

# Build This Variable AC Bench Supply

*If you can find a Variac transformer, that is.*

How many times have you home-brew folks had the need for a variable 120 VAC power supply? Well, at least several. We know that working with 12 volt DC on the bench is certainly no problem. If a mistake is made, you might lose an IC or two, but no fires erupt. With AC — well, things can get lethal before the fuse blows, and this is especially true when using 120 VAC. We have all done those dumb things that have jump-started our heart from time to time. This "Variac" variable supply will prove safe on those start-ups of those questionable home-brew circuits that require AC supplies.

Let's look at the central component, which is called a Variac transformer. This is also known as an autotransformer in some circles. A certain ham who has tried to declare himself to be the authority in this field has also called the "autotransformer" a current transformer when it is used in RF impedance matching devices called baluns.

Well, it is particularly a variable secondary winding transformer that allows a continuously variable primary-to-secondary ratio, thus providing a continuously variable AC voltage from zero to 130 VAC. These devices have become very expensive when purchased

new, and are usually in the \$130 range for the 3 A models. I do not recommend the purchase of a new Variac transformer.

Now, look at the list of local hamfest flea market supply get-togethers. Usually a five dollar entry fee will get you into one of these events. They take place usually on Sunday mornings from 9 a.m. to 1 p.m. You can look into *QST*, *CQ*, or *73* magazines under the "coming hamfests" section to determine the location and date of each event. You can also check into your local two meter repeaters and someone can help you, since nearly all of the events are sponsored by repeater

groups. Anyway, look for a Variac under the vendors' tables since they do not seem to have a high dollar value or a large demand these days. I found mine for a price of fifteen dollars. I did not even try to bargain or dicker, since the condition was very good. Try to ensure that the knob is with it, since the completed unit with knob will look more professional. Finding a replacement knob can become a real problem, so do your best.

The next item is some type of voltage indicator. It is possible to use a digital voltmeter and do calibration on the front panel, but a nice analog AC voltmeter is best since the AC line

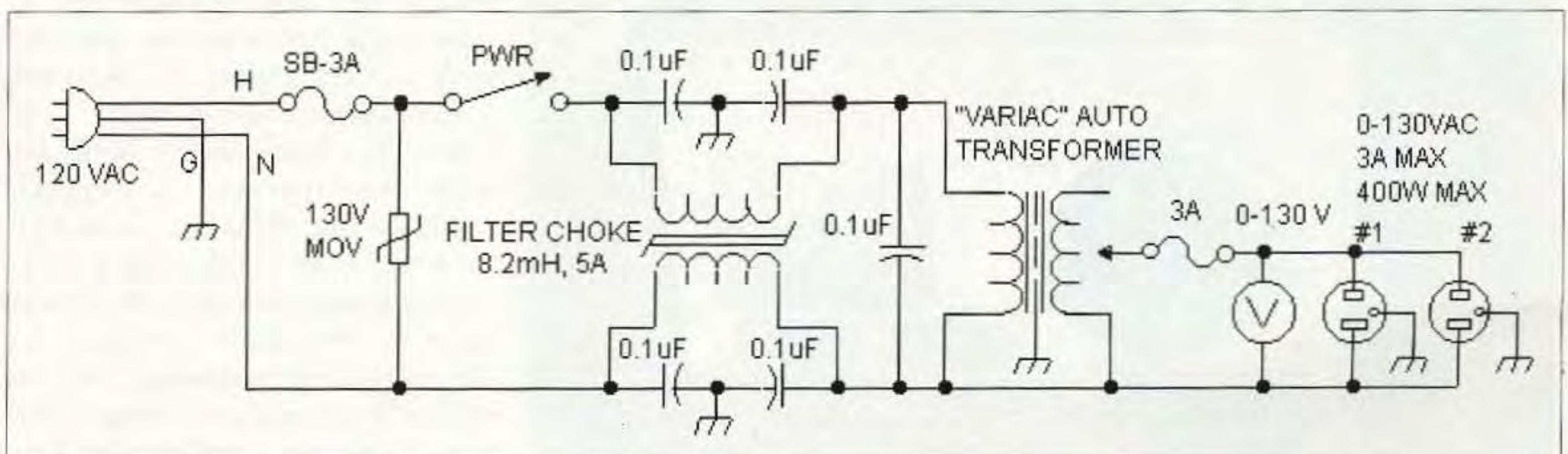


Fig. 1. Supply schematic.

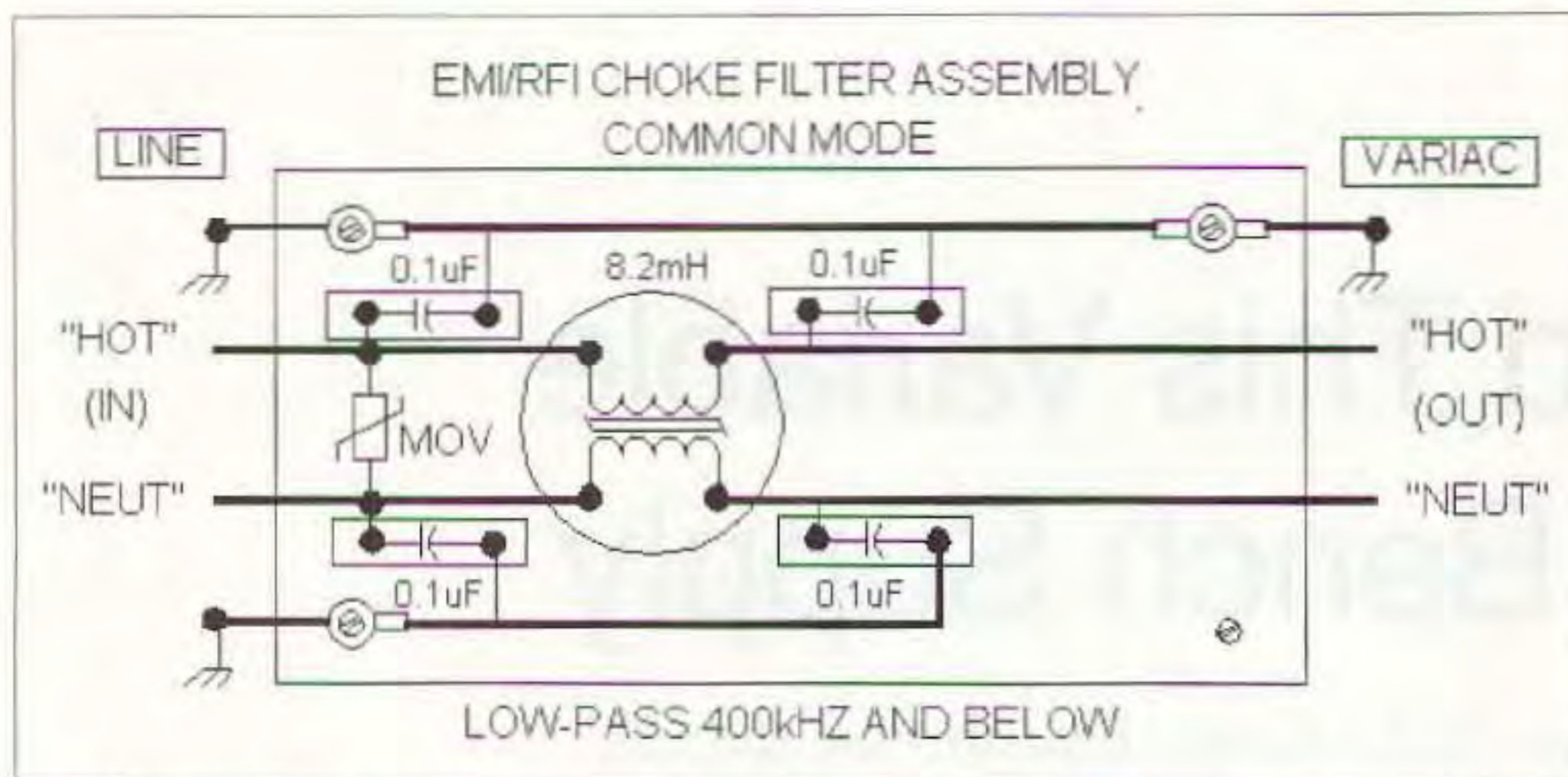


Fig. 2. EMI/RFI choke filter assembly. Mount using 0.25-inch aluminum standoffs.

voltage may vary at your location. I found an old Lafayette model #99-51161 0-250VAC type. The vendor wanted one dollar, so I smiled and paid the man and thanked him. It's that old story of one man's junk is another man's gold. He also had several new, boxed Heathkit 200  $\mu$ A meters for one dollar each. No, you do not have to ask me! The plastic covers snap off and two screws hold the metal scale plate in place, so reversing the plate and drawing a new scale is not a problem on these meters. With a shunt resistor, the meters can be used for nearly any DC application. A trimpot in series will adjust the scale in the voltage mode. For AC, you can use a bridge rectifier and adjust. All this "stuff" is in your *ARRL Handbook* and many other good books. Be creative, spend

one buck, and have some fun. If you feel you just have to purchase a new, good-looking meter, you can go to your local Radio Shack and order one (RS #22-412) at about thirteen dollars a pop!

For safety's sake, we want to double fuse the little box. Use a 3 A slo-blo 3AG fuse on the primary side and a 3 A fast blow 3AG on the secondary side. This is all the protection that is needed. That expensive Variac needs primary and secondary protection for sure!

When working on electronic projects, it is always nice to filter the 120 VAC line to keep garbage noise out of the circuits being tested or developed. An inexpensive low pass (common-mode) filter is employed on this project, and can be seen in Fig. 1.

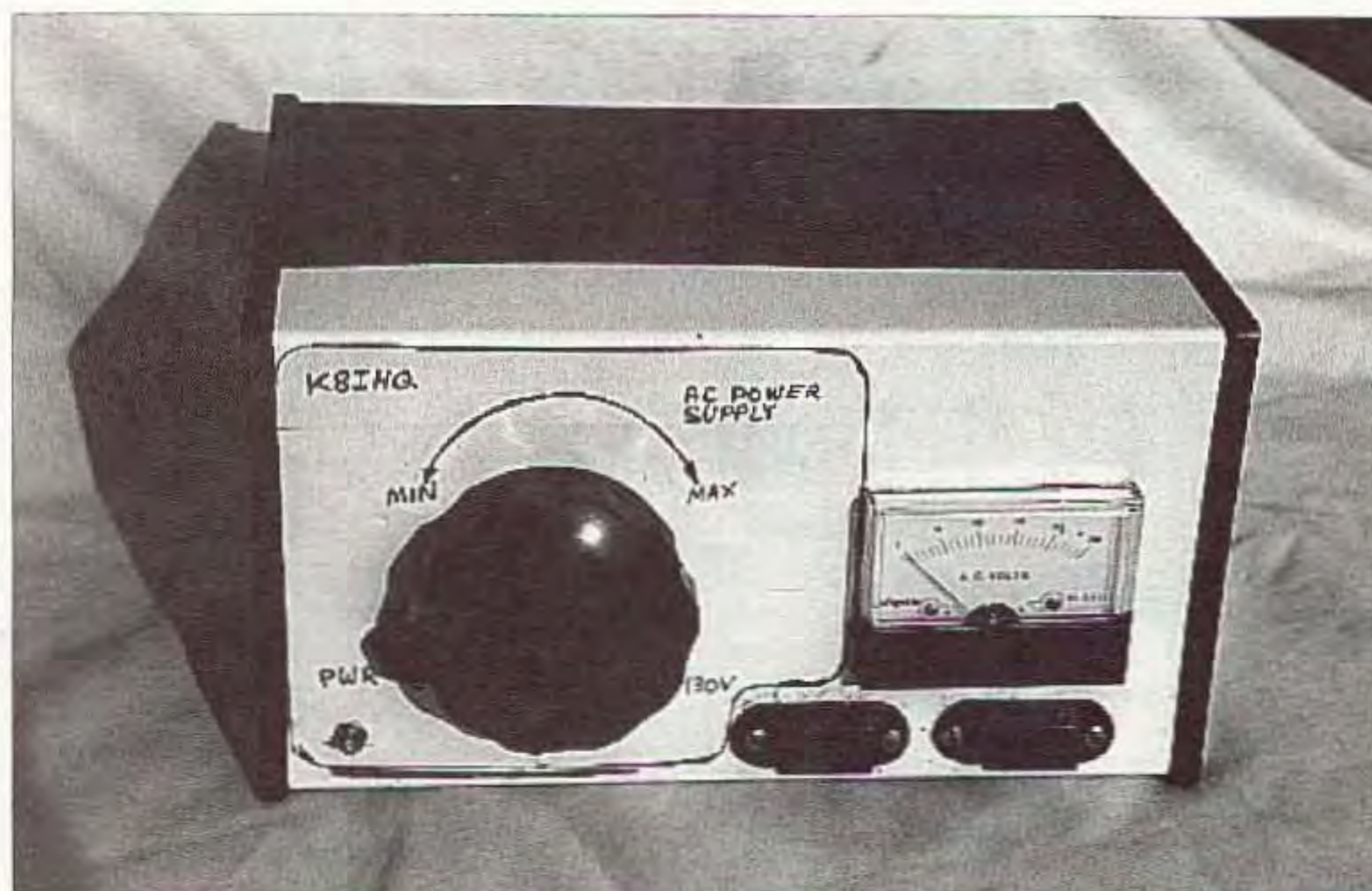


Photo A. In case, ready to go.

Something like an electric motor appliance putting common-mode noise on the line will give you nightmares. An inexpensive common mode filter is installed, which all but eliminates noises from appearing on the primary or secondary of the Variac transformer. Working with digital circuits using a DC wall transformer for power can move tremendous hash and noise to the 120 VAC line and get unbelievable noise from the folks you live with. The 8.2 mH filter is rated at 5 AC amps (RMS) so the 3 A requirement is well covered. The 0.1  $\mu$ F capacitors and 130 VAC MOV take care of any large peak voltage spikes very well. This is nice insurance in case a transient tries to get to the filter circuit. The MOV or metal oxide varistor device is for those unexpected current slugs that the electric utility ignores. It will clamp off at the 150 V level, figuring in the variable voltage to variable time factors. This device is rated at 130 VAC but is just not very fast.

The line cord must be a three conductor (NEMAL) type preferably in the AWG #14 wire size. The green ground wire, when attached to the aluminum enclosure, will ensure safe operation no matter the situation. It is required these days by NEC (code), so it is a good idea to use it. Another note on the source of AC power which should be covered is the problem of GFI (ground fault) devices. If you use one of these safety devices to supply your power to the workbench be aware of all the Triac/SCR noise that they produce. The common-mode filter will take care of that nasty little item. I have considered using this filter as a filter on the devices which NEC requires in the bathroom areas and when within six feet of water. That is another weekend project for the future!

Now, let's look at the enclosure situation. Any type that is aluminum would be OK. Again, we are looking for some degree of safety since we are fooling around with 120 VAC. I found a Ten-Tec Model MW-8 enclosure at a flea market and purchased it for five dollars. The new price is about seventeen dollars plus shipping these days. Just be creative!

Well, the MW-8 I found had holes in the bottom, back, and also the front panel. The hole in the front got bigger to accommodate the AC voltmeter. The other front holes got covered by a piece of contact paper purchased at a local office supply house. Use a black felt marker to put the markings and scales on. The holes in the rear of the enclosure were enlarged to handle the two fuses, and one new one was made for the 0.5-inch strain relief for the line cord. Again, use the felt marker to identify the fuse sizes, etc. The marker can be had at your local post office for one dollar! It has both a broad and very fine point. What a deal for one buck!

Once the components are mounted, you will be ready for the wiring of the unit. Use insulated AWG #18 or larger. See Table 1 for parts info. The

Qty.	Part	Source	Cost
1	MW-8 enclosure	Ten-Tec	\$17.00
1	3A SB fuse #31-155	Hosfelt Electronics (HE)	.30
1	3A fuse #31-359	HE	.06
2	Fuseholders #43-206	HE	1.50
1	Strain relief	Local	.25
1	Line cord #60-372	HE	1.75
1	120 VAC 3A Variac auto xfmr	Hamfest or flea market	15.00
1	130 VAC MOV #V130LA20B	HE	.60
2	Panel-mount AC receptacles	Local	1.00
1	150 VAC panel meter (RS #22-412 = \$13)	Hamfest or flea market	1.00
4	0.1 µF 250 VAC box caps #15-828	HE	.25
1	Dual 8.2 mH toroid choke 250 VAC 5A 0.2 Ω #18-129 Pulse Engg #96180	HE	.35
1	SPDT 3 A toggle switch #51-268	HE	.75
1	Perfboard RS #276-1396	Radio Shack	3.50
OR			
1	PCB	FAR Circuits	4.00 + 1.50 s/h
4	Sets aluminum standoff hardware #6	Your choice	1.00
3	Solder lugs #6	Your choice	.15

Table 1. Parts list.

suppliers' info is listed below in the text. The use of clear 100% silicone caulk to mount the components onto a perforated board works well. Or, you can use the PCB available from FAR Circuits. (I originally used perfboard, but now there is a PCB available.)

Now that you have all the components and assemblies, you can wire the components together using the schematic. Follow the schematic in Fig. 2, and as each wire is installed use a yellow hi-lighter (Broad Point) to mark each wire on the schematic. I find that nearly no mistakes will happen when this procedure is used.

When everything is wired and checked, you can plug it in and flip the switch with the Variac at zero volts. No smoke generally indicates you have done a good job. A blown fuse indicates you did something wrong! If everything is OK, then plug a lamp into the utility plug and turn the Variac slowly to 120 VAC, watching the bulb's intensity increase as voltage increases. Ensure the AC voltmeter is also functioning correctly.


Now you have a soldering iron heat controller — among some other good things! Good luck!

#### Notes/Sources

FAR Circuits, 18N640 Field Ct., Dundee IL 60118-9263. PCB is \$4 + \$1.50 S/H.

Hosfelt Electronics, (1-888-264-6464), catalog.

Jameco Electronics, (1-800-831-4242), catalog.

Ten-Tec, (1-800-231-8842), catalog. 

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##### LINEAR AMPLIFIERS

**HF Amplifiers**  
PC board and complete parts list for HF amplifiers described in the Motorola Application Notes and Engineering Bulletins:

AN779H (20W)	AN 758 (300W)
AN779L (20W)	AR313 (300W)
AN 762 (140W)	EB27A (300W)
EB63 (140W)	EB104 (600W)
AR305 (300W)	AR347 (1000W)

**2 Meter Amplifiers**  
(144-148 MHz)  
(Kit or Wired and Tested)

35W - Model 335A,	\$79.95/\$109.95
75W - Model 875A,	\$119.95/\$159.95

##### HARD TO FIND PARTS

- RF Power Transistors
  - Broadband HF Transformers
  - Chip Caps - Kemet/ATC
  - Metallized Mica Caps - Unelco/Semco
  - ARCO/SPRAGUE Trimmer Capacitors
- We can get you virtually any RF transistor! Call us for "strange" hard to find parts!  
**DIGITAL FREQUENCY READOUT**  
For older analog transceivers  
TK-1 (Wired and Tested) \$149.95

##### ATU Down Converters

(Kit or Wired and Tested)  
Model ATV-3 (420-450)  
(Ga AS - FET) \$49.95/\$69.95  
Model ATV-4 (902-926)  
(GaAS - FET) \$59.95/\$79.95

##### ADDITIONAL ITEMS

- Heat Sink Material
- Model 99 Heat Sink (6.5" x 12" x 1.6"), \$24
- CHS-8 Copper Spreader (8" x 6" x 3/8"), \$24
- Low Pass Filters (up to 300W) for harmonics \$12.95
- Specify 10M, 15M, 20M, 40M, 80M or 160M
- HF Splitters and Combiners up to 2KW

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