

The Rene R Circuit Battery Charger

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Radiant or High Voltage Pulse Charger

Parts list, and how to do it

(please read through this entire document before you order parts)

Parts needed and where to get:

Radio Shack:

- 1 N20355 Transistor battery -\$2.99
- 3 1N4007 or 1N4005 Diodes -\$1.49 (can use other diodes as long as they have at least a 250v rating but if using a transformer for the bifilar coil, get the higher voltage diodes)
- 1 330 ohm resistor ½ watt- \$1.49
- 1 neon bulb (optional - see note below) RS Model 272-710 \$1.49
- 1 5K Potentiometer -\$3.49 (can use 2K)
- 1 terminal block or strip (8 or 12 pairs) -\$3.49 (or you can just solder parts together but that is going to be a lot of exposed wires/joints -i.e. shorts!)
- total costs at Radio shack is \$14.44 pre-tax
- Digikey.com also has most of these items

To be built or found:

- 1 bifilar coil
 - needs magnetic wire and ferrite core (bar or toroid)
 - Magnetic wire 3 pack bundle at Radio Shack is \$8.99
 - may be found in old PC power supply -see below
 - may use transformer instead - see below
- 1 heat-sink (optional)- see note below

Off Internet:

- 1 24 volt power supply (but see note below on using other power supply)
- off internet - about \$15-18

Wal-mart/Loews/Home Depot

- 2 bolts and 4 nuts (if using heat-sink)
- 1 cheap on-off switch (optional) (simple AC light switch or more expensive toggle or rocker switch in automotive) -\$0.57 to 4.99
- 2 solderless terminals (or electrical tape)

Harbor Freight or other place:

- 1 red wire with alligator clip
- 1 red wire with battery clip
- 1 black wire with alligator clip
- 1 black wire with battery clip
- Voltmeter (or Wal-mart or other discount store) -\$6

We suggest you get a PC power supply from an old computer and tear it apart. You will usually find a bifilar coil already built and a heat sink in it as well as all the colored wire you will need for the build. You may find a spare toroid in it too. Radio Shack (or Digikey.com) will normally have the other components, including magnetic wire to build a bifilar coil and the terminal block (but normally only in a 12 pair size).

If you can't find a ferrite toroid or ferrite bar, just use a nice heavy piece of iron

(check with a magnet to ensure it will attach to the piece, then it's ok to use).

You will also need the following:

Soldering iron and solder

pliers (to tighten nuts and hold wires when soldering)

wires (yellow, blue, red, black, green but if all you have is black or one color, you can still make the charger – just make sure you know which wire is which)

wire stripper

wood board for base

screws

screwdriver(s)

Drill and drill bits

volt-ohm meter

electrical tape

plastic clamps, silicone or other adhesive

Note on transistor:

The 2N3055 has two leads coming out of the bottom. One is the base and the other is the emitter. The entire case is the collector (“C”). To determine which lead is the E (emitter) and which is the B (base), place the transistor on a table with the two leads up. Now look at the middle of the transistor (an imaginary line dividing the transistor in half) and turn the transistor so that the leads are located below the middle of the transistor. The lead on the left will be the E, and the lead on the right will be the B. See Schematic.
Google “2n3055 image”

Note on heat-sink:

You don't need a heat-sink to make the charger work.

As noted above, you can find one in an old power supply. Break open the power supply (screws hold it together). Inside you will find a circuit board with one or two heat sinks. You will need to de-solder it from the circuit board (or break the board apart) and take off the transistors already on the heat-sink, then clean the heat-sink and drill the holes for the transistor. To do this, get a heavy piece of paper and place the transistor's leads through the paper. Now trace the transistor's outline and the holes onto the paper. Then use the paper as a template to drill holes in the heat-sink. Make sure your lead holes are large enough for the leads to have wiggle room, you don't want the leads touching any part of the heat-sink – that would fry the transistor. So you may want to order 2 transistors when ordering (if you fry one, you have a spare, and if you don't fry one, you can make another charger – I have one for 12V auto batteries and 1 for household batteries)

You can use any medium thickness piece of aluminum for the heat-sink – just make sure the transistor is solidly connected.

But you do need some way to connect the case (the collector or “C”) to the terminal board. You can try soldering a wire to the transistor case, but soldering

a wire to the transistor is hard. Use a small bolt and two nuts if you can get them at the hardware store. Worse comes to worse, use an alligator clip.

Note on Soldering:

You want a soldering iron that works well. Wal-mart (walmart.com) has a cheap one for about 8 bucks or less and it works well (and it comes with solder! -if you don't need solder go to the automotive electrical section -there is a soldering iron there). Plug the iron in and let it heat up. Then tin (google "tinning a stripped wire" to find a video on how to tin) the tip with solder. When soldering wire, tin the wire first with solder before connecting to the part to be soldered. Use pliers to hold the wire because it gets hot!

When soldering to the B or E lead, tin the lead first, then tin the wire, then solder them together – it makes for a nice tight connection.

Use rosin core solder designed for electrical work, not acid core. If unsure, get new solder.

Note on Neon Bulb:

the neon bulb is not necessary for the use of the charger, it is a safety precaution to prevent the transistor from burning out if something goes wrong and voltage greater than 90volts is sent to the emitter E. The one mentioned above from radio shack will need to have wires soldered to its contacts. If you have an old neon bulb or neon nightlight, you can use that instead.

Transistor and heat-sink work:

Attach transistor to heat-sink with two bolts and two nuts

Transistor will only go in properly only one way

make sure transistor leads are not touching heat sink!

Attach one side of neon bulb to one bolt of heat-sink with the 2nd nut

Attach one yellow wire to 2nd bolt of heat-sink with remaining nut

Attach by solder one red wire to Emitter ("E" side of heat-sink) of transistor

Attach by solder one green wire to Base (other side of heat-sink) of transistor

lay heat-sink close to terminal block then cut yellow wire, red wire and green wire to proper length (long enough to attach from heat-sink to terminal block)
strip yellow wire, red wire and white wire ends about 1/4"

Note on Diodes:

The diodes you get will have one side with a silver bar on the end of the diode, the other side will not have a bar on it. The silver bar end is the cathode end.

Go to Google and type in "Diode image" and you can see more information, but for our purpose, just note that the diode has two ends, one with a bar and one without. If you took apart a microwave to get a microwave transformer, you should have found some HV diodes. You can attempt to use those, but they take

some effort to attach, and you need to verify which end is the cathode end (the bar end on a smaller diode) – use the images from google to figure this out. If you connect up the diode incorrectly, you can fry the diode (been there, done that!) especially when bridging the power supply.
The 1N4007 is rated at 1000 volts and 1N4005 is rated at 500 volts.

These are all on the left side of the terminal block:

- attach green wire (collector) from transistor to 1st top hole of terminal block, tighten screw in terminal block to hold
- attach other side of neon bulb and red wire (emitter) from transistor to same hole of terminal block (position 2 from top), tighten screw in terminal block to hold
- attach yellow wire (base) from transistor to 6rd hole from top of terminal block, tighten screw in terminal block to hold
- attach another red wire and the bar side of one diode to terminal 3, tighten screw in terminal block to hold
- attach another black wire and the other side (non-bar side) of that same diode from terminal 3 to terminal 4, tighten screw in terminal block to hold
- attach another red wire (with alligator end on one end) to terminal 5, tighten screw in terminal block to hold
- attach a blue wire to terminal 7, tighten screw in terminal block to hold

These are all on the right side of the terminal block:

- attach non bar side of a diode and another blue wire to terminal 1, tighten screw in terminal block to hold
- attach a jumper from terminal 2 to terminal 4 (any color), tighten screws in terminal block to hold
- attach the bar side of the diode from terminal 1 and the non- bar side of another diode to terminal 3, tighten screw in terminal block to hold
- attach the bar side of the diode from terminal 3 to terminal 5, tighten screw in terminal block to hold
- attach the 330 ohm resistor to terminal 6, attach the other end of the resistor to the middle prong of the potentiometer (solder), tighten screw in terminal block to hold
- attach a wire (solder) to one end prong (not the middle one) of the potentiometer and the other end to terminal 7 (it does not matter which prong you choose as long as it is not the middle one), tighten screw in terminal block to hold

Note on bifilar coil:

A bifilar coil consists of two insulated wires (let's assume one is red and one is green) wound around and through a ferrite toroid or wound around a straight ferrite bar – all at the same time (you do not wind one wire then the other, you wind them both together). The number of winds should be at least 30 – the more you have the greater the high voltage pulse. You can use magnetic wire or just

plain wire. When completed you will have four wires from the toroid or the bar. Two (one red and one green) will be the beginning of the wind and two (one red and one green) will be the ending of the wind around the toroid or the bar. Take one of the beginning wires (let's use the red one) and solder it to the the other ending wire (the green ending wire - NOT the green beginning wire!). The solder point will be where you will attach a black wire (see below), this joint is call the common or middle point of the bifilar coil.

Here is a good picture of a toroid wound bifilar coil:

http://en.wikipedia.org/wiki/File:Bifilar_wound_toroidal_transformer.jpg

Normally you want to use magnetic wire, with two different gauges or thicknesses. Radio shack has some. You would use a 28 gauge which may be red with a 30 gauge which may be green (the lower the number the thicker the gauge). The thicker of the two wires would be the primary coil, and the thinner would be the secondary of the coil. If you just used plain insulated wire of the same size, just denote one of the wires as primary and one as secondary.

As noted above, you may be able to find a toroid in an old PC power supply. If you get a coil out of a power supply, make sure there are 4 leads (some toroid coils from a power supply only have two, and some have 6 or more-which is usable - you just have to figure out which leads form a coil and use two coils) and that the wires are wound around the toroid at least 30 times (count and guess). Verify which leads complete a circuit (which makes a coil) with an ohm meter and then as above, connect (solder) the end of one lead of a coil to the beginning of the the other lead of the other coil - this is your common or middle point.

You should use an ohm meter to verify that the beginning of the coil (red wire) completes a circuit with the end of the coil (green wire) - if it does not, recheck.

If you are using magnetic wire with enamel coating (red and green or what ever color you have), you will have to scape the enamel insulation off the wire to get good contacts - use an ohm meter to verify contacts as the scraping off of the enamel can be tricky.

You can also use a transformer which normally has two coils. Use an ohm meter to determine if the coils complete a circuit and are not shorted to the housing. You can get a transformer from a old thrown away microwave oven (these are pretty heavy) or other electronic device and these can produce great spikes. The thicker coil is going to be the primary coil and the thinner coil is going to be the secondary coil. You will want to connect the end of the primary coil to the beginning of the secondary coil and this junction will be the middle or common point.

See Schematic

These are attachments away from the terminal block:

attach the blue wire from the right side of terminal 1 to the secondary of the

bifilar coil (solder)
attach the blue wire from the left side of terminal 7 to the primary of the
bifilar coil (solder)
solder the black wire with alligator clip to the common or middle point of
the bifilar coil (see above) - this will go to your battery to be charged
- the negative side
The red wire with alligator clip from terminal 5 will go the positive side of
the battery to be charged

The red wire from the left side of terminal 3 will go the plus of your power supply
The black wire from the left side of terminal 4 will go the negative side of your
power supply

Note on Power Supply:

Google "24 volt razor motor scooter battery charger" and get the best price -
usually about \$15-\$18 dollars with shipping.

The power supply used here is already a battery charger and has circuitry in it to
reduce the power as it charges the battery, even so, you want to watch how long
you use the charger as it is easy to overcharge some batteries (carbon zinc and
alkaline).

If you are only going to charge 1.5 volt batteries, you can use a smaller voltage
power supply. The circuit requires a voltage differential of about 6-8 volts to
create the radiant (high voltage pulse) charge. So if you are just doing 1.5v, you
can use any 9 or 12 volt power supply (which you can probably find in your house
somewhere!). And if you find a 18v (HP printers) power supply, you can use that.

If worse comes to worse, just connect up two batteries to get the voltage
difference (two 6 volt batteries, or two 12 volt batteries depending on what you
want to charge).

The razor motor power supply is rated at about 1.5 amps. If you want more amps
going to the battery you will need to find another power supply that has greater
amps or use larger amp batteries as the power supply. You may also have to
upgrade the connecting wires to at least 18 gauge, possibly 16 gauge if the amps
are over 10 amps.

The power supply has two ends. One side is the power cord and it gets plugged
into a wall socket and the other side provides the 24 volts to the charger.

With the unit unplugged, cut off the terminal from the 24 volt side and split the
ends apart and strip about $\frac{1}{2}$ inch off of each end.

Keeping the ends separate, plug the power cord into a wall socket then use a volt
meter to determine which of the 24 volt wires is the positive and which is the

negative. Mark or remember which is which.

The charger does not have a switch. To add a switch (optional – otherwise just unplug the power supply), note that the power cord has two wires going to the black box (which hold the components of the power supply). What we will do is splice into one of these power cord wires near the black box and attach the switch so that it completes the connection of the wire. We will leave the other side of the power cord wire alone (i.e. uncut) –Make sure the unit is not plugged in while doing this! Tape up the switch with electrical tape to prevent electric shock.

If you are going to use another power supply other than the 24 volt Razor, you should determine if you want a switch and then where to install the switch. Most power supplies can be left plugged in (some power supplies don't even have a power cord so that you can switch the power off) as long as you have a switch to prevent the power supply from providing a complete circuit to the charger. This means you should put the switch on the positive feed wire going to the charger.

Test the switch to make sure it turns the power on and off
unplug the power cord

connect the red wire from the left side of terminal 3 to the positive of the 24 volts

connect the black wire from the left side of terminal 4 to the negative of the 24 volts

tape up these terminals or use the solder-less terminals

Testing of the unit:

Get an AM radio

Get a battery that needs charging

Connect the red wire with the alligator clip from the left side of terminal 5 and the black wire with the alligator clip from the bifilar coil to your battery (red to positive, black to negative)

plug in the 24 volt power supply, making sure the switch is off

turn on the AM radio

turn on the switch

if the radio starts getting all statically, great, it works!

If not, check all connections and make sure the transistor leads are not touching the heat-sink

You can also disconnect the charging power leads from the battery with the power still on – if you see sparks flying where the alligator clips attach, the system is working even if there is little if any AM static

If you have an oscilloscope, hook up and check the pulse! Connect the scope probe to the negative of the charging battery and the collector of the transistor (the case of the transistor).

Use the voltmeter to check the power being supplied to the battery
If charging a 1.5 battery the voltage being supplied should be anything above 1.5 (2.5, 3, etc), same for any other voltage battery, the amount being supplied should be greater than the rating of the battery being charged

The Potentiometer when turned one way or the other will increase or decrease the measurable voltage going to the battery as well as increase the pulse oscillation. Verify with voltmeter and or oscilloscope if you want.

If the charging voltage is less than the voltage rating of the battery, recheck your connections

Once satisfied, screw the terminal block to a wood board, and using plastic clamps or other things like silicone adhesive, connect the power supply and the bifilar cord to the board

You can use a metal case, but if you do so, you must isolate the heat-sink (transistor if no heat-sink) away from the metal case as the heat-sink will have power going through it at all times while the charger is on - so if not isolated, the heat-sink will cause a short and fry your components
Same with the bifilar coil, it too must be isolated electronically from a metal case. Hence the wooden board
it may look clunky but it works

Congratulations on building the charger!

Radiant or High Voltage Pulse Charger Instructions

This charger will charge up 1.5v AAA, AA, C and D size batteries (carbon zinc, alkaline, NiCd (nickel cadmium) and NiMH(nickel metal hydride)

This charger will charge 12 automobile batteries and other 12 volt batteries

The charger will also charge up any rechargeable battery pack up to 18 volts.

However, this charger should not be used on Lithium Ion batteries!

This is what we call “Radiant” charging. This is sending the battery a high voltage pulse. For Lead Acid Batteries without broken plates or shorts the high voltage pulse will assist in de-sulfating the battery which will make the battery hold the charge longer and work better. This will happen over time as the battery is drained (i.e. used) and recharged. It will not happen all at once.

For other batteries, the radiant charger will fill up the battery with the voltage quickly and the battery will work better.

NiMH and NiCd batteries are very good at being charged and work better with this charger almost immediately (the lower the drained voltage the better the charge). Alkaline and carbon zinc batteries will work but they don't get better with use, and there is risk of blowing out the batteries if too much voltage is applied.

The radiant charge (high voltage pulse) is not measurable except with an oscilloscope. Depending on the bifilar coil use, the voltage can be well over 200 volts. However, you can measure the underlying amount of voltage being applied to the battery with a voltmeter.

For more information about this charger, look up the following on Google: “**radiant battery charger**”

Procedure for use

The correct procedure for use is to make sure the charger is turned off or unplugged, then connect the leads to the battery, then plug in the charger then turn on the charger. Wait a bit depending on the size of the battery (see times of charging below). Turn off the charger. Measure the battery voltage and if satisfied, stop charging, otherwise, turn on again and repeat.

The charger has two sets of leads. One for the traditional 12v car batteries and the second set has alligator leads for attaching to battery packs or for direct charging of single 1.5v batteries. You can purchase battery holders at Radio Shack to make it easier to hold the batteries during charging.

Battery Charging Times

The smaller the battery the less time is required.

A “AAA” battery might take 30-40 seconds, a “AA”, “C” and “D” about 1-2 minutes

12 volt batteries (depending on size and amp ratings) can take over an hour
Your experience will vary depending on lots of factors
Verify your charge by using the Battery Charging Voltage method below

Battery Charging Voltage Method

After charging the battery, turn off the power and wait at least 10 seconds (some power supplies take that long to get rid of voltage in their system), get out your voltmeter and measure the voltage across the battery, better still, disconnect the battery from the charger and then measure the voltage

For 1.5v carbon zinc and alkaline batteries, you can safely charge to 1.5 volts

For 1.2v NiCd (nickel cadmium) and NiMH(nickel metal hydride) you can safely charge up to 1.4 volts

For 12 volt lead acid batteries, you can go up to 12.8 volts

For 14 or 14.2 volt battery packs, you can go to 14.2 volts

For 18 volt battery packs you can go to 18.5 volts

WARNINGS

The charger will continue to charge until turned off or unplugged, so remember this!

There is no safety feature to prevent shock, so do not touch the leads to your body or short the power leads.

If the battery gets hot stop charging! Wait till it cools then try again. If it continues to get hot, stop, as the battery will pop, leak or explode if pushed too hard.

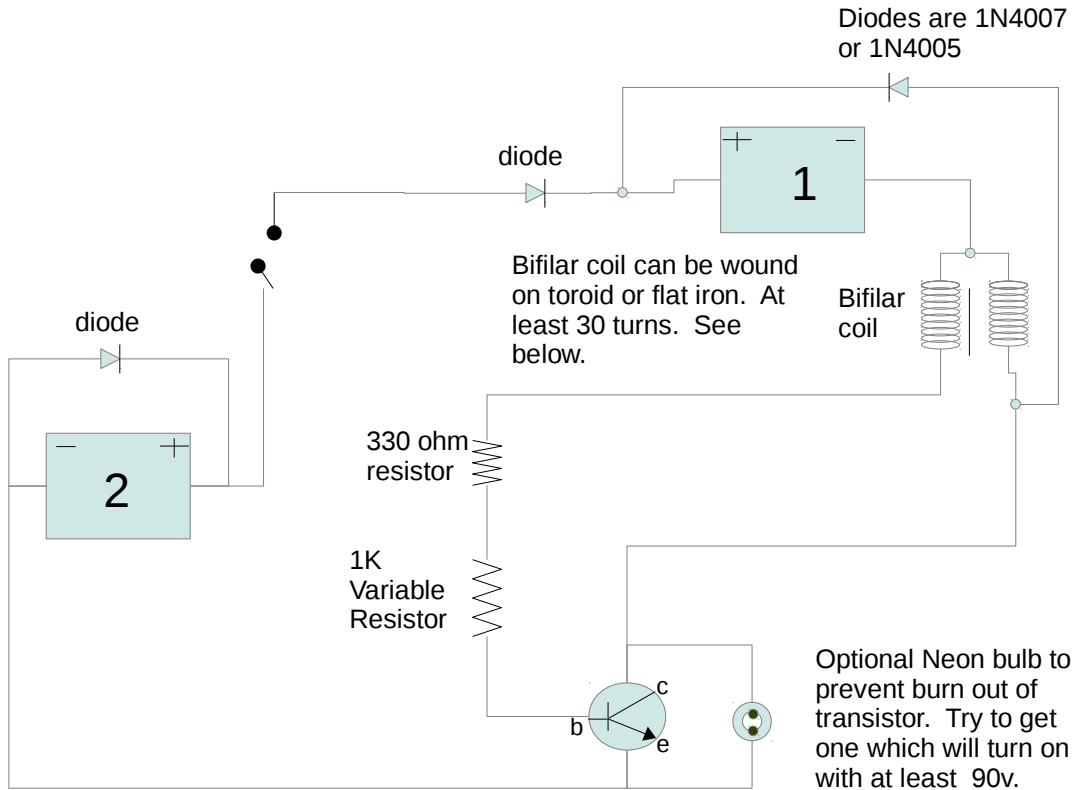
The charger should only be used on partial drained or fully drained batteries. If the battery is already fully charged, don't use the charger on it – don't top off the battery, this may cause the battery to pop, leak or otherwise quit working. This is especially true of Alkaline and Carbon Zinc batteries! The other types of batteries are less susceptible to this, but why ruin the battery?

The charger will not fix a bad battery (warped plates or shorts or other mechanical problems), but it should do wonders for good batteries.

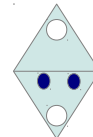
Batteries, especially lead acid batteries can pop, leak or even explode. Take proper precautions!

<http://www.uwsa.edu/risk-management/ehs/occupational-safety/misc-safety/battery-safety/>

The charger may cause AM Radio interference when in use.

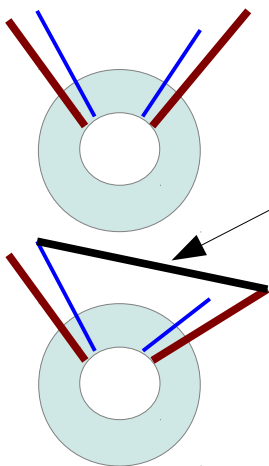


Transistor is 2N3055. Lay on back. Leads should be below middle line. Left lead is Emitter, right is Base. The entire case is the Collector



Battery 2 is source battery (or power supply) of +18 volts and Battery 1 is battery to be charged

Beginning of wires End of wires



Bifilar coil on Toroid:

Get two wires (magnetic if possible). Wrap wires around toroid (or flat piece of iron). 30 turns at least. Now connect the end of one wire to the beginning of the other wire-this diagram shows a connecting wire, but you can also just twist them together (solder to ensure contact). This connection will be the top point where you will connect your wire from the negative of the battery to be charged. You will then have two end wires left over. Connect one to the 330 ohm resistor and the other to the Collector of the transistor.

If you have an old computer, you can take apart the power supply and find a toroid and good wire for connections. I use a Radio Shack connector-part #274-680 for connecting the parts together- it's about \$3.49. Works well.

