Marshall design avoids this, but the tone with all controls set to 0 is not something you'd be likely to use anyway.

Here are the same charts for Marshall tone controls. As mentioned already, the main points to note are the smaller range of adjustment, the higher frequency for the middle cut control, and the higher overall signal level. The smaller adjustment range and higher level are both caused by the use of the 33K resistor in place of Fender's 100K. The also gives the tone stack a lower input impedance, requiring it to be fed from a lower output impedance (cathode follower) preamp tube stage.



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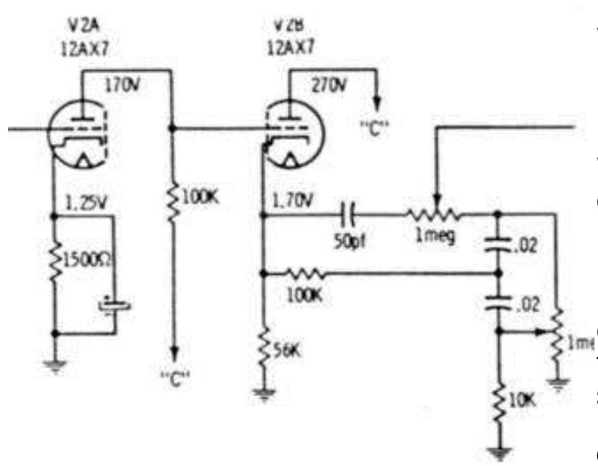
Tube power amplifiers often provide an additional presence control (which reduces negative feedback in the power amplifier section) to provide a small amount of boost at frequencies above the treble control.

The VOX type Top Boost circuit response is used in the TC-15. This is well-known for it's interactive nature.



When VOX re-designed their AC30 and removed the EF86, they added a Top Boost circuit to regain some of the high end sparkle the amp had lost. What was used was the high gain circuit from the 1954 Gibson GA-77 "Vanguard" - An Amplifier known for it's 'high gain' channel. The interesting point is that the original Gibson diagrams happen to have an error on the Bass pot, grounding one end that should be left floating.

Glen Lambert - 2002. For more information see: http://www.geocities.com/vintage325/topboost.html

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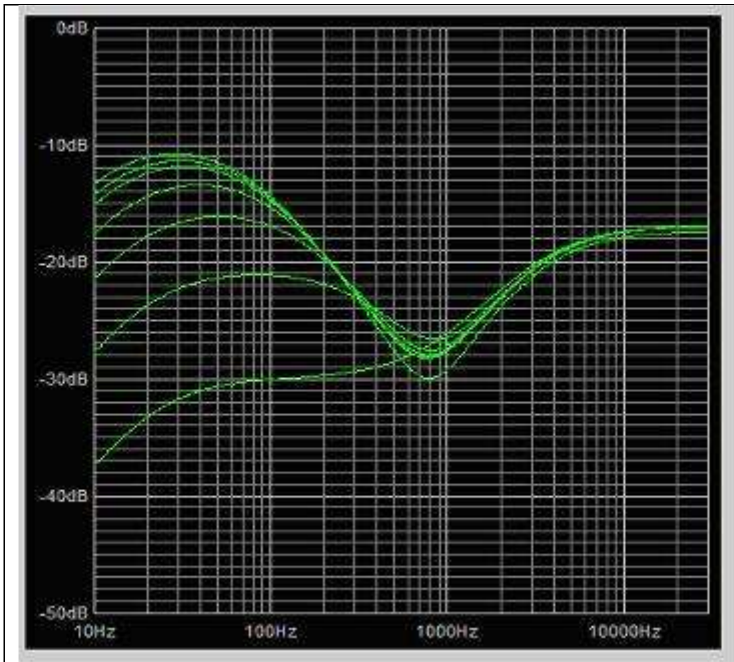
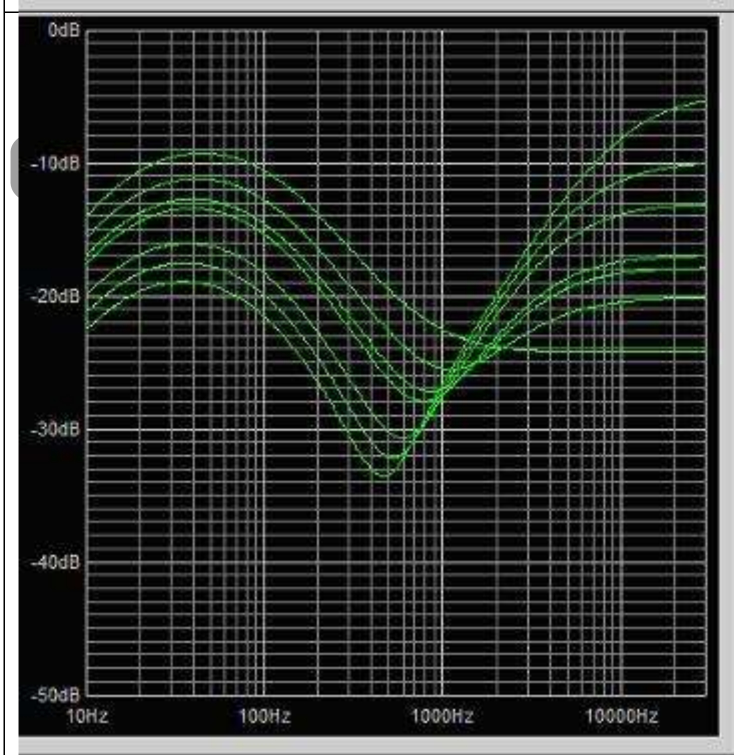
This error was carried across to the VOX JMI 'Brilliance' unit. This affects the way the tone controls interact and the effect of the Bass control on mid band. Normally it would be desirable for the Bass control to effect only the Bass content, but in this case the Bass control will effect the midrange and to some extent the Treble when it is at it's extreme travel. Even in correct form the circuit is not ideal. It's a compromise to keep the component count low, but the error does make it slightly harder to control Treble and Bass separately.

This same circuit will be present on every VOX amp that contains a Top Boost section.

If you're curious to hear how the tone controls were meant to respond it's not a difficult thing to do. Just unsolder the ground connection from the Bass pot. You can leave it floating or join this terminal to the wiper to make it a variable resistor.

		Trinity 15/TC-15 Bass Control Frequency Response. Note the interactive effect on Treble control.
		Trinity 15/TC-15 Treble Control Frequency Response. Note the interactive effect on Bass control.

Distortion

The overdriven sound of a tube power amplifier is highly desirable, with many different output stage designs to produce the variety of trademark sounds heard

on modern recordings. The only problem is that a tube power amplifier is only capable of producing this sound at one volume (usually, fairly loud!).
There are probably 3 distinctly identifiable types of tube power amplifiers used:
Leo Fender's classic early designs used 6V6 tubes, and later, the higher powered 6L6's. This gave a characteristic full and punchy sound, suitable for many styles of the day, and later. Steel and country players like the chime-like clean sounds, and blues players were quick to discover the classic way it breaks up when pushed hard. At really high overdrive, though, the sound becomes quite dirty, with bass in particular sounding flabby.
Marshall designs started as Fender copies, but soon switched to EL34 output tubes, possibly for local supply reasons. Anyway, the rest is history. These tubes exhibit a softer overdrive transition, and maintain clarity even at high overdrive levels. They also have a limited middle response, giving rise to the famous Marshall crunch sound. The lower powered EL84 tubes have similar characteristics.
Vox AC30 (and the more popular top boost model) uses a Class AB power amplifier design, with the tubes biased 'hot', so while this operates in class A at lower levels, it is a class AB design. There's no negative feedback in the power amp either, so this gives a different sound, often described as a sweeter overdrive. Listen to Brian May's sounds for plenty of good examples.
The Fender and Marshall designs use class AB for their output designs, biased with the tubes almost off with no signal. This is more efficient (more watts per tube), and better for tube life. When you play, tubes take turns handling each half of the signal. This leads to some (unwanted) distortion as the tubes cross over. Class A designs are rare in medium to high power guitar amps, but true class A has the tubes operating at half power, with no signal applied. When you play, the tube fluctuates between full and no power, so there is no switching to add unwanted distortion. This is a very superficial explanation; please read elsewhere on the Internet for more detailed descriptions.

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Wide Dynamic Range A plucked guitar string requires a wide dynamic range to handle the initial peak, and then cleanly amplify the decaying string vibrations. Some poor designs do not have this capability in their preamp stages, let alone the power amp to handle this. Pre-amplifier stages need generous power rails, and should not have gain stages which cause the initial plucked part of the string sustain envelope to be clipped.

Instrument Speakers Unlike hi-fi speakers, which are designed to keep the coil entirely within the magnetic field to maximize linearity, instrument speakers are designed to have the coil partially leave the magnetic field at the extremes of cone travel. This is partly to protect the speaker, but also produces a 'soft-clipping' effect which is desirable with guitar amplifiers. It is also therefore important to match speaker power ratings reasonably closely with the power of the amplifier. Popular instrument speakers are available from Tone Tubby, Celestion, Jensen and others.

Note: If you were to use two cabinets hooked directly into the amp, be sure to set the amp at half the impedance of the cabinets. For example, if your cabinets are 8 ohms each, set the impedance selector to 4 ohms.

Durability Most musical styles will require the amplifier to be overdriven for extended periods of time, and the amplifier must be designed to provide this without duress on any components. Common non-guitar design principles assume that circuitry will be designed to avoid overdrive, and technicians working in this field have to 'un-learn' many basic assumptions. Popular circuits have evolved through trial and error, due to a general lack of documented knowledge in the field of non-linear amplification.

Road Worthiness Musical equipment of this type needs both physical and electrical protection. A band often has its equipment transported and set up by a road crew with little guarantee of physical care. Likewise, an assumption should be made that the output stage will at times be inadvertently shorted, so most professional equipment is designed to handle this contingency, preferably electronically, and at the very least without fuses inside the chassis.

General Amplifier Operation

Some DO NOTS

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- **Never, Never, Never run the amp without a speaker plugged in.** This can cause major damage.
- Do not flip the power switch off, and then back on rapidly. This can cause power supply damage.
- Never replace a burned out fuse with a bigger-amperage one. Remember - there was a reason the first one burned out, usually protecting something more expensive. Putting a bigger fuse in will just ratchet up the power level until something really vital burns out. If the second equal-rating fuse pops, turn it off and get a tech to look at it.
- Never ignore signs of high heat inside - a wisp of smoke or a burning smell is **NOT** normal.
- Your amp produces lots of heat, and will continue to do so even if you block the fresh air vents. Blocking the vents will overheat the amp and you may have to get some very expensive repairs done.
- Never ignore a red glow other than the small orange ends of the filaments. A red glow over a large part of the internal plates of the output tubes means they're about to melt. If you notice this, shut it down and get a tech to help you find out what it wrong.

Some DOs

Add another speaker into the "external speaker" jack; a mismatched speaker load won't kill it, while an open circuit (disconnected speakers) may do so.

Overdrive the stuffing out of it. Tubes are very forgiving of massive overdrives, unlike solid state stuff. As long as they tubes don't overheat or stay overdriven for long periods, it's not fatal.

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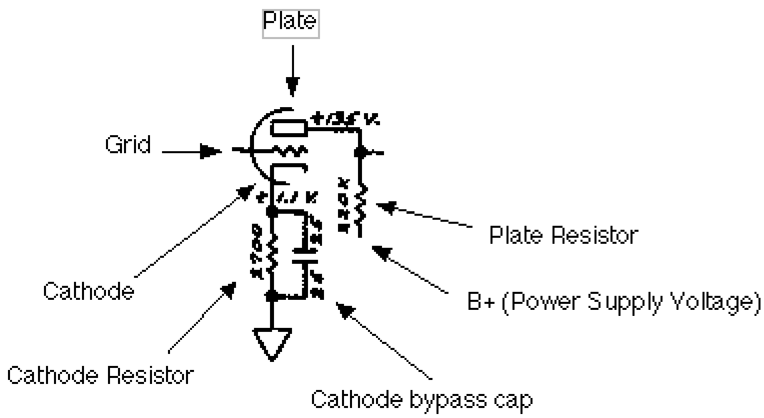
Introduction to Vacuum Tubes and Common Terms

Reprinted with permission from Aron from diystompboxes.com

Here are a few terms that you may see online when referencing tube schematics. Like distortion pedals, tube circuits seemingly have their own language! I present this knowledge in the hopes that it may help you decipher the interesting life of tubes! :-) Below, is a picture and a very simplistic view of a tube stage.



As you can see above, in this tiny snippet of a tube schematic, the terms you commonly see are there in this triode stage example.

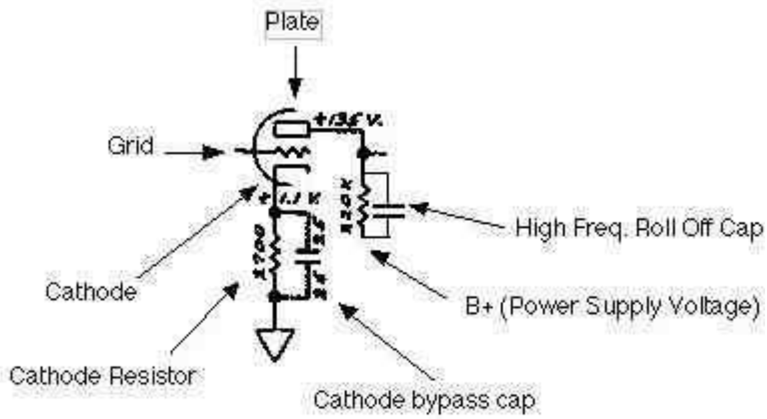
Plate - the plate is usually connected to a plate resistor which is usually connected to the B+ or power supply voltage. Typical Plate Resistor values are 100K, 150K, 220K. Larger values equal more gain.

The **Grid** is where the signal enters the tube.

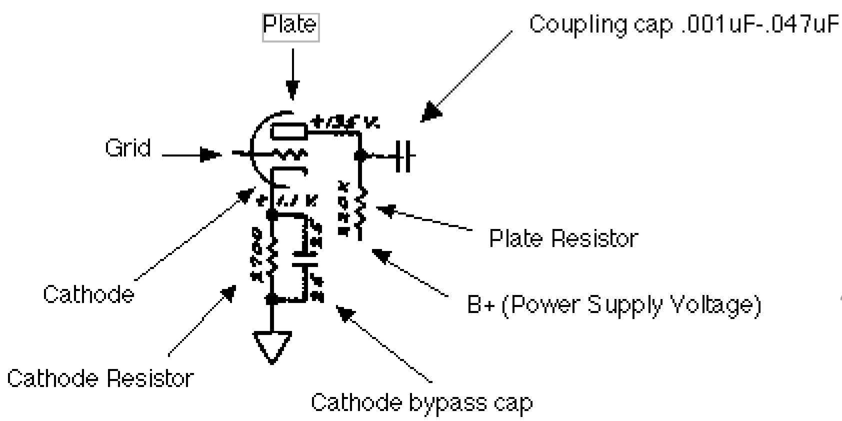
The Cathode is usually connected to a cathode resistor which usually goes to ground. The cathode resistor, along with the Plate resistor, control the gain of the tube stage. Typical values are anywhere from 100 ohms to 10K. Smaller values = more gain.

It is common to see a cathode bypass cap connected in parallel with the cathode resistor. By altering the values of the cathode resistor and cathode bypass cap, it is possible to roll off various degrees of bass with this triode stage. The cathode resistor and plate resistor control the biasing of the tube. The cathode bypass cap also gives the stage more gain.

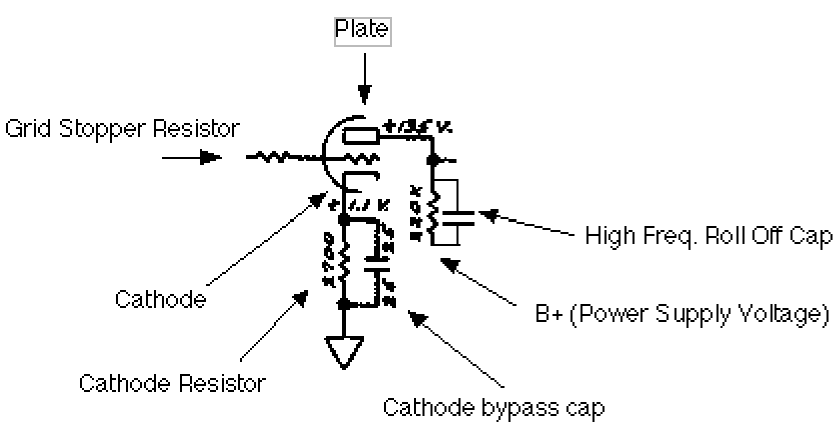
Sometimes you see a capacitor in parallel with the plate resistor, much like the cathode resistor bypass cap. It is usually a small value (i.e. .001uF) and it rolls off highs in the stage. Sometimes you see a high frequency roll off cap going from the plate pin to the cathode pin - 350pf->500pf in value.



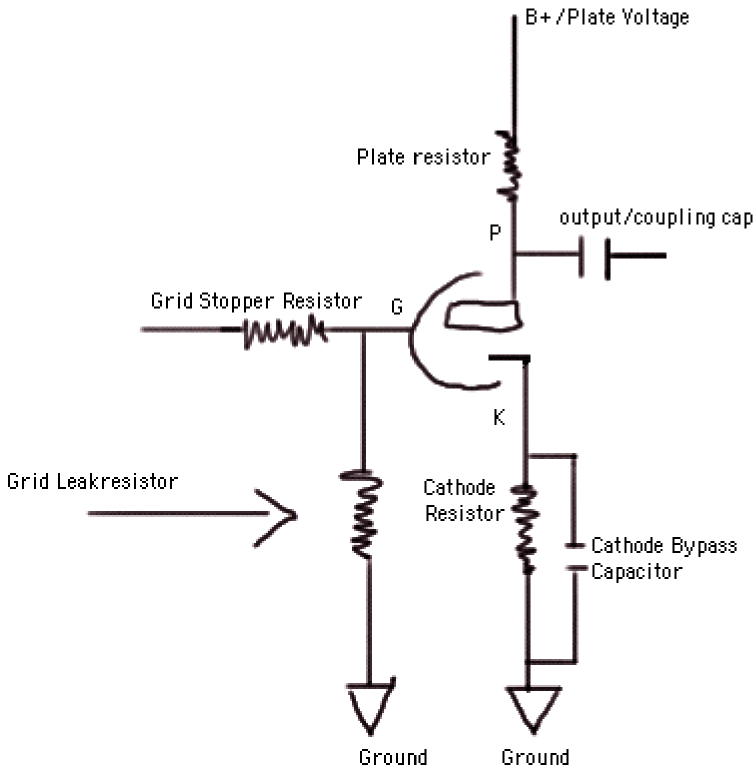
You will also see a coupling cap in between triode stages. The coupling cap controls the bass and rolls off bass between stages and blocks DC from entering the next stage - which could throw off the bias on the next tube stage. As usual, smaller values roll off more bass, larger values retain more bass between stages.



Another modification you may see is a Grid Stopper Resistor, this can also control gain between stages and also interacts with the tube to roll off highs. Values can be 1.5K->100K. Larger values roll off more highs and reduce gain between stages. The Grid Stopper Resistor works best when mounted directly or as close as possible to the grid pin.



"Complete" typical tube preamp stage:



G = grid, P=plate,K=cathode

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The grid ("leak") resistor, typically sets the impedance of the stage and biasing. It is interesting because it and the previous stage's plate resistor form a voltage divider on the signal. What this means to you is that the grid leak resistor can be used to control the level into the stage. Low grid leak values will attenuate the signal into the tube stage. If you look at different tube amp schematics, you can see where they control the level into the stage by using different values for the grid leak resistor. There is a maximum value that you need to adhere to. Check the datasheet for the tube you are using to see the typical value of the grid leak resistor. This particular circuit is called cathode bias which you can read about here.

In summary, the cathode resistor, plate resistor and grid resistor, determine the biasing of the tube stage. The cathode bypass cap controls the degree of bass reduction - generally 25uF passes all frequencies - commonly used in Fender amps, 1uF an 0.68uF are used in Marshall amps. A capacitor can be placed in parallel with the plate resistor to roll off highs and you see this in bass channels of amps sometimes. The plate receives the voltage from the power supply through a plate resistor, the grid receives the AC signal as input and the cathode is grounded through a cathode resistor.

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 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.

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.

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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

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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. 30 to 40W soldering iron
2. 60/40 rosin core solder
3. wire stripper
4. wire cutter
5. needle nose pliers
6. screwdrivers
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:

1. Use 60/40 rosin-core solder.
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.
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.

The solder joint should be clean and shiny. 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

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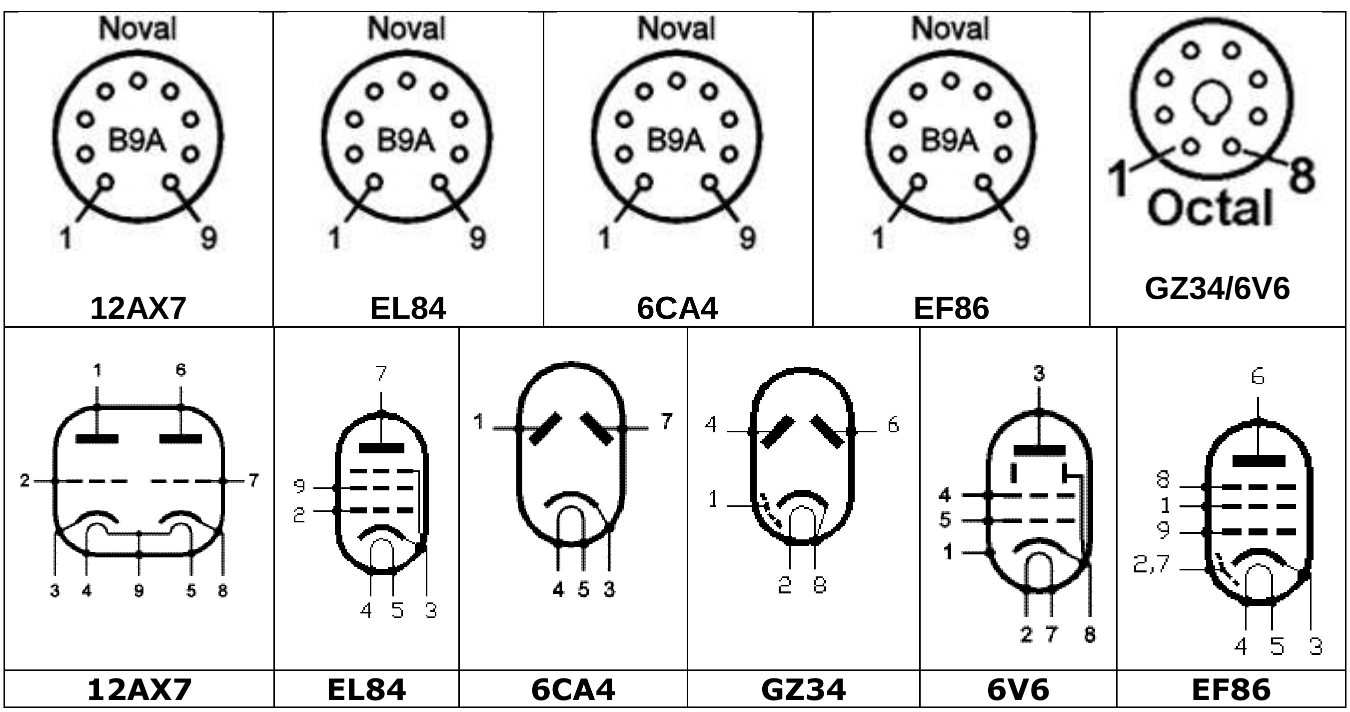
The pins on a 9-pin tube socket are numbered 1 to 9 in a clockwise direction when a tube or socket is viewed from the bottom. Note that there is a gap between pins 1 and 9. The pins on an 8-pin tube socket are numbered 1 to 8 in a clockwise direction when viewed from the bottom. Note that there is a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



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.

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Assembly Steps Summary

1. Install Tube sockets on the Chassis.
2. Wire up the heater wires to the sockets.
3. Install remainder of parts on the chassis.
4. Assemble the eyelet board and Install on chassis.
5. Wire up Mains, Power Supply, Rectifier tube socket, power switches and pilot light.
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.

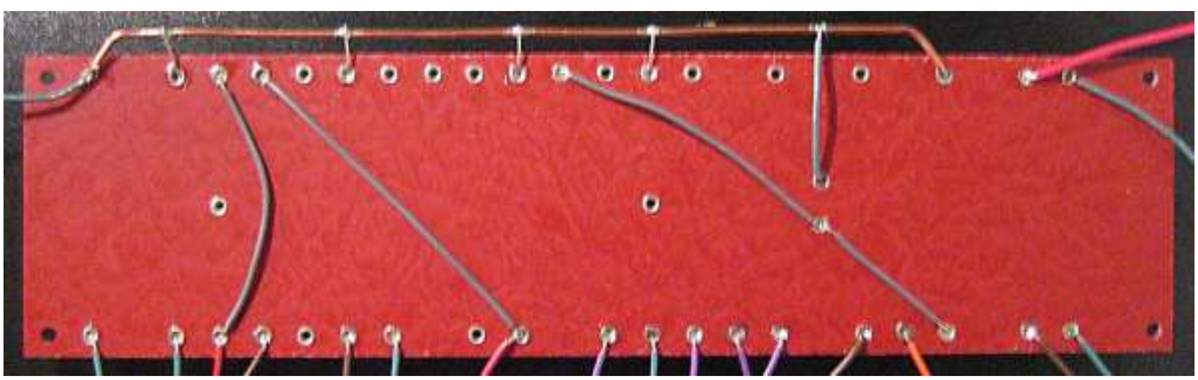
OUT OF DATE

Turret / Eyelet Board Construction

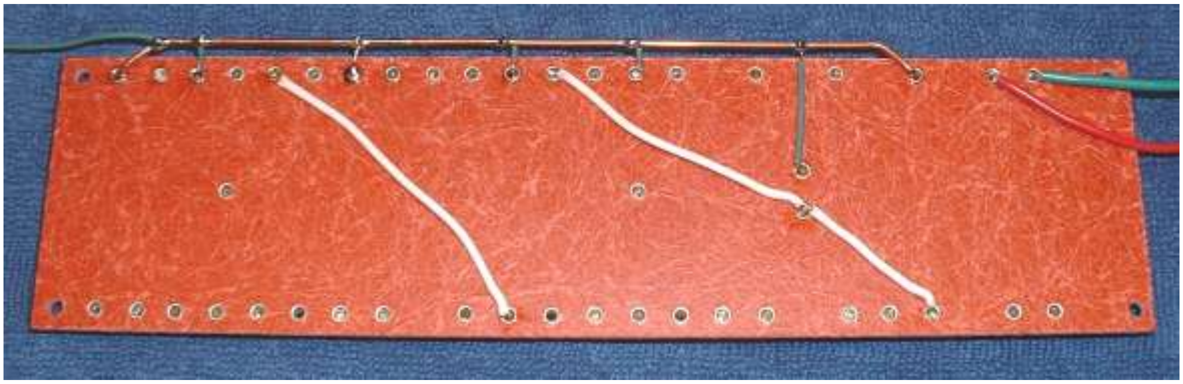
If you do not have a pre-built Trinity amps turret board, now is the time to build it.

First install a ground buss bar onto the Trinity 18 board. This can be made from ordinary solid core house wiring, stripped bare and soldered in place with several solid copper wire connections to the board.

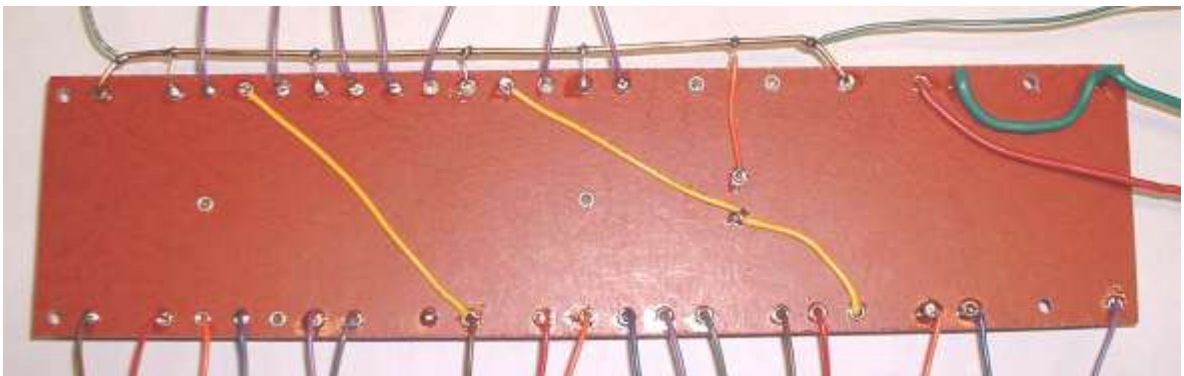
Install jumper wires on the underside of the board. Follow the pictures below.



Trinity 18 TMB Board Underside

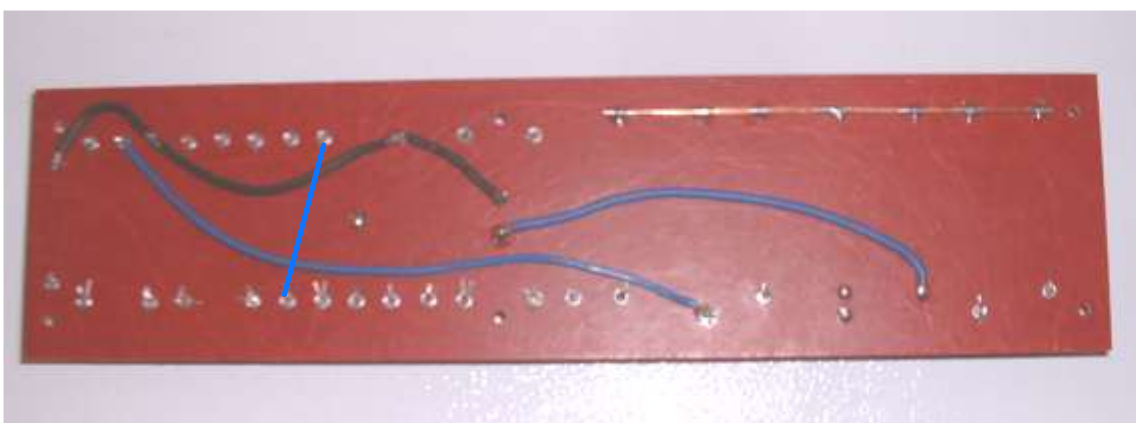


Trinity 18 sIII Underside

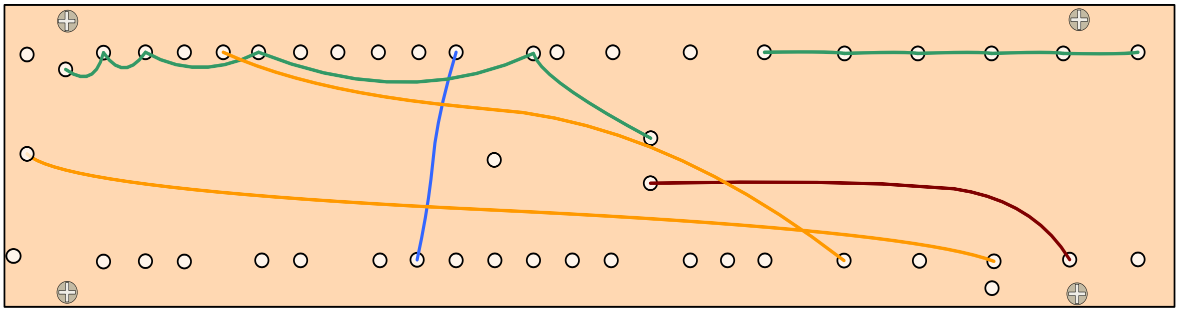


OUT OF DATE

Trinity v6 Underside



Trinity 15 Eyelet Board Underside



Trinity TC-15 Eyelet Board Underside

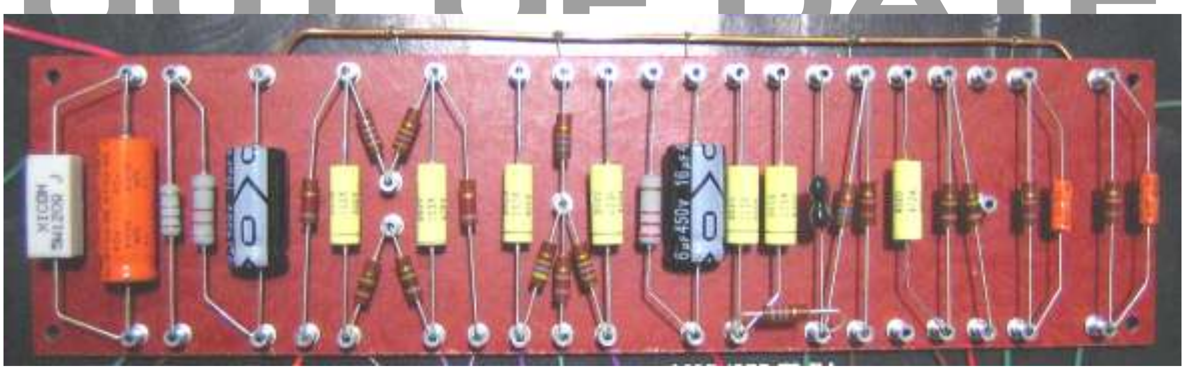
Align the board according to the layout diagram and follow the diagram closely.

Carefully identify the board components and their values. 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.

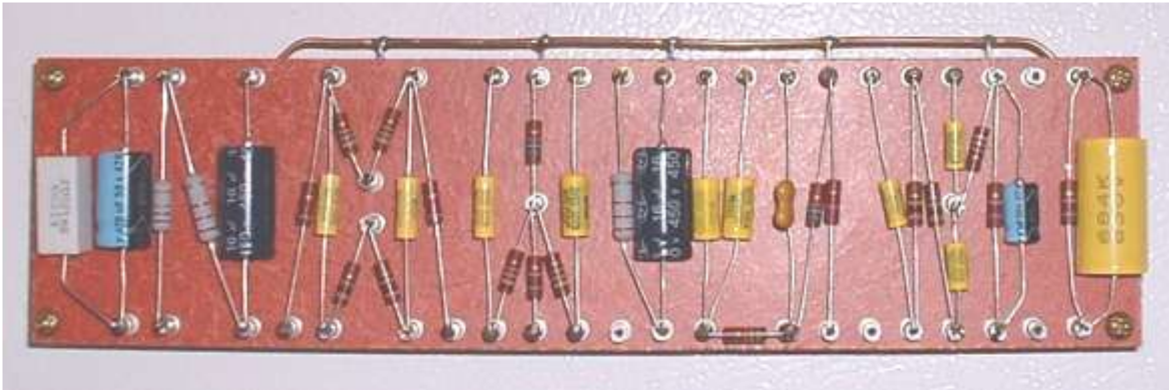
Install the components on the board by following the layout – from left to right. Solder in place as you move along.

Note: For multiple component leads that must fit into one eyelet or 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 eyelet/turret, squarely and neatly. Solder each turret / eyelet once all component leads that connect to it are in place.

OUT OF DATE



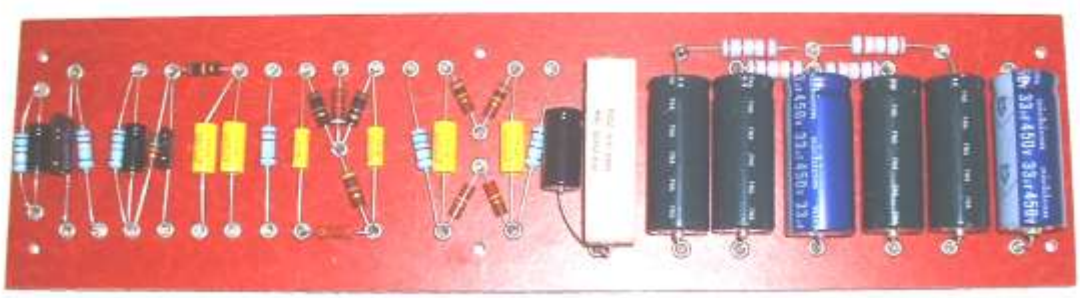
Trinity 18 TMB Completed Board Top View



Trinity 18 sIII Completed Board Top View

OUT OF DATE

Trinity v6 Completed Board Top View



Trinity 15 Completed Board Top View

Trinity TC-15 Board Top View

Now, 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.

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

Install the Hardware

Install all the tube sockets. The sockets with the shields are for V1 to V3. The other 9 pin sockets or 8 pin sockets are for the EL84s, 6CA4 or GZ34 tubes. They may have attachment lugs for the spring tube retainers. For spring type retainers, install the last few loops of the spring through the mounting lug on the socket. Note: Some people prefer to wire up the rectifier socket before installing the fuse holder.

OUT OF DATE

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

Insert any grommets for wire leads passing through the chassis from a choke or 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 their values and the layout. Cut off the locating tabs on the potentiometers in order to flush mount them. For the jacks you probably will need only 1 fibre washer to mount them flush.

Trinity 18 sIII/TMB 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.

Trinity TC-15 Rear

OUT OF DATE

Inside the chassis, install tag strips (several solder lugs or 'tags' attached to an insulated strip) for the power connections, input resistors to the EL84s, 68K input resistors, TMB volume and grid stopper resistor. The tag strip for the input to V1, is optional, but recommended. The tag strip for the TMB volume and 470K grid stopper resistor is necessary to prevent excessive feedback squealing in the TMB Master Volume channel. It is not required on the sIII TMB design.

Install the power transformer, output transformer and the choke if fitted. Orient the power transformer so that the high voltage leads from the transformer to the rectifier are shortest. Orient the output transformer such that the leads to the B+ are closest to the filter capacitors. 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, replace the nuts with supplied lock nuts.

Install the turret or eyelet board on the spacers using the four #6 X 1" bolts and tighten in place with #6 lock nuts.

Wiring

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

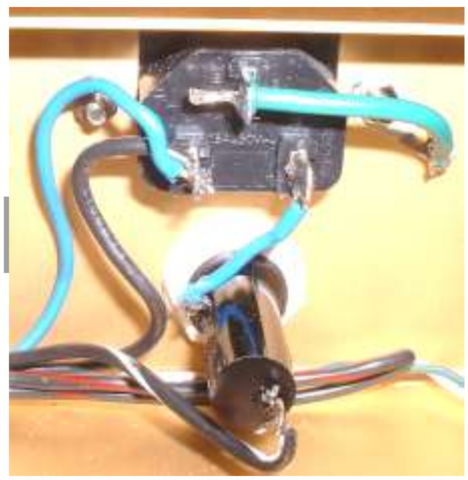
- Use 20 gauge solid for hook up from board to tubes
- Use 20 gauge solid for hook up from board to pots/front panel
- Use 20 Gauge twisted for tube heater wiring (20 solid will work if you prefer)
- Use Red and Black, 20/18 Gauge, stranded, 600v for power supply hook up - to transformers, rectifier, standby etc.
- Re-use cut offs from the transformers as well.

- Use RG174U for input to V1 and as indicated on layouts
- Use green wires for ground wires.

Heater Wires

For the heater wires, one wire comes from the terminal strip/transformer to the first Power Tube to pin 5, the other wire to same Power Tube but pin 4. Then these go to pins 4 and 5 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 'Polarity' on the preamp tubes and heater tubes needs to be maintained.

It is important to wire the tube filaments carefully. First twist two long lengths of wire tightly together. This will help to minimize any hum. Solder each wire to the tag strip adjacent to the transformer. Now route the twisted pair wire around the 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. green on pin 4 of both EL84 and white on pins 5. Do one tube socket at a time. Complete the 12AX7s using the same process. Green on pins 4 & 5 tied together and white on pins 9. Don't switch the heater wire polarity.



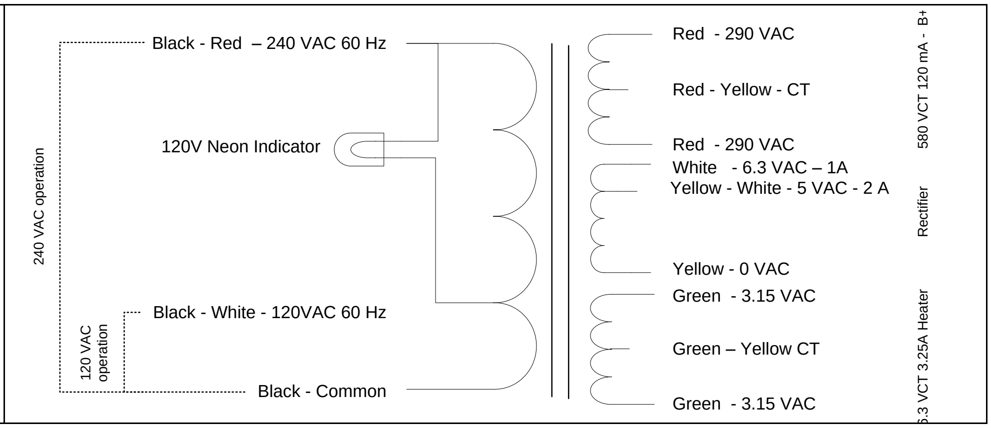
Then wire up the rest of the main power supply. Start with the IEC connector and ensure it is grounded to the bolt/lug on the chassis immediately beside the socket. Liberally use star washers to lock this well into place. Run a wire from the 'Hot' side of the IEC connector to the lug on the side of the fuse holder and from the end of the holder to the power switch. Make sure the switch is in the desired on position when the connection is 'made'. The switch may have the option of being 'On' in either 'Up' or 'Down' position.

OUT OF

From the other side of the switch, connect to the transformer 120V input. The other side or 'Neutral' gets routed to the 'Common' side of the power transformer.
A second wire is attached to the power switch and runs from there to the 120V neon indicator light. The other side of the indicator light goes to the 'Common' side of the power transformer as well.

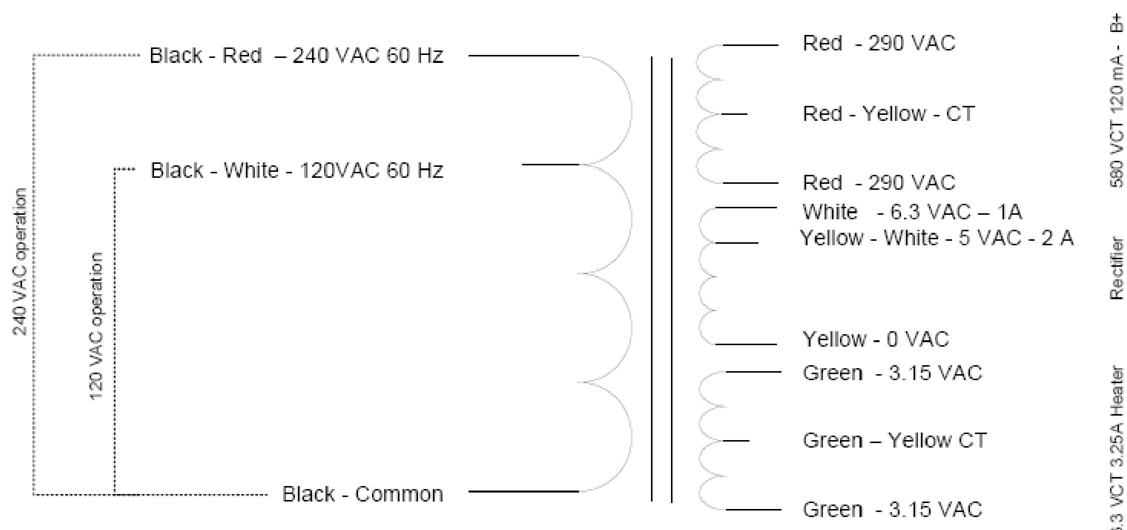
Wiring of Mains circuits: European vs North America			
	Ground	**Hot (L)**	**Neutral (N)**
Europe	Green/White or Green/Yellow	Brown	Blue
North America	Green [USA-plug round prong]	Black [Small flat prong]	White [Large flat prong]
European 240V	Green/White or Green/Yellow	It makes no difference how the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

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



Tie off any unused taps that are is 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 the 5 lug terminal strip.

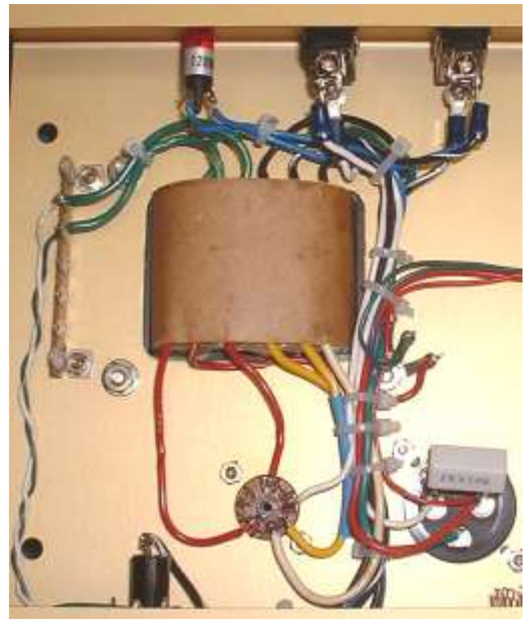
OUT OF DATE



Trinity Amps Power Transformer

Connect the two 6.3V heater wires from the transformer to the tag strip where the twisted heater wires were connected. Connect the center tap ground of the filament heaters to the "power" star ground point located between the power transformer and turret/eyelet board.

Wiring the 18 Rectifier



On an 18, connect the 6.3 V Rectifier heater wires to pins 4 and 5 of the 6CA4 rectifier. Connect the high voltage (290V) wires to pins 1 and 7 of the 6CA4. Route the wire from pin 3 back to the standby switch center pole. Make sure the switch is in the desired on position, the connection is 'made'. The switch may have the option of being On in either 'Up' or 'Down' position.

Attach a wire to the other side of the standby switch and route that to one side of the can cap. From this point connect to the center 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 single star ground point.

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

Wiring the 15 Rectifier

Connect the 5 V Rectifier heater wires from the transformer to pins 2 and 8 of the GZ34. Connect the high voltage (290V) wires to pins 4 and 6 of the GZ34. Connect the center tap of the high voltage from the transformer, and ground it at the single star ground point.

OUT OF DATE

Route the wire from pin 8 to the standby switch center pole. Make sure the switch is in the desired on position, the connection is 'made'. The switch may have the option of being On in either 'Up' or 'Down' position.

Attach a wire to the other side of the standby switch and route that to one side of the can cap. From this point connect to the center 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.

For 120V Operation Connections on the Trinity Amps Power Transformer - Connect the Black to common. Connect Black/White 120V line. See Power Transformer schematic below. Tie off all unused ends.

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.

Connect the 120V Neon Indicator directly across the power switch. There are two wires that go the transformer - Brown/Brown white and two that go from the power switch (Black to Black /White). For clarity these are not shown on the schematic. Note: If you want, you can connect up a 6.3 V pilot light.

Test the Power Transformer

Check your mains wiring to the power transformer and ensure all wires are safely connected or tied off. Install a fuse and turn on the power. Measure the AC voltages to ensure they are within spec of the provided transformer schematics.

Connecting the Board

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

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

Start at one end of the board and work your way sequentially around the board 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 V5.

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.

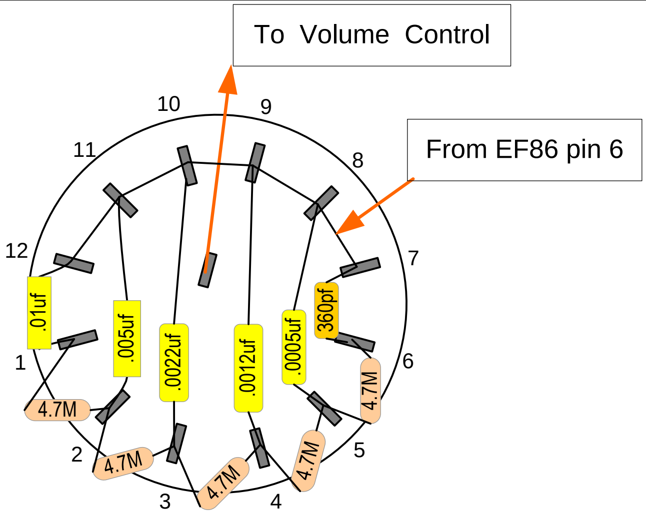
Also, some require components need to be installed for tone controls etc.. Pre-form these components to fit into place and use some heat shrink tubing make ensure they do not touch other parts. Solder them in place following the layout provided.

TC-15 Tone Contour Wiring

The easiest [and only] way to wire the contour switch is to do it on the bench and install it later. It is tight assembly so it is important to correctly 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 once.

On the rear of the switch are numbers molded into the plastic body. Get familiar with them. **Important**: <u>Turn the rotary switch fully anti-clockwise</u>. Remove the nut and lock washer and set the tang to the number 6 for a 6 position switch (this operation is described later in the manual). Confirm it is set correctly. There should be 5 clicks when set correctly. Replace the nut & washer.
Be sure to connect the lead to the inside terminal before the capacitors are all soldered in place.

OUT OF DATE



Rear View of Selector Switch Set to 6 positions
(tang in position 6)
Switch pin numbering 1-12

R-C Circuit Tone Contour

Procedure:
Start with a 4.7M resistor at pin 6 and make a bend at only one end. Place one lead through pin 5 switch terminal and the other trough 6. Take the 360pf capacitor and form it to fit. Then push the leads through terminal 6 and 7. Solder 6 only. Trim the wires at pin 6 only.
Now take another similarly formed 4.7M resistor and push it through at terminal 4 and 5. Take the .0005uf capacitor and form it to fit. Then push the leads through terminal 5 and 8. Solder 5 only. Repeat this procedure until finished. Use the .01 capacitor lead to weave around pins 12 through 7 soldering at all the terminals. Then connect the lead that will eventually go to EF86 to switch pin 7.

Install the assembly onto the chassis.

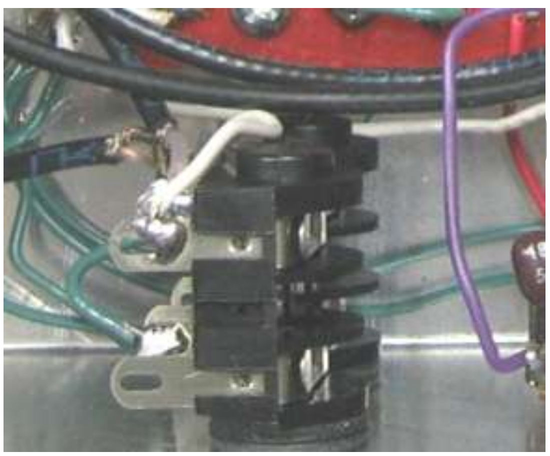
OUT OF DATE

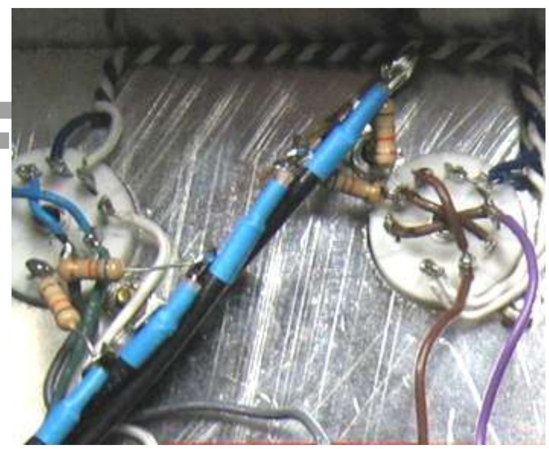
Input Jacks

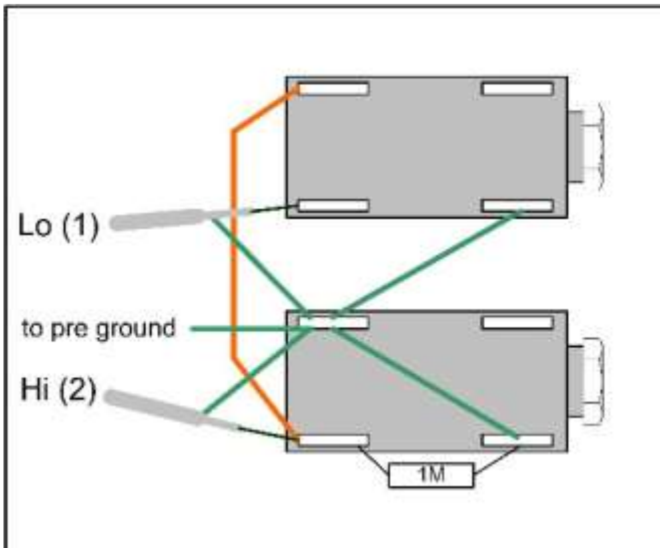
Wire up the input jacks. Use shielded wire from the input jacks to the tube and be careful when wiring switched input jacks. It is easiest to remove the jacks, wire them with the resistors and jumpers and then reinstall them. The ground wires on the input jacks go to the pre-amp ground along with the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

To prepare the co-axial cable for connections:

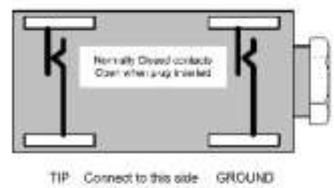
1. Cut back the outside plastic covering at both ends by about 5/8" to reveal the braided shield.
2. At on end, pull back the shield and cut it off at the 5/8" mark. Put some heat shrink around the end covering the area where it was cut off.
3. At the other end, pull back the shield but poke a very fine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





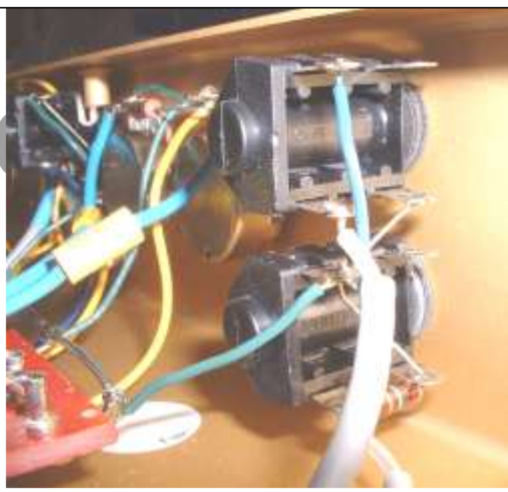


Wiring of Cliff Shorting Input Jacks



Schematic of Switched Cliff Jacks

Cliff Jacks have Normally Closed, internal contacts that open when a ¼" plug is inserted.
TIP connection is on the end farthest from the chassis.
Connect the "Hot" side of the input to the TIP.
Connect the GROUND to the other pin on the SAME side.

	
Input Jacks	Input to V1

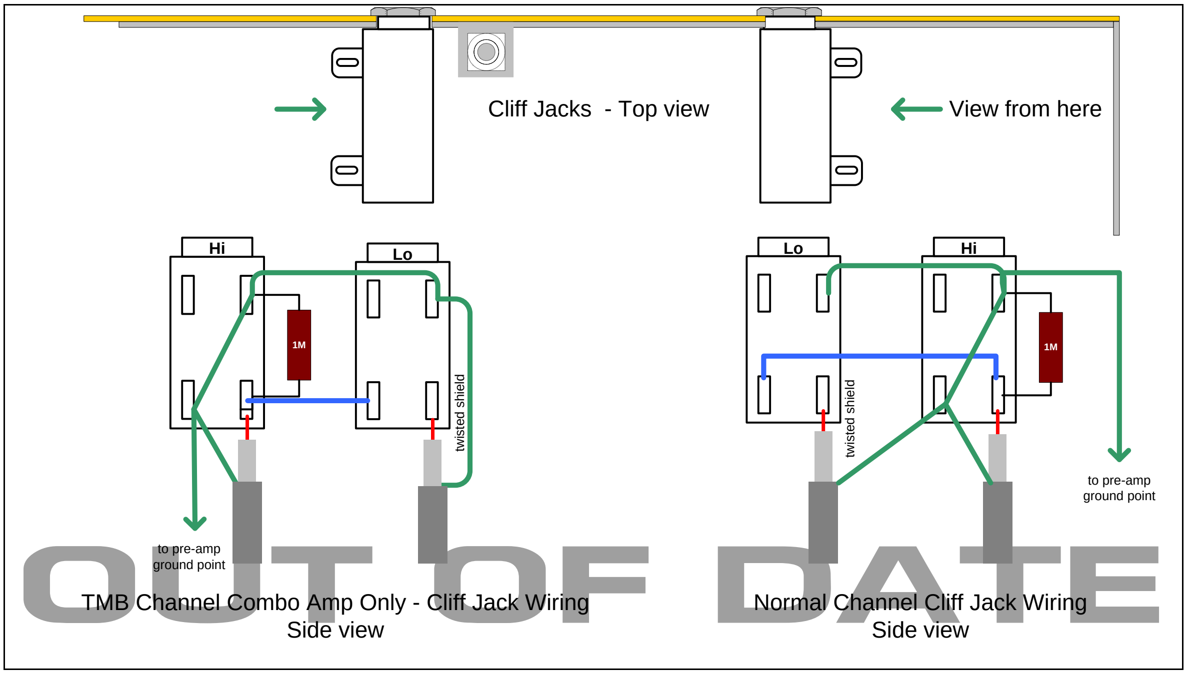
Input to V1

Install a 3-lug terminal strip at the base of V1 closest to the board. Use the tube socket mounting bolt to hold the strip in place.
Note: You may need to trim the end of the so it fits in the available space.

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

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.

On the input jack end, connect the 2 shields together, and connect them to the ground point on the jacks, which in turn go directly to the buss bar. Do not connect the shields at both ends of the cable or you will induce hum.



Combo Chassis Cliff Jack Wiring

Grounding Scheme

The 15 and sIII use a two point grounding scheme where the power side of the amp is connected to a single common ground point, and the pre-amp 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.

TMB Volume Control Wiring for the 18

To minimize TMB channel feedback squeal, we recommend that you wire up the connection from the TMB channel Volume the following way.

Install a 3-lug terminal tag strip at the base of V2 closest to the board. Use the tube socket mounting bolt to hold the strip in place.
Note: You may need to trim the end of the terminal strip so it fits in the available space.

Rather than installing the 470K grid stopper resistor on the board, mount it on a tag to pin 2 of V2. Make the end that connects to pin 2 as short as possible.

Solder the shielded cable centre conductor to the 470K resistor on one tag.

Connect the shield to the ground point on the tag strip that is connected to ground. Do not connect the shields at both ends of the cable or you will induce hum/squeal. Note: Some people prefer to connect the shield to the volume potentiometer grounded terminal

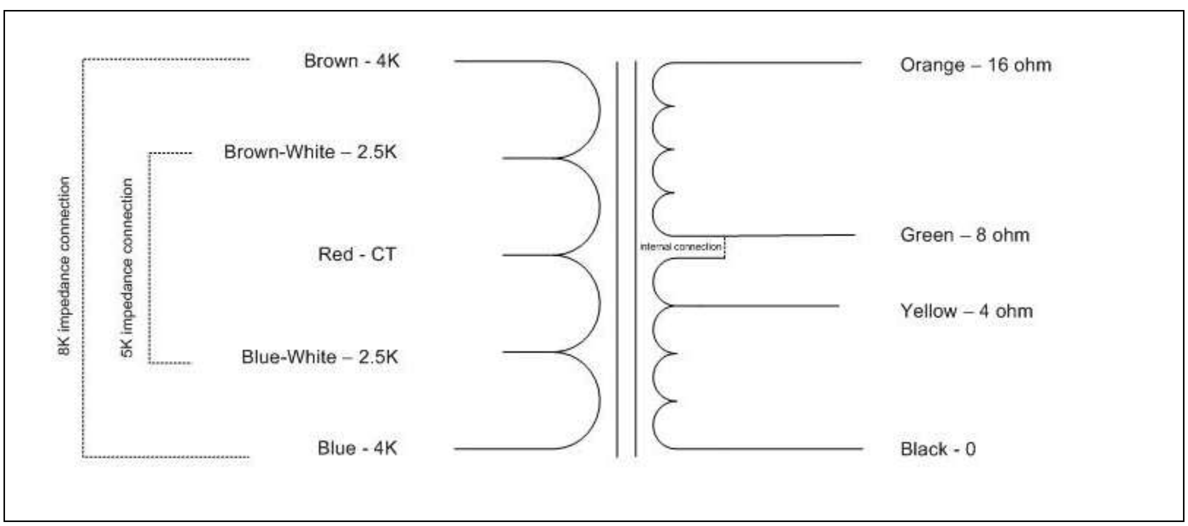
Output Transformer - Output Jacks

Refer to the Output Transformer schematics. Twist the output leads from the transformer to the output tubes. Leave enough transformer lead length to reverse the leads from one EL84 to the other if necessary to eliminate amplifier squealing.

For an 18W amp, start by soldering the Brown output lead to V4 and the Blue to V5.

OUT OF DATE

Refer to the Output Transformer schematics and wire up the output jacks/impedance selector paying particular attention to the leads for the correct impedance.



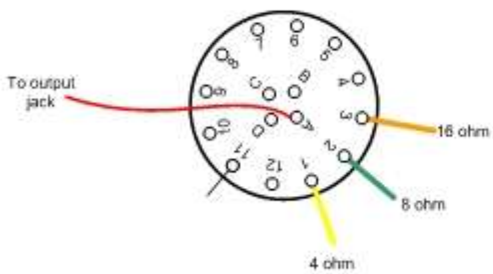
Trinity Amps RS Clone Output Transformer

Connecting the Impedance Selector

Referring to the Output Transformer schematics above, wire up the Impedance Selector to the transformers and output jacks paying particular attention to the leads for the correct ohmage. You will have a switch with either 1 or 4 poles. Only one is necessary to be connected unless you want to connect for higher amperage. It is easier to connect the wires prior to installing the switch into the chassis. Leave enough lead length to be able to install it without undue strain on any wires. Refer to the diagram below for the connections.

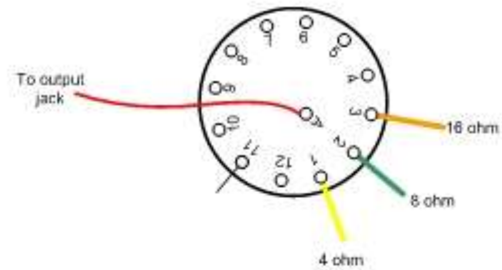
Note: Check to ensure the switch is set to 3 positions only. If not pre-set properly, then adjust the number of positions by rotating the tang washer provided to adjust number of positions. The tang on the flat side sets the switch for three positions.

Tang Washer

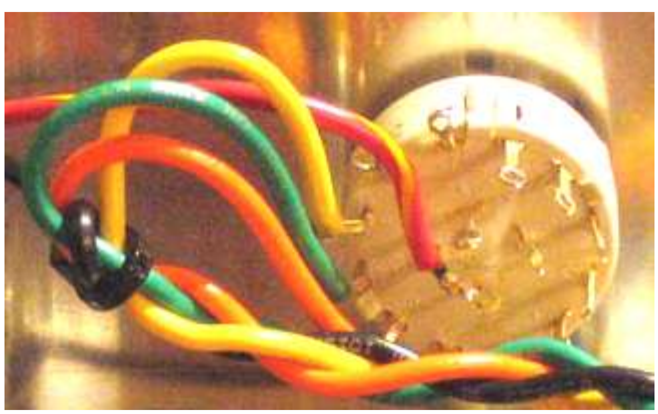


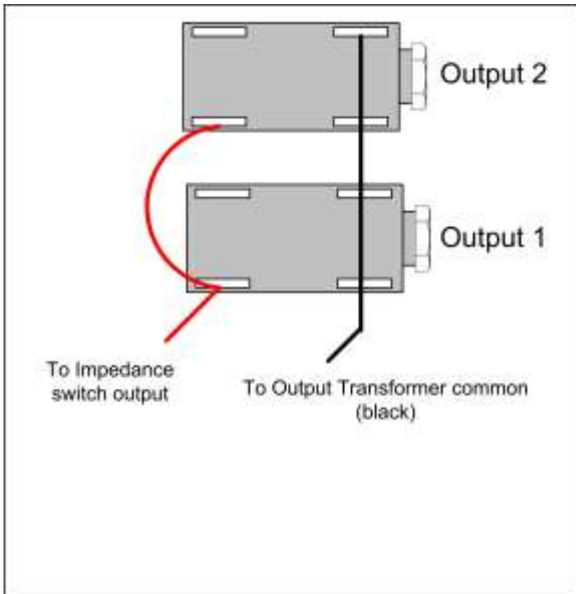
Impedance Switch Rear View
5A hook-Up

OR

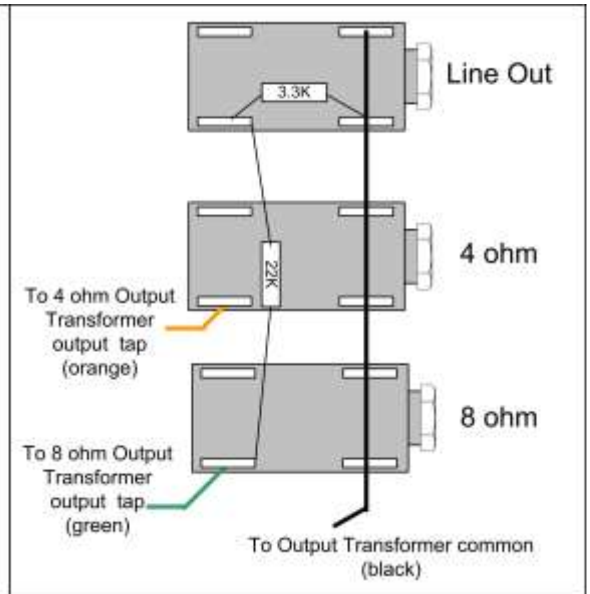


Impedance Switch Rear View
5A hook-Up





Wiring of Cliff Output Jacks for Trinity 18



Wiring of Cliff Output Jacks for Trinity 15

Final checkout

When you finish assembling the amp, double-check the wiring and the components. Trace or highlight the connections on a copy of the layout provided with the amp to ensure the amp is wired correctly. Check everything at least once!

OUT OF DATE

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.

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

Power Up

REMEMBER: DO NOT OPERATE YOUR AMP WITHOUT A LOAD

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.

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 the filament voltages and ensure they are on the correct pins for all tubes.

If all is OK, then shut off, install the rectifier and apply power without the preamp or power tubes installed. Turn on the Stand-By switch on the 18. Check the plate voltages on the tube sockets. The plate voltages will be slightly higher than the voltages listed on the schematic because there is no load provided by the tubes. If everything is okay, power off the amp. **Connect a speaker** or 8 ohm load. Install the three preamp (12AX7) and two power tubes (EL84) and power on again.

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.

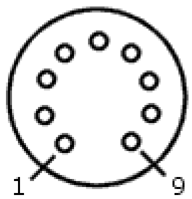
OUT OF DATE

If all seems in order, and the fuse has not blown, turn the volume up a bit. Touch the input lead with a small screwdriver to see if you can induce some hum, or static sound. If everything seems fine, plug in a 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.

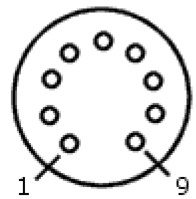
Hopefully, there are no problems but if you think there are e.g. hum, squeal etc., then move on to the troubleshooting section of this manual.

Trinity 18 TMB & sIII Voltages

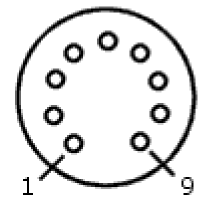
AC Mains Voltage 123VAC;B+ 440 VDC no tubes installed;350 VDC with tubes



12AX7/ECC83



6BQ5/EL84



EZ81

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 (12AX7/ECC83)	155	--	1.0	--	--	155	--	1.0	--
V2 (12AX7/ECC83)	180	--	1.5	--	--	272	--	180	--
V3 (PI) (12AX7/ECC83)	220	52	75	--	--	217	62	75	--
V4 (6BQ5/EL84)	--	--	12	--	--	--	345	--	340
V5 (6BQ5/EL84)	--	--	12	--	--	--	345	--	340
V6 (EZ81)	292	--	350	--	--	--	292	--	--

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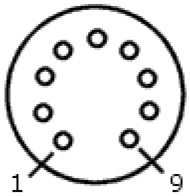
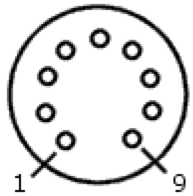
Trinity 18 TMB / sIII / Plexi / v6 Voltage Chart

(Used to record your measured voltages)

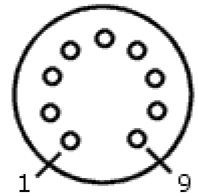
AC Mains Voltage	**VAC**
B+ No tubes installed	**VDC**
B+ All tubes installed	**VDC**



12AX7/ECC83



6BQ5/EL84



EZ81

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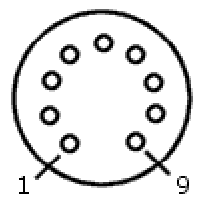
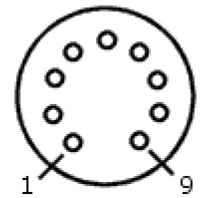
TUBE	**Pin 1**	**Pin 2**	**Pin 3**	**Pin 4**	**Pin 5**	**Pin 6**	**Pin 7**	**Pin 8**	**Pin 9**
V1 (12AX7/ECC83)	155	--	1.0	--	--	155	--	1.0	--
V2 (12AX7/ECC83)	180	--	1.5	--	--	272	--	180	--
V3 (PI) (12AX7/ECC83)	220	52	75	--	--	217	62	75	--
V4 (6BQ5/EL84)	--	--	12	--	--	--	345	--	340
V5 (6BQ5/EL84)	--	--	12	--	--	--	345	--	340
V6 (EZ81)	292	--	350	--	--	--	292	--	--
6V6 (1)									
6V6 (2)									

Trinity TC-15 / 15 Voltages

AC Mains Voltage 123VAC;B+ 440 VDC no tubes installed;355 VDC with tubes



12AX7/ECC83



6BQ5/EL84

TUBE	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Pin 9
V1 (12AX7/ECC83)	130	--	1.21	--	--	130	--	1.21	--
V2 (12AX7/ECC83)	159	--	1.27	--	--	197	--	160	--
V3 (12AX7/ECC83)	190	--	61	--	--	231	--	61	--
V4 (6BQ5/EL84)	--	--	5.9	--	--	--	298	--	--
V5 (6BQ5/EL84)	--	--	5.9	--	--	--	291	--	--
V6 (5AR4)	--	--	--	--	--	--	--	298	--
V7 (EF86)	56	--	1.5	--	--	90	--	1.5	--

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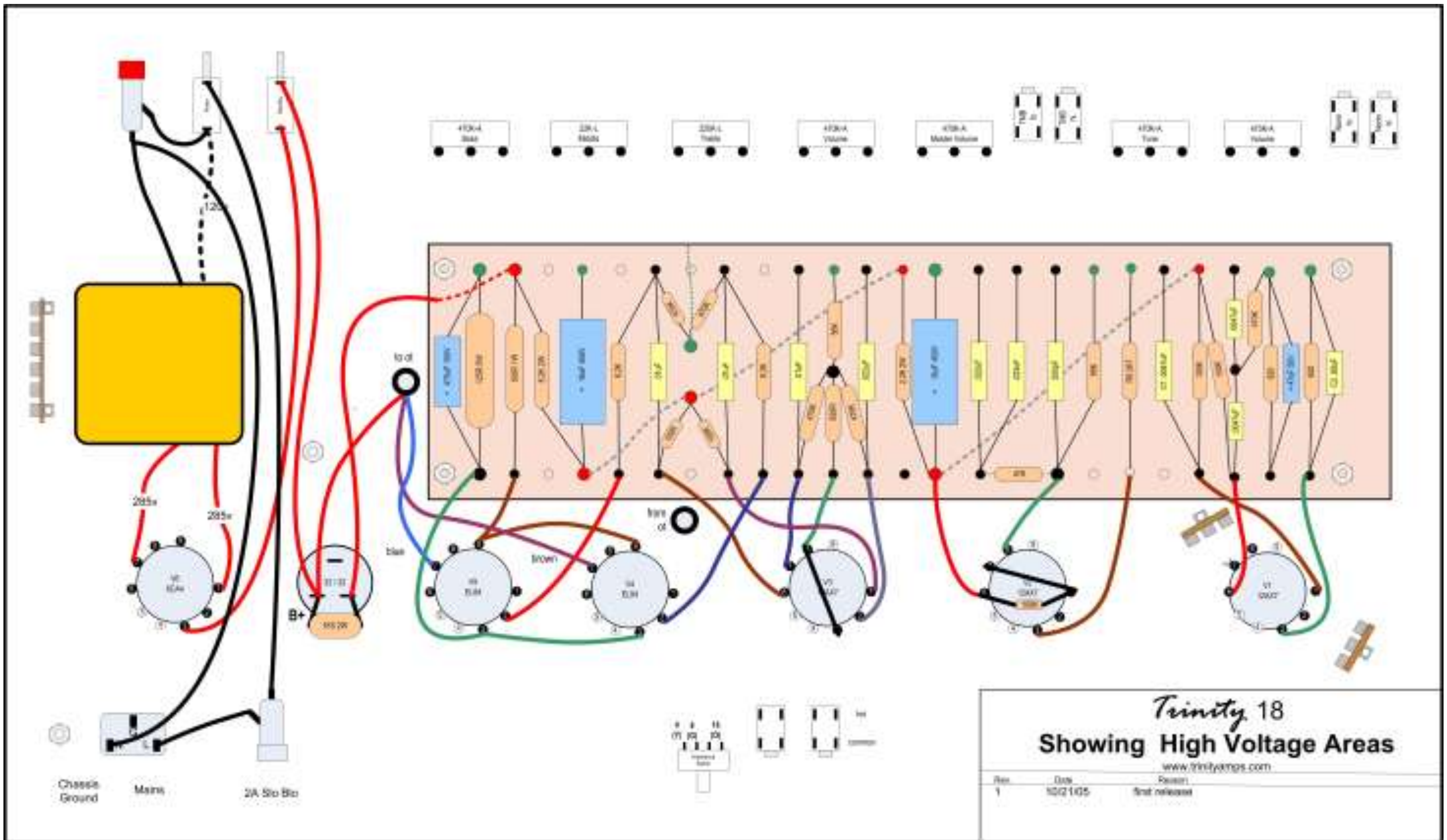

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The above layout above indicates areas of the Trinity 18 where you should take extreme caution. There are voltages in this area in excess of 350 VDC.

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.**

Troubleshooting

When debugging a newly built amp the first things to do are check the wiring, make sure the correct components are installed, and look for bad solder joints.
Use a voltmeter to check voltages and compare them with the voltages listed on the schematic. Remember that you can calculate current by measuring the voltage drop across a resistor and dividing by the resistance.
An incorrect voltage or unusual current may give you a clue to the source of the problem. A low voltage often indicates that something is drawing more current than the power supply can handle and dragging down the voltage.
Probing with a non-conductive object such as a chopstick while the amp is powered on is a good way to find bad connections or problems with the way the wiring is laid out.
Remember that dangerous voltages are present when the amp is powered on. Always drain the filter caps and disconnect the mains before working on the amp. To learn how to do this safely, see the following 'Faulty power supply filter caps' discussion.
Never operate the amp without a load or you will damage the output transformer. You can use an 8 ohm 15 watt power resistor as a dummy load in place of a speaker.

Hum

Hum is the most common problem and is usually caused by AC line noise leaking into the filament wiring or input stages and getting amplified. Here we provide a comprehensive step-by-step troubleshooting guide.

First, measure the resistance from each parts ground connection to the chassis. All readings should be less than 1 ohm, typically 0.5 ohms.
Make sure the Mains ground at the chassis is **very** tight.

Volume Test

A good way to troubleshoot is to divide and conquer by turning the volume control(s). If the hum changes levels as you do this, then the source of the hum is something that affects the stages of the amp before the volume control. A faulty, humming preamp tube can be isolated this way very quickly. Conversely, if the volume control does not affect the hum, the cause is somewhere after the volume control.

Faulty tube

Tubes sometimes develop internal hum. Do some tube swapping to locate the problem. Use the volume control test.

Severely unmatched output tubes in a push pull amplifier

Push pull amplifiers get by with less power supply filtering because they're supposed to cancel this ripple in the output transformer. The cancellation can be upset by output tubes that use different amounts of bias current, allowing the hum to be heard.

Faulty power supply filter caps

There are a limited number of ways for the power supply filter capacitors to be bad. All of the tests on power filter capacitors must be considered hazardous since they may store lethal amounts of voltage and charge even with the amplifier unplugged.

Any time you suspect power filter capacitors, do the following: With the amplifier unplugged and the chassis open, connect one end of a clip lead to the metallic chassis. Clip the other end of the lead to a 10K 1/2W or larger resistor. Holding the resistor with an insulating piece of material, touch the free end of the resistor to each section of the power filter capacitors for at least 30 seconds. This will safely discharge the filter capacitors.

Then:

Visually inspect the capacitor(s) for any signs of bulging, leaking, dents and other mechanical damage. If you have any of these, replace the capacitor. Also note the condition of any series dropping resistors connected to the capacitors to see if they have been damaged by heat. Replace them if they have.
Use an ohmmeter to measure the resistance from the (+) terminal of each capacitor to the (-). This should be over 15K ohms (Ω), preferably much over that. If you get less than that on any capacitor, unsolder that capacitor and re-measure just the capacitor. Less than 15KΩ indicates a dead or dying capacitor; replace it. If the resistance is now much higher with the cap unsoldered, there is a low resistance load pulling current, not a faulty capacitor. Always check all of the power filter capacitors while you're in there. If one is bad, consider replacing them all.
If there is no obvious mechanical problem and the resistance seems high enough, temporarily solder a new, known good capacitor of at least as high a capacitance and voltage across the suspected capacitor or section, then plug in and try the amplifier again. If this fixes the problem, turn the amplifier off, unplug it, drain the filter capacitors again, and replace at least the bad section if not all of the filter capacitors.

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If you are replacing a multi-section can capacitor, get a replacement can with multiple sections matching the original before you remove the original capacitor. Once you get it, make yourself a note of the symbol on each terminal of the old capacitor, such as square □=1uF/450V, triangle Δ=20uF 450V, etc. and then clip the old terminal with the symbol off the old can. Remove the old can, mount the new one, and use the symbol chart and lugs still on the leads to make sure you connect the right sections up in the new capacitor.

Faulty bias supply in fixed bias amplifiers

A bias supply with excessive ripple injects hum directly into the grids of the output tubes. Check that the bias supply diode is not shorted or leaky, and then bridge the bias capacitor with another one of equal value to see if the hum goes away.

Unbalanced or not-ground-referenced filament winding

The filament power must be referenced to the DC in the tubes in some way, otherwise you may get a lot of hum. The filaments are usually a center tapped 6.3VAC winding, with the CT grounded for the necessary reference.

If the winding is not grounded and balanced around ground, it will cause hum. Measure the voltage from each side of the 6.3V to ground; it should be pretty much exactly half the AC

voltage at either end. If it is unbalanced to ground, tweak the pot or change the resistors to get it to be.
Note: If you have grounded center tap style supply that is not centered on ground, this indicates a faulty power transformer.

TIP: If your heater wires did not have a center tap to connect to ground, then put a 100 Ω anti-hum resistor to ground from each side of the heater wires to the common ground point. This will add a ground reference to the heater voltages and help to reduce hum.

Other methods are low value pot (200-500 Ω) across the whole 6.3V with the wiper grounded.

Defective input jack

If the input jack is not making good contact to the guitar cord shield, it will hum. Likewise, if the jack has a broken or poorly soldered ground wire, or not-very-good connection to the grounded chassis, it will cause hum. If messing with the jack changes the hum, suspect this.

TIP: If hum or noise exists when the input plug is removed, try re-soldering the connections to the Input jacks.

Poor AC grounding

In amps with two wire cords, defects of the 'ground reverse' switch and/or capacitor can cause hum. A leaky power transformer can also cause this.

Induced hum

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Placement of the amplifier near other equipment can sometimes cause it to pick up radiated hum from other equipment. Suspect this if the hum changes loudness or tone when you move or turn the amp. There is usually nothing you can do about this except move the amp to where the hum is less.

Poor internal wire routing

If the signal leads inside the amp are routed too near the AC power wires or transformer, or alongside the high-current filament supply wires, they can hum. Sometimes using shielded cable for signal runs inside the cabinet can help. It is hazardous to do, but you can open the amp up and use a wooden chopstick (NOT A PENCIL) to move the wires around inside to see if the hum changes. This is hard to do well and conclusively, since the amp may well hum more just because it is open. BE VERY CAREFUL NOT TO SHORT THINGS INSIDE THE AMP.

Poor AC Chassis Ground at Power Transformer

A common problem is the main ground point to the chassis. The green wire ground to the chassis, the 'line reverse' cap, the CT on the filament windings, the CT on the high voltage windings, and other things associated with power or RF shield grounding are often tied to lugs held under one of the power transformer mounting bolts. If this bolt becomes loose, or if there is corrosion or dirt under the lugs, you can get an assortment of hum problems.

Defective internal grounding

There are potentially lots of places that must be tied to ground in the internal wiring. This varies a lot from amp to amp. If one is broken loose or has a poor solder joint or poor mechanical connection, it can show up as hum. Note that modified amplifiers are particularly susceptible to this problem, as the grounding scheme that the manufacturer came up with may well have been modified, sometimes unintentionally. With the amp unplugged, open and the filter capacitors drained, carefully examine the wires for signs of breakage.

Hiss

Some noise or hiss is normal. These amps are supplied with Carbon Composition resistors similar to the original. This style of resistor has inherent noise. If this amount of hiss is bothersome, you will need to replace the resistors in the signal chain with Metal Film resistors.

Metal Film Resistor Substitutions

If you really want to eliminate hiss, use metal film resistors where the signal level is small and the following amplification is high - a classical description of an input stage. The input to an amp should probably have a metal film plate resistor to minimize noise.

Substitute them on the grid resistors in all but output stages because the signal level is typically too low.

Substitute them on the Cathode resistors. They typically only have a few volts across them, and they're often decoupled with a capacitor, both of which would minimize the carbon composition resistor distortion (carbon comp "Mojo").

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The best place to use CC's is where there's big signal - plate resistors, and ideally the stage just before the phase inverter. The phase inverter would otherwise be ideal, with plate resistors carrying the highest signal voltage in the amp, but phase inverters are often enclosed in a feedback loop. The feedback minimizes the distortion the resistor generates.

Squealing/Feedback

Squealing usually occurs when there is coupling between the input and output stages. The positive feedback causes the amp to become an oscillator. Vary the volume and tone controls to see if it affects the oscillation.
That will tell you if the coupling is occurring before or after the control. Sometimes the problem can be solved by minor changes to the wiring (moving output wires away from input wires, shortening excessively long wires, etc.).

Use shielded wire on the input jack to help a hum or squealing problem.

Ensure the shielded wire goes on top of the board, not underneath it.

If you've built a TMB-MV 18, you may have a squeal when you turn up the Volume & Master Volume together. Try the following to eliminate it.

1. Move the 470K grid stopper resistor to attach directly to pin 2 of V3.
2. Use shielded wire from the TMB Volume pot wiper to the resistor.
3. Connect wire shield to the socket, or chassis at V3; some people prefer to attach to the potentiometer.

4. Reduce the 470K value (to 68K min.) until the squeal goes away; 68K will give you a nicer impedance, but if you are going for gain, just bypass that resistor with shielded wire and enjoy.
5. If all that doesn't work reverse the output transformer leads on pin 7 on V4, V5.

Explanation from s2 Amplification: One of the primary leads is in phase with one of the secondary taps. In a high gain amp, this phase relationship needs to be maintained.

6. If step 5 was necessary, you might be able to return to 470K grid stopper resistor value. Note: If you are looking for gain, you could omit the grid stopper or bypass it with a cap. If not, you should try to leave it in there. This point in the design happens to have the most effect on gain.

In extreme cases, you may need to ground the output jacks to the chassis.

Radio Interference

If you are picking up radio stations on your amp:

1. Try a .01 uF or 47 pf capacitor on very short leads between the 'ground' side of the input jack and chassis.
2. Make sure the chassis is fully enclosed electrically. Install a piece of thin Aluminum sheet metal or HVAC Aluminum tape sandwiched between the chassis & cabinet and make sure it makes contact with the chassis.
3. Make sure the 68K grid blocking resistors are located at/on the V1 tube socket.
4. Use shielded wire between the input jack and the 68K grid blocking resistor.
5. Place ferrite beads over the shielded input cable.
6. Try grounding the shield of the shielded input cable to the chassis instead of the preamp ground.

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Other useful measures to take in extreme circumstances:

1. Use a filtered IEC connector for your mains power connection.
2. Put a 100pf across the V1 Plate and cathode pins 1&3

Scratchy Sounds on Potentiometer(s)

If you are hearing scratch sounds on a pot when you rotate it, measure the DC voltage from the terminals to ground. A leaky coupling capacitor or tone stack can cause this to happen.

Amp Buzz or Rattle When Installed in Cabinet

If you get a buzz in an amp when it's installed in a cabinet, it could be due to any one or a combination of the following things. Start with the easy things and work your way through the tests.

First, is it a metallic buzz? Is it a tube (ringing) buzz? Is it a softer buzz (wooden/plastic sound?)

Try using an external speaker, isolated from the amp to see if it goes away. This should tell you it's related to the cabinet mechanics or not.

Testing Cabinet Mechanics

- Are the Speaker mountings tight?
- Are the cabinet construction screws tight?
- Are the Vents loose? Use more fasteners; Rubber gasket between vent and chassis; hard rubber washers to hold vent assembly on
- Does the power transformer touch the mounting boards ? Check for a gap and then separate the power transformer from the mounting board.
- Is the Speaker cable rattling against back of chassis? Hold it & listen. Tie it down if necessary.

Loosen the chassis from the cabinet and see if the buzz goes away. This will isolate the chassis as the problem. If it does go away, Test the chassis mechanics.

Testing Chassis Mechanics

- Are all the nuts fastening parts to the chassis tight? (sockets, transformers, tag strips etc.).
- Are there Shields on pre-amp tubes? Remove & listen.
- Are there Spring retainers on power and rectifier tubes? Remove them or temporarily tie them down somehow & listen. Cover in heat resistant tubing if necessary to isolate them from the tubes; or remove them; or you can retain tubes with a small amount of silicone.
- Are the tubes mechanically rattling? Hold them and see if the rattle goes away. Replace if necessary.
- Are the Controls loose? (toggles/mounting rings etc.)
- Is the Chassis loose? - tighten & listen
- Is the Chassis loose against backboard? - Remove backboard & listen
- Is the Chassis pushed up hard against cabinet? Tighten; Use Rubber gasket (neoprene 3/8' X 1/8' window/door sealer) around where the chassis touches the cabinet

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- Is there a gap between panels/chassis & cabinet? Tighten it up, use rubber gasket where the faceplate meets cabinet. Rubber gasket (neoprene 3/8' X 1/8' window/door sealer) between panel and cabinet
- Is the Chassis vibrating around backboard? Remove the backboard and listen. Use a Vibration damping strip or rubber gasket between chassis and backboard.
- Is the Chassis vibrating around the tranny? Hold tranny & listen; Are there washers between tranny & chassis. Flush mounting (i.e. no washers) could cause rattle. Use rubber gasket between transformer or use washers
- Is the Circuit board mounted tightly against chassis? Tighten mounting screws - check standoffs.
- Are there components touching the turret board? Use a chopstick to prod some of the larger ones first, then space them off the board; You can even silicone the rattling parts to board if necessary (especially larger caps).
- Are there Components touching each other? Use a chopstick to prod some of the larger ones first, then separate them; Silicone the rattling parts to separate them (especially larger caps)

Other Tests

- Try different tubes - if it is coming from both channels, try output tubes first. Tap them when removed from the amp to see if you can hear any rattles.
- Input/Output jacks - try plugging a spare 1/4' jack into the other jack(s) when playing or the end of a chopstick. Replace the noisy jack.
- Speaker - vibration between alnico magnet & bell cover; or voice coil rub. Try a different speaker; Replace speaker if necessary

- If you have a signal generator you can sweep from a low frequency noting where any rattles occur. Then leave the frequency generator at that position while you prod around looking for the source of the problem. Fix it and move on to the next one. If you don't have a signal generator, then you'll need to pluck certain strings of your guitar in sequence and see what excites the rattles.

  At three separate and different frequencies you might find:
  - Components vibrating against the board;
  - Chassis rattling against the cabinet; and
  - Mechanically noisy tubes (V1 for example).

Make sure all the components are away from the board and not touching, and put neoprene 3/8’ X 1/8’ window sealer with one adhesive side, between chassis and wherever it touches the cabinet.

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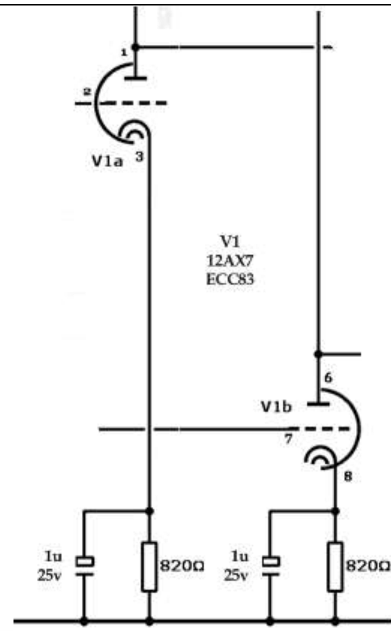
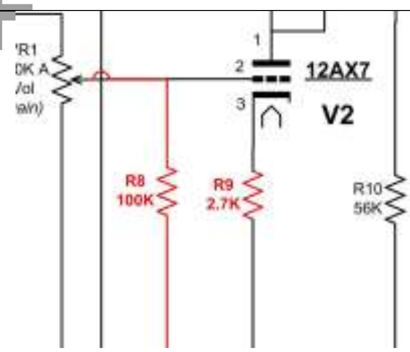
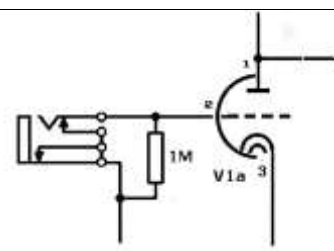
Tone Tweaking

Below are some modifications you might choose to implement in order to change the tone and response of your Trinity 18 Watt TMB-MV. There are several 18 Watt interest groups on the Internet who can provide some direction. Some of these also apply to the sIII TMB version.

Front End Bass Roll-Off On the 2 cathodes of V1, the R-C filter is set to 1uF X 820 ohms. This will roll the bass off slightly. Increase the capacitance up to 25uF to increase bass response of the front-end pre amplifier. Try the following combinations for the pair for the TMB channel connected to V1a. 2.7K/68uF; 1.5K/25uf; 2.2K/2.2uf; The lower the capacitor value, the less bass response.	
TMB channel gain To change TMB channel gain, reduce R9 in increments of 820 ohms.. the lower the value, the more the gain. 820 would be the lowest value, highest gain for this tweak. For more gain, eliminate R8 altogether. We expect that adjusting R9 downward will provide sufficient gain.	
TMB channel input impedance To change TMB channel input impedance, replace the 1M resistor with 820K; 560K or 470K resistors. This may be necessary for particular instruments.	

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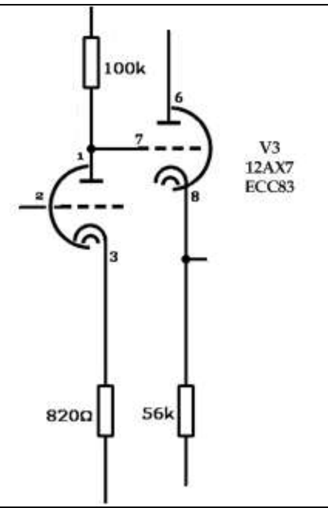
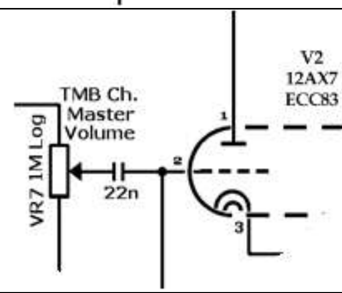
V3 Bias – Dirty Sound

Change the 56K cathode resistor on V3 to 47K. This changes the bias, and operates the tube in a different part of its operating curve and it will not sound as clean.



Master Volume Range

To change the range of the Master Volume, reduce the MV potentiometer from 1M Log/Audio, to 500K.



Increased Treble Control

For modified Treble control, try the following modification to the R-C filter around the Treble control potentiometer.

33K /250pf– more gain and treble;
47K/330pf - middle of the road;
56K/500pf – bassier slope, less gain

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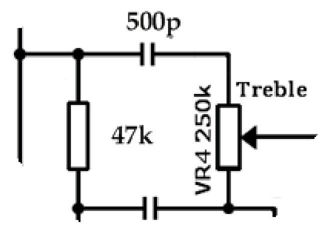
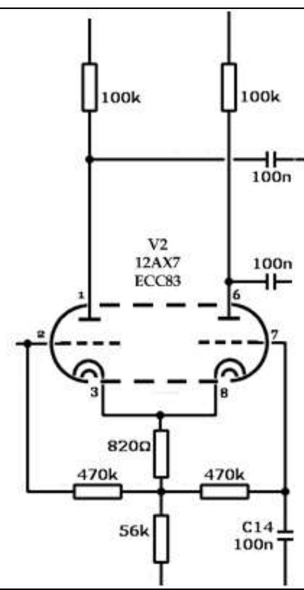
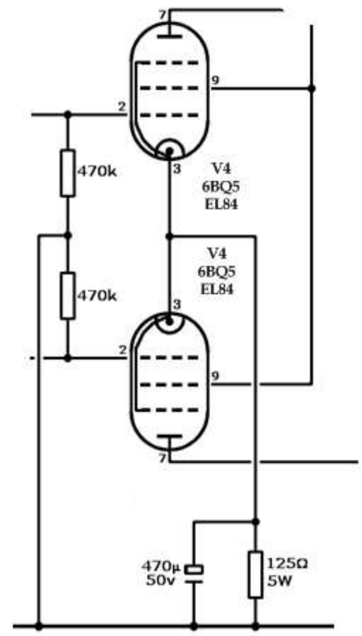
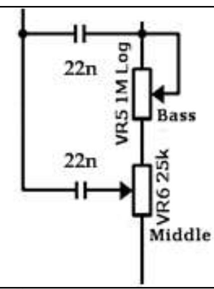
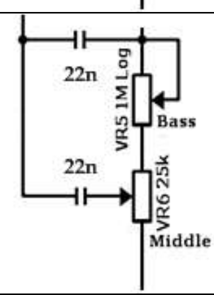


Gain and Biasing of the Inverter

To change the gain and biasing of the phase inverting stage, reduce the resistors in the chain to the following:

Change the two 100K resistor to 82K or 68K (add a 100pf cap between the plate resistors). Change the 470K resistors to 330K or 220K for cleaner sounds.



Low Frequency Response of the Output Stage Output tubes, cathode bypass filter: The original Marshall 18Ws used 500uF, and the Watkins Dominators they derived from used 50uF, there is no right value. Larger values will give more bass response. What is used depends on the type of speakers, cab, OT and even guitar. The -3db low frequency cutoff point is approximately 1/(2 x pi x R x C), so for example, 125 ohms and 50uF has a lower cutoff of 25 Hz. Try either a 50 or 100uF. Some people find that lower values keep the low end from getting muddy or boomy. This is not like a conventional high pass filter in that there is still some gain/band pass at Low Frequencies. Instead of a continuous cutoff there is a step in the gain response, lower gain below the crossover point, and higher above.	
Bass and Midrange Control Filter If you want to modify the frequency of the control, change the 22n capacitors. Try 10n for the Bass and 47n for the Middle.	
Bass Control Effect If you want to modify the effect that the Bass Control has, change the value of the potentiometer to 500K or 250K.	

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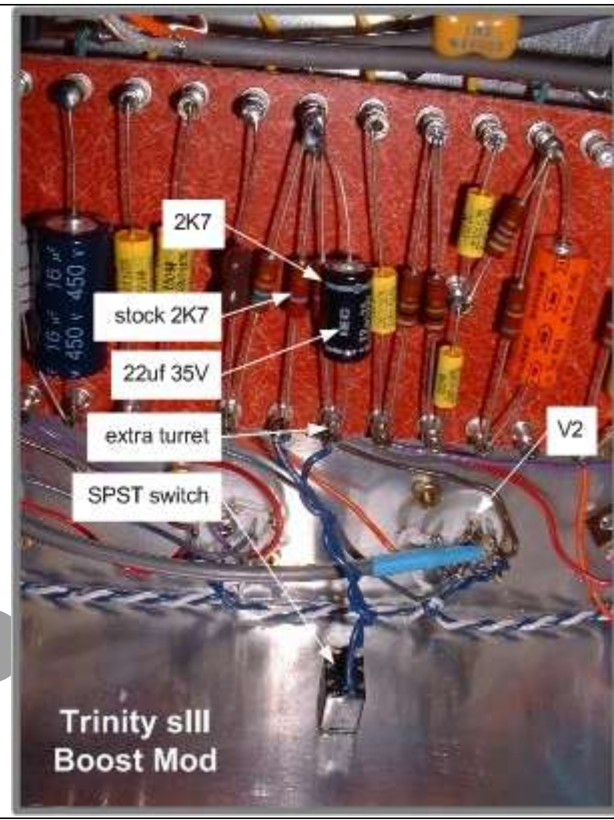
sIII/v6 Specific Tweaking Notes

This section contains information on tweaking the sIII design to taste. Note the tweaks are not listed in any order. There are several places to adjust gain and tone in this circuit and each of them do it in a different way and to different effect. You may find you only need one of them, a few of them, all of them, or none of them.

sIII Channel Boost Switch Start with one 2K7 in parallel with the V2 cathode resistor and a 1 uf as well. Put both in parallel with R9 on the turret board. This is from V2 , pin3 to ground. Just solder it across the Trinity Amps turret board because there is an extra turret there to use if you want to. 1 uf works fine. It accentuates the high end. 47 is also fine but allows a lot more signal through - good and dirty. 22 uf seems to be just right. This uses a toggle switch though, not a foot switch.	
To Increase Gain on **sIII Channel**	1. Remove R8 2. Change VR1 to 1M-A 3. Change R9 to any value between 470R and 2.7K--lower values = more gain 4. Bypass R9 with a cap between 0.68uF and 47uF. Higher values = more bass 5. Increase R4 to 220K 6. Increase R7 to 220K 7. You may need to change VR7 to 250K-A or 100K-A to keep the PI from overloading from the increased gain
To Fatten Tone on sIII Channel	1. Change C1 to 0.022uF 2. Change C2 to 2.2uF -OR- change R5 to 2.7K -OR- both 3. Change R11 to 33K 4. Change VR5 to 500K-A or 250K-A to give the bass control more useful range
The **Normal channel** configuration is the original 18 Watt Tremolo Channel without the tremolo.	
For less distortion in Normal Channel	The normal channel uses two capacitors in series (.0047 uF) off V1b 12AX7 plate with the junction of them going to a 470K bleeder (R29) then to ground. The bleeder resistor from the coupling

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	cap to ground is R29. Replace it with a 100K or 56K.
Gain in Normal Channel	Changing the cathode resistor by itself won't lower gain if it is bypassed by a capacitor (C16). If you lower the bypass capacitor you will filter out certain low frequencies, which will lower gain a tiny bit. Another option is to just remove the cathode bypass cap C16. Then maybe also increase the Cathode resistor R27 to 1k, 1.5K.
Bass Response in Normal Channel	To tighten up the bass (e.g. for humbuckers), drop the cathode cap C16 from 47uF to something like 2uF, 1uF, or .68uF

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More Tips for fine tuning your amp

Reprinted with permission from Aron from diystompboxes.com

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..

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Tube Substitutions

Preamp and driver tube substitutions: 12AX7 (high gain dual triodes with pin out 9A)

12AD7*	12DT7	7729
12AU7#	5751*	B339
12AU7A#	5751WA*	B759
12AX7	6057	CV4004
12AX7A	6681	E83CC
12AX7WA	6L13	ECC803
12BZ7*	7025	ECC83
12DF7	7025A	M8137
12DM7*	7494	

EF86 - high gain pentode
Close or identical 6267, 6F22, CV10098, CV2901, Z729
Different rating or performance EF806S

6BQ5/EL84 (miniature pentode with pin out 9CV)

6267	7189	EF86
6BQ5	7189A	EL84
6BQ5WA	7320	N709
6P15	E84L	Z729

* means appropriate for parallel filament circuits

means may not work in all circuits

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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.

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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})

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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%
M +/	20%
N +/	0.05%
P +100%	0%
Z +80%	20%

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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, 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 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, 350 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: The new pictures show the wiring of the rectifier socket, V6. The picture (2nd in new series) shows an additional wire not shown on the layout from pin 1 to I'm guessing the power switch. What is this for, where does it actually go and do I need it if I'm following the layout I have?
A: In the layout, that extra wire is an illusion. It is really the fuse wire just above the socket. It does look like it is on pin 1 though.

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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, 32/32 cap can and the 125 Ohm 5 watt resistor turret
A: Connect the 120 V ground to a bolt that fastens the IEC plug.   This is next to the IEC plug. On newer chassis, I have added an extra grounding screw on the chassis for safety as you're not supposed to use the same bolt that holds parts, to also attach a ground strap. You can drill a small hole if you prefer to have it that way. **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: Just to check, on the 500K TMB volume pot center lug the 100K resistor goes to the ground rail and then to the turret for the 16 uf cap on the board? It shows on the layout, but when I blow up the picture it's not as obvious as the other ground connections.
A: You are correct on the volume wiring. The 100k resistor can also go between the left and center lugs (looking at the picture and layout) of the 500k pot if you prefer. At the point you mention, the buss bar is connected to the 56K resistor with a wire from the board, not the resistor lead.

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, 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 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.

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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. In newer chassis, there is a separate hole to mount these if you prefer.

Q: Is there hardware for mounting the transformers? Or is that supplied by S2?
A: I haven't supplied these. I think they are 8-32, and you would need nuts, washers, lock washers. Since I don't know which transformer a customer is going to buy, it would be hard to provide these.

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 & 18 Watt forum. Right click on them to download if you want print in large, colour format.

TIP: Flatten or remove the locating tabs on the pots so that they tighten properly on the chassis.

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.

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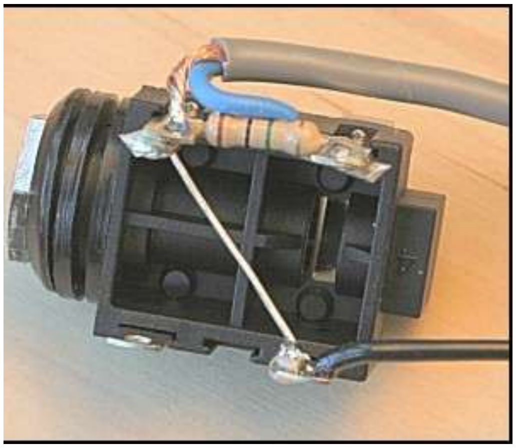
Cliff Jacks Explained

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.

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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

Hardware

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

Part	Qty	Where to use
4-40 X ¼ (no nuts reqd.)	16	Mount tube sockets, [optional lock washer under head on threaded chassis];
4-40 X ½	8	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	3	Mount 3 power ground # 6 chassis lugs with lock nut. Mount Capacitor clamp
6-32 X 1-¼	4	Mount turret board to chassis using stand-off. Use with lock nut.
8-32 X ½	1	Mount Mains ground **ONLY**. Use additional lock washers with #8 chassis lug.
8-32 X ½	2	Mount Output trans. with lock nuts. Extra #8 nuts for Power trans. mounting.
8-32 X 2	4	If provided to replace short Power Transformer bolt.
8-32 lock nuts	5	4 "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.

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QtyTC15	Item	Comments
2	100 2W Metal Oxide Resistor	
1	120 5 Watt Resistor	Possible 130 or 10W
1	1K2 ohm carbon 1/2 watt Resistor	Br R R
4	1K5 ohm carbon 1/2 watt Resistor	Br G R
1	1K5 metal oxide 5 watt Resistor	Br G R
1	2K2 ohm carbon 1/2 watt Resistor	R R R
1	10K ohm carbon 1/2 watt Resistor	Br Bk Br
5	22K ohm metal oxide 2 watt Resistor	R R O
1	47K ohm carbon 1/2 watt Resistor	Y P O
1	56K ohm carbon 1/2 watt Resistor	G B Or
4	68K ohm carbon film 1/2 watt Resistor	B Gy Or
4	100K ohm carbon 1/2 watt Resistor	Br Bk Y
1	100K ohm carbon 1/2 watt metal Resistor	R R Y
4	220K ohm carbon 1/2 watt Resistor	Br Bk G
1	330K ohm carbon film 1/2 watt Resistor	Br Bk G
1	470K ohm carbon 1/2 watt Resistor	Y P Y
2	1M ohm carbon 1/2 watt Resistor	Br Bk Gr
2	1M ohm carbon film 1/2 watt Resistor	Br Bk Gr
1	2M2 ohm carbon film 1/2 watt Resistor	R R G
5	4M7 ohm carbon film 1/2 watt Resistor	Y P G (or larger value)
1	51pf Silver Mica Capacitor	
2	180pf Silver Mica Capacitor	
1	360pf Silver Mica Capacitor	
1	.0005uf Mallory 150 Axial Capacitor	501K
2	.0015uf Mallory 150 Axial Capacitor	152K
2	.0022uf X 600v Mallory 150 Axial Capacitor	or 223K ETR
1	.0047uf Mallory 150 Axial Capacitor	472K ETR or 502K
3	.01uf X 600v Mallory 150 Axial Capacitor	103K poss. Mallory 150/ETR
4	.022uf X 600v Mallory 150 Axial Capacitor	223K poss. Mallory 150/ETR
1	.1uf X 600v Axial Capacitor	104K ETR
5	22uf 500v Electrolytic Capacitor	
3	25 uF 50V Axial Electrolytic Capacitor	poss 22uF
1	32uf X 32uf 450V JJ Electrolytic Can Capacitor	
1	220uF 50V Xicon Axial Electrolytic Capacitor	
1	250K-Linear pot Treble (3/8")	
1	1M-Audio pot with pull switch	
4	1M-Audio pot (3/8")	
7	Chicken head knob - white	
1	Chicken head knob - black	
2	Rotary Switch Shorting 1-12 Pos	impedance selector, contour control
1	IEC Socket	
1	Panel Mounted Fuse Holder Screw 1/4X1.25" fuses	
1	Fuse 2A SLO BLO	
1	Indicator Lamp Xicon Neon 110V Red	
2	Carling DPDT Toggle Switch 125v 5A	
1	DPDT Switch	Crunch/Munch
2	Chassis Grommets (3/8")	
1	Terminal strip 5 lug solder type	
3	Terminal strip 3 lug solder type	
3	9-pin RF shield (7/8")	
1	9-pin socket bracket (7/8")	
2	9-pin Tube EL-84 spring retainers	
6	9-pin ceramic tube socket	
1	8-pin ceramic tube socket	
1	8-pin tube retainer	
6	Cliff 1/4" jacks mono switched; metal nut	
1	Plastic Caps for chassis	2 head, 1 combo
14	#4 X 5/16" machine screw	
8	#4 X 1/2" machine screw	
8	#4 hex nuts	

1	#4 Chassis lugs	
4	#6 X1" Machine Screw	
3	#6 X 3/8" Machine Screw	
7	#6 hex nut	
3	#6 Chassis lugs	
4	#6 Standoffs Nylon 1/4" OD 1/2"	
3	#8 X 3/8" Machine Screw, ground bolt, OT mtg.	
7	#8 hex nut	
1	#8 Chassis lugs	
4	#10 X 1-1/4” machine screw	
4	10-32 (M5) cage nuts	
1	TC15 eyelet board	
1	1-3/8" Electrolytic Can Cap clamp	
1	Front Panel - TC-15 Watt	
1	IEC Power Cord 8', 18/3	
10	20 Gauge solid wire, various colours (feet)	
3	Shielded cable (feet)	
1	Heat shrink tubing - 1/8" 4"	
1	Heat shrink tubing - 1/16" 4"	
6	Tie Wraps	
1	Builders Guide	
1	Power Transformer - 18 watt	
1	Output Transformer - 18 watt	
2	EL84 / 6BQ5 tube JJ	
3	ECC83 / 12AX7 tube JJ	
1	GZ34 - Rectifier, Full Wave, JJ	

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QtysIII	Item	Comments
1	100 2W Metal Oxide Resistor	
1	120 5 Watt Resistor	Possible 130 or 10W
3	820 ohm carbon 1/2 watt Resistor	Gy R Br
1	1K5 metal oxide 5 watt Resistor	Br G R
1	2K2 metal oxide 2 watt Resistor	R R R
2	2K7 ohm carbon 1/2 watt Resistor	R P R
2	8K2 ohm carbon 1/2 watt Resistor	Gy R R
1	8K2 ohm metal oxide 2 watt Resistor	Gy R R
1	47K ohm carbon 1/2 watt Resistor	Y P O
2	56K ohm carbon 1/2 watt Resistor	G B Or
4	68K ohm carbon film 1/2 watt Resistor	B Gy Or
6	100K ohm carbon 1/2 watt Resistor	Br Bk Y
1	100K ohm carbon 1/2 watt metal Resistor	R R Y
5	470K ohm carbon 1/2 watt Resistor	Y P Y
2	1M ohm carbon film 1/2 watt Resistor	Br Bk Gr
2	500pf Silver Mica Capacitor	or 501K ETR
4	.0047uf Mallory 150 Axial Capacitor	472K ETR or 502K
3	.01uf X 600v Mallory 150 Axial Capacitor	103K poss. Mallory 150/ETR
3	.022uf X 600v Mallory 150 Axial Capacitor	223K poss. Mallory 150/ETR
1	.68uf X 600v Axial Capacitor	684K poss. Mallory 150/ETR
2	16uf 500v Electrolytic Capacitor	or 16/450V
1	25 uF 50V Axial Electrolytic Capacitor	poss 22uF
1	32uf X 32uf 450V JJ Electrolytic Can Capacitor	
1	47uf 50V Electrolytic Capacitor	poss 50uF
1	220uF 50V Xicon Axial Electrolytic Capacitor	
1	25K-Linear pot Mid (3/8")	
1	250K-Linear pot Treble (3/8")	
5	500K-Audio pot Vol, Tone, sIII Master Vol, Bass (3/8")	
7	Marshall knobs	
1	Chicken head knob - black	
1	Rotary Switch Shorting 1-12 Pos	impedance selector, contour control
1	IEC Socket	
1	Panel Mounted Fuse Holder Screw 1/4X1.25" fuses	
1	Fuse 2A SLO BLO	
1	Indicator Lamp Xicon Neon 110V Red	
2	Carling DPDT Toggle Switch 125v 5A	
1	DPDT Switch	Boost switch
2	Chassis Grommets (3/8")	
1	Terminal strip 5 lug solder type	
2	Terminal strip 3 lug solder type	
3	9-pin RF shield (7/8")	
3	9-pin Tube EL-84 spring retainers	
6	9-pin ceramic tube socket	
6	Cliff 1/4" jacks mono switched; metal nut	
2	Plastic Caps for chassis	2 head, 1 combo
12	#4 X 5/16" machine screw	
8	#4 X 1/2" machine screw	
8	#4 hex nuts	
1	#4 Chassis lugs	
4	#6 X1" Machine Screw	
3	#6 X 3/8" Machine Screw	
7	#6 hex nut	
3	#6 Chassis lugs	
4	#6 Standoffs Nylon 1/4" OD 1/2"	
3	#8 X 3/8" Machine Screw, ground bolt, OT mtg.	
7	#8 hex nut	
1	#8 Chassis lugs	
4	#10 X 1-1/4" machine screw	
4	10-32 (M5) cage nuts	
1	18 watt Turret Board	

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1	Copper Ground Buss (12 Gauge solid)	
1	Aluminum chassis	
1	1-3/8" Electrolytic Can Cap clamp	
1	Front Panel - 18 Watt	
1	IEC Power Cord 8', 18/3	
10	20 Gauge solid wire, various colours (feet)	
3	Shielded cable (feet)	
1	Heat shrink tubing - 1/8" 4"	
1	Heat shrink tubing - 1/16" 4"	
6	Tie Wraps	
1	Builders Guide	
1	Power Transformer - 18 watt	
1	Output Transformer - 18 watt	
2	EL84 / 6BQ5 tube JJ	
3	ECC83 / 12AX7 tube JJ	
1	6CA4 - Rectifier, Full Wave, JJ	

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OUT OF DATE

QtyTMB	Item	Comments
1	100 2W Metal Oxide Resistor	
1	120 5 Watt Resistor	Possible 130 or 10W
4	820 ohm carbon 1/2 watt Resistor	Gy R Br
1	1K5 metal oxide 5 watt Resistor	Br G R
1	2K2 metal oxide 2 watt Resistor	R R R
1	2K7 ohm carbon 1/2 watt Resistor	R P R
2	8K2 ohm carbon 1/2 watt Resistor	Gy R R
1	8K2 ohm metal oxide 2 watt Resistor	Gy R R
1	47K ohm carbon 1/2 watt Resistor	Y P O
2	56K ohm carbon 1/2 watt Resistor	G B Or
4	68K ohm carbon film 1/2 watt Resistor	B Gy Or
6	100K ohm carbon 1/2 watt Resistor	Br Bk Y
1	100K ohm carbon 1/2 watt metal Resistor	R R Y
5	470K ohm carbon 1/2 watt Resistor	Y P Y
1	1M ohm carbon 1/2 watt Resistor	Br Bk Gr
2	1M ohm carbon film 1/2 watt Resistor	Br Bk Gr
1	500pf Silver Mica Capacitor	or 501K ETR
4	.0047uf Mallory 150 Axial Capacitor	472K ETR or 502K
4	.01uf X 600v Mallory 150 Axial Capacitor	103K poss. Mallory 150/ETR
4	.022uf X 600v Mallory 150 Axial Capacitor	223K poss. Mallory 150/ETR
2	1uF 50V Axial Aluminum Electrolytic Capacitors	
2	16uf 500v Electrolytic Capacitor	or 16/450V
1	32uf X 32uf 450V JJ Electrolytic Can Capacitor	
1	220uF 50V Xicon Axial Electrolytic Capacitor	
1	25K-Linear pot Mid (3/8")	
1	250K-Linear pot Treble (3/8")	
4	500K-Audio pot Vol, Tone, sIII Master Vol, Bass (3/8")	
1	1M-Audio pot (3/8")	
7	Marshall knobs	
1	Chicken head knob - black	
1	Rotary Switch Shorting 1-12 Pos	impedance selector, contour control
1	IEC Socket	
1	Panel Mounted Fuse Holder Screw 1/4X1.25" fuses	
1	Fuse 2A SLO BLO	
1	Indicator Lamp Xicon Neon 110V Red	
2	Carling DPDT Toggle Switch 125v 5A	
2	Chassis Grommets (3/8")	
1	Terminal strip 5 lug solder type	
3	Terminal strip 3 lug solder type	
3	9-pin RF shield (7/8")	
3	9-pin Tube EL-84 spring retainers	
6	9-pin ceramic tube socket	
6	Cliff 1/4" jacks mono switched; metal nut	
2	Plastic Caps for chassis	2 head, 1 combo
12	#4 X 5/16" machine screw	
8	#4 X 1/2" machine screw	
8	#4 hex nuts	
1	#4 Chassis lugs	
4	#6 X1" Machine Screw	
3	#6 X 3/8" Machine Screw	
7	#6 hex nut	
3	#6 Chassis lugs	
4	#6 Standoffs Nylon 1/4" OD 1/2"	
3	#8 X 3/8" Machine Screw, ground bolt, OT mtg.	
7	#8 hex nut	
1	#8 Chassis lugs	
4	#10 X 1-1/4” machine screw	
4	10-32 (M5) cage nuts	
1	Copper Ground Buss (12 Gauge solid)	
1	Aluminum chassis	

1	1-3/8" Electrolytic Can Cap clamp	
1	Front Panel - 18 Watt	
1	IEC Power Cord 8', 18/3	
10	20 Gauge solid wire, various colours (feet)	
3	Shielded cable (feet)	
1	Heat shrink tubing - 1/8" 4"	
1	Heat shrink tubing - 1/16" 4"	
6	Tie Wraps	
1	Builders Guide	
1	Power Transformer - 18 watt	
1	Output Transformer - 18 watt	
2	EL84 / 6BQ5 tube JJ	
3	ECC83 / 12AX7 tube JJ	
1	6CA4 - Rectifier, Full Wave, JJ	

OUT OF DATE

OUT OF DATE

QtyPlexi	Item	Comments
1	100 2W Metal Oxide Resistor	
1	120 5 Watt Resistor	Possible 130 or 10W
3	820 ohm carbon 1/2 watt Resistor	Gy R Br
1	1K5 metal oxide 5 watt Resistor	Br G R
1	2K2 metal oxide 2 watt Resistor	R R R
2	2K7 ohm carbon 1/2 watt Resistor	R P R
2	8K2 ohm carbon 1/2 watt Resistor	Gy R R
1	8K2 ohm metal oxide 2 watt Resistor	Gy R R
1	47K ohm carbon 1/2 watt Resistor	Y P O
2	56K ohm carbon 1/2 watt Resistor	G B Or
4	68K ohm carbon film 1/2 watt Resistor	B Gy Or
6	100K ohm carbon 1/2 watt Resistor	Br Bk Y
1	100K ohm carbon 1/2 watt metal Resistor	R R Y
5	470K ohm carbon 1/2 watt Resistor	Y P Y
2	1M ohm carbon film 1/2 watt Resistor	Br Bk Gr
3	500pf Silver Mica Capacitor	or 501K ETR
1	.0047uf Mallory 150 Axial Capacitor	472K ETR or 502K
1	.01uf X 600v Mallory 150 Axial Capacitor	103K poss. Mallory 150/ETR
7	.022uf X 600v Mallory 150 Axial Capacitor	223K poss. Mallory 150/ETR
1	.68uf X 600v Axial Capacitor	684K poss. Mallory 150/ETR
2	16uf 500v Electrolytic Capacitor	or 16/450V
1	32uf X 32uf 450V JJ Electrolytic Can Capacitor	
2	220uF 50V Xicon Axial Electrolytic Capacitor	
1	25K-Linear pot Mid (3/8")	
1	250K-Linear pot Treble (3/8")	
5	500K-Audio pot Vol, Tone, sIII Master Vol, Bass (3/8")	
7	Marshall knobs	
1	Chicken head knob - black	
1	Rotary Switch Shorting 1-12 Pos	impedance selector, contour control
1	IEC Socket	
1	Panel Mounted Fuse Holder Screw 1/4X1.25" fuses	
1	Fuse 2A SLO BLO	
1	Indicator Lamp Xicon Neon 110V Red	
2	Carling DPDT Toggle Switch 125v 5A	
1	DPDT Switch	Boost switch
2	Chassis Grommets (3/8")	
1	Terminal strip 5 lug solder type	
2	Terminal strip 3 lug solder type	
3	9-pin RF shield (7/8")	
3	9-pin Tube EL-84 spring retainers	
6	9-pin ceramic tube socket	
6	Cliff 1/4" jacks mono switched; metal nut	
2	Plastic Caps for chassis	2 head, 1 combo
12	#4 X 5/16" machine screw	
8	#4 X 1/2" machine screw	
8	#4 hex nuts	
1	#4 Chassis lugs	
4	#6 X1" Machine Screw	
3	#6 X 3/8" Machine Screw	
7	#6 hex nut	
3	#6 Chassis lugs	
4	#6 Standoffs Nylon 1/4" OD 1/2"	
3	#8 X 3/8" Machine Screw, ground bolt, OT mtg.	
7	#8 hex nut	
1	#8 Chassis lugs	
4	#10 X 1-1/4" machine screw	
4	10-32 (M5) cage nuts	
1	Copper Ground Buss (12 Gauge solid)	
1	Aluminum chassis	
1	1-3/8" Electrolytic Can Cap clamp	

1	Front Panel - 18 Watt	
1	IEC Power Cord 8', 18/3	
10	20 Gauge solid wire, various colours (feet)	
3	Shielded cable (feet)	
1	Heat shrink tubing - 1/8" 4"	
1	Heat shrink tubing - 1/16" 4"	
6	Tie Wraps	
1	Builders Guide	
1	Power Transformer - 18 watt	
1	Output Transformer - 18 watt	
2	EL84 / 6BQ5 tube JJ	
3	ECC83 / 12AX7 tube JJ	
1	6CA4 - Rectifier, Full Wave, JJ	

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Qtyv6	Item	Comments
1	100 2W Metal Oxide Resistor	
1	120 5 Watt Resistor	Possible 130 or 10W
1	250 5 Watt Resistor	poss 270 ohm
3	820 ohm carbon 1/2 watt Resistor	Gy R Br
2	1K5 metal oxide 2 watt Resistor	Br G R 2K2 2W possible
1	1K5 metal oxide 5 watt Resistor	Br G R
1	2K2 metal oxide 2 watt Resistor	R R R
2	2K7 ohm carbon 1/2 watt Resistor	R P R
2	8K2 ohm carbon 1/2 watt Resistor	Gy R R
1	8K2 ohm metal oxide 2 watt Resistor	Gy R R
1	47K ohm carbon 1/2 watt Resistor	Y P O
2	56K ohm carbon 1/2 watt Resistor	G B Or
4	68K ohm carbon film 1/2 watt Resistor	B Gy Or
6	100K ohm carbon 1/2 watt Resistor	Br Bk Y
1	100K ohm carbon 1/2 watt metal Resistor	R R Y
5	470K ohm carbon 1/2 watt Resistor	Y P Y
2	1M ohm carbon film 1/2 watt Resistor	Br Bk Gr
2	500pf Silver Mica Capacitor	or 501K ETR
4	.0047uf Mallory 150 Axial Capacitor	472K ETR or 502K
3	.01uf X 600v Mallory 150 Axial Capacitor	103K poss. Mallory 150/ETR
3	.022uf X 600v Mallory 150 Axial Capacitor	223K poss. Mallory 150/ETR
1	.68uf X 600v Axial Capacitor	684K poss. Mallory 150/ETR
2	16uf 500v Electrolytic Capacitor	or 16/450V
1	25 uF 50V Axial Electrolytic Capacitor	poss 22uF
1	32uf X 32uf 450V JJ Electrolytic Can Capacitor	
1	47uf 50V Electrolytic Capacitor	poss 50uF
2	220uF 50V Xicon Axial Electrolytic Capacitor	
1	25K-Linear pot Mid (3/8")	
1	250K-Linear pot Treble (3/8")	
5	500K-Audio pot Vol, Tone, sIII Master Vol, Bass (3/8")	
7	Marshall knobs	
1	Chicken head knob - black	
1	Rotary Switch Shorting 1-12 Pos	impedance selector, contour control
1	IEC Socket	
1	Panel Mounted Fuse Holder Screw 1/4X1.25" fuses	
1	Fuse 2A SLO BLO	
1	Indicator Lamp Xicon Neon 110V Red	
2	Carling DPDT Toggle Switch 125v 5A	
2	DPDT Switch	Boost switch / Tube switch
2	Chassis Grommets (3/8")	
1	Terminal strip 5 lug solder type	
2	Terminal strip 3 lug solder type	
3	9-pin RF shield (7/8")	
3	9-pin Tube EL-84 spring retainers	
6	9-pin ceramic tube socket	
2	8-pin ceramic tube socket	
2	8-pin tube retainer	
6	Cliff 1/4" jacks mono switched; metal nut	
16	#4 X 5/16" machine screw	
8	#4 X 1/2" machine screw	
8	#4 hex nuts	
1	#4 Chassis lugs	
4	#6 X1" Machine Screw	
3	#6 X 3/8" Machine Screw	
7	#6 hex nut	
3	#6 Chassis lugs	
4	#6 Standoffs Nylon 1/4" OD 1/2"	
3	#8 X 3/8" Machine Screw, ground bolt, OT mtg.	
7	#8 hex nut	
1	#8 Chassis lugs	

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4	#10 X 1-1/4” machine screw	
4	10-32 (M5) cage nuts	
1	v6 Turret Board	
1	Copper Ground Buss (12 Gauge solid)	
1	Aluminum chassis	
1	1-3/8" Electrolytic Can Cap clamp	
1	Front Panel - 18 Watt	
1	IEC Power Cord 8', 18/3	
10	20 Gauge solid wire, various colours (feet)	
3	Shielded cable (feet)	
1	Heat shrink tubing - 1/8" 4"	
1	Heat shrink tubing - 1/16" 4"	
6	Tie Wraps	
1	Builders Guide	
1	Power Transformer - 18 watt	
1	Output Transformer - 18 watt	
2	EL84 / 6BQ5 tube JJ	
2	6V6 Power tubes	
3	ECC83 / 12AX7 tube JJ	
1	6CA4 - Rectifier, Full Wave, JJ	

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Trinity Amps Schematics and Layouts

OUT OF DATE

OUT OF DATE