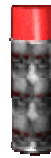# HowlHaunter's Workshop

http://home.comcast.net/~pumpkin1000/props/debug.htm

Simple Electronics Circuit Debug

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You'll find many little hobby circuits out on the Web to use for Halloween props. So, you try to put them together yourself and it just doesn't work. How do you figure out what is wrong? Here's what many years of experience has taught me.

1) Be safe. If you are dealing with any dangerous voltages, you simply must be aware, alert when you are doing debugging...or just don't continue with this hobby. It's one thing to dealing with a simple little LED flasher powered by a 9 Volt battery...and quite another to be dealing with a full 120 VAC powered circuit. See these Safety Guidelines.

2) Say you are putting together a 555 timer controlled circuit that is powered by a 9 volt battery and the thing just isn't working. The LED won't flash, the relay won't click, the speaker won't make a sound.

3) First off, you hopefully have put the circuit together first on a breadboard Make sure you have a good one with good contacts. I had an old one that had flakey connections

and drove me bonkers until I figured this out. I then tossed that one and purchased a new one. Note to self: Don't try to force cram component leads or wire jumpers into a breadboard if they are too big to insert! This will damage your board connectors and cause intermittents. If your circuit is not working, then re-check your schematic. Do all the leads of all the components plugged in match the numbering on your chips? Check to make sure that correct voltages are on each pin with a multimeter (cheap) or oscilloscope (expensive). Do you have all your jumper wires in place correctly? Are they fully plugged into the board? Do you have the polarity right on your diodes, capacitors? Are the values correct on your resistors, capacitors, etc.? Resistor color bands can be tough to read on the small resistors.

4) After your prototyping debug is finished you can move it all over to a perf board. Now, you have to deal with soldering it up correctly. Same thing as before. Check your connections against the schematic, match sure connections that should be touching are soldered together...and those that shouldn't aren't touching!

Here's an example of what a simple 555 timer circuit looks like on a perf board. The solder connections are on the underside of the board. You can see 4 holes drilled in the perf board corners. These are screw holes to allow the board to be put in a project box.

4a) You'll save a lot of time if you have a good soldering workbench with the proper tools. I've arrived at this workbench setup through years of experience. Use the ideas as you like.

5) Minimize your IC chips, transistors, etc. exposure to soldering. Most of these components these days can handle the hot temperatures on their leads, but I like to use chip sockets whenever I can and plug the components in after all soldering is done.

6) If your circuit works intermittently, then you obviously have a bad connection somewhere..re-check all solder joints and connections again. If you can press down around the board and the circuit begins to work...you may have isolated the connection problem.

7) Swap components for similar components. Your LED or speaker to indicate your circuit is working or not...may have died. Simply replace it with another one. Or the battery. You could have zapped one of your ICs and you need to replace it. Or relay. Or capacitor. I've recycled a bunch of parts from old circuit boards that would normally get tossed...and sometimes you get some bad ones. Don't scratch your head trying to figure out why your little 555 blinker circuit won't work...start replacing parts until it does!

8) Simplify and isolate. If one part of your circuit is working fine but other parts aren't, then cut the wires to the bad parts and isolate the problem. You may want to take the components off and back to the breadboard for testing.

9) If any of your components get warm or hot (or heaven forbid smoke), remove the power immediately and go over your schematic and connections once more before

powering on again! You may have replace components after you find your wiring problem.

10) Dirty, greasy connections are the enemy of electronic circuitry. My car remote opener key fob will act up sometimes and the battery in it is just fine. I know what has happened...eventually the normal skin oil from my hands gets on the contacts and causes problems. All I do is open it up, remove the battery, and clean all the contacts with a little rubbing alcohol and cotton swab...put it back to together...and viola!...the thing will open up the car from way across the parking lot again. Ever wonder why your flashlights are dim and the batteries are still fresh? Just rub a bit of steel wool across the end of the bulb and the ends of the batteries...and you'll get a bright light again. Have a TV remote control that works intermittently, but the batteries are fresh? Check the connections where the batteries are placed! Are they dirty or rusty? Even if they look clean, clean them anyway!

11) If your circuit works now, give the board a few light raps on your desktop while it is running. If it can stand this, you should now have a solid circuit. Any circuit that is going to be in an environment that is bumpy and vibrating constantly will have problems with loose connections. Think about this: Mechanical connections..nuts/bolts,etc. that are meant to keep electrical components together get loose. Wires can get frayed and short out with repeated rubbing against metal parts if they aren't properly tied down. Then, suddenly things will just quit and you don't know why. Wonder why old cars.... or cars that have been in accidents have so many goofy problems? Or cars that have been flooded with dirty water? They have a bunch of bad electrical connections. With all the microprocessor chips in cars now, one bad electrical connection to those chips can do all sorts of weird things!