

ATX BENCH SUPPLY

This is a great way to get a cheap lab power supply, and serves as an introductory project in electronics. It was actually my very first successful electronics project. Computer PSU's supply a good range of low voltages, which is useful for all sorts of smaller electronics projects. Your garden variety ATX supply has a +5, +12, +3.3, -5 and -12 volt rails. The positive 5 and 12V rails can supply enough amps to power projects consuming hundreds of watts, while the other rails are rated for just one amp or so. The negative rails have actually been regulated by 7905 and 7912 ICs in many of the supplies I've disassembled.

However these PSU's won't function outside of a computer without some hacking first. Most of what's written here applies for AT supplies too.



Finished supply, with indicator LED.

First you have to know which voltage is on which line. Typical wiring configurations for AT and ATX PSU's are shown below.

AT Power Supply Pin out

Pin	Name	Color	Description
1	PG	Orange	Power Good, +5 VDC when all voltages has stabilized.
2	+5V	Red	+5 VDC (or n/c)
3	+12V	Yellow	+12 VDC
4	-12V	Blue	-12 VDC
5	GND	Black	Ground
6	GND	Black	Ground

ATX Power Supply Pin out

Pin	Name	Color	Description
1	3.3V	Orange	+3.3 VDC
2	3.3V	Orange	+3.3 VDC
3	COM	Black	Ground
4	5V	Red	+5 VDC
5	COM	Black	Ground
6	5V	Red	+5 VDC
7	COM	Black	Ground
8	PWR_OK	Gray	Power Ok (+5V & +3.3V is ok)
9	5VSB	Purple	+5 VDC Standby Voltage (max 10mA)
10	12V	Yellow	+12 VDC
11	3.3V	Orange	+3.3 VDC
12	-12V	Blue	-12 VDC
13	COM	Black	Ground
14	/PS_ON	Green	Power Supply On (active low)
15	COM	Black	Ground
16	COM	Black	Ground

17	COM	Black	Ground
18	-5V	White	-5 VDC
19	5V	Red	+5 VDC
20	5V	Red	+5 VDC

In the best of cases shorting the green "Power Supply On" wire to ground will be enough to turn on the PSU. To run outside of a computer most ATX PSU's require a minimum load. A power resistor between +5v and ground or +12V and ground is used. One 2.7Ω 10W for the 5V line or 10Ω 15W for the 12V line will work with most PSU's. In some cases Power OK must be shorted to ground to make the PSU run. Putting a LED on Power Ok will solve this and indicate when the PSU is on. A reader has informed me that the new 24-pin ATX supplies have a sense wire which must be connected to the +3.3V rail. This sense wire is usually brown. These are usually the only steps it takes to start a PSU.

If all is good you should be getting 12V on the yellow wires and 5V on the red wires, give or take 0,5V. If the voltages are a little low the minimum loads might need to be increased, which is to say the load needs lower resistance.



Minimum load installed close to fan.

Variable Voltage?

Converting an ATX supply for variable voltage is surprisingly simple, and only takes one potentiometer. The PSU's I've hacked used a KA7500B for PWM, but the TL494, HA17339, KIA494, KA7500, IR3M02, and MB3759 are drop in equivalents of the KA7500B, so if your PSU uses one of these you are in luck.

To regulate the voltage down:

Find the resistor which goes from pin 14 on the PWM IC to pin 2. Now simply place a 10K potentiometer in series with this resistor and pin 14. What this does is mess with the regulating reference. Pin 14 is the internal regulated +5V from the IC. The resistor we put a potentiometer in series with is part of a voltage divider, which supplies ~2.5V originally. Turning the pot decreases this voltage and the PWM IC thinks the output voltage is increasing, so it compensates by reducing the duty cycle. Reduced duty cycle means less power and less voltage. Regulating the voltage down can be done without modifying other components.

To regulate the voltage up:

If you want the PSU to live for long you'll need to replace the rectifiers and capacitors. The absolute maximum voltage I've experienced was 25V, so 30V capacitors and rectifiers will do. Of course this voltage may have been limited by the capacitors/rectifiers shorting on me!



50.8 volts from the +12V and -12V rails combined.

First find pin 1 on the PWM IC. Then trace back along the circuit trace until you find 2 or 3 resistors. These resistors should be connected to one or both of the power lines (+12V and +5V) and ground. If shorting these resistors trips the short-circuit protection you have most likely found the right ones. What the resistors do is act as a voltage divider, developing ~2.5V typically at pin 1. The reference voltage can be checked on pin 2 while the PSU is running. Unsolder one end of both resistors at the pin 1 end, and solder the ends together outside of the circuit. Now solder a potentiometer in series with the resistor pair and pin 1, completing the circuit once again. The potentiometer should be about twice as large as the resistors. 10-20K for the potentiometer will often work fine. Turn the pot to 0 ohms before you turn on the PSU, that way the mod hasn't been "enabled" yet and everything should work as normal. This modification works much like the previous one. The resistors we put a potentiometer in series with form a voltage divider, which feeds 2.5V to pin 1. Their voltage source is the output voltage, which under load will sink.

A lower voltage on pin 1 means longer duty cycle and more power. Turning the potentiometer reduces the voltage at pin 1 and the PSU thinks the output voltage has dropped, and thereby increases the duty cycle to compensate.

Once the potentiometer is installed turn on the PSU, and slowly turn the potentiometer while measuring voltage. The PSU should short. But before it can do that the voltage should have increased. If you measured a higher voltage on the +12V or +5V rail before the short you have the right resistors, if not solder them back in place and keep looking. In my experience the PSU will short at 13-14V. The next paragraph has info on how to disable the overvoltage shutdown.

If you need a circuit diagram to follow things better, this one is similar to almost every PSU I've come across. The feedback resistors are R25 and R26 in the following schematic, the ground resistor is R20 and 21 in parallel.

Disabling overvoltage shutdown:

Now you might have noticed the PSU shorted at a mere 14v or so. This is because the overvoltage protection kicks in. Overvoltage protection works by setting pin 4 high, which sets maximum deadtime. A transistor is often used to change the signal level, and disabling it will prevent the overvoltage/short-circuit protection from kicking in. Find pin 4 on the PWM IC, and trace back from it to the first transistor you find. To see if it's the right one short the collector and emitter together. If this shorts the PSU it's the right transistor.

Unsolder the transistor and remove it from the circuit. Alternatively you could just wire a direct connection from pin 4 to ground ensuring that it remains low.

Source: <http://uzzors2k.4hv.org/index.php?page=atxbenchsupply>