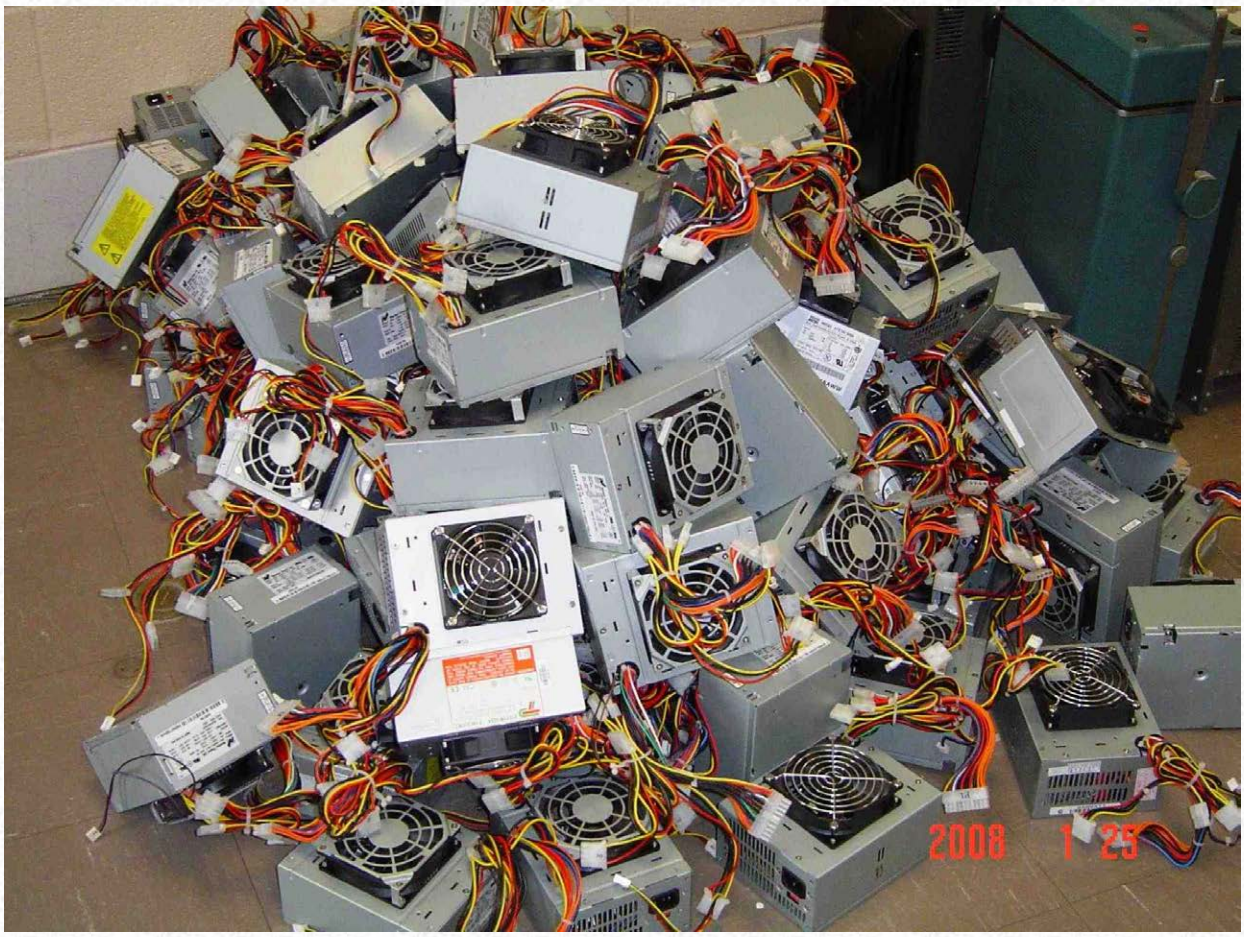
Desktop Power Supply from a PC

Updated March 13, 2009

(See the narrative and disclaimer at the bottom of the page)

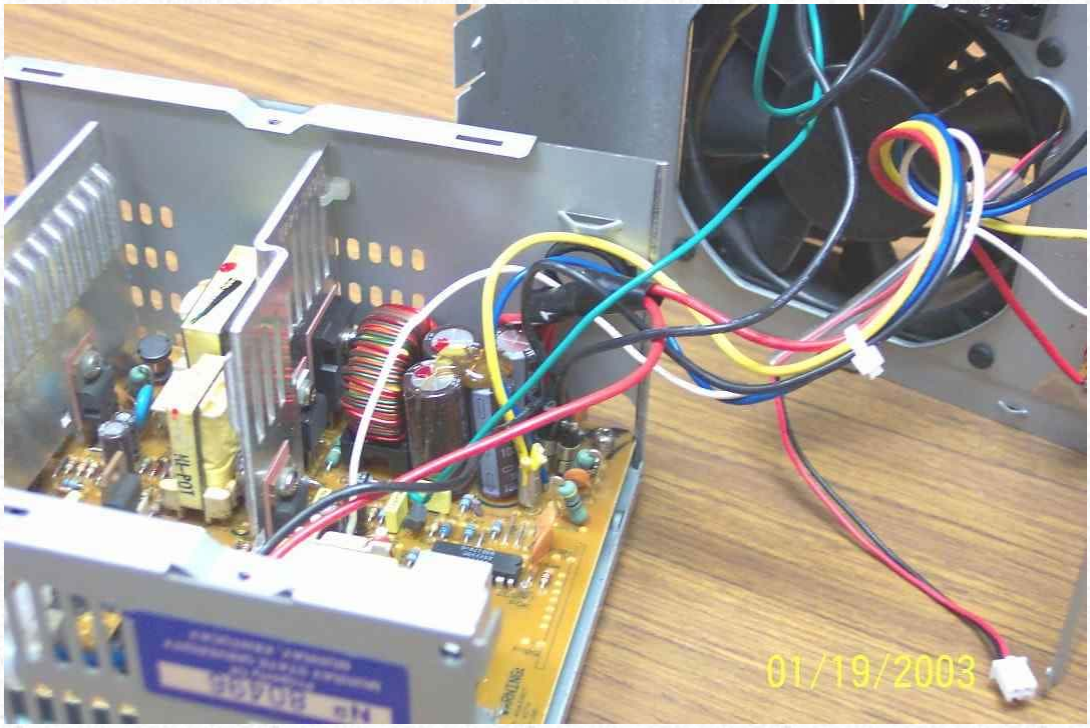
Do you have an interest in converting one of these:



into one of these:

A completed 145 watt ATX power supply with switch, binding posts, labels and feet. Notice the zip ties in the ventilation slots
that hold the load resistor.

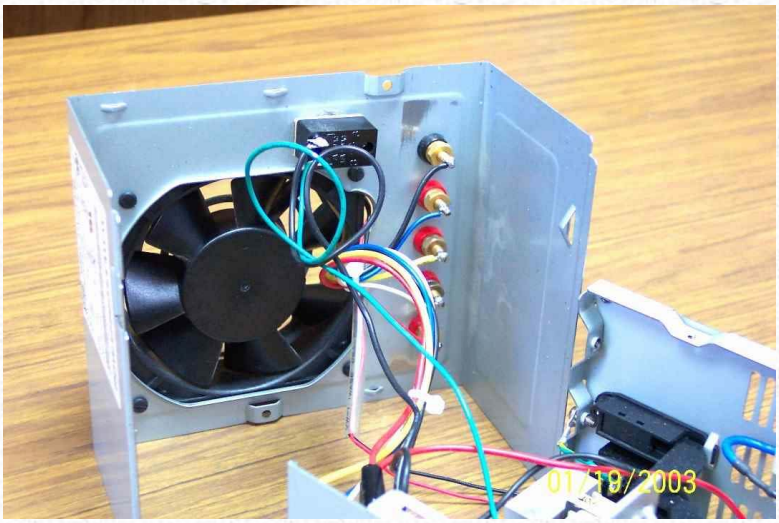
If you find building your own desktop powersupply from a recycled PSU and a few parts from the local electronics store appealing, then grab some tools, pour yourself a cup of coffee (or personal preference) and let's get started. The LED (light emitting diode) was also salvaged from an old PC. If you want to add a power on indicator, LED's add a nice touch and can easily be wired into the +5v rail. I do strongly encourge you to read the contents of this site and associated links before beginning your conversion -- there are a number of hints included in the associated pages.



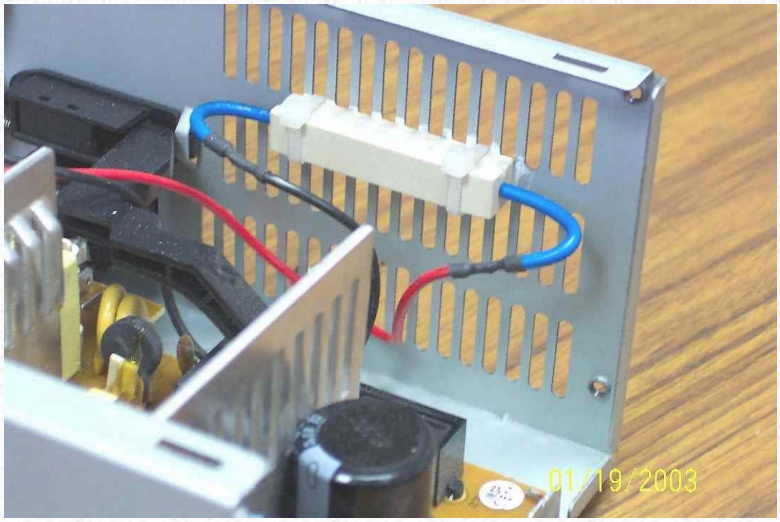
This ATX PS board has leads for +5 (RED), -5 (WHITE), +12 (YELLOW), -12 (BLUE) volts, Ground (BLACK) and switch (GREEN). Be warned that some DELL power supplies manufactured between 1996 and 2000 do not follow the industry standard pinout and color codes. The fan has also been unplugged for better viewing. Since this PS was converted for use in the logic and robotics labs, the selected voltages were tapped. Other users may want combinations of +3.3 V (ORANGE), +5 V and/or +12 V if they are converting one of the newer supplies. For R/C applications, the 5 volt output can also serve as a desktop source to drive receivers and servos. If used as a power source for the micro and sub-micro servos, you must be careful not to drive the servo to either endpoint to avoid stripping the smaller gears in these units. Most standard servos have sufficiently robust gear trains and will simply stall if pushed to the mechanical stops..

Measured voltages on this particular PS (1996 P5-100 MHz Gateway) were about 5.15 and 11.75 volts. The remaining

leads have been clipped off at the circuit board.



View of the case top with fan, binding posts and switch. The switch (SPST) and binding posts are available at Radio Shack or other electronics suppliers.



Power supplies in today's computers are known as SWITCHMODE or Switching Mode power supplies and require a load to continue to operate after being switched on (the term switching mode actually applies to the technique of A/C to D/C conversion and not to the power up action). This load is provided by a 10 watt, 10 ohm wire wound load resistor (sandbar - about $0.80 at Radio Shack) across the +5 volt supply. While many of the newer power supplies will Latch_On without a preload, you will find that adding the resistor will (1) increase the measured voltage on the 12 volt rail slightly and (2) help stabilize the voltage level in this rail by minimizing voltage drop when the powersupply is loaded with a charger. Some inexpensive power supplies may fail if forced on without a load although the Design Guide states that the supplies should not be damaged if run without a sufficient load. The sandbar resistor has been zip tied to the case with a small amount of heat sink compound applied to the flattest side of the resistor . I will also take a file and remove any stamping flash that may remain around the ventilation slots. Without cooling, the resistor will get very hot and may fail prematurely; with this arrangement, the resistor will remain barely warm to the touch.

Be warned that many of the heat sink greases can be quite toxic and any excess should be cleaned up and disposed of

properly. Also be sure to thoroughly clean your hands and tools after use. While most heatsink compounds are rated to 160 to 170 C, some may dry out over time and their effectiveness will diminish -- a periodic check for good contact between the case and resistor is a recommended practice.

Additional comments

Disclaimer: The information presented should not be considered a "HOWTO" article, but merely a documentation of my conversion process. Modern PC Power Supplies can produce high output current levels that may cause internal overheating in the PS or damage to devices connected to them. Any individual attempting their own conversion is cautioned to carefully research their PS specifications and to be mindful of the associated voltages and power. DO NOT work on your opened power supply with it plugged in!!!!

The PS in the picture is a 145 watt ATX salvaged from a 1996 P5-100 MHz Gateway -- I salvage all usable parts from the older PC's before dumping them. This one is set up for a logic lab, hence the +5, -5, +12, -12 volt taps. We also use the +5 to drive servos in the robotics lab. This supply does not have a 3.3 V source, but the newer supplies do. INTEL has continued to modify the ATX specifications to include additional power connectors to support the increased power requirements of the newer motherboards. **Before** any modification is attempted, you should be sure of the type of power supply you are working with and the output currents being produced at each voltage level. Higher wattage supplies can generate fairly hefty levels of current and may overheat or damage devices attached to them. See the Table of Representative Current Levels for other power supplies.

Wiring coming off an industry standard circuit board will be:

ORANGE	+3.3 V
YELLOW	+12 V
BLUE	-12 V
RED	+5 V
WHITE	-5 V (May not be present on recently manufactured supplies)
BLACK	GND
GREEN	POWER-ON (Active high -- must be shorted to ground to force power up)
GRAY	POWER-OK What is this??
PURPLE	+5 V STANDBY
BROWN	+3.3 V REMOTE SENSING Design Guide Update

*** Note that the 1996-2000 Dell's did not completely follow this color coding -- check your voltage levels with a meter before wiring ***

The yellow, red and black wires will likely be grouped together with a clip. Some of the PS's will have a detachable plug for the fan and some will have the fan permanently attached to the circuit board. If the fan is attached, I usually clip the wires then re-solder and cover with heatshrink tubing -- this gives more working room while modifying the PS and allows me to lube the fan.

If you are going to use only the +12v and +5v, you may clip the other wires at the circuit board level or leave the

unused wires about an inch long, gather common colors together, slip a piece of heatshrink tubing over the bundle and shrink -- it is an easy way to corral and insulate loose ends.

For the +5 / +12 volt PS, you will need the following combinations:

GREEN / BLACK	Power on Switch (Use a SPST switch; a momentary switch will not work)
RED / BLACK	Pre-Load Resistor (See text for recommended values and a possible substitution)
YELLOW / BLACK	+12 volt source
RED / BLACK	+5 volt source
ORANGE / BROWN	See the Design Guide Update

I use a single common post (GND -- black) for all voltage sources. Our loads are light and we don't require separate grounds for each.

Leave 3 black wires -- switch, load resistor and common (GND) binding post

Leave 2 red wires -- 5 volt binding post and load resistor

Leave 1 yellow wire -- 12 volt binding post

Leave the green wire -- power on switch

If sense wires are present, refer to the Design Guide Update

If you expect to place high current demands on your powersupply, it may be prudent to run two wires to each binding post -- while it is very unlikely that the 18 AWG wire will overheat, there have been some instances of melted wires and connectors occurring on high demand motherboards.

Cut everything else off even with the board or bundle together as noted above. I usually cut the power harnesses so I can keep as much together as possible. The wires remaining in the power supply should be left long and cut to length as needed. If you leave them too long, they will get in the way when boxing it up, especially if the fan is internal rather than external. Be sure that they stay out of the way of the fan blades.

Wire in your power switch between the green (PS_ON) rail and any DC ground (black). The switch (single pole, single throw) and binding posts can be found at local electronics supply houses or online. If your powersupply has a master switch, usually located near the AC plug, you may simply solder the green PS_ON directly to DC ground and use the master switch to power up. This works just as well and will save you the expense of a switch and time needed to install it.

Install the 10 ohm 10 watt pre-load resistor between DC ground and the +5V rail (red). Don't forget to heatsink this resistor.

Attach your other rails, DC ground, +12v, and +5v if used, to the appropriate binding posts. These posts **must not be grounded** to the powersupply case, so be sure to check for any continuity between the case and post before trying to powerup the supply.

If you want to add a power on indicator light, now's the time to do it. LEDs are quite inexpensive, have incredibly long lifetimes if run at 20 ma or less, produce essentially no heat and can be wired to the +5v rail. However, LEDs are current driven devices and will require a dropping resistor to ensure that it does not burn out immediately. A 1/4 watt carbon film resistor rated at 180 to 220 ohms wired between either of the leads and the PSU will work nicely. LEDs, being a diode, are also polarized and must be wired with the positive lead (anode) attached to +5v rail and the negative

lead (cathode) attached to DC ground. LEDs have a flat molded into one side of the base --- this flat will be on the same side as the cathode. If your LED is new and has not had the leads shortened, the longest leg will be the positive lead or anode, but locating the flat is the safest means of determining polarity. Although commercial mounting clips are available, a 3/16" ID rubber grommet works out just as well. Drill your case to accept the grommet, pop it into place and push the LED in until the base bottoms out against the grommet. It will protrude about 1/8" for good visibility. I prefer diffuse lens to clear since they show up better when viewed from the side, but either lens style will add a little DIY pizzazz.

When reassembling the case, be sure to reattach the fan -- some supplies will not function without the fan attached - in any event, you need the cooling. This PS in the pictures has the fan mounted on rubber shock mounts and is extremely quiet. I will also disassemble the fan and lube the bearings while I have the PS open. Since these are salvaged, the fans have been in use for some time and normally the bearings are dry -- I use a high grade sewing machine oil from SINGER. Any light oil will work, just don't use WD40 --

As an aside, you can get 7 volts from the +5 V and +12 V outputs -- the +5 V is considered the negative (GND) and +12 the positive -- some geeks will use this combination to run their fans at a lower speed to reduce noise.

I've followed all the instructions, but the output voltage on the +12 V side is still low -- what can I do?? Many of the R/C folks are converting power supplies for the purpose of driving field chargers and are finding that voltage levels below 12 volts are sometimes insufficient to power their chargers. Read these **TIPS** for some options that may help increase this voltage level, provide a little theory, identify the connector pinouts found on most PC supplies and give a few troubleshooting hints.

Is there any way I can get more amperage out of my converted PSU?

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Improvements in battery technology, brushless motors and more robust speed controllers have allowed "electrics" to expand into model sizes that were once the province of nitro and gas engines only. Obviously, as the motors became more powerful, the batteries required to drive these motors also increased in capacity, measured by the amperage they are able to supply to the flight system. To realize a reasonable charge time, modern battery chargers must be able to deliver more current to these batteries than ever before. In the electronics environment, as in all other closed systems, there ain't no free lunch. Consequently, the chargers also need a higher amperage power source than previously required. Converted PC power supplies may be stretched to the limit by these demands for more current. Is there anything that can be done to squeeze more amps from one of these PSU's?

There may be a possible fix to this problem, but your PSU must be one of the newer ATX12V models for you to be able to apply the modification. Visit **this page** to see if a solution is available for your conversion.

Resistor Substitute

A viable alternative to using a power resistor is to substitute an 1157 automotive signal lamp in its place. This is a dual filament lamp and its load, with both filaments powered, is usually sufficient to maintain Latch_On and to raise the voltage on the 12v rail to an appropriate level for most needs. Your options are to solder a 5v line (red) to both positive pins on the lamp and ground the base to DC ground or to pick up a twist-lock socket when you buy the lamp. The advantage of using a socket is the ease of replacement should the lamp fail. If you don't feel comfortable with your soldering skills, it is also a little easier to work with the wiring on the socket rather than the pins on the lamp. Just remember that the socket housing is the ground and the two wires in the base are to be attached to the 5v rail. More importantly, you must be very careful that neither the bulb base nor socket housing touch any of the internal components in the power supply. These lamps may be purchased at any automotive supply store and most Walmarts.

I prefer the use of resistors since the final converted product is wholly self-contained and I have more control over the applied load, but the use of a lamp does simplify finding and installing components. It also makes a very obvious Power_On indicator!

I usually deal with on-line suppliers such as Jameco, Digikey, Mouser, etc. because we are buying in larger quantities and Radio Shack is too expensive for large numbers of items. However, you should be able to convert your PC supply for $5.00 or $6.00 dollars -- less if you have a junk box of parts. I suppose you could add an LED indicator with a 220 ohm dropping resistor to the 5v rail to show the PS is turned on, but the fan is a pretty good hint. We have had supplies running 24/7 for months without problems -- just electricity consumption.

The PS has some fairly hefty electrolytic capacitors and can still give a bit of a shock immediately after being unplugged -- let it sit a couple of minutes before poking around inside. Obviously, you can get whacked if you are inside the case with it still plugged in -- probably won't kill you, but you WILL turn it loose (never mind how I discovered this bit of information).

If you have any questions, comments or corrections, feel free to mail me.

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