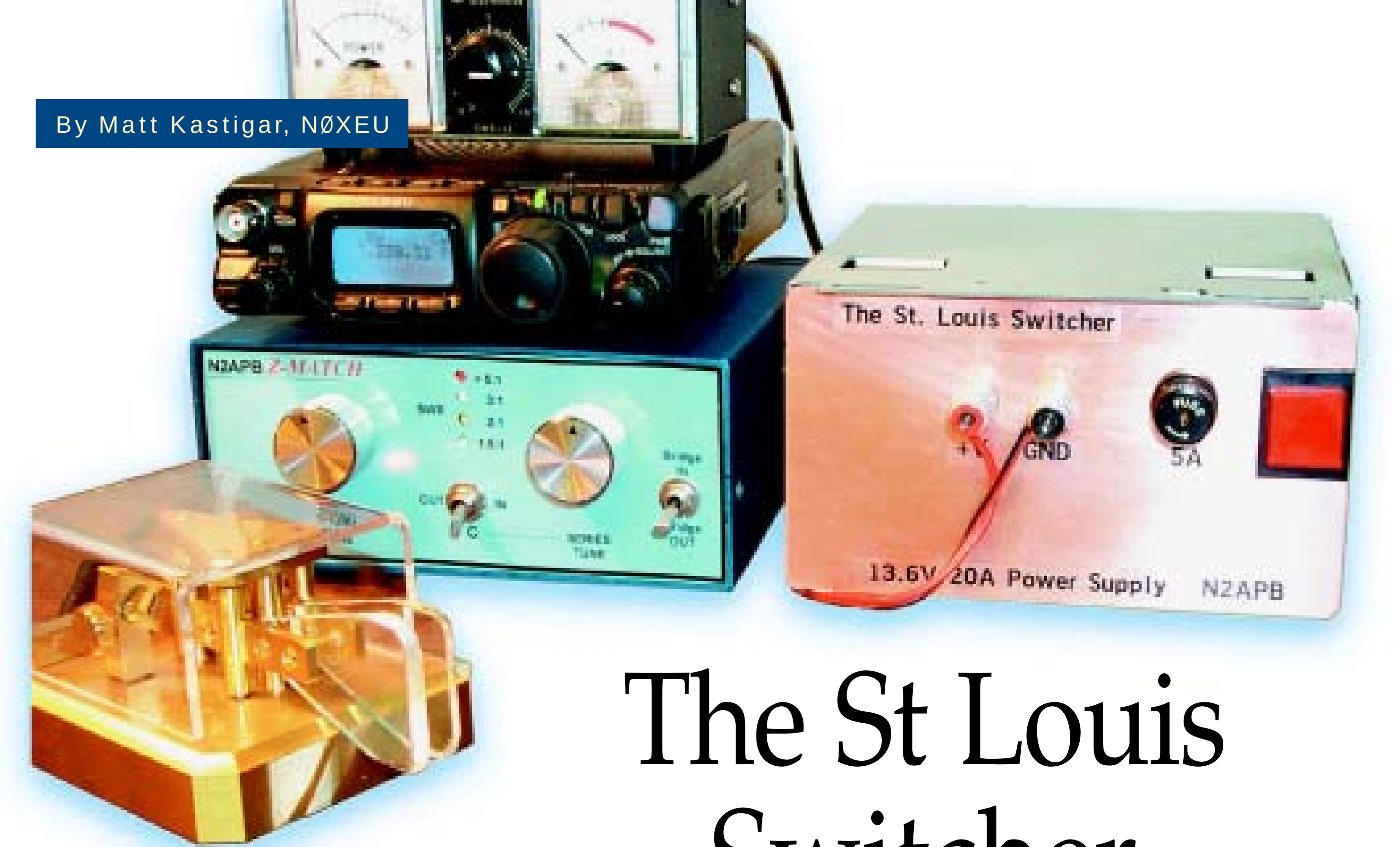
By Matt Kastigar, NØXEU



The St Louis Switcher

Need an inexpensive bench supply that will also run an HF rig for under $10? PC power supplies are getting cheap and used computer chassis are piling up in landfills!

The quickly advancing PC industry has yielded a cornucopia of component opportunities for Amateur Radio homebrewers in the form of discarded equipment. Older PCs are sitting idle in basements and dumpsters just waiting to be dissected for their internal connectors, memory chips, cases—and *power supplies*. Yes, these old computers often have perfectly good switching power supplies that can be suitable for powering a 100-W transceiver requiring 13.8 V at 20 A or more. All you need to do is extract it from the computer cabinetry, clean it up a bit, bump up the terminal voltage and install some connectors, a meter, a fuse and a switch. Here's the step-by-step process I followed in creating a top-notch 20-A supply for my operating bench.

Getting the Parts

You'll first need to procure a PC power supply with a rating of at least 250 W if you wish to ultimately power a 50-W mobile rig, or preferably select a power supply rated at 350 W or more if you wish to power a 100-W transceiver. I bought a 300-W unit at a local surplus house for $5. While there, pick up a set of binding posts ($0.25 each), a 20-W 3-Ω resistor ($0.50 for a metal-cased one with mounting tabs), a power switch if your supply does not have one ($0.75), four stick-on rubber feet ($0.10 each), a 1.5-inch diameter ferrite FT140-43 toroid core ($0.50) and a power cord ($1). The total is about $9, but a well-stocked junk box can reduce this overall price.

Before making any modifications, make sure you have a working unit. Test the supply by loading the 5-V side so that the regulator works. Here's how:

- Verify that the supply is not plugged in. Remove the power cord and put it out of reach.
- Solder the 3-Ω, 20-W resistor across the red wire (5 V) and a black wire (ground).

Connect a multimeter across the yellow wire (+12 V) and black wire (ground). Plug in a power cord and power up the supply if it has a switch. You should measure 12 V and the fan should run. If you've successfully reached this point, you can proceed. If not, get another supply and try again.

Starting the Modifications

Unplug the power cord from both the wall outlet and the supply and set it aside. Unsolder the 20-W resistor and set it aside for now. Open up the supply—it will be dirty and will need to be "blown out." Disassemble the unit as much as possible and clean the supply chassis and fan. An old toothbrush comes in handy here, as will a cheap paintbrush; better yet, you could use a can of compressed air. Be careful not to bend any component leads or to brush too hard; it does not take much to get the tumbleweeds out.

Wires Wires Everywhere

Either 12 or 5 V dc powers the fan, and you should leave these fan wires intact. If the PC board is not marked with voltages where the many wires emanate from it, you can probably assume the following color scheme: red wires are 5 V, yellow wires are +12 V, and black wires

Building the St Louis Switcher

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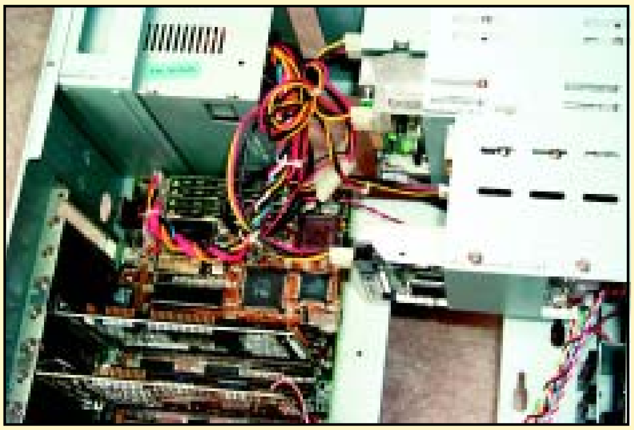
I was quite thrilled to follow NØXEU's guidance in the accompanying article to produce a standard accessory on my operating bench, and with Matt's blessing I present a pictorial essay to augment his fine project.

Here's the finished product. The "standard" switching power supply was removed from an old PC, doctored up in the manner described by NØXEU, and has a new "front panel" fashioned out of printed-circuit board (PCB) material. See how this was accomplished in the following photos.

Step 1—Find an Old PC

With the cover off, you can see the motherboard, bunches o' wires, and then the switching power supply in the upper left hand corner of this photo.



Step 2—Remove the Supply

You probably need to remove other components (like the floppy and hard drives) and various screws holding the supply in the chassis in order to extract it. Be careful not to remove any of the screws in the power supply box itself, as these often hold the ac receptacles.

Step 3—Open up the Supply

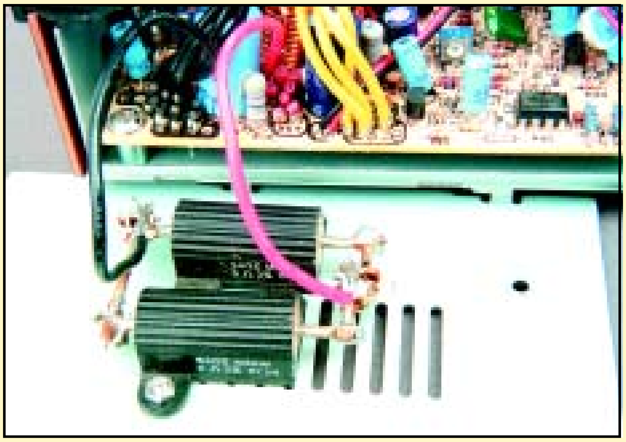
You may find it a bit tricky to open up the enclosure of the PC switching supply. They often manufacture these things for a simple snap fit. It'll be like trying one of those Chinese Puzzle Boxes you had as a kid. Once you find the tabs holding it in place the top should pop off to expose the PCB and wires inside.

Step 4—Identify the Wires

Once you separate all the wires and untangle them as they come off the PCB, you'll probably have a bunch of red wires (5 V), black wires (ground), yellow wires (12 V), and perhaps another color or two for other purposes. You'll want to snip off (or unsolder) all but a few of each, as NØXEU describes in the text.

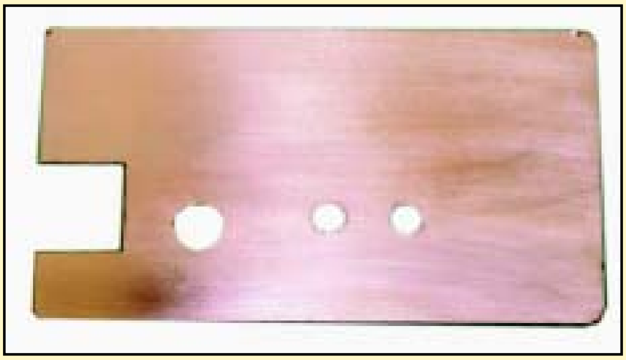
Step 5—Internal Load Resistor

It's important to put a decent load on the 5-V lines to enable the regulator to…well, to regulate! Here you see two 10-Ω power resistors wired in parallel connected to the 5-V wires, providing a constant 1-A load for the regulator circuit.



Step 6—The Front Panel

The original power supply chassis "front panel" had some ugly holes, and when the extra holes were put into it for the fuse, binding posts and power switch, it looked awful. So, I cut some double-sided PCB material to size, shined it up and protected it with some Krylon clear lacquer. The components actually held the panel in place over the ratty-looking original chassis.



Step 7—Testing!

I was lucky to find an internal potentiometer in the regulator circuit to allow me to adjust the terminal voltage up to almost 13.6 V, as shown in this photo. Interestingly, as Matt points out in the article, the 5-V line also went up, providing even more "load current" and heat in the power resistors, but that's okay.

Step 8—Using it!

Here you see the St Louis Switcher in proud display being used on my operating bench with the Yaesu FT-817 QRP transceiver, my homebrew Z-match tuner and an SWR bridge. As it turns out, I've recently acquired an ICOM IC-756 transceiver and the St Louis Switcher nicely supplies the added *oomph* on the rare occasion when I need to use the extra power of this 100-W rig.

are ground. Other colored wires may have –5 V and –12 V, but you won't be using these. In fact, you should unsolder (or clip off) all wires but one red, four black and four yellow. You can now remove these extra wires, and snip off the PC motherboard connectors from the seven wires still coming from the supply's PC board. This should clear away lots of space for you to finish up the job.

Mounting the Power Resistor

Mount the power resistor in a clear area on the inside of one of the chassis sides. Use screws, nuts and washers so that the heat generated in the resistor will be "sinked" to the metal side of the supply chassis. Solder a red (+ 5 V) and black (ground) wire to the resistor and use heat shrink tuning or tape to insulate the connections in case they come in contact with anything else (the heat sink, case or other components). The 5 V portion of the supply has to have a load for regulation to occur and this resistor provides it.

Mount the Connectors and Controls

In this section you'll be drilling holes in the supply chassis for mounting the binding posts, power switch, fuse holder and possibly a meter. Before you drill any holes, consider the internal layout of the supply, being aware of heat sinks and vertically mounted parts that you'll need to avoid while installing the extra components.

I mounted two binding posts on the "front" of the supply, but if the back (the power cord side) has more space, or if it is your preference, go for it. Be careful to avoid internal heat sinks and board-mounted components. After mapping out the holes for the new connectors and controls, drill the holes in the panel being careful to thoroughly remove all metal chips from the PC board and chassis area.

Next, connect the PC board to the binding posts. You can use the existing black and yellow wires, or you can remove them and replace them with single runs of #14 wire. If you use the existing wires, you'll need to use at least 3 of each to handle the current. If you decide to replace them with runs of #14, look for a common area on the PC board where all the yellow wires and all the black wires are connected. You will need to remove the wires at the PC board and enlarge one of the holes to handle the #14 wire. Be careful not to get too close to neighboring copper traces.

In order to ensure that RF hash would not be delivered to the radio ultimately being powered, I wound the wires between the PC board and the binding posts around an FT140-43 toroid. Twelve to 15 turns will do it. This step was necessary in my case, but others might find the supply clean enough without it as N2APB did.

There is usually an on-board miniature fuse—mine was 3.5 A. I removed it and wired the ends of its holder to a panel-mounted fuse holder on the front of my supply and put a 3AG fast-blow fuse in it.

I broke the black (hot) ac line and put a 5-A toggle switch in series with it, mounted on the front panel for convenience. Your supply might already have a power switch.

If you want voltage and current meters, mount and wire these now. The voltage meter connects across the output binding posts (in parallel). The ammeter is in series with the positive post—the "+" meter terminal to the board and the "–" meter terminal to the red binding post.

Check all wiring and remember that there are lethal voltages in this small box!

Increasing the Terminal Voltage

At this point you have a 12-V bench supply, capable of supplying at least 12 A. But many mobile radios will not work or will not operate at full output power with only a 12 V supply, as they are specified for 13.8 V (automobile voltage). You'll probably be able to adjust your supply to provide this increased terminal voltage.

There is usually a single regulator used for both the 5 V and the 12 V portions of the supply and changing its voltage divider resistors will change both output voltages. Voltage regulation is usually achieved by means of pulse-width modulation and the IC is probably a house-numbered part. If your supply has a voltage adjust pot, you're in great shape and you can easily adjust the supply up to 13.8 V. If not, however, before you even start this project, you should determine whether the IC in the power supply you want to use has enough identification to allow you to obtain a data sheet that tells you how to set up the voltage dividers. There are plenty of power supplies available for a few dollars at most ham flea markets, so it should be easy enough to find one you can work with. In some cases, 12 V may be perfectly fine for your application, so you may not need to adjust the supply at all.

If you can change the voltage divider, follow the traces from the pins on the regulator to find the control resistors, which are most likely the only precision resistors on the board. This is a vague description, but because of the different flavors of power supplies, I cannot be more specific. I replaced two resistors according to the component data sheet example and the output went from 12.0 V up to 13.5 V, which was close enough to my 13.8 V target.

Stress-Testing the Power Supply

When I put a load on this supply, I found that it was able to maintain 13.2 V up to a load of 15 A (200 W). The voltage drops to 12.5 V at a load of 17 A. The heat sink gets warm to the touch—caution: some heat sinks are electrically "hot"! With a load of 17.5 A, the 3.5-A fuse on the ac side of the supply let go. With a 350-W supply, 20 A (continuous) can be reached. The 5-V supply now draws minimal power, with the lion's share being available for the 13.5-V terminal output. Further increases in load current are not feasible as we are reaching the limitations of the PC board traces for current.

N2APB's version of the power supply (described in the sidebar of this article) was tested in the ARRL Lab with generally good results. Noise on the output was about the same as current ham-market switching supplies. You can always add the ferrite mentioned earlier if you want to reduce it even more. Output ac ripple was quite low at 15 mV worst case. Load regulation was a bit on the poor side—no-load voltage was 13.55 V, and with a 20-A load the output was 12.77 V. Although not a serious drawback, it isn't as good as higher-cost switchers. This is, however, an economical approach even if you buy a 400+ W PC supply new from a dealer. Such a supply might cost about $50, which is still quite a bit less than a ham-market switching supply.

Batten Down the Hatches!

Now that you're done making the mods to turn your PC supply into a custom accessory, you can button up the chassis. Be careful not to pinch any wires during reassembly. Take your time and use nylon tie wraps to keep wiring away from heat sinks and the fan blades.

If you build this supply, please send me an e-mail describing how it worked for you and what modifications you made. A local ham, Ken Gianino, WBØQNA, tied several "stock" switchers together to form a 24-V supply for a telephone system at his office. What applications do *you* have?

You can contact the author at 28 Woodcrest Dr, Ladue, MO 63124-1468; **n0xeu@arrl.net**.

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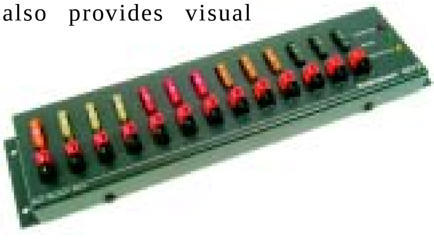

STRAYS

2002 NORTH AMERICAN METEOR SCATTER RALLY

◊ The 2002 North American Meteor Scatter Rally will be held 0000 UTC April 27, 2002 through 2359 UTC May 5 during the Eta Aquarids meteor shower. The object is to work as many stations as possible, in as many Maidenhead grid locators as possible, via meteor scatter on the amateur bands above 50 MHz. Complete Rally rules are available on the Web at **www.qsl.net/wa5ufh/**.