

How To Build A "Simple Switcher" Power Supply

Does this look familiar?

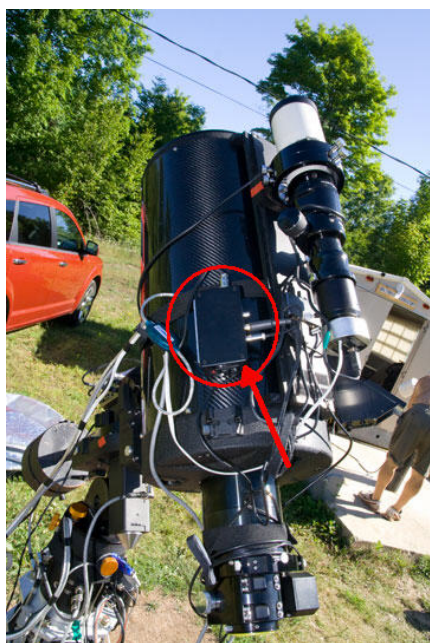
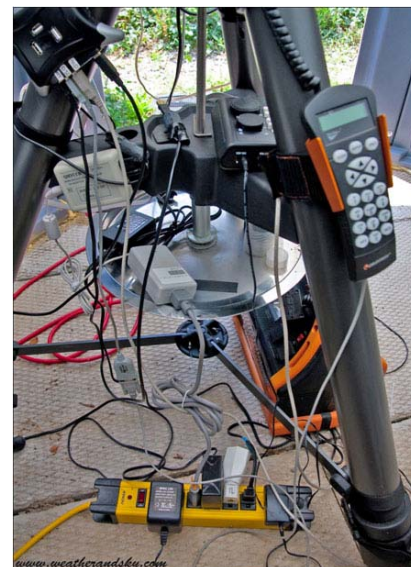
Every piece of electronic astronomy gear you own uses DC power. Yet, in this photo there are numerous AC Adapters that output DC in several common voltages:

- 12V/18V/48V for mounts
- 8V/12V for DSLR and CCD cameras
- 5V/9V/12V for motorised focusers
- 5V for USB Hub (it really does need to be powered)
- 12V Dew Heater Controller

The most important items need to move when the scope moves.

Why not....

- Run everything from DC power to begin with?
- Build a "Simple Switcher" Power Supply:
 - o Small & light weight that mounts on the telescope
 - o A single 12V power cord
 - o Outputs
 - 5V for USB Hub
 - 8V for Canon DSLR
 - 12V for Motorized Focuser or CCD Camera
- A single cord (12V) takes the place of 3 cords
- Inexpensive (\$30 - \$40) including plastic box, switch, fuse, connectors
- Use LM78xx power supplies (approx. \$ 1.50)
- Parts stocked by most electronic parts stores
- Easy to build



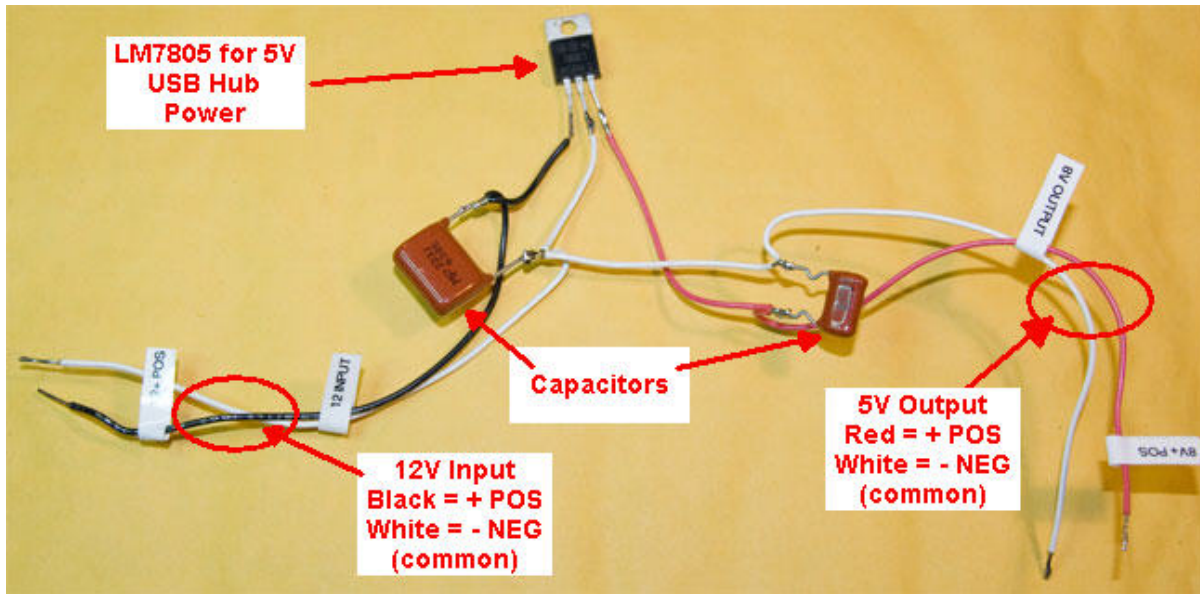
Why is a “Simple Switcher” so simple?

A single component does everything. It will accept DC input voltage of 5V to 18V and output a regulated fixed voltage. You simply buy the version that gives you the desired output:

- LM7805 = 5V
- LM7808 = 8V
- LM7809 = 9V

The LM78xx component is fairly old technology but it’s cheap, simple, and... **it works!** There are newer, more efficient components (no heat) but they are difficult to obtain.

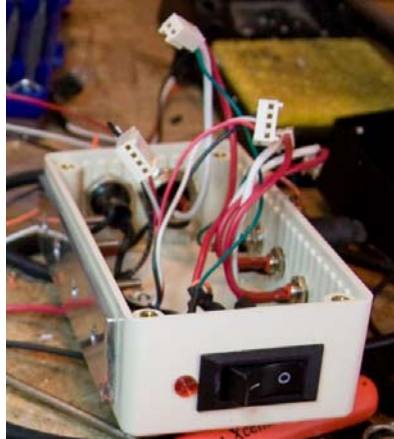
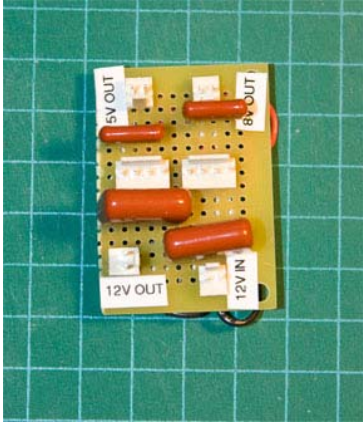
The only downside to the LM78xx component is that the by-product of voltage reduction is heat and as such, a heat sink is mandatory. It is recommended that you add a capacitor to input and output which helps to smooth out voltage spikes. Below is what the entire circuit looks like:



If a single voltage is all you want, then the above photo would just need a small box to house the circuit, a heat sink, and a way to connect incoming and outgoing power. However, I wanted to have 3 different output voltages and the following instructions will show you how to do that.

Let's Build A Power Supply!

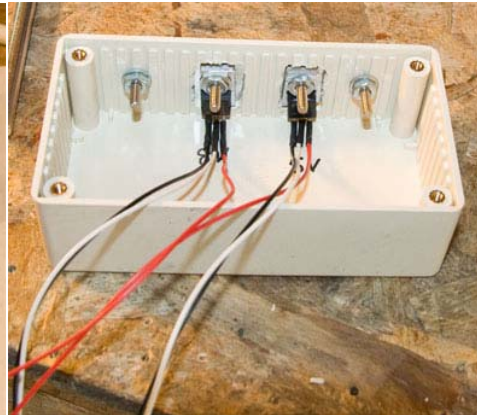
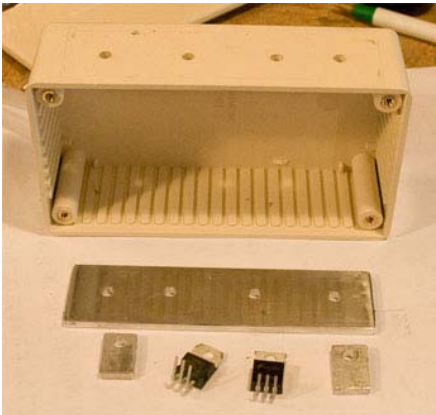
Stuffing all the components, wires, and connectors into a small box is the hard part. Because the LM78xx chips need to be mounted to a heat sink, I found it easier mount some components onto a piece of circuit board (bread-board) and use "molex style header connectors" and to connect various components. The male headers solder to the circuit board and the female plugs connect the components to the board. The female plugs use "crimp-on pins" and insert into the female plugs.



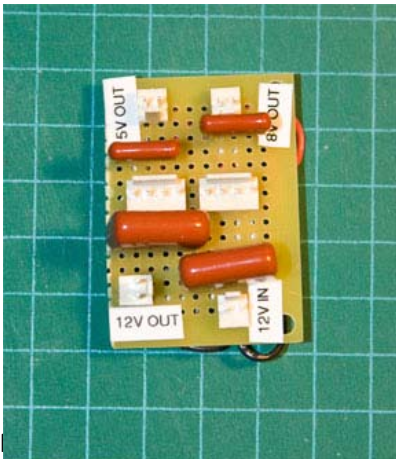
My design uses :

- A simple master power switch
- LED light (optional) – indicates switch is ON
- Master fuse (10 Amp fuse)

For the heat-sink I used pieces of 1/8" X 1" aluminum. The large piece is placed on the outside of the plastic box. Then I cut 2 pieces of aluminum "spacers" and then cut holes in the plastic box using a dremmel tool. A #6 machine screw nut is used to fasten the LM78xx component spacer to the larger piece of aluminum (radiator if you will). The spacer does a nice job of conducting heat through to the "radiator".



This is how the circuit board is wired:



The circuit board contains only "headers" and capacitors.

The headers are just an easy way to connect wires coming from:

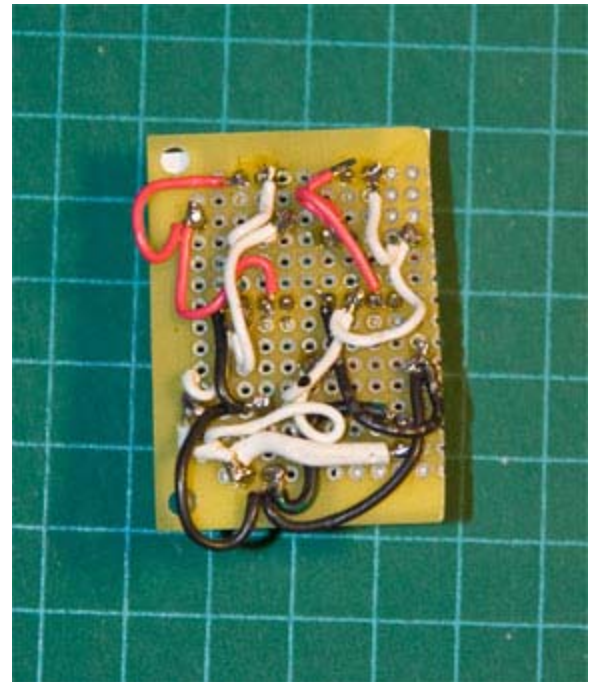
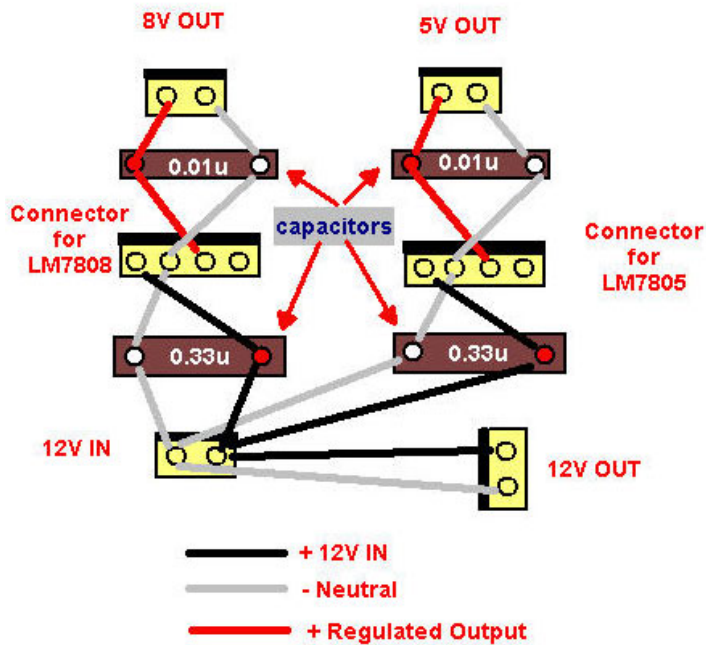
- 12V Input
- LM78xx component:
 - o 12V Input
 - o Neutral
 - o Regulated Output
- Output Voltage
- Since a 12V output is also used, the board also has a header that connects to RCA

Note: Headers only come in even number of pins (2/4/6 etc). A 4-pin is used but only 3 are connected to anything

by Gary Bennett for Starfest 2011

It's not pretty, but it works!

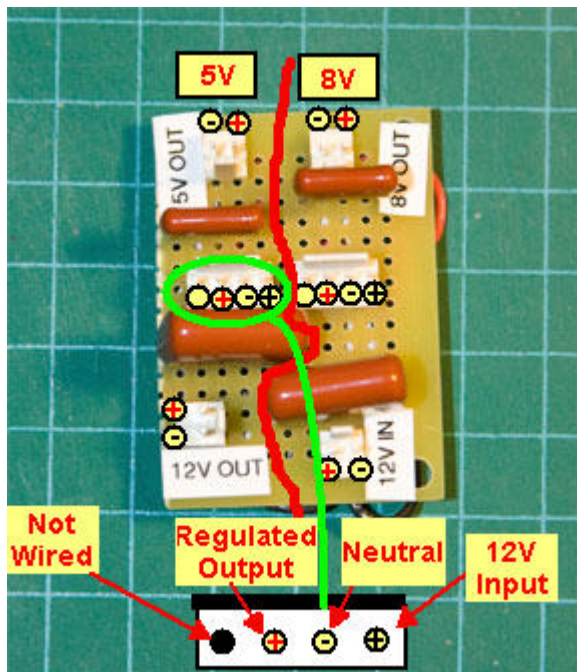
The diagram AND photo view is the back inside of the board.



Circuit Board Diagram

NOTE: This view is the BACK of the board which is opposite (mirror) to the front

Front View



Chassis Connectors, Switches, Fuse

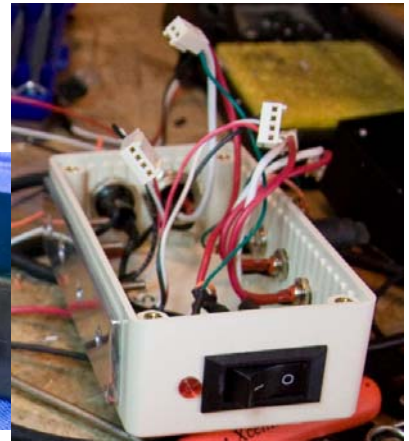
I haven't attempted to show mounting location of exterior components. The size of the plastic box, type of connectors (plugs), switches, and fuse will determine the best place to locate those items. It's more of a personal taste.

Hints and Tips:

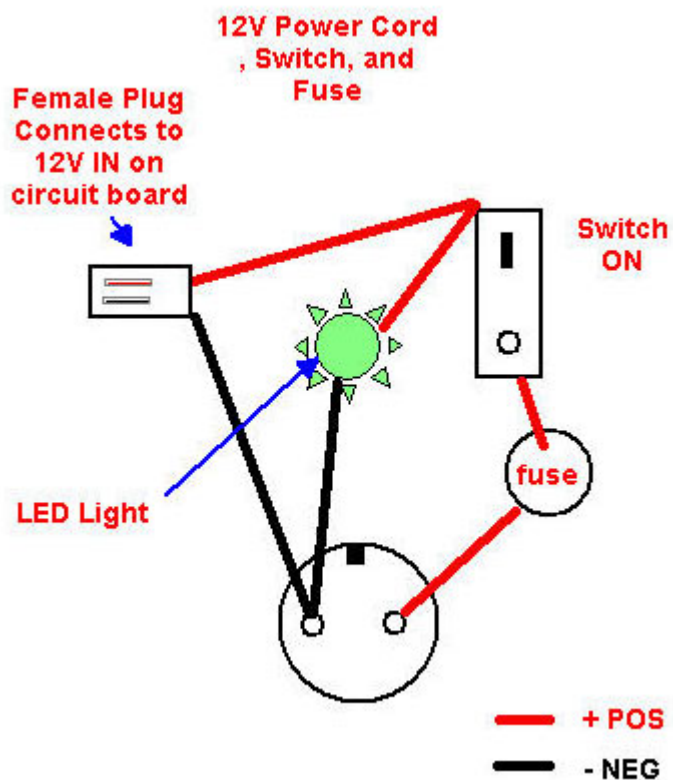
- All "bayonet" style plugs are "Tip Positive" and the outside shell is - Neutral (negative)



Tip Positive means that the center of the female chassis connector is + Positive



Switch, Plug, LED Light



Output Connections

Use the same 2-pin Female plugs to connect to the RCA Chassis Connectors

Where to buy components:

- A1 Electronics in Etobicoke will sell everything except the "Molex Style" header/plugs
- Sayal Electronics (several locations) sells the headers/plugs