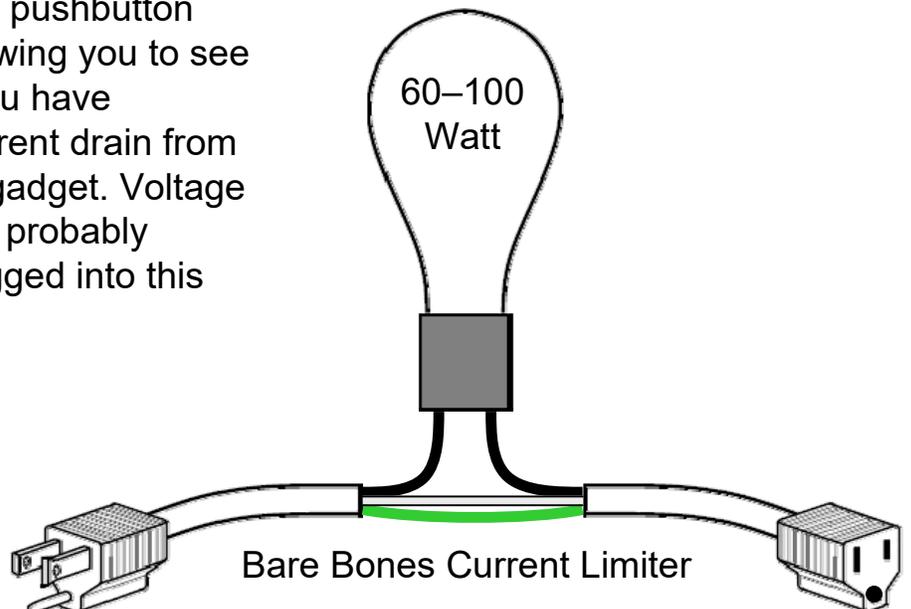


# Light Bulb Current Limiter



This workbench gadget allows you to connect a light bulb in **SERIES** with your amp. It will allow you to determine if your amp is drawing excessive current due to a shorted PT or filter caps, etc., without blowing fuses or smoking valuable components such as a PT. A dead short on the primary side of the PT will cause the bulb to glow at full brightness. Partial shorts or a short on the secondary side of the PT will show some increased level of brightness. A properly working amp will cause the bulb to glow fairly bright when first turned on, but will fade to a dimmer glow as the amp warms up.

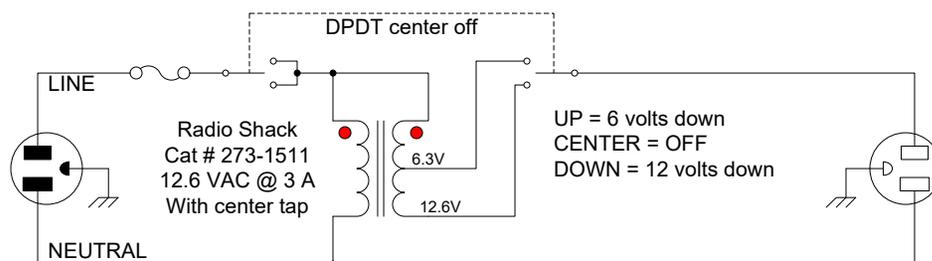
The fancy version above includes a pushbutton switch that bypasses the outlet allowing you to see the lamp at full brightness. Once you have confidence that there is no high current drain from your amp, you should remove this gadget. Voltage measurements will be very low and probably meaningless while your amp is plugged into this gadget.





## Buckaroo!

AC adapter for old amps



This gadget uses a “bucking” transformer to reduce AC line voltage. It’s useful for reducing today’s 120-125 VAC line voltage by approximately 6 or 12 volts which will also reduce your HT and filament voltages by an equal percentage.

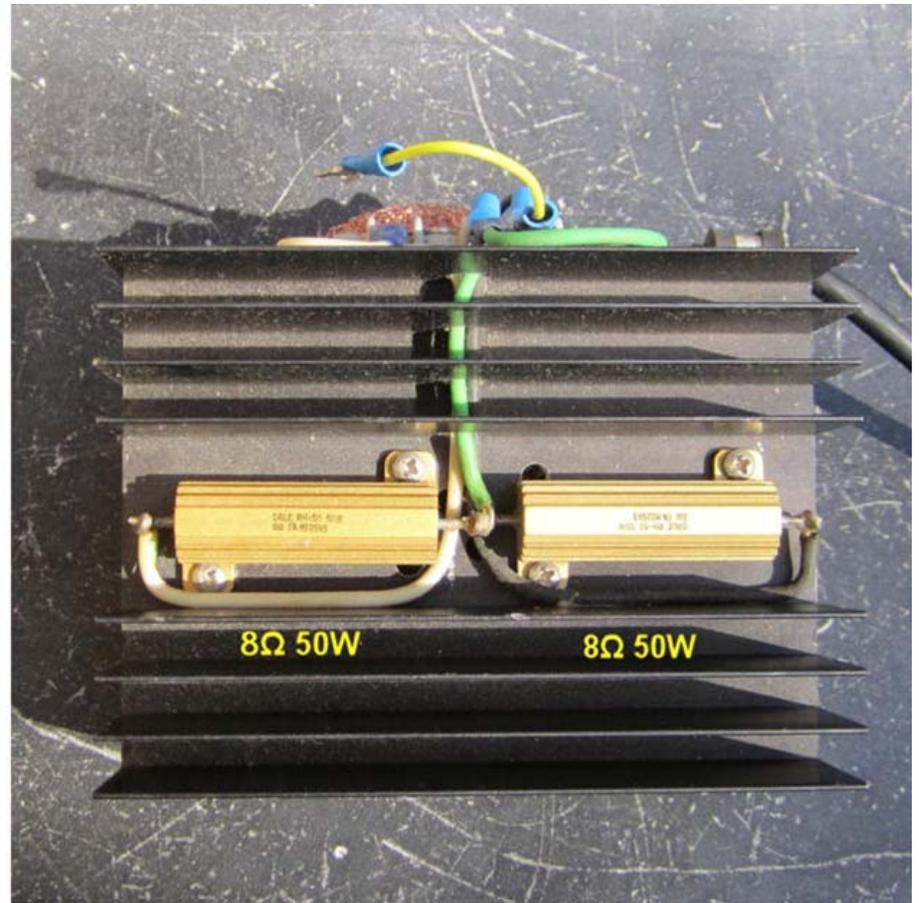
*(Tip. If you find that the output voltage actually increases, you have the transformer phased for a “boost” operation. Simply reverse the primary leads to correct this.)*

*Note. I actually used a 4PDT switch just because I had one.*



## My no frills Dummy Load

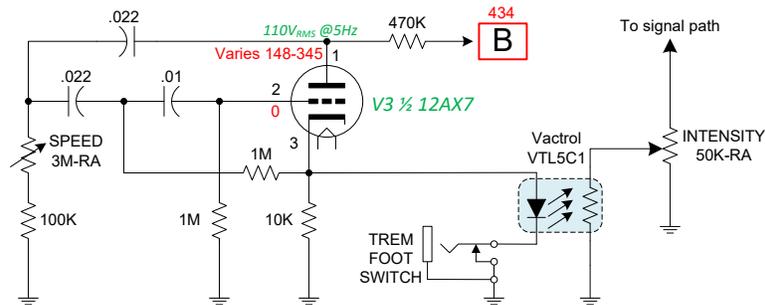
Select 4 $\Omega$ , 8 $\Omega$ , or 16 $\Omega$  by using the terminal block.



# TREM-O-NATOR

By sluckey 02/12/2019

Final version as used in my '67 AB763 Bandmaster

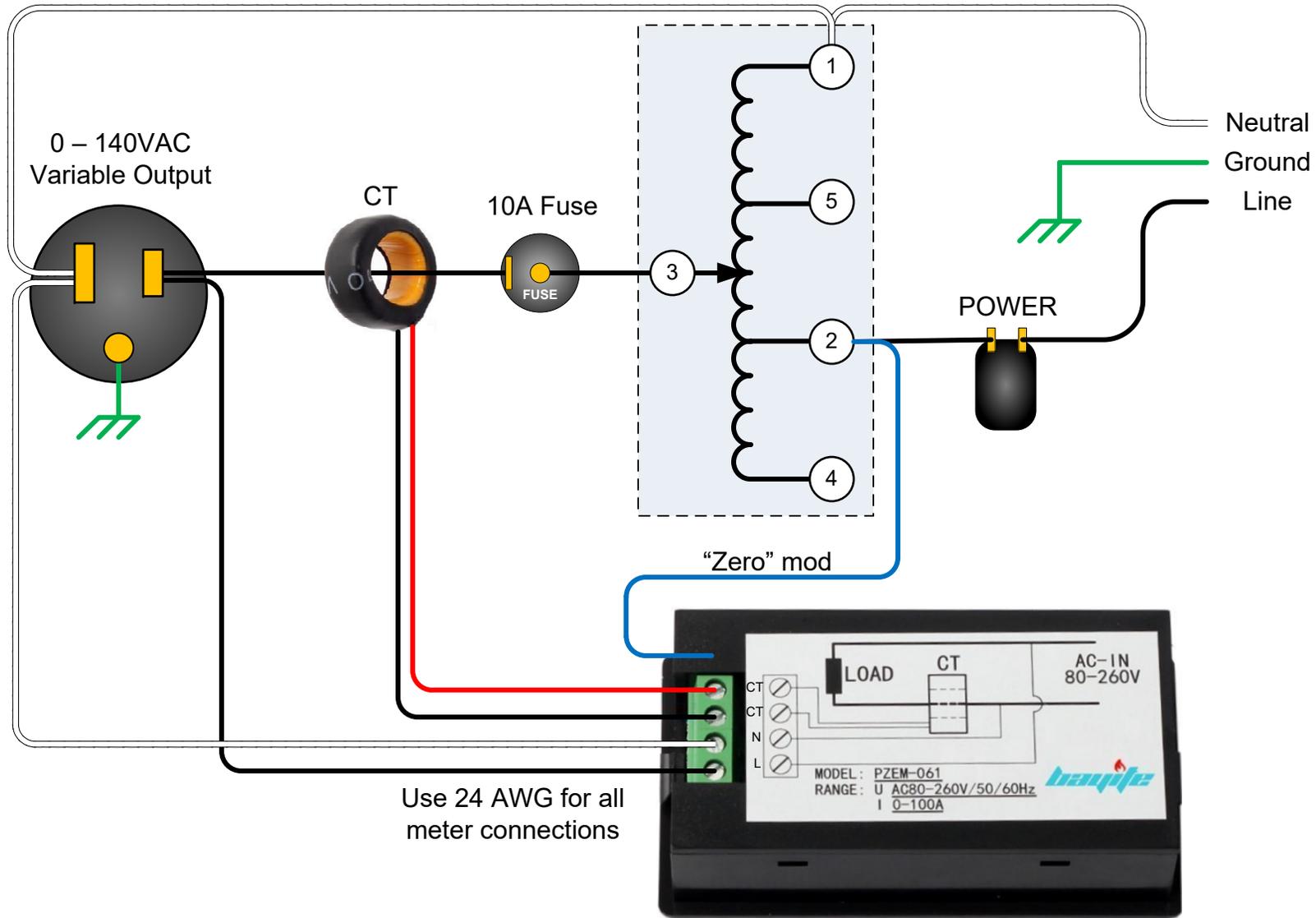


This is a typical tremolo oscillator as found in many Fender amps, but the cathode resistor and bypass cap have been replaced with the LED portion of the optocoupler. This circuit produces a very strong tremolo effect without any annoying ticking, breathing, thumping, or pumping sounds. The circuit simply taps into the signal path and operates by smoothly shunting the signal to ground at the tremolo speed. The speed range is greater than the typical Fender circuit.

Intensity pot value depends on which part of the signal path you tap into. The 50K-RA pot shown works very well in a Fender AB763 amp. You may need a different value pot to use in another circuit. Some circuits may also require a series resistor between the INT pot and the signal path. Experiment to determine the pot value and/or series resistor value needed for a particular amp.

Voltages shown are actual measurements from my AB763 Bandmaster.

# Superior Powerstat 3PN216C Autotransformer with PZEM-061 panel meter



VIP!!! Neutral must connect to the PZEM-061 as shown. Otherwise, the “Zero” mod will not work.

# Superior Powerstat 3PN216C Autotransformer with PZEM-061 panel meter

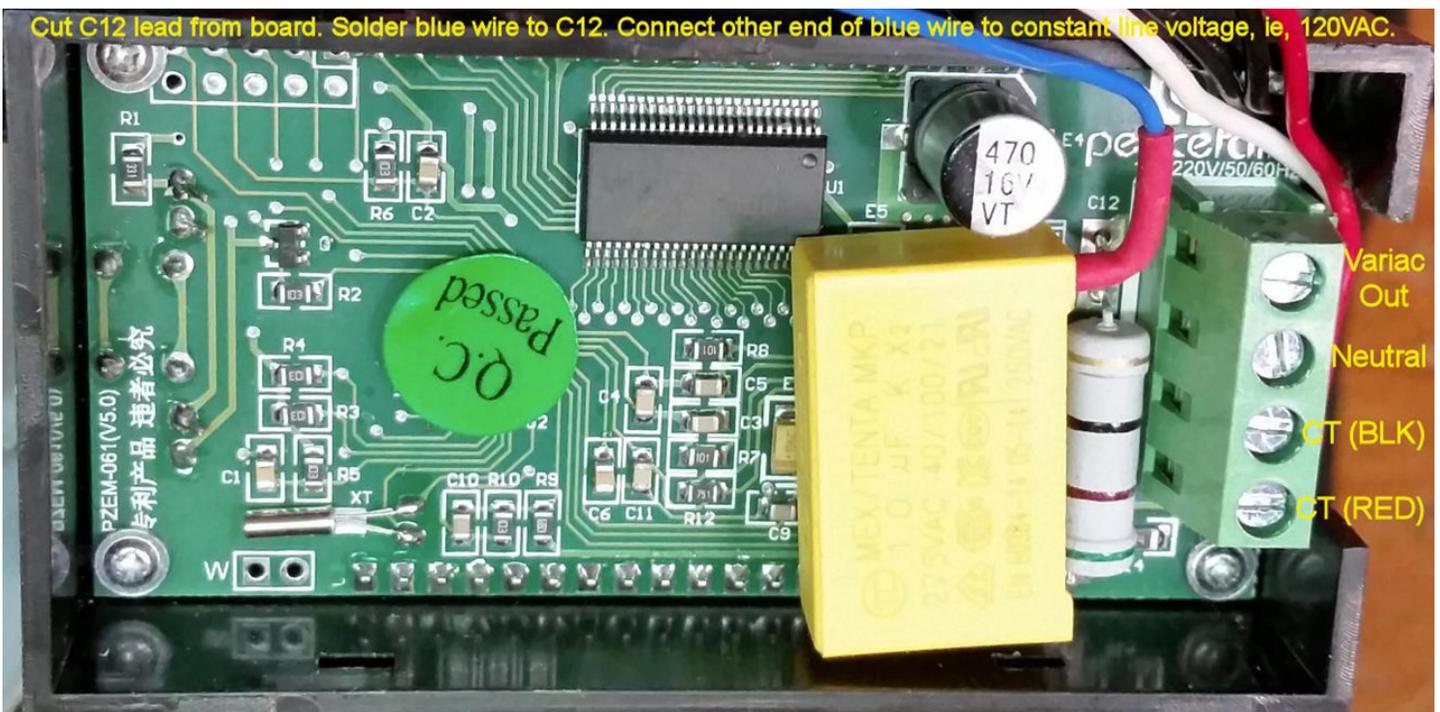


## “Zero” mod

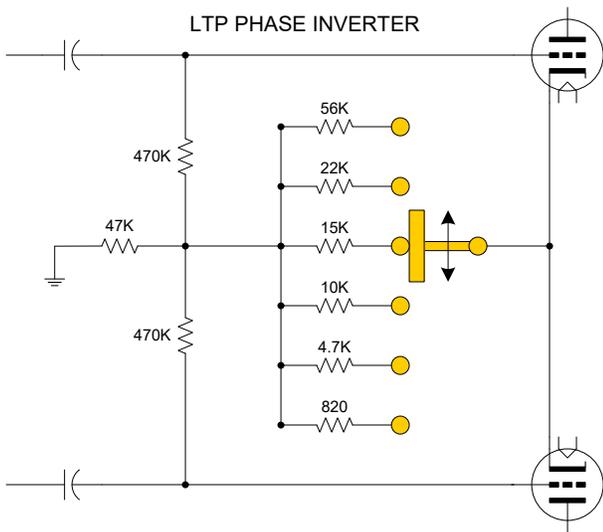
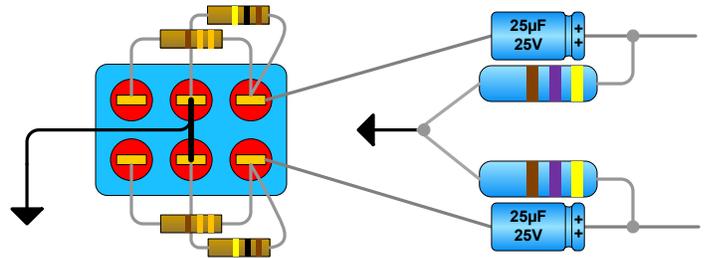
The only caveat with this simple four wire hookup is that the meter needs a minimum of 60VAC to operate. This means that whenever the variac output is adjusted lower than 60VAC, the meter ceases to operate. That's not ideal when using a voltmeter with a variac.

However, there is a simple one wire mod that allows the meter to measure down to zero volts. The AC voltage that feeds the meter power supply is coupled through that big yellow cap, C12. Simply cut the lead closest to that 470 $\mu$ F/16V cap. (I suggest you leave a stub of the cap lead on the board just in case you ever want to reverse this mod.) Next solder a small wire (blue wire in the photo) to the free end of C12 and connect the other end of this wire to the input of your variac, which is a constant line voltage. Now your meter circuitry operates independently of the variac setting and will allow measurements all the way down to zero volts.

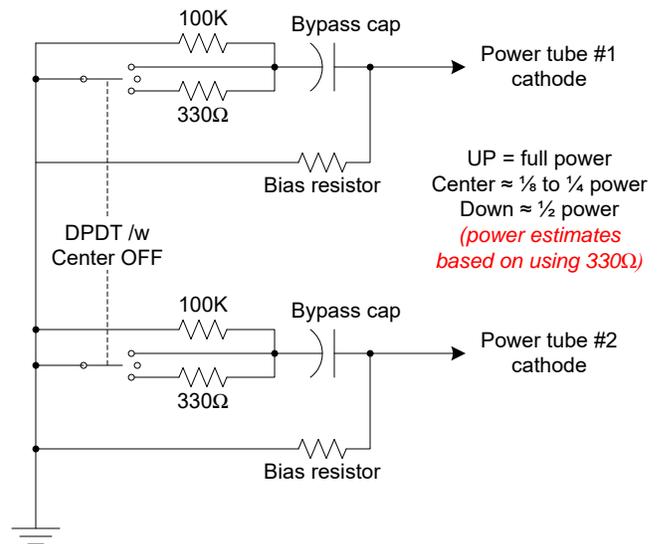
**Neutral must connect as shown below.  
Otherwise, the “Zero” mod will not work.**



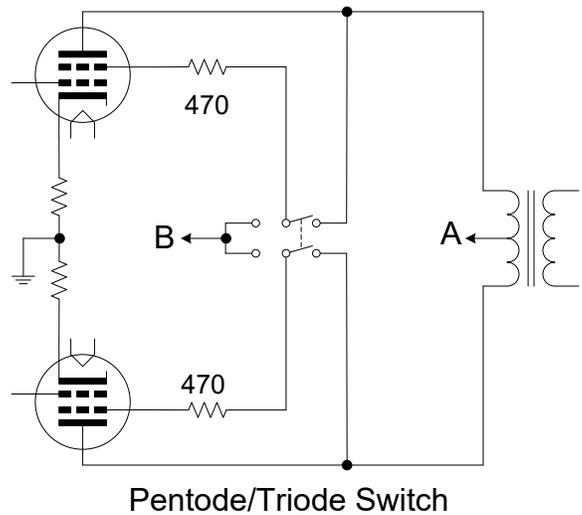
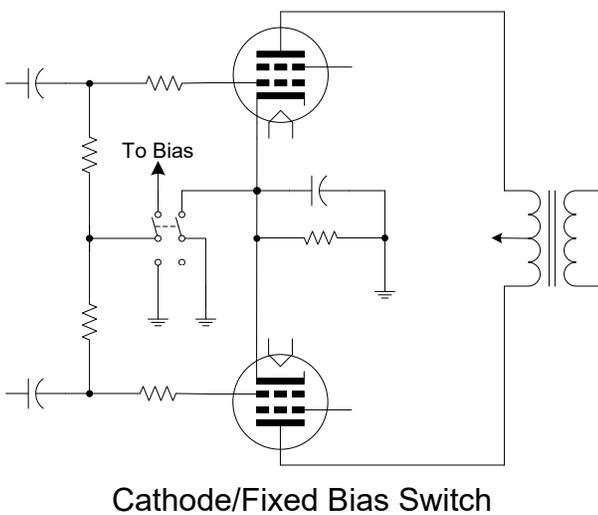
# Power Switching Schemes



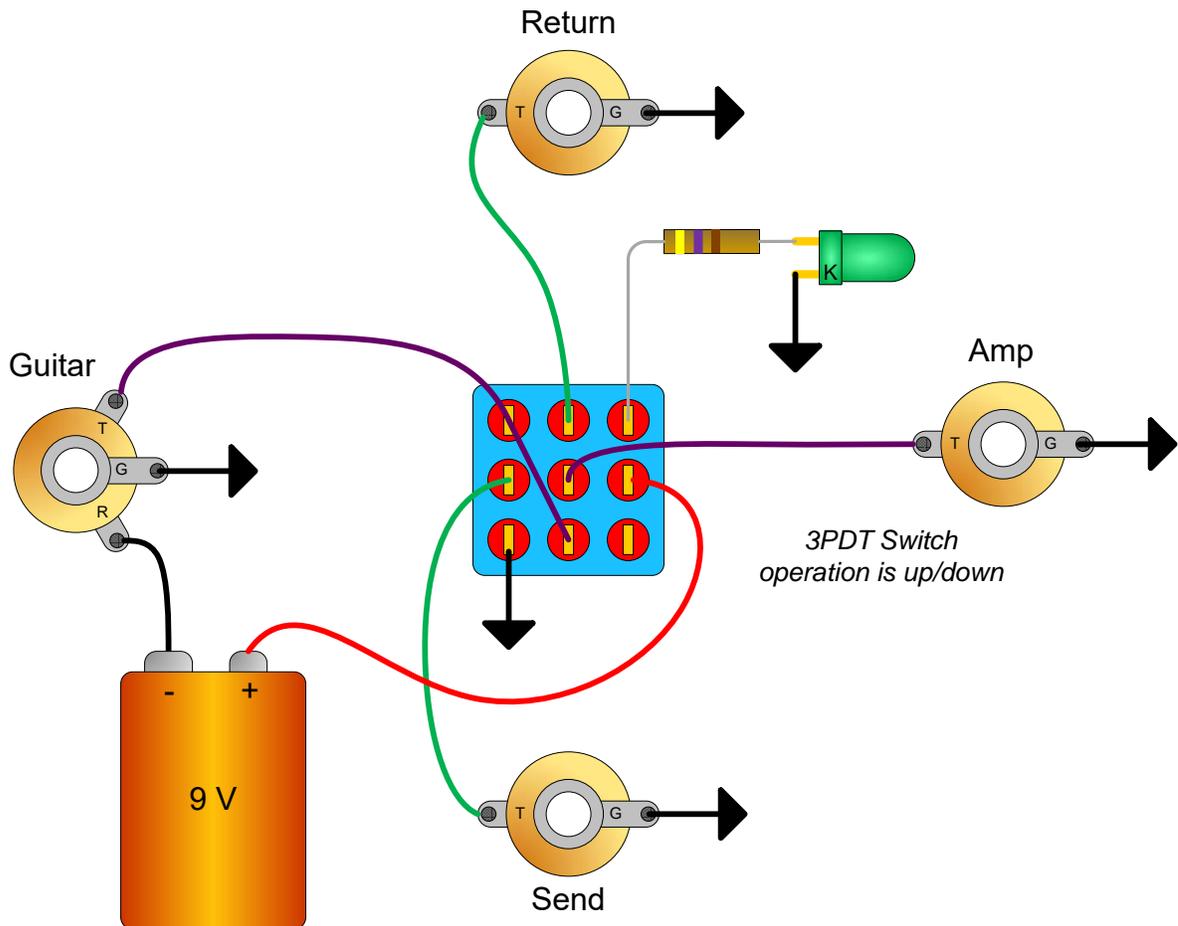
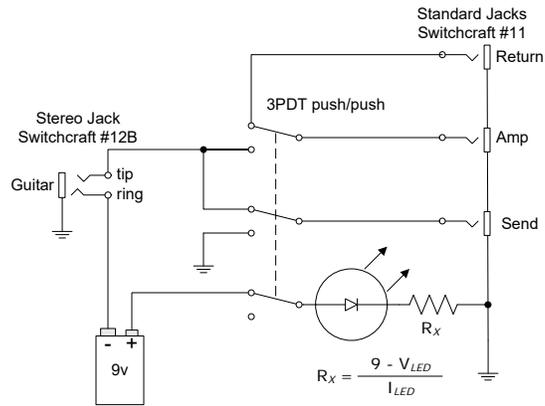
**Marshall 18 Watt Power Dampening Switch**  
*(can be adapted to other LTP phase inverters)*



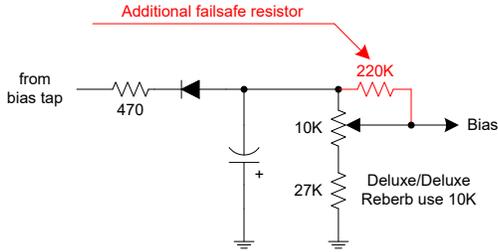
**Da Geezer's Bypass Cap attenuator**  
*(Bias resistor value will be 2X the value of a single bias resistor)*



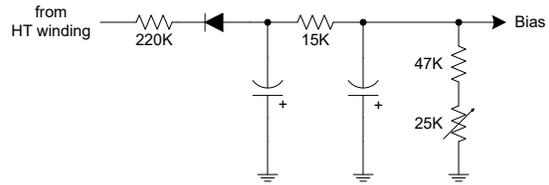
# True Bypass Switch Box



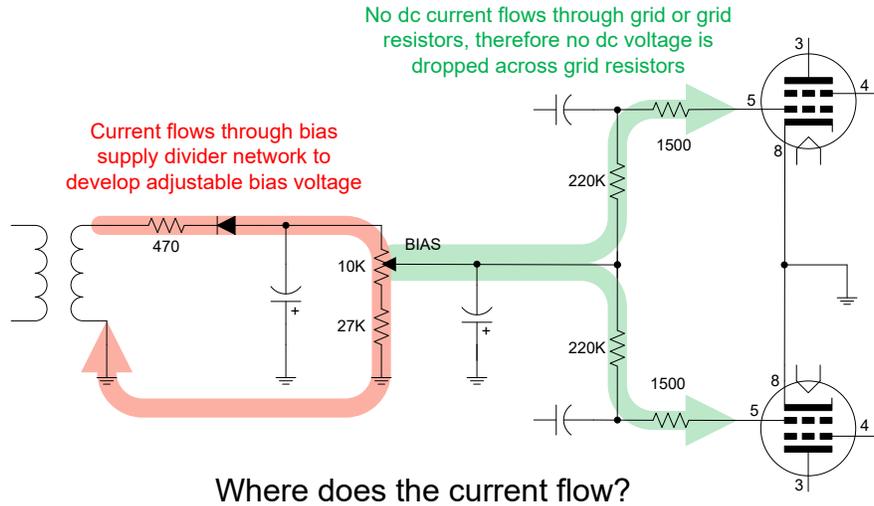
# Bias Circuits



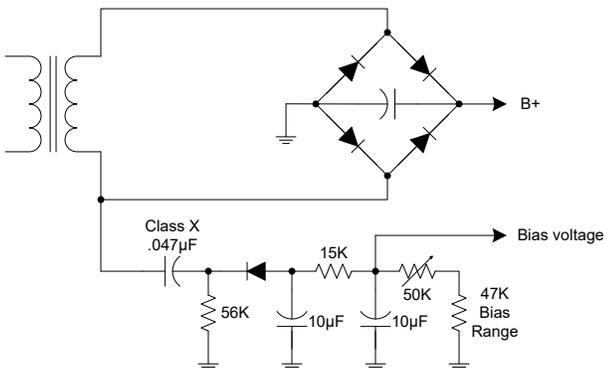
Typical Fender AB763



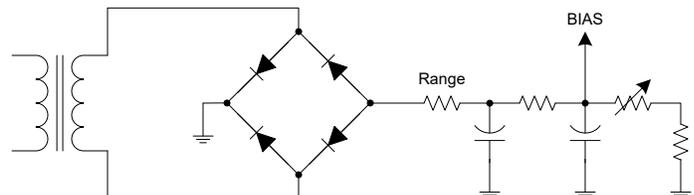
Typical Marshall



Where does the current flow?



Bias circuit and full wave bridge from Marshall JCM900 and some old Amps  
*(See following page for circuit description)*



Separate bias winding and full wave bridge  
*(nice when you have a separate bias winding)*

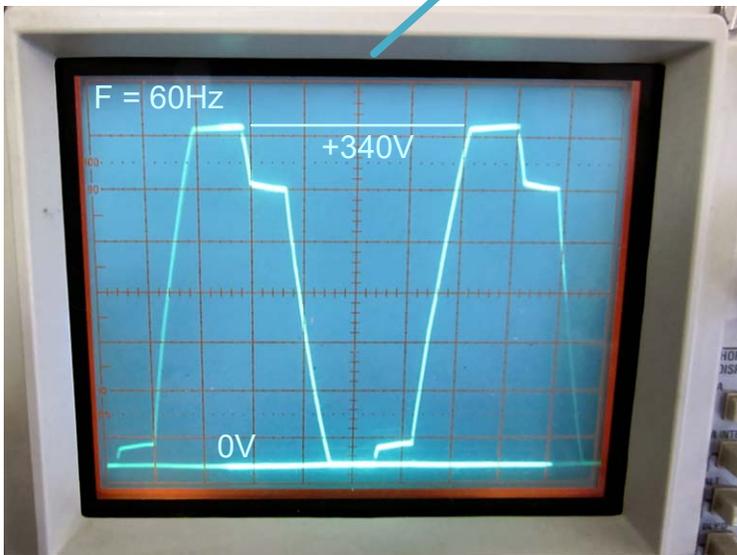
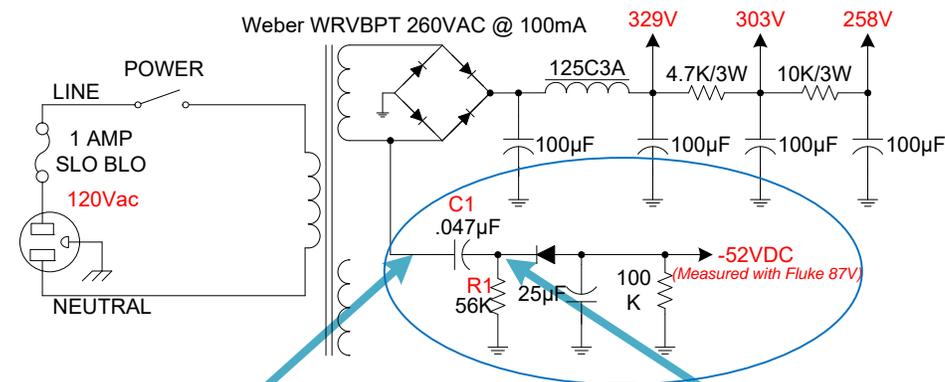
# Bias circuit and full wave bridge

(from Marshall JCM900 and some old Ampegs)

## How does it work?

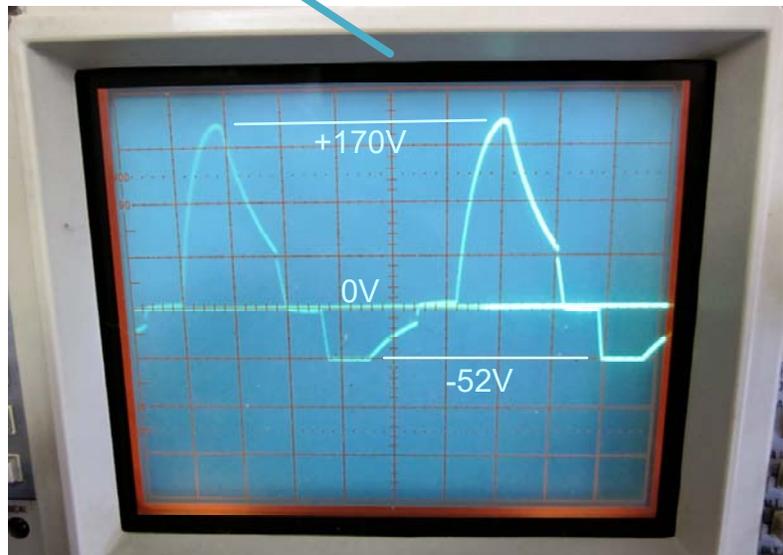
The test bias circuit inside the blue circle was just breadboarded and connected via clip leads to the power supply of my Revibe. The AC at the bridge is a pulsing positive DC waveform. C1/R1 couple this waveform to the input of the diode and also shift the baseline such that the waveform now has a positive as well as negative half cycle.

Shifting the baseline in this manner is the key to the operation of this bias circuit.



340VAC<sub>pp</sub> with 0V baseline

Notice that this waveform never goes negative with respect to ground. If you were to apply this signal directly to the cathode of this simple half wave rectifier, the diode would block the entire waveform and the resulting DC output would be zero volts.



222VAC<sub>pp</sub> (170V positive, 52V negative)

Well, C1 and R1 have certainly affected the shape and amplitude of the input AC waveform. But more important, the baseline has shifted and now a portion of the signal goes below zero volts. The diode blocks the positive portion and passes the negative portion. The resulting unloaded DC output is now -52VDC.

# Fixed/Cathode Bias Switching

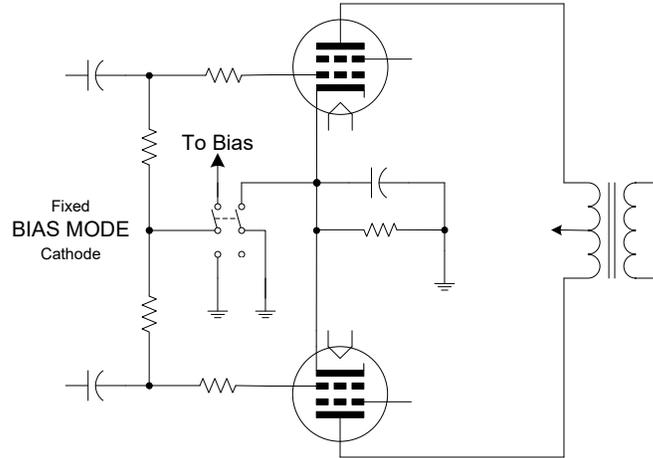


Figure 1. Use this DPDT switch with any bias supply.

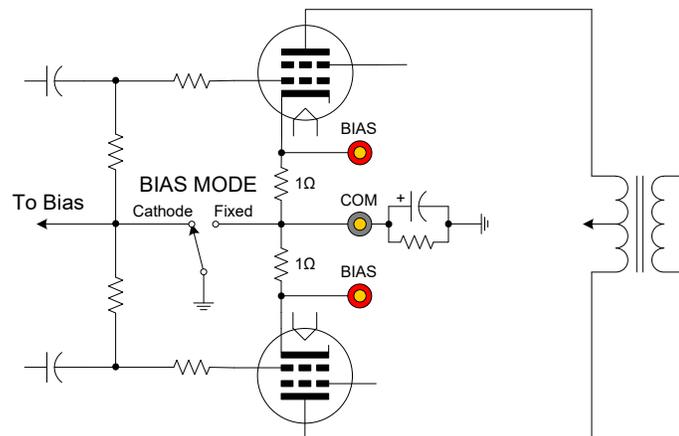


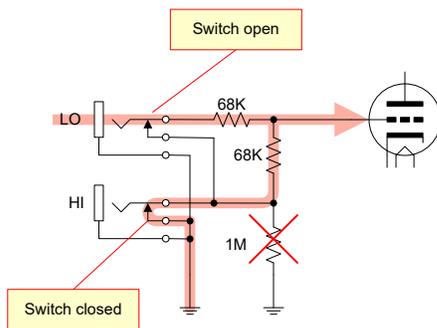
Figure 2. Use this SPDT switch with a bias supply that gets it's AC supply from one end of the PT HT winding **\*\*\*AND\*\*\*** uses a high value resistor between the PT and the bias rectifier/filter circuit. *(See Fender Princeton Reverb for example.)*

# Understanding Hi/Lo Input Jack Switching

Hi/Lo Input jack switching is often misunderstood. The operation is usually straightforward, but the actual circuit drawing is often confusing, especially to the casual observer. Hopefully the following illustrations will demystify the circuit operation.

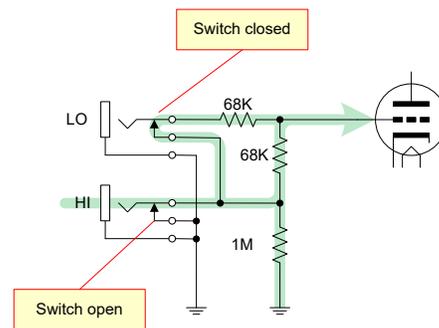
These first two circuits represent the typical Hi/Lo jacks found in most Fender and Marshall amps. Many other amp manufacturers use this circuit as well.

Using the Lo Input



The LO jack delivers the signal to a 2:1 voltage divider made up of the two 68K resistors. The 1meg is shorted out by the switch contacts on the HI jack. The signal taps off the junction of the two 68Ks. Half the signal is dropped across each 68K, therefore only 50% of the signal is applied to the tube.

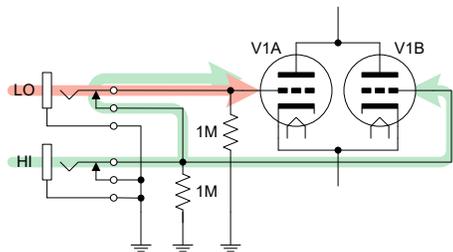
Using the Hi Input



The HI jack delivers ALL the signal to the tube. The signal enters the HI jack and first sees a 1 Meg resistor to ground. Since the LO jack switch is closed, the two 68Ks are parallel for an effective resistance of 34K and the signal travels through the paralleled 68Ks to the tube. There is no voltage divider so 100% of the signal arrives at the tube.

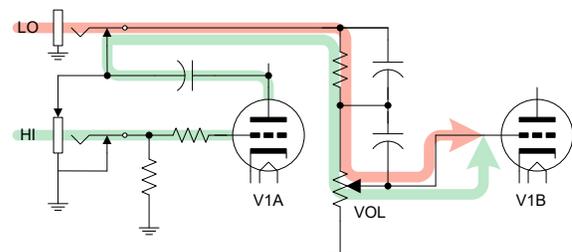
The following circuits represent special case switching. The first shows the Marshall 18 Watt parallel tube switching circuit and the other shows a Marshall JCM-800 high gain cascade switching circuit.

Marshall 18 Watt Normal Channel Inputs



The LO jack delivers the signal to V1A only. The HI jack delivers the signal directly to V1B and also to V1A through the closed switch of the LO jack. The parallel tubes give a fatter sound with a slight gain increase.

Marshall JCM-800 2204 Channel Inputs



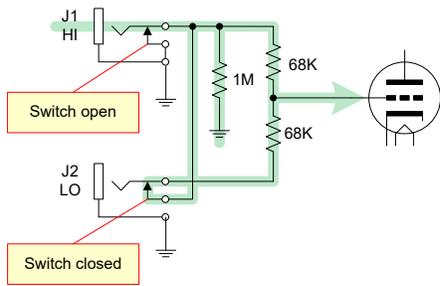
The LO jack delivers the signal directly to V1B for a single gain stage. The HI jack delivers the signal to V1A and then to V1B through the closed switch of the LO jack. The cascaded tubes give a high gain sound.

# Vox AC-30 Hi/Lo Input Jack Switching

There are two variations of the input switching jacks for this amp. Type A is the classic circuit that has been used in many Fender and Marshall amps. Type B uses a slightly different circuit to accomplish the same functionality. The Hi input operation is slightly different for the two type circuits. However, the difference is so slight that it can be practically ignored. You would need precision lab equipment to even measure the slightly different signal levels applied to the tube grid. When comparing the Lo input operation, it can be seen that the two type circuits become identical, although achieved through a slightly different approach.

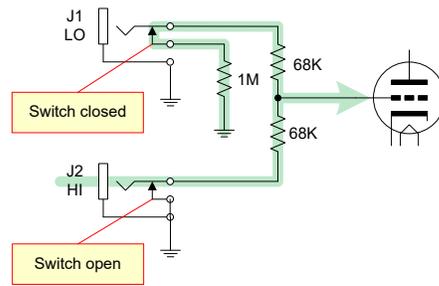
Hopefully, the summary below will explain the functionality of both types and also point out the slight differences.

**Type A** Using the HI input



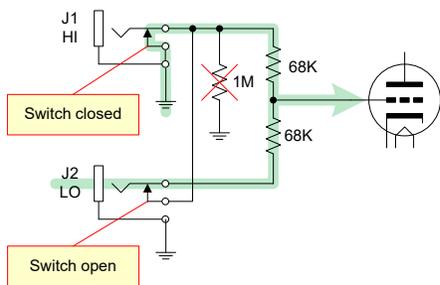
The HI jack delivers ALL the signal to the tube. The signal enters the HI jack and first sees a 1 Meg resistor to ground. Since the LO jack switch is closed, the two 68Ks are parallel for an effective resistance of 34K and the signal travels through the paralleled 68Ks to the tube. There is no voltage divider so 100% of the signal is applied to the tube.

**Type B** Using the HI input



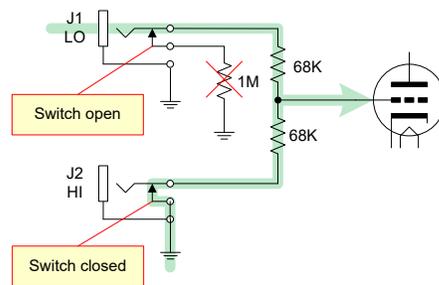
The HI jack delivers almost ALL the signal to the tube. The signal enters the HI jack and is applied to a voltage divider consisting of both 68Ks and a 1M through the closed switch on J1. 6% of the signal is dropped (lost) across the first 68K. The other 94% signal that is dropped across the second 68K and 1M is applied to the tube.

**Type A** Using the Lo input



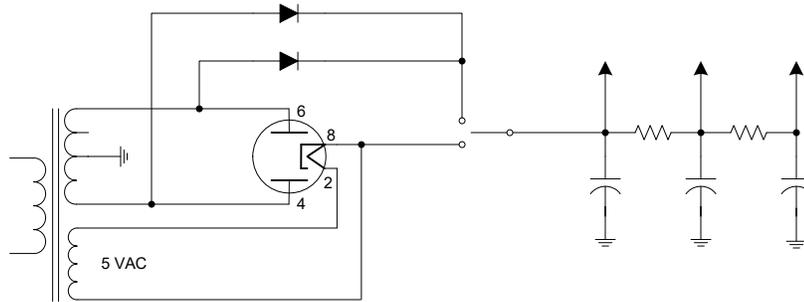
The LO jack delivers the signal to a 2:1 voltage divider made up of the two 68K resistors. The 1meg is shorted out by the switch contacts on the HI jack. The signal taps off the junction of the two 68Ks. Half the signal is dropped across each 68K, therefore only 50% (-6db) of the signal is applied to the tube.

**Type B** Using the Lo input



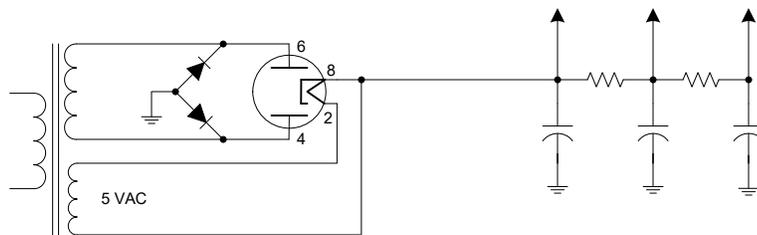
The LO jack delivers the signal to a 2:1 voltage divider made up of the two 68K resistors. The 1meg is removed from the circuit by the switch contacts on the HI jack. The signal taps off the junction of the two 68Ks. Half the signal is dropped across each 68K, therefore only 50% (-6db) of the signal is applied to the tube.

## SS/Tube Rectifier Switching



Using a SPDT Center Off switch allows for SS – STBY – TUBE function.

## Hybrid SS/Tube Bridge Full Wave Rectifier

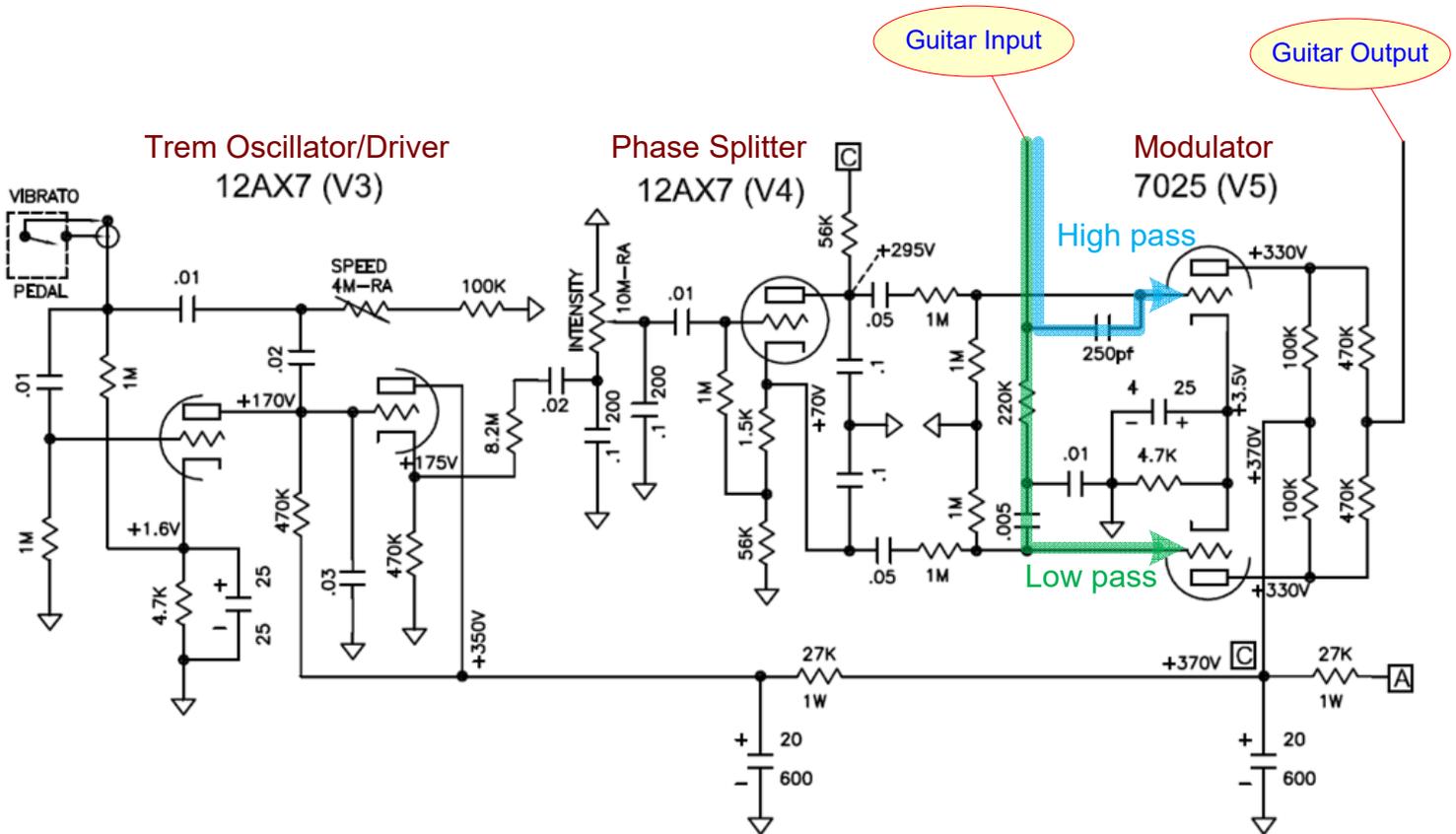


This full wave bridge circuit retains the characteristics of a tube rectifier.  
Note there is no center tap on the HT winding.



# Fender 6G4A Harmonic Vibrato

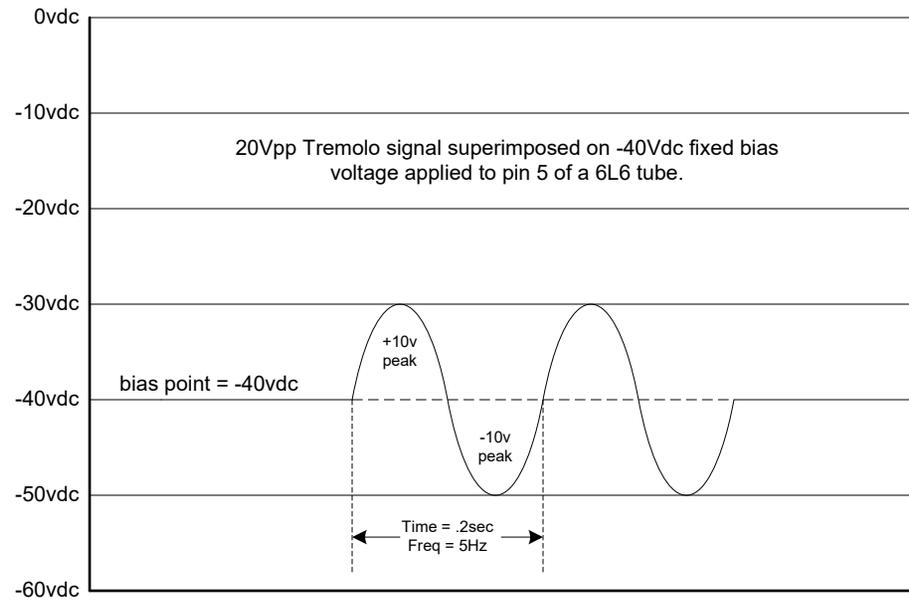
*This circuit is also found in several other 6Gxx amplifiers*



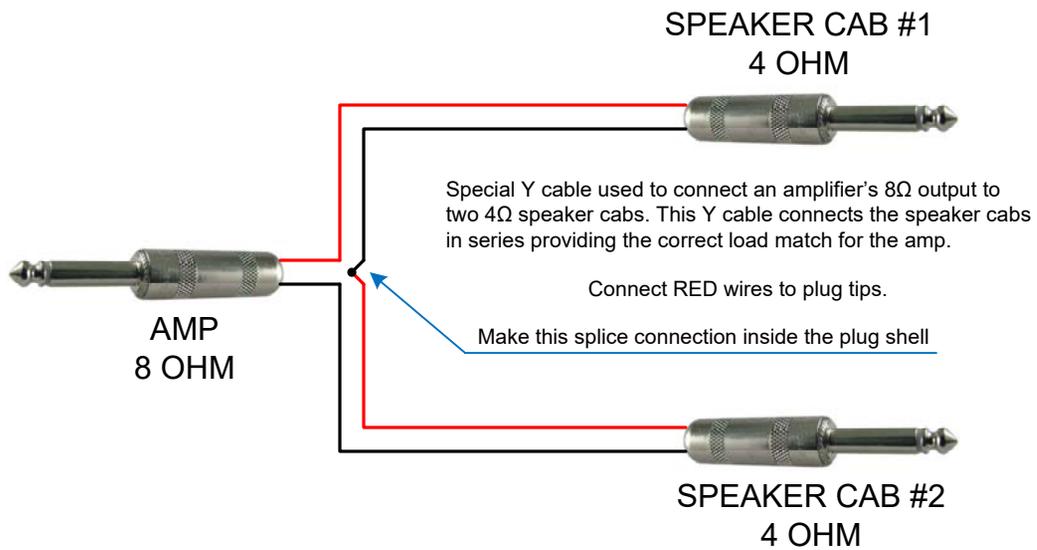
The Oscillator is a standard Phase Shift Oscillator that operates at a low frequency range of approximately 3-10 Hz. The oscillator output is coupled through a cathode follower driver and then applied to the input of a phase splitter through the Intensity control. The phase splitter produces two identical outputs that are 180° out of phase with respect to each other. Each output is coupled to the grid of a modulator tube and will control the gain of that tube by modulating the bias at the slow oscillator frequency.

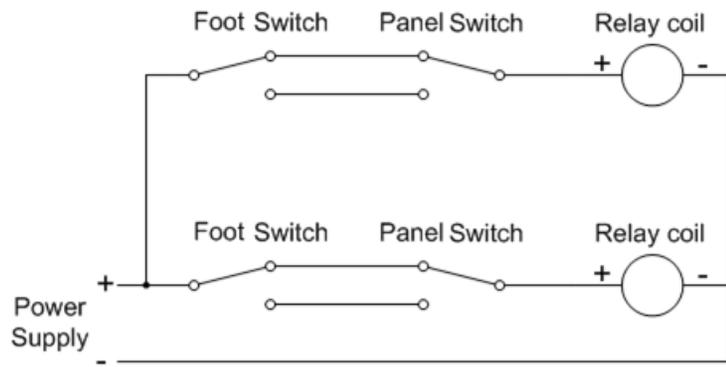
The input guitar signal is split and also applied to the grids of the modulator tubes. However, the guitar signal passes through a high pass filter to get to the top tube and passes through a low pass filter to get to the bottom tube. So, the top tube amplifies only the high frequency components of the guitar signal and the gain is varied/modulated by the Tremolo oscillator signal. Likewise, the bottom tube amplifies only the low frequency components of the guitar signal and the gain is varied/modulated by the Tremolo oscillator signal that is 180° out of phase with the top Tremolo signal.

The modulated high frequency guitar signal is recombined with the low frequency guitar signal in the two 470KΩ mixing resistors. The out of phase Tremolo signals are also recombined in these mixing resistors, but since they are equal amplitude and 180° out of phase, the Tremolo signals cancel each other, leaving only the guitar signal. Since the Tremolo signals cancel each other, you will not hear the Tremolo signal 'breathing' when no guitar signal is applied.



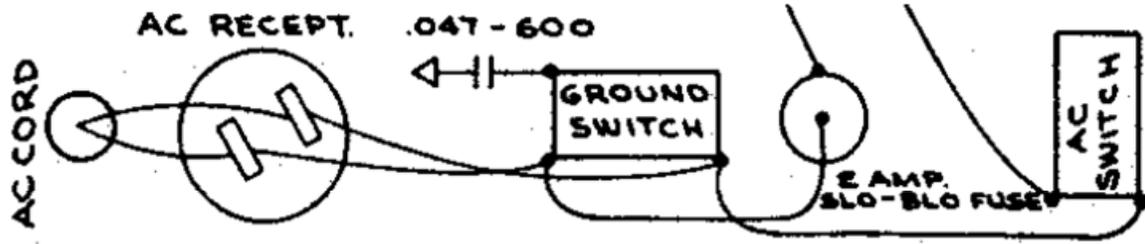
This graph shows that a 20Vpp Tremolo signal superimposed on -40Vdc fixed bias voltage will cause the resultant bias voltage to vary between -30vdc and -50vdc. You could simulate the tremolo effect simply by rhythmically adjusting the bias pot between -30 and -40vdc. Changing the bias will affect the gain of the 6L6 thus varying the loudness of the instrument signal.



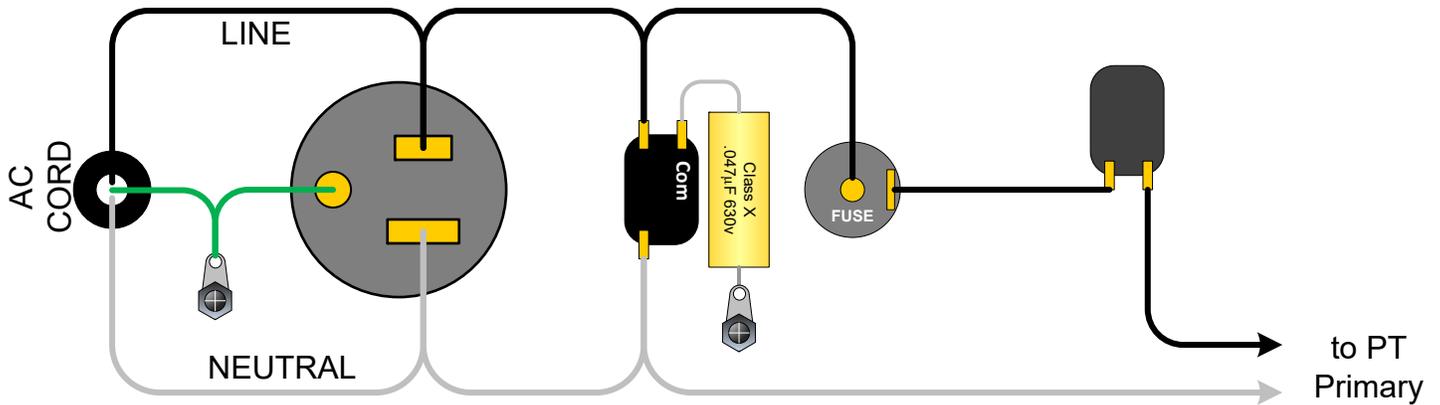


Dual 3-Way footswitch for relays

# Typical Fender Mains Wiring



# Improved Fender Mains Wiring



# Improved Fender Mains Wiring with switched outlet

