Converting PC Power Supply to Bench Supply

Turn a surplus computer power supply into a bench power supply to run your amateur radio transceiver and other equipment

Overview
This project will show you how to turn an ATX power supply unit (PSU) from a computer into a bench power supply capable of providing the DC power necessary to operate your mobile amateur radio equipment as a base station using your AC utility power.

These computer power supplies are 12VDC switching power supplies that operate off of normal AC utility power. Many of them have a switch near the power input connection to allow for 110 or 220VAC input. Coincidentally, most mobile ham transceivers are designed to work off of 12VDC power available from your vehicle. Technically, these types of radios typically are designed to operate off of the slightly higher voltage supplied from the vehicle’s electrical system while the alternator is running. However, many (if not most) power supplies of this type have a potentiometer which allows the output voltage to be slightly adjusted and we can achieve the output we need to run our radios.

This type of power supply is readily available, often for free, from dead computers. Many computer service shops throw them out by the dumpster full and most home users throw them away along with the rest of the computer when they upgrade. By combining this low cost (or free) unit with about $5 worth of parts from your electronics supplier, you can not only keep these items out of landfills but also save 90% or more on the cost of a new bench power supply for your 12V transceivers.

You may have seen a similar project described in a circa-2002 QST article entitled “The St. Louis Switcher.” The idea is the same, although evolving computers and processors have necessitated evolving power supplies and this project overview covers creating the power supply with current PSUs.
Things You Will Need
To complete this project, you will need the following items:

- An ATX power supply unit (PSU) capable of providing enough power for your needs
- A power resistor to provide a dummy load on the PSU 5V line
- A single pole single throw (SPST – on/off) switch to act as the main power switch
- Your favorite power connectors (Anderson Power Poles, binding posts, etc.)
- Wire cutters/strippers
- Soldering iron, solder, heat shrink and such items commensurate with fabricating cables.
- Optional rubber stick-on feet for the bottom of the supply

As mentioned above, many of these items can probably be found in the junk bin in your shack or at computer shops. If you do not already have these items they are generally inexpensive to purchase online or at local electronics/hobby shops, such as our friends at MCM Electronics.

Given our steady supply of surplus ATX power supplies, the total cost of each bench supply is around $5, which encompasses the price of the power resistor, switch and connectors.
Converting the Power Supply

CAUTION: Power supplies may contain high voltages and currents even when they are unplugged. Ensure that all capacitors are discharged and exercise caution when working with electrical equipment.

The first step is open up the power supply unit (PSU) case. There are typically around four screws that secure the lid of the case to the bottom. Inside is the PSU circuit board, heatsinks, fan and bundles of cables with connectors which, in a previous life, attached to motherboards and other computer hardware.

We are not interested in any of the computer hardware connectors on the wires, so we can cut them off (as close to the connectors as possible, for now) and bundle the wires together by color as shown in the image below.

![Image of power supply](image)

Standard wire colors are as follows:

- **BLACK** (ground)
- **RED** (+5V)
- **ORANGE** (+3.3V)
- **YELLOW** (+12V)
- **BLUE** (-12V)
- **PURPLE** (+5V standby)
- **GRAY** (power good)
- **GREEN** (power on)

Note that this power supply has an additional set of **YELLOW/BLACK** wires for the second +12V rail. Also note the power output adjustment potentiometer indicated by the red arrow.
The specs for the PSU that we are using for this document are listed as follows on the product label:

- **AC INPUT:** 100-127/220-240 VAC 7/3.5A 60/50 Hz
- **DC OUTPUT:**
  - +5V 20A MAX
  - +5V(SB) 2A MAX
  - -12V 0.5A MAX
  - +3.3V 20A MAX
  - +12V1 10A MAX
  - +12V2 13A MAX

Note that the PSU has two +12V rails capable of providing up to 10A and 13A of current, respectively. A typical 65W transceiver may draw around 14A when transmitting at high power. The two +12V rails may be connected together (as we do in this document).

The power resistor is necessary to place a dummy load on the 5V side of the supply to ensure that the output voltage is properly regulated. We used a 20W 8 Ω ceramic resistor for this job.

Next, we want to remove all of the wire leads that we neither need nor want. You can either de-solder the leads or clip them off. Be aware that the large bundles of wire and the board itself act as quite an effective heatsink, so you will likely need a relatively hot soldering gun if you wish to de-solder the leads.

If you wish, you can leave some of the other leads in place to provide alternative voltages from your power supply. However, we are only interested in +12V output for the purposes of this document. Rather than describing which wires to remove it is easier to describe which ones to leave intact. To create a 12V bench power supply, leave the following intact (cutting to length where appropriate when connecting as described below):

- 2x YELLOW wires (12V rail 1)
- 2x YELLOW/BLACK wires (12V rail 2)
- 6x BLACK wires (ground)
- 1x RED wire (5V)
- 1x GREEN wire (power on)

As we are using binding posts for the power output connectors on this PSU, we drilled two 5/16” holes in the front of the case approximately 1.5” apart and installed two binding posts (one red, one black) into these holes. To the red binding post (+) are attached two YELLOW and two YELLOW/BLACK wires. To the black binding post are attached four BLACK wires.

If you are using a different type of power connectors, determine an appropriate method of attaching them to the PSU output lines and bringing them out of the case. Connect any other power output wires you will be using.

Next, we need to supply the dummy load to ensure that the PSU output is correctly regulated. Attach one red wire to one leg of the power resistor and one black wire to the other leg. Mount the power resistor securely to the case if using the case as a heatsink for passive cooling or mount it in front of the fan for active cooling.

For the main PSU power switch, attach one black wire to one leg of the SPST switch and one green wire to the other leg. For the PSU documented here, we drilled another 5/16” hole on the rear of the case above the AC input line and mounted the switch there.
As previously mentioned, these power supplies are designed to output exactly 12V on the yellow leads but most mobile radios aren’t designed for exactly 12V. See the example power specifications below for a 65W 2m mobile transceiver.

<table>
<thead>
<tr>
<th>Power supply</th>
<th>13.8 V DC ±15% (11.7 ~ 15.8 V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td></td>
</tr>
<tr>
<td>Transmit (max.)</td>
<td>14 A or less</td>
</tr>
<tr>
<td>Receive (at 2 W output)</td>
<td>1.0 A or less</td>
</tr>
</tbody>
</table>

Although the transceiver is designed for 13.8V, it is tolerant of some power fluctuation. However, we still want to try to keep it in the middle of the range as much as possible to avoid under-powering the unit since there will be some voltage drop when the transceiver is operating.

Most PSUs of this type have a variable resistor (potentiometer or “pot”) on the circuit board for slightly adjusting the power output. The pot on this board is shown in the picture at right, labeled VR301.

On our sample unit, this pot could be adjusted up to achieve a no-load voltage of 13.7V before the unit turned off (if this happens, cycling power to the unit off and then on should revive it). Backing off to a no-load voltage of 13.4V left us with 13.3V with the radio powered on and 13.1V while transmitting – plenty to keep the transceiver happy.

Attach rubber feet to the bottom of your new bench power supply to protect your shack surfaces if you like.

You now have a bench power supply to operate your mobile amateur radio transceivers as “base stations” and you are also saving money and keeping electronic equipment out of landfills.

References
Original QST article on the St. Louis Switcher by NOXEU
Wikipedia article on computer PSUs
MCM Electronics for project parts
Louisville Ham Radio website