**LM317T 12V Lead-acid charger**

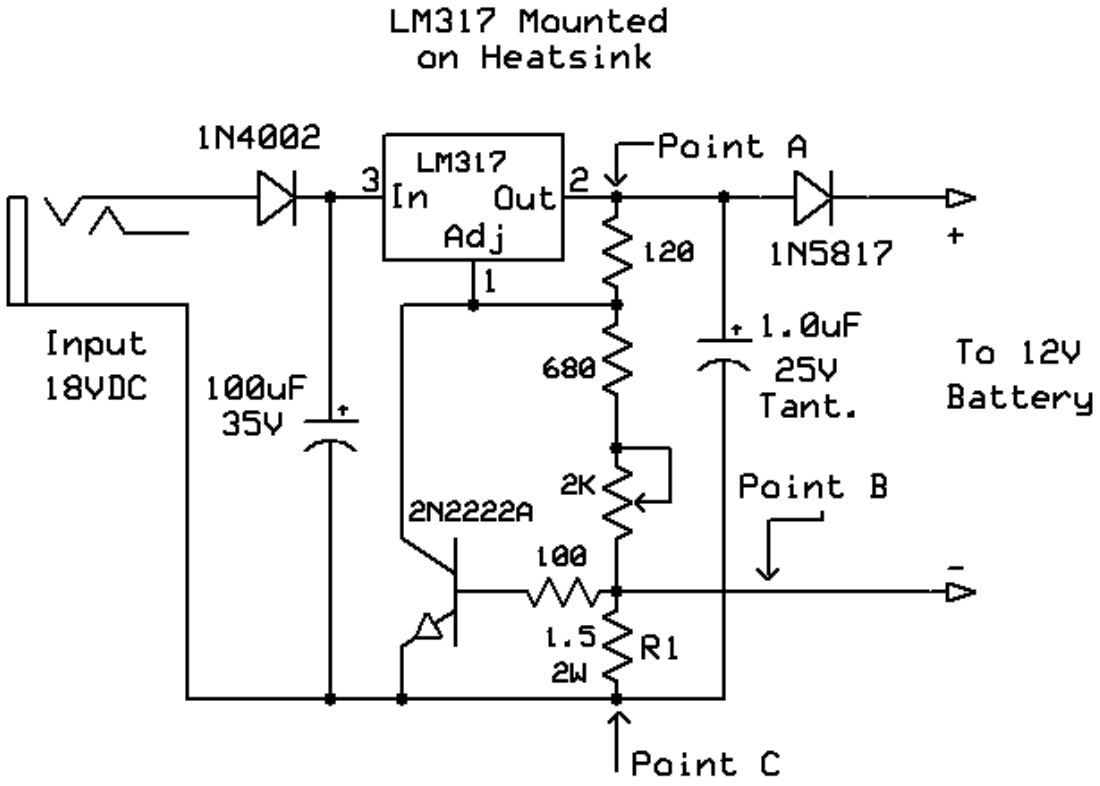
The AC/DC adapter in use is capable of 600mA @ 18V. (I used an Magnetek WDU18-600 adapter) Using parts on hand I chose to limit the charge current to about 450 mA. True the LM317T has built in current limiting, but it exceeds the rating of the AC/DC adapter. This adapter is a Class II transformer and has internal circuit protection, and using this internal protection without external current limiting could cause premature failure of it. For this reason I chose to use current limit in the LM317T circuit. The minimum input voltage for 450mA charging is very close to 17V.

LM317T circuit.R1 is selected to limit the current to a maximum amount and is determined by 0.7/ILimit. In the case of the shown circuit the current limit = 0.7V/1.5 ohms or 0.466A or 466 mA. To change the current limit value, just calculate the value of R1=0.7V/ILimit.

The charge voltage can be adjusted with no load on the charger. With a calibrated DVM connected + lead to point A and - lead connected to point B adjust the 2K potentiometer so the DVM reads 14.0 VDC. This sets the charger to the float or standby method of charging, or 13.7V.

The circuit boards are Radio Shack 276-159B, they come as one unit and can be snapped apart. Looking at the top of the board. The two larger red and black wires go the battery to be charged. The smaller red and black wires to the 2.1mm power jack. The various colored wire jumpers are the same type used on solderless breadboards. The color indicates their length in 0.1's of inches. For example yellow is 0.4" long. The long black one was made out of #22 solid black wire. I used a thermopad when fastening the LM317 to the heatsink, but regular heatsink grease could be used.

## Schematic



**Charge Indicator**

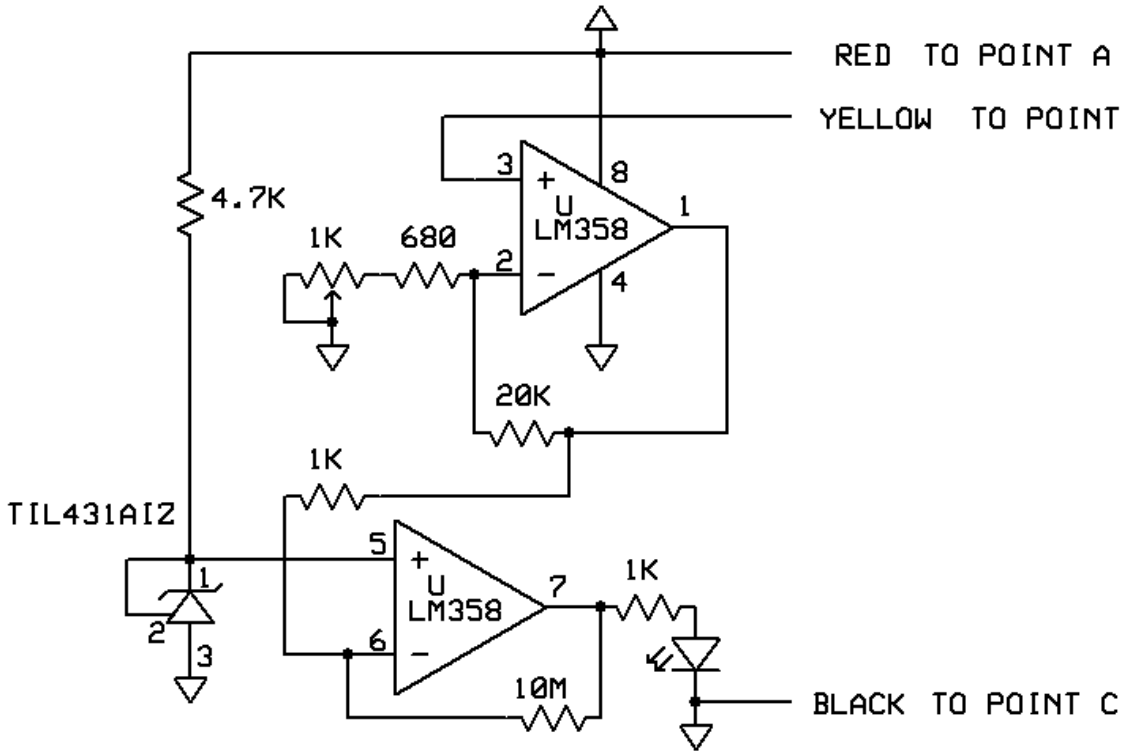
The charge indicator monitors the charge current and when this charge current decreases to the set level the LED is turned on. The colored wires are as follows: Red connected to point A, Yellow connected to point B, and Black connected to point C. All connections are to the charger schematic

IC1 is a voltage comparator that is using the reference voltage from the TL431AIZ precision regulator. The reference voltage is 2.5V @ 1%. This reference voltage is applied to the non inverting input (pin5). The sample voltage from the current limit resistor (R1) is amplified by U2, and is applied to the inverting input (pin 6). When this input voltage decreases to and is = too or less than the reference voltage, the comparator output goes high and turns on the LED thru the current limiting resistor connected to pin 7. This voltage amplifier U2 has a voltage gain = 1+20K/(R2 + R3).

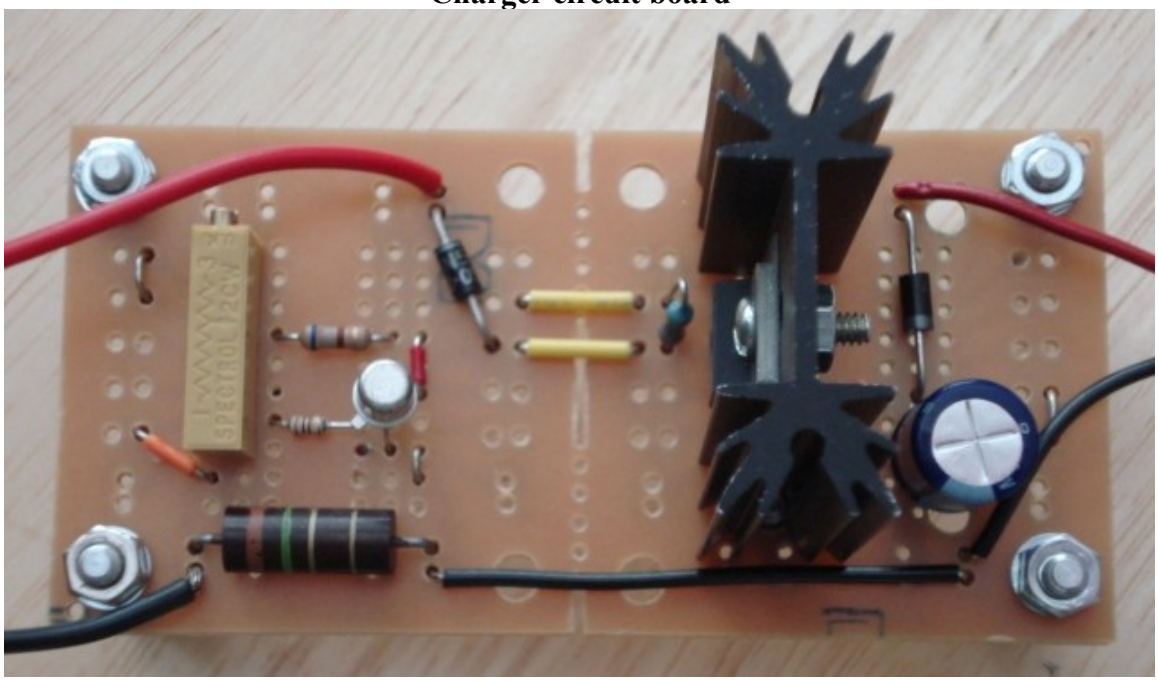
The circuit as shown, when adjusted for a 7AH battery, the LED turns on when the charge current drops to 70mA. (7AH/100). With R1 of 1.5 ohms this voltage is 0.126V. From ohms law E=IR. So E=.070 x 1.5 =0.105V. The gain of U2 then has to be Vref/VR1 for the selected battery. Gain in this case=2.5/.105 = 23.81. To make this adjustment without a battery connected for a 7AH battery, connect a 200 ohm 2W resistor on the output terminals and adjust the 1K potentiometer on indicator board until the LED just comes on. For other size batteries calculate the charge current and value of resistor based on the charge voltage of 13.7 volts.

This circuit is also built on a Radio Shack 276-159B proto board. It also uses some of the preformed breadboard jumpers, the grey and white have been bent to connect some traces. The longer wires on the board are connected to the charger board.

## Schematic



**Charger circuit board**



**Charge indicator circuit board**