Power Transfer/Charger Kit

(Prototype 12/2017)

Summary Description

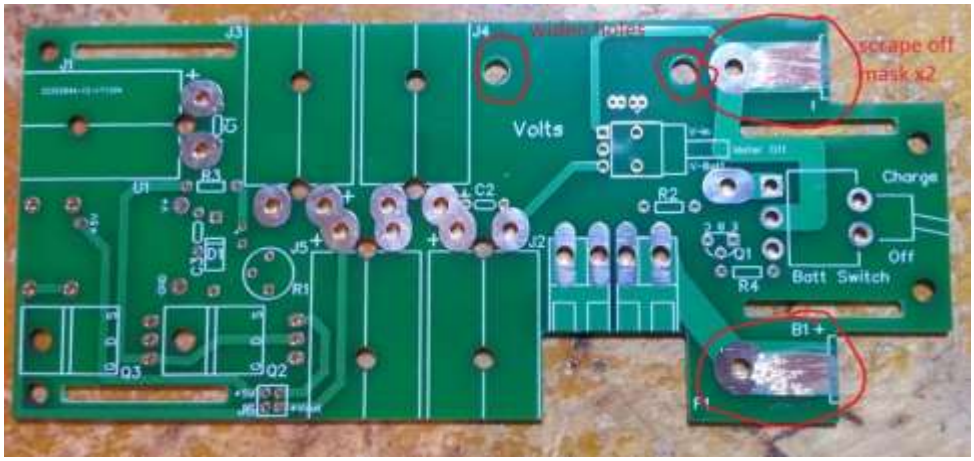
This circuit is designed as a battery transfer and charger circuit that fits on top of a 9Ah SLA (Gel/AGM) lead-acid battery. It will take input from a regulated power supply at 13.8V and distribute it to 4 output connectors (unfused). The board can carry up to 30A for distribution and up to 15A continuous usage from the battery. Power is connected through world-standard Anderson PowerPole connectors. The circuit is designed to connect the battery both when there is power coming in, and charge the battery up to just below the input power voltage. When external power is removed, the battery switches in to the circuit through a very low resistance MOSFET to provide power to the equipment attached to the outputs, without interruption – similar to an online UPS for AC. There is also an adjustable over-voltage cutoff circuit that will disconnect the battery from power in the event external power goes over the set limit, protecting the battery from over-charging. The board has a 2.5A USB Charger module built-in, with access to the +5V supply on an optional header connector. The DVM measures the input/output voltage, or the battery voltage, or can be turned off completely. The battery is switchable so that it can be isolated from the power if desired.

Notes Before you Begin:

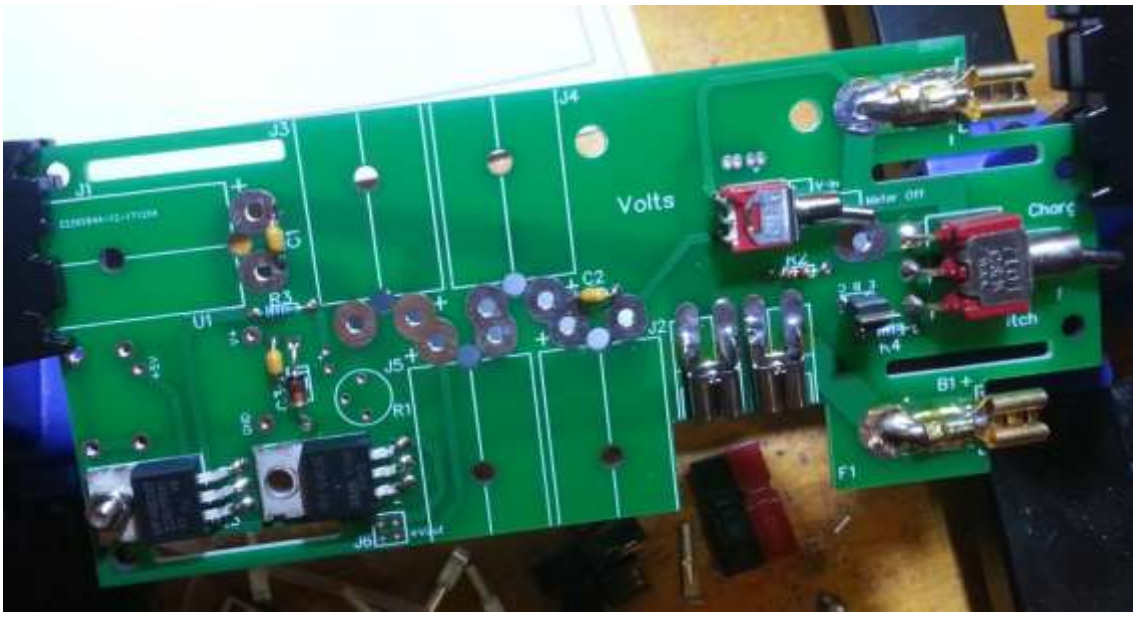
This is a Prototype – not quite a finished and thoroughly tested product. That being said, it should *work*… You've been selected to help find any deficiencies or improvements, so that may require some understanding of the (simple) electronics of the circuit. Please make sure to send all feedback and suggestions to K9JEB@K9JEB.com. Troubleshooting help will be best effort through email.

Assembly Instructions (such as they are)

1. Identify all parts in the kit and where they go on the board. If anything is missing, stop before building and send email.
2. Start with the battery terminals. The solder mask was mistakenly applied on the board over the traces to solder the terminals, so scrape it off gently with a razor blade or knife to get down to the actual copper.



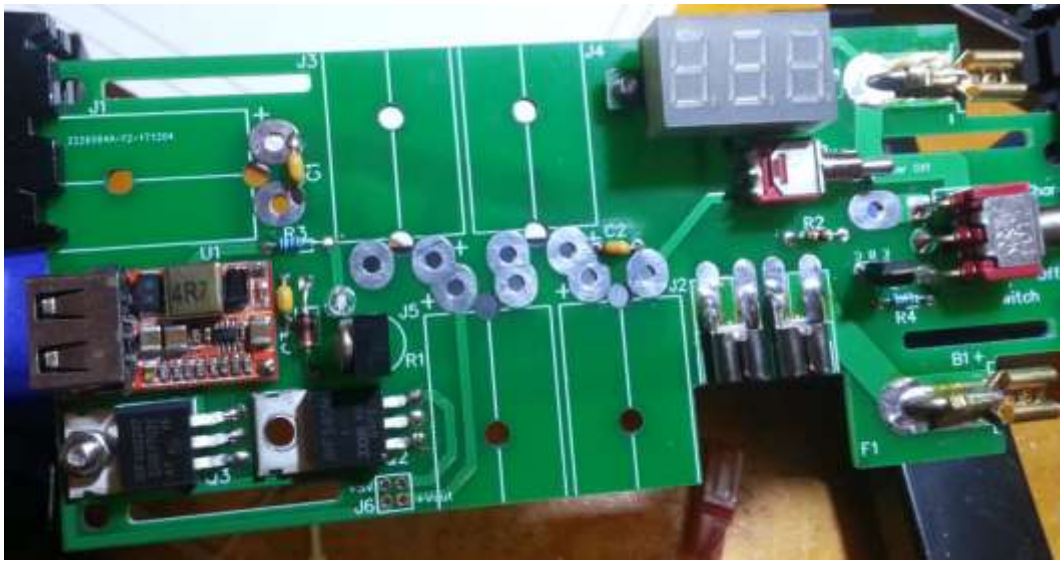
3. Crimp the brass lugs around about ¾” length of copper wire and bend to fit between the battery and your board for first the negative terminal. The wire should come all the way up to where the flat part was curled around to make contact with the battery tabs – almost 3/8”. The lugs are kind of weak, so don’t bend them too much or they’ll break off – and that’s a problem. Solder it in place for the negative terminal, then do the same for the positive terminal. See the pictures.
4. Not all battery contacts are 1.75” centers (as I found out) so your connectors will be placed more or less to fit your battery. There is more than adequate slack on both sides for this.



5. Make sure the lugs line up to the actual battery terminals before soldering in place – it’s hard to unsolder it and move it after the fact. It should be ok to connect them to the actual battery – nothing is on the board yet, and no fuse.
6. Mount and solder in the capacitors, resistors and Zener diode, these are low profile and won’t get in the way of soldering other components.
7. Solder in both switches.
8. Solder in the fuse holders. Place them gently on the fuse and tack solder them in place with the fuse in place, then remove the fuse and finish soldering them fully. Might want to scrape off mask down to copper for the fuse holders also.

9. Solder in Q1, keep it close to the board so it doesn’t stick up and get squished.
10. Solder in Q3 and then Q2 in that order. Make sure that the hole in the board lines up with the transistor before soldering, and for Q3 add thermal grease on the back of the transistor before soldering. Use the M3 screw and nut on Q3 to ensure heat transfer to the board. Q2 does not need a screw or grease.

11. First test, then solder in the LED also about 1/8” off the board. Use low heat as quick as possible as these melt quick. Carefully observe polarity! These are impossible to unsolder and flip.
12. Solder in the U1 USB module using leads clipped from the capacitors vertically through the V+ and GND inputs. Then solder the ground contacts at the edge of the board to hold it in place (they aren’t needed electrically). If you need +5V out on J6, solder in the +5V contact through the plated through hole on the bottom of the board - otherwise you might want to leave it out.
13. Solder in the trimpot. (One shown on board here is not the same as the blue Bourns 3362P in your kit.)
14. Prepare the Digital Voltmeter [DVM] by snipping the black and red wires to about ¼” long and tin them so they will go into the board holes. I use a #6-32 tap to thread the holes in the meter ears, that way I don’t have to find a tiny nut to go on top. The holes in the prototype board don’t quite match the meter ears (or vice versa), so you might want to drill out the hole in the board one side or the other to allow slack for the screws to go in. Use the flat head #6-32 screws to set the meter with the tinned wires in the +/- holes (don’t strip the threads) and solder in place.



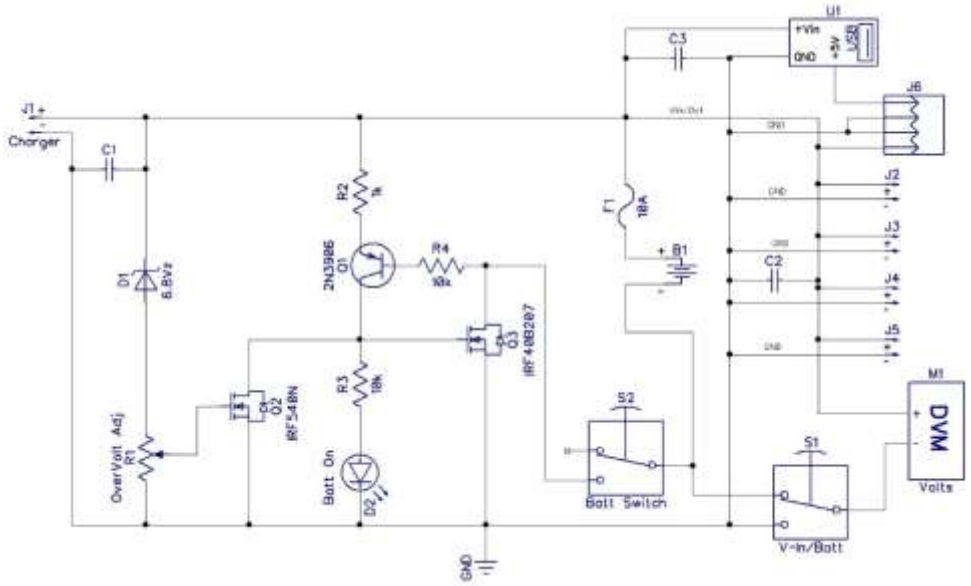
15. Cut about ¾” segments of wire and crimp and solder on each of the PowerPole contact pins.
16. Assemble the PowerPole shells sliding red up into black, with red on right with them pointing Away from you. See pictures if any questions, double check if unsure. Then check again.
17. Insert the contact pins into the PowerPole shells, and bend them with pliers or other tool to fit into the holes on the board, matching the connectors’ hole with the hole in the board. Solder each in place and ty-wrap them in place to secure them to the board if desired.
18. Inspect the board and make sure there are no solder bridges or shorts.

Testing/Adjustment

1. All voltage measurements mentioned are with reference to Ground – the negative (black) side of Vin/out and *NOT* the battery “–“ terminal…
2. Install F1 fuse, use a low amperage one if you have it - 3A or less for testing.
3. If anything goes wrong pull the fuse and/or disconnect it from the battery. But hey – what could go wrong??
4. Switch battery Off with the battery switch.
5. Switch meter to Battery – it doesn’t matter if the battery is on or off.
6. The meters typically read high by 0.1 to 0.2V in the 13V range, and they are not adjustable sorry.
7. Touch board contacts to battery terminals briefly, meter should light up and flash, then read battery voltage.
8. If anything else happens… stop here and use a multimeter to find the problem. Otherwise continue.
9. Switch meter switch to Vin, turn battery on – this will energize the circuits. USB module should come on, and you should see +5V on J6 if you connected that pad.
10. Assuming all looks good, switch meter back to Battery.
11. Turn the trimpot all the way CCW this should set the gate of Q2 to 0V and turn off the OV circuit.

12. Connect a 13.8V power supply to any PowerPole connection, if it's charging you should immediately see the battery voltage start to rise and the green LED should be on.
13. Turn the power supply voltage up to about 14V and adjust R1 CounterClockwise until the LED just goes off indicating the Over-Voltage clamp Q2 has been activated. Now any voltage over 14 should not charge the battery, and adjusting it back down to 13.8 or lower will release the clamp, charge the battery and keep the green LED on.
14. Switch the meter back to Vin and disconnect the external power, the battery should continue to power the meter and anything connected to the PowerPole connectors.
15. Green LED is on whenever the battery is connected to the outputs.

Schematic



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