Adjustable DC Step Down Source

(12/24/2016)

This report describes how to make a universal, highly efficient, light weight, adjustable voltage, step-down DC to DC power supply or battery charger for survival use. 15 circuits found on eBay were tested for stability and power usage efficiently in the range of cost $0.75 to $8.00. The 12th one was found to be more efficient than all the rest. It was also one of the cheaper ones, at less than $1.00 per unit. This write up shows how to put together this light weight unit for survival use. It is light enough to carry in a back pack. It will run off any source of DC of less than 24 volts. It will charge smaller cells such as AA, AAA cells for flash lights, head lamps, charge a USB device or can produce survival light.

Parts used in this unit:

Voltage adjust resistor = 25 turn 100k ohm pot to replace the pot in the circuit board
D1 = 1N5820 Schottky diode 3A 20V for output back flow protection
D2 = 1N5408 3A 1000V for input protection
Polly Fuse = .9A 30V found on eBay used to limit the current during a short circuit condition.
R2 = 51k ohm resistor for LED to just glow enough to act as on indicator.
LED = 5mm white light supper bright 20ma max
No-12 Circuit from eBay = description: “Mini 3A DC-DC Converter Adjustable Step down Power Supply Module LM2596”
Switch = DC 30V 1A mini torch push button switch.
Box- white plastic box = ebay description -- Plastic Electronics Project Box Enclosure Case DIY 3.34"L x 1.96"W x 0.83"H
4ft of 18 gauge lamp cord for input. Less gauge or length if needs to be lighter in weight.
8” of 20 gauge red and black silicon flexible wire.
45mm alligator clips red and black for input
35mm alligator clips red and black for output

What it looks like:

Input 11 to 24 Volts DC is on the left and the adjusted lower DC output is on the right. This unit converts input to AC then steps it down in voltage and rectifies it. It has a measured efficiency of about 80% to 90%. When conserving input power is needed this approach is much better than using a resistor or wall warts to adjust the voltage and current flow.

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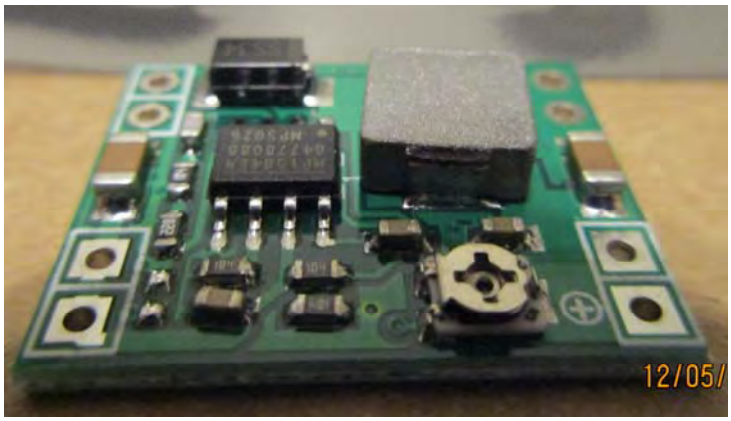
Construction Notes

The only tricky part is removing the old single turn pot and replacing it with a 25 turn 100k ohm. The old one can be removed if one uses a sharp pock knife and gently uniformly pry on the exposed edges.



I found about one out 5 to 10 are not successful and tear the plating off the circuit board. If you are good at unsoldering the old component then use that approach.

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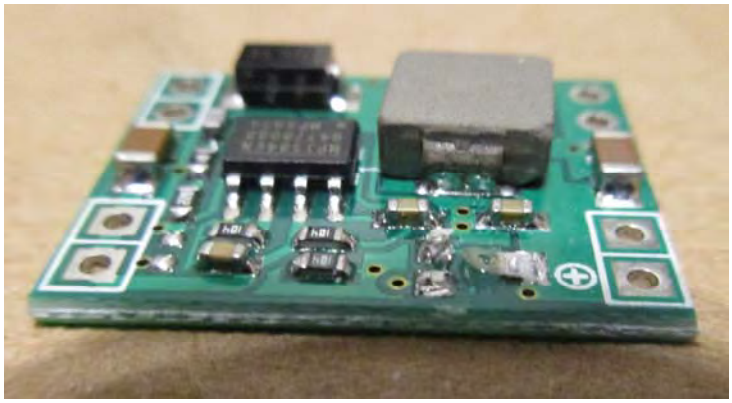
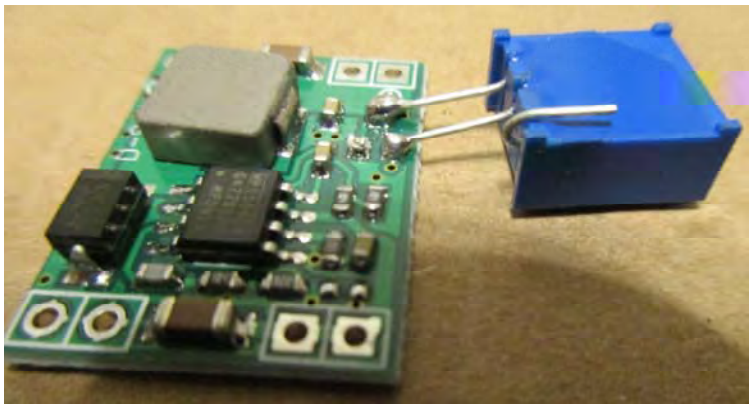
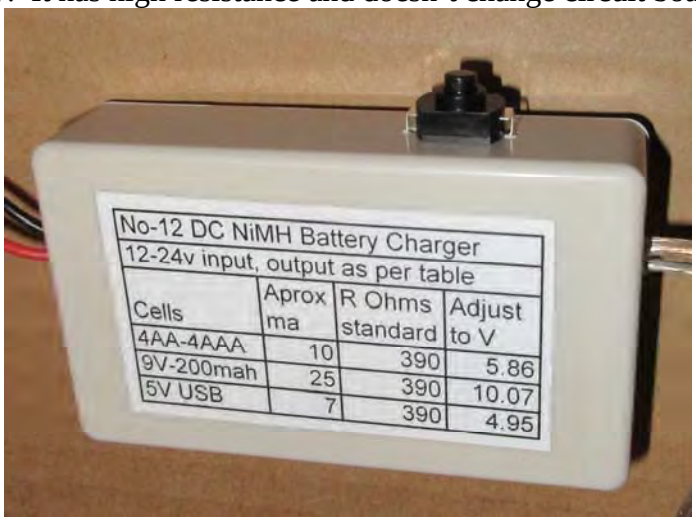


The adjustment screw for the blue 25 turn 100k ohm pot is on the top and is close to the far end in the picture below.



After soldering then bend the pot to be upright. Type 1 Silicon rubber can be used to seal the board against humidity. It has high resistance and doesn't change circuit board values.



Adjust the voltage according to the table shown above. 5.86 volts or for 4AA-4AAA cells is the proper voltage for driving the two 3 watt white LEDs at about 1.1 watt. See below. The unit can be used as a USB charger (if adjusted for 4.95v) or for changing 9V NiMH or for charging 4AA or 4AAA cells or running two 3Watt LEDs in series. Put the test 390 ohm resistor across the leads as a load when adjusting the voltage.

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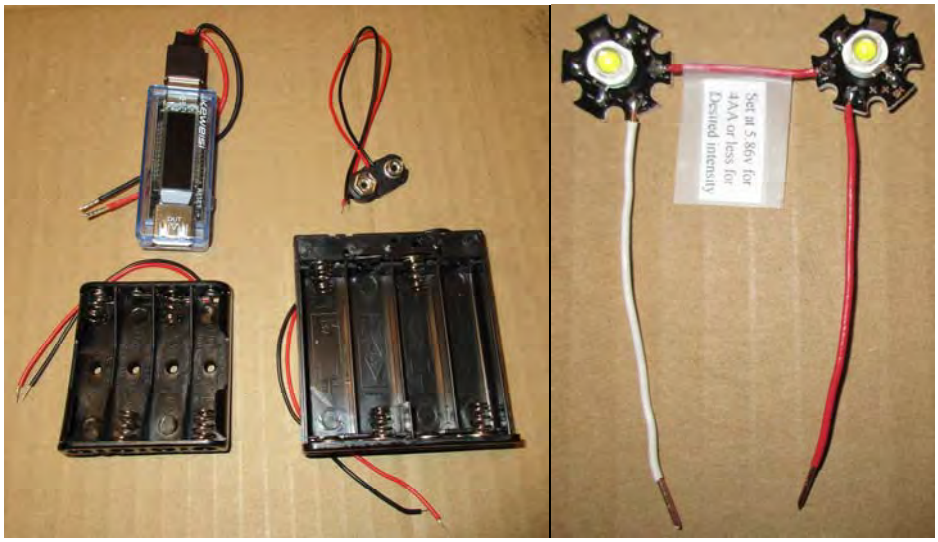
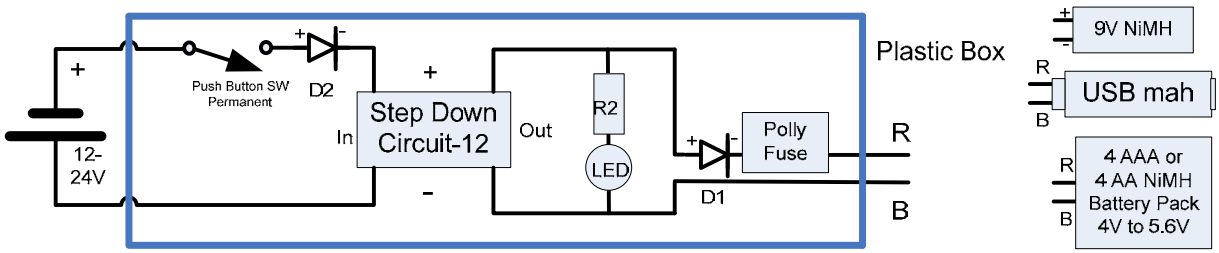


This USB mah volt meter shown on upper left above is found on eBay by searching for “USB Charger Doctor”. This unit can be used to measure and adjust the voltage between 3-7 volts (limited range), only if one pre-checks the accuracy of the voltage measurements with a good reference DC volt meter. The LEDs are cool white 3 Watt beads 280LM from ebay, found to be the most efficient at light production. At 4AA or 5.85 volts they use .19 amp or a power of 1.1 watt. This is an efficient range of use of power to convert to light. Also one can turn down the amount of light by lowering the voltage of the supply. Thus one can produce light on as small amount of power as is needed.

Circuit:



DC to DC Universal Adjustable Charging No-12 Circuit

Labels for the unit:

Front side:

High Efficiency DC to DC step down No-12 charger

Input: 11-24VDC
Red +, Black -;
Reverse hookup
protection

Output: DC
Adjustable,
table on back;
Back flow and
short circuit
protection

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Back side:

No-12 DC NiMH Battery Charger			
12-24v input, output as per table			
Cells	Aprox ma	R Ohms standard	Adjust to V
4AA-4AAA	10	390	5.86
9V-200mah	25	390	10.07
5V USB	7	390	4.95

Notes on its use:

Normal use is to adjust the voltage with a 390 ohm resistor across the circuit to what is given in the table above. Charging 4AA or 4AAA cells takes over night to 24hrs get to the float voltage of a full charge. The cells can be left on charge for days without harming the NiMH cells. In a survival situation you may want to quick charge for about 4-8 hrs before reusing. The output voltage can be adjusted to anything less than input voltage by about 2.3 volts. Then the unit will hold stably this output voltage until the input voltage drops below 2.3 volts of intended output voltage. When adjusting to 10.07 volts output (charging a 9v NiMH) one needs to have a minimum of 12.4 volts input.

When short circuited or drawing high currents, the Polly fuse will trigger at about 1.2-1.8 amp and limit the flow to about .09-.12 amp. Minimum voltage the output can be adjusted to is about 0.8 V. Single to multi cells NiMH can be recharged if needed by using approximately 1.46 V per cell for NiMH cells. Rechargeable Lithium, NiCD, NiZN, and other batteries can be charged using this charger as long as the float voltage is set to be equal to or less than the manufactures recommendation for the battery. The useful current range for this power supply is 0 to about 1.1 amp at adjusted voltage. Repeated slow triggering after the first trigger can be as low as 1.2 amp. See red line below.