

Useful & Simple Supporting Circuits for a Primitive Environment

In a primitive environment having a low priced precision voltage reference can be useful for calibrating voltage sources and meters. A variable regulated voltage source can be very useful for calibrating the turn on and turn off voltages of monitoring circuits. The state of charge for any battery can be estimated if one knows the resting state voltage. The result is only as good as the accuracy of voltage measurements made and depend on the accuracy of ones meters. This is how one can determine the accuracy of ones meters. Every primitive survival technician should have one each of the following circuits.

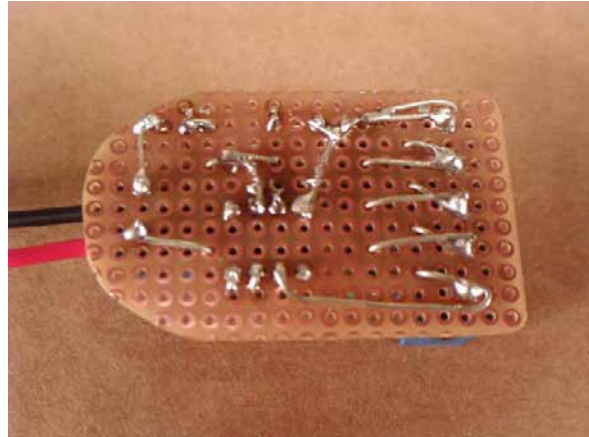
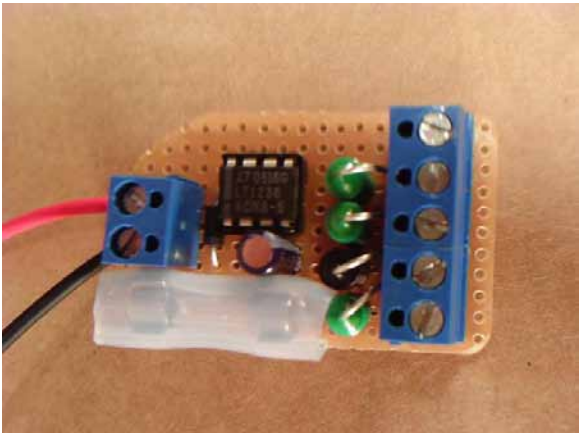
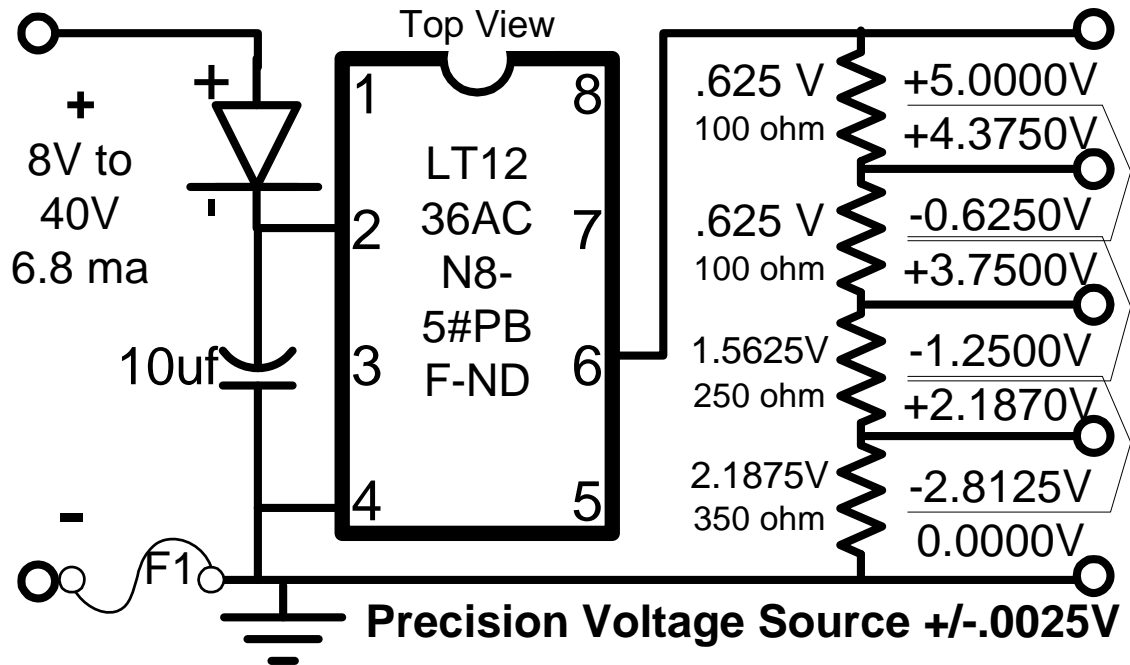
PRECISION VOLTAGE SOURCE

This circuit is capable of providing voltage to within plus or minus .0025 volts over a wide range of temperature and humidity. I tested it down to 15 degree F in my freezer and it still showed the same voltage 5.00 volts on my voltmeter. Condensation formed on the circuit as it warmed up and this did not affect the voltage. This circuit is capable of providing up to 10 ma of current. It can be used to calibrate digital volt meters on several scales. If a calibrated higher voltage is needed then it can be made from using a set of series resistors where the drop across each resistor is near 5 volts. By calibrating one digital meter at 5 volts one can then measure the drop across each of these resistors. The resulting sum of the voltages will be what the higher voltage source is now calibrated to. This can then be used to check higher voltage scales on digital meters. One can bootstrap up or down into any voltage needed.

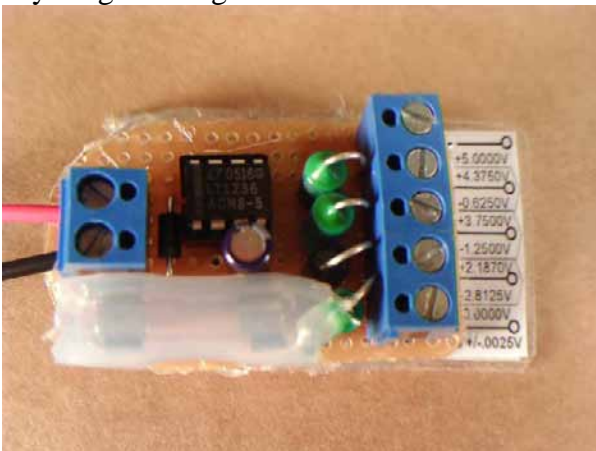
Parts list from Digi-key:

| Quantity | Part Number | Description | Unit Price | Extended Price |
|---|---------------------|---------------------------------|-----------------|----------------|
| | | | USD | USD |
| 1 | LT1236ACN8-5#PBF-ND | IC PREC REF 5V 5PPM/DEGC 8-DIP | 7.75 | \$7.75 |
| 2 | MR102-100-.05-ND | RESISTOR 100 OHM 1/8W .05% WW | 4.83 | \$9.66 |
| 1 | MR102-250-.05-ND | RESISTOR 250 OHM 1/8W .05% WW | 4.83 | \$4.83 |
| 1 | MR102-350-.05-ND | RESISTOR 350 OHM 1/8W .05% WW | 4.83 | \$4.83 |
| 1 | 1N4001FSCT-ND | DIODE GEN PURPOSE 50V 1A DO41 | 0.09 | \$0.09 |
| 2 | WK6242-ND | FUSECLIP 5MM 6.3A PC MNT | 0.14 | \$0.28 |
| 1 | 486-1233-ND | FUSE 500MA 250V 5X20 FAST GLASS | 0.23 | \$0.23 |
| 2 | ED2580-ND | TERM BLOCK 5.08MM VERT 2POS PCB | 0.28 | \$0.56 |
| 1 | ED2581-ND | TERM BLOCK 5.08MM VERT 3POS PCB | 0.42 | \$0.42 |
| 1 | P5178-ND | CAP 10UF 50V ALUM LYTIC RADIAL | 0.15 | \$0.15 |
| http://www.digikey.com/ | | | Subtotal | \$28.80 |

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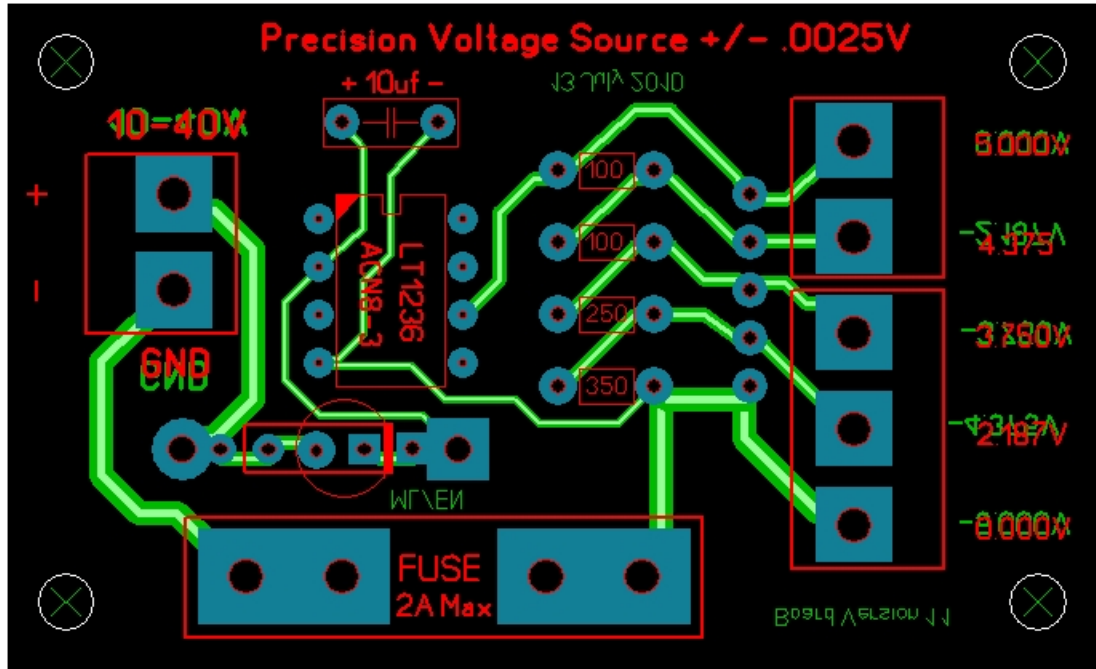


A small left over chunk of PC project board from radio shack was used. Once the circuit was soldered together, then a thermal glue gun was used to seal the bottom of the board from touching anything that might short it out while in use.



Finished usable result.

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PC board layout above is for Precision Voltage Source circuit. An LED can be used in place of the polarity diode. This has the benefit of indicating an ON condition, but at the cost of requiring nearly 10 V as a minimum input to give valid reference voltages.

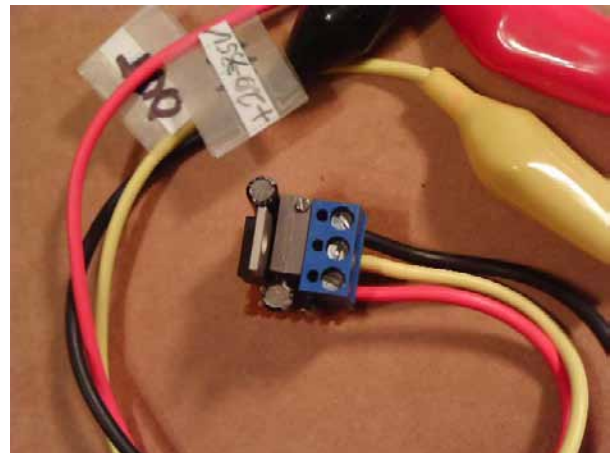
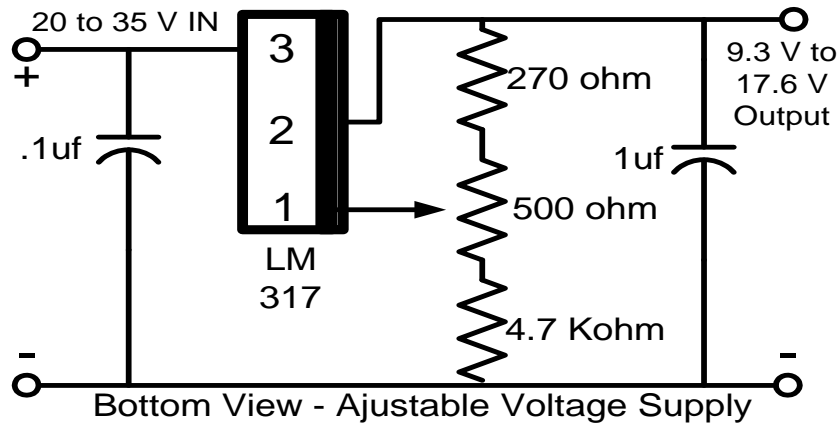
Adjustable regulated voltage source

Can be used to test and set the Battery controller circuit. First calibrate your volt meter for 15 volt range. Put 3 equal sized resistors in series and adjust the output voltage around 15 volts. Measure the voltage of the precision source above on your volt meter. Determine the offset (plus number of digits or minus number of given digits). Next measure the voltage of each of the resistors on the output of the circuit below and add up the result. Now add or subtract three times the digits off that the precision source shows to get the accurate value. Now measure the near 15 volt value and determine the difference between the determined accurate value and what you read. This is the offset calibration that will be used for this scale of the meter and to set the voltage accurately for the battery controller circuit.

All that is needed is two small (low power) 12 volt batteries wired temporary in series to give 24 volts. This used as input the following circuit. The output is adjusted using the 25 turn pot to the desired voltage. This can then be used to adjust the above controllers to turn ON or OFF.

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| Quantity | Part Number | Description | Unit Price | Extended Price |
|--|------------------|---------------------------------|-----------------|----------------|
| | | | USD | USD |
| 1 | LM317TFS-ND | IC REG ADJ 1.5A 3 TERM TO-220 | 0.48 | \$0.48 |
| 1 | CF1/4270JRCT-ND | RES 270 OHM 1/4W 5% CARBON FILM | 0.2 | \$0.20 |
| 1 | CF1/84.7KJRCT-ND | RES 4.7K OHM 1/8W 5% CF AXIAL | 0.09 | \$0.09 |
| 1 | 490-2925-ND | TRIMPOT CERM 500 OHM 25TRN TOP | 0.86 | \$0.86 |
| 2 | P824-ND | 1.0UF 50V MINI ALUM ELECT (KA) | 0.14 | \$0.28 |
| Most can be found at http://www.digikey.com/ | | | Subtotal | \$1.91 |



A small piece of project PC board was used. Notice the adjustment 25 Turn pot in the center.

Note: The circuit above can be used to construct a low voltage between 1.2 and 1.7 volt battery charger given the proper resistance values.