Build A Super Variac™ Box with Meters

By Mark Palmquist

The first time I power up a radio found at a swap meet (working or not) is to plug it into my custom Variable Transformer (aka Autotransformer or Variac) box and observe the AC current that the radio draws as the voltage is slowly increased from 0 to 117 volts. Most radios will draw from 0.3 Amps (300 milliamps) to about 800 milliamps. If the radio draws no current, it usually means an open tube filament in an AC/DC radio or possibly an open power transformer primary in an AC only radio. It could also mean a bad power switch, defective AC line cord, or blown fuse. If an AC radio shows very high current (more than 1 ampere) at low voltage, it generally means that one of the power transformer windings is shorted. If a radio works but draws excessive current it could indicate a leaky coupling capacitor to the grid of the audio output tube, which causes the output tube to draw excessive current. The ability to observe the current flow and voltage simultaneously is a very powerful diagnostic tool to assist in troubleshooting power supply problems in radios. Figure 1 shows a picture of my home built Variac box, which includes a fuse, power switch, pilot lamp, voltage meter and current meter. Electrical equipment of this type should always be enclosed in a metal case that is connected to the "ground" terminal of the AC wall socket.

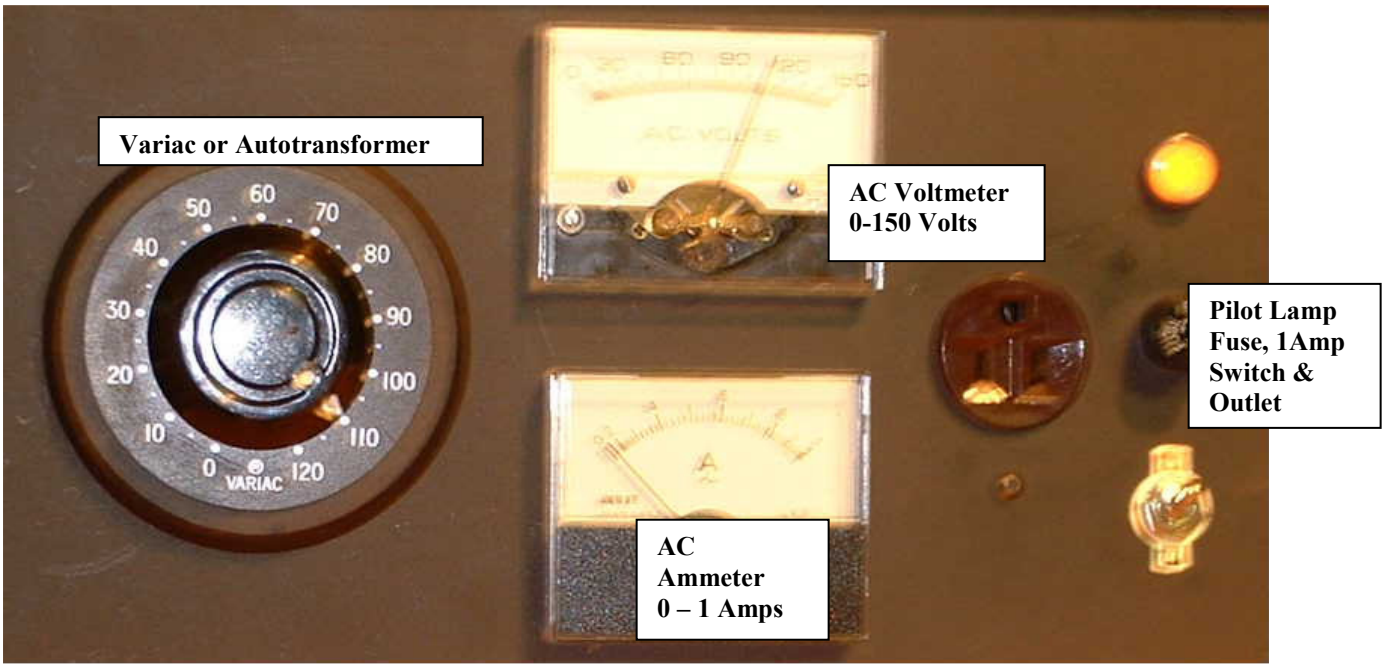

Figure 1 Front Panel of Author's Metered Variac Box

The **Autotransformer**, often called by its trade name **"Variac"** is an adjustable transformer that enables one to manually adjust 60 Hz AC voltage to a load. The output of a typical Variac goes from 0 to 130 volts and can handle maximum current from 2 to 10 amps. A typical Variac is shown in Figure 2. It has connections for the input voltage from the wall socket, and connections to an output, typically a standard 120 VAC outlet. Variacs can be found on Ebay or at Hamfests or

Swap meets. Prices can range from $4 to $30 for used ones. A new one can set you back $60 to $200 in electronics catalogs such as Newark Electronics (**www.newark.com**). The one pictured above is a 2 Amp unit, the smallest and cheapest one made. 2 Amps is normally enough to power any but the largest and oldest radios. (My Atwater–Kent Model 70 draws between 1 and 2 Amps).

Figure 2 A 5-Amp Autotransformer purchased on Ebay. It is completely enclosed and comes equipped with binding posts marked "input" and "output". The knob took a beating in shipment but is easily replaced. This one is massive, measuring about 6 x 6 x 6 inches.

Building and Wiring your Variac Box

If you are going to build your own Variac box you will have to find a metal project box large enough to hold the Autotransformer and the meters and switches shown on the front panel. Panel meters come in all sizes. The ones shown in **Figure 1** were purchased at RadioShack.com in Atlanta before they closed their doors. I am always on the lookout for panel meters at Hamfests and swap meets. A fellow collector at the NC meet sold me a bunch of 0-150 AC Voltmeters that he rescued from a defunct electronics school for a buck apiece. AC ammeters are harder to find but do show up frequently on Ebay. 1 Amp full scale is ideal for radio work. One of these went on Ebay last week for $10. New ones can cost from $25 to $80. You could always get a cheap digital panel meter, but analog meters are preferred for radio work. A moving needle tells the story better than flashing digits. Remember digital car speedometers? Neither do I. They came and went because they are less human-readable-friendly and they cost a fortune to repair. Switches, lamps, outlets and fuse holders are all commodity items you can find at most any electronics store or raid from defunct electronics equipment.

Once you have all the components, you will have to lay out the front panel and cut, drill, punch, nibble or saw the openings for the components and mounting screws. The end result will depend on what parts you are able to scrounge. Once you have mounted all the parts it's time to do the wiring. The Variac, if purchased new, should have a wiring diagram that shows which terminals

go to the “line” and which terminals go to the “load”. If you buy a used one without a diagram, contact the manufacturer to get the wiring instructions. The diagram shown in Figure 3 shows how to wire a Superior PowerStat Model 10C, a 2-Amp unit available from Superior Electric, 383 Middle Street, Bristol, CT 06010.

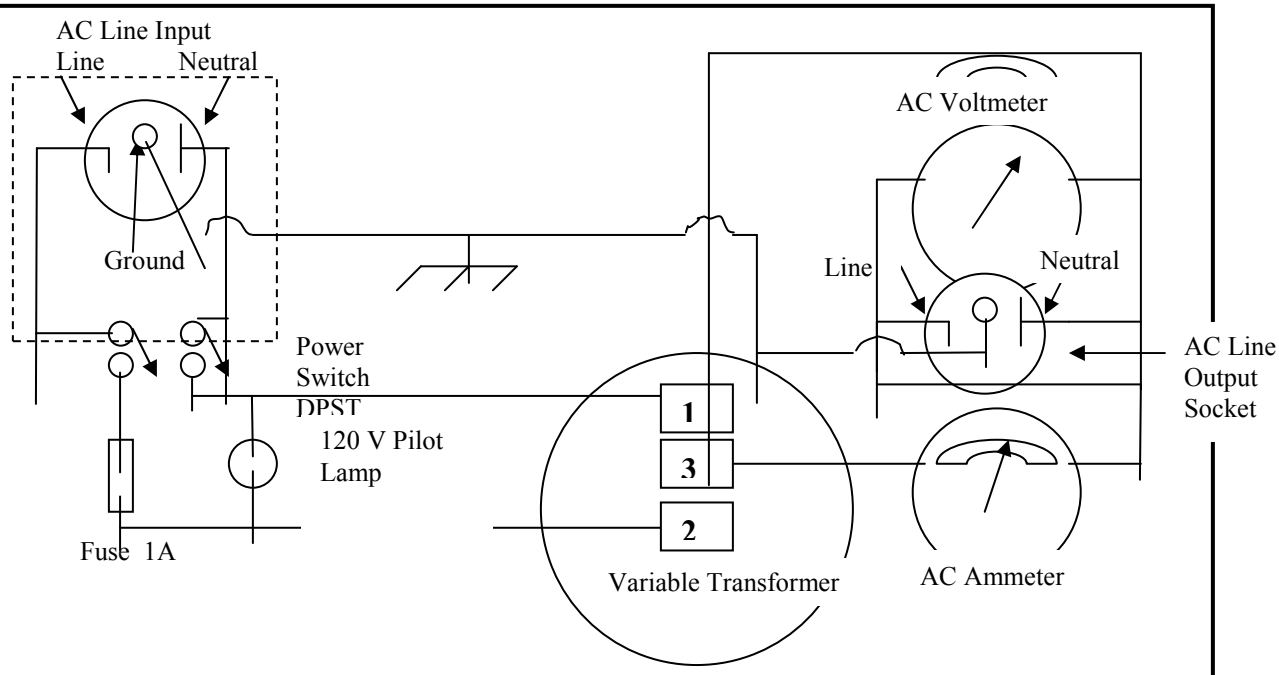

Figure 3 Wiring for A Superior Electric 10C Variable Transformer

Note: You should consult the manufacturer’s instructions for the Variable Transformer you are using.

Circuit Description

Caution: If you are wiring your own Variac box, DO NOT plug in the power cord until all wiring is completed and you have double-checked each connection!

In the diagram above, the 3-wire line cord comes into the box from the wall socket. The ground wire (usually green) connects to the metal chassis of the enclosure and also to the ground connection on the output socket. The Neutral wire (usually white) connects to one side of a Double Pole Single Throw (DPST) switch, as does the Line wire (usually black). In an American wall socket made to current standards, the wall plug has 2 slots and one round hole. The smaller vertical slot is the “Line”, meaning the wire that is “hot” or measures 120 volts AC with respect to “Ground”, which is the round hole. The ground wire goes back to your breaker box and is physically connected to a ground rod driven into the earth. The Neutral wire is connected to the larger of the two vertical slots in the wall socket. This wire should have white insulation. It goes all the way back to the breaker box and connects to the ground bus inside the breaker box. One way to be sure about which wire is “hot” is to connect a neon circuit tester between ground and one of the slots in the electrical outlet. The lamp will glow when connected between ground and the “Line” wire. It won’t glow when connected between ground and the “Neutral” wire.

The DPST switch connects or breaks both wires simultaneously. After going through the switch, the Line (hot) wire goes through the fuse to terminal 2 of the Variac. A One-Amp (1A) fuse

should be enough for radio work. The Neutral wire goes to terminal 1 of the Variac. The AC Voltmeter measures the voltage between the Neutral wire and terminal 3 of the Variac, which is the variable output. If wired correctly, the voltmeter should show increasing voltage as the Variac knob is rotated clockwise. The Ammeter is wired in series between terminal 3 of the Variac and the Line connector on the outlet. If current flows to the load, the ammeter will measure it.

A Tombstone with a Unique Dial – The US Radio Model 9A

By Mark Palmquist

A couple of months ago, some SARS members took me on a field trip to a self-storage facility in Rockmart, Georgia to meet a collector who was disposing of his entire collection. Like most collectors who have been at it for a while, I'm out of space so have to be careful about what I bring home. A new acquisition will have to offer something very interesting or challenging these days to find its way to my basement. The radio described below fits this description exactly because of its unique dial mechanism and variable gain control. **Figure 4** shows a portion of the front of the radio with volume, tone, tuning and AVC control. The close-up of the dial shows each of the controls is coupled with a dial string to a spring-loaded pointer over a back-lit indicator. The variable AVC control works quite well, and is normally not found in consumer radios. Amazingly, all the dial cords were intact and working.

Figure 4 Front Panel with close up view of Backlit Dial US Radio 9A

Another find on this trip was a **Gauers VHF** portable transistor radio made in Switzerland. It looks like something aviators would favor, with a direction finding mechanism for picking up beacons on the 200-500 KHz band and an FM band that picks up flight control stuff just above the standard FM band. For $3.00 I couldn't pass it up!

Figure 5 Gauers VHF 3 Band Portable

Caution: Performing repairs on radios could be dangerous. SARS assumes no responsibility for accidents resulting from any information contained in this web site. .