



# **The Trinity Amps Amp Safety and Voltage Measurement Guide**

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## Version Control

Version	Date	Change
22.1	14Feb21	First issue





# WARNING

## Read this Information Carefully

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

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## ***Working Inside A Tube Amplifier Safely***

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

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

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

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

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

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

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

## ***Making a Voltage Measurement***

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

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

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

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

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

## ***Discharging the Power Supply***

If you need to service the amp after having it on, you must “discharge” the power supply capacitors. This is done by unplugging the amp, turning the power and standby to the on position and letting it sit for 30 seconds or so. If you do not have a standby switch, you will need to short the capacitor positive leads to ground with a 220K 2W resistor on a lead with an insulated wire. You hear a small pop when this is done. This is just the cap discharging itself. Always use a multimeter to check the residual B+ voltage in the large filter capacitors to make sure it is fully discharged.

**REMEMBER: DO NOT OPERATE YOUR AMP WITHOUT A LOAD**