

Positive / Negative Ion Generator Kit (Order Code 3057)

General Guidelines for Electronic Kits and Assembled Modules

Thank you for choosing one of our products. Please take some time to carefully read the important information below concerning use of this product. The assembly and operating instructions are on the following pages. Help with component identification can be found on our website at www.quasarelectronics.com/componentid.htm. If you are unsure about any aspect of the assembly or use of this product please contact our Support Team before proceeding.



WEEE Directive (Waste Electrical and Electronic Equipment)

Notice To All European Union Citizens. Important environmental information about this product.

The crossed out wheeled bin symbol on this product, package or documentation indicates that disposal of this product after its lifecycle could harm the environment. Do not dispose of this product (or batteries if used) as unsorted municipal waste. It should be disposed by a specialized company for recycling.

The unit should be returned to your distributor or to a local recycling service. Please respect the local environmental rules. If in doubt contact your local authorities about waste disposal rules.

Safety: General rules concerning safe use of our Kits or Modules.

To ensure your safety, please observe these safety measures. In no way are these complete. As safety requirements vary, please check with your local authorities, in order to comply with local requirements. If in doubt, seek the help of a qualified person.

Battery or wall-adaptor operated devices are safe devices. They do not require special attention unless mains voltage is connected to an output e.g. a relay.



To ensure electrical safety, and also protection from fire or personal injury, make sure your mains operated equipment complies with these safety hints:

- Use a suitable plastic enclosure. If a metal enclosure is used, make sure it is properly earthed.
- Use a power switch if the device consumes more than 10W. Use a double pole switch for mains operated, transformer-less kits.
- Mount a fuse in series with the mains switch. Use a slow blow (T) 50mA fuse for transformers up to 10W and a 100mA fuse for transformers up to 20W.
- Use a mains input connector, or a robust power cord with a clamp.
- Internal wiring carrying mains voltages must have a minimum cross-sectional area of 0.5mm².

If supplied, attach the power rating label near the power cord of the device and fill-out the mains voltage, frequency, power consumption and fuse values.

Troubleshooting and Support

90% of non working kits are due to poor soldering.

We operate a Get-You-Going service for non-working kits but there is a charge based on the time and components needed to complete the repair. Quite often it is not economically viable for us to repair and it is cheaper to supply a new ready made product at full cost.

Disclaimer

Quasar Electronics reserves the right to change product specifications or to discontinue products without notice. Quasar Electronics cannot be held responsible for any loss or damage, direct or indirect, which might occur from the use of a product. Quasar Electronics Kits or Modules are intended for educational and demonstration purposes only. They are not intended for use in commercial applications. If they are used in such applications the purchaser assumes all responsibility for ensuring compliance with all local laws. In addition, they are not suitable for use as or as a part of life support systems, or systems that might create a hazardous situation of any kind.

Positive / Negative Ion Generator Kit (Order Code 3057)

An ion generator or ioniser is a device which creates ions and puts them into the air. A high negative voltage of around 5000V will make negative ions and a high positive voltage will make positive ions. There are supposed to be health and other benefits about living in an environment which has an excess of negative ions. This is a topic we will return to at the end of this documentation.

The simplest and easiest way to generate ions is to use a Cockcroft-Walton multiplier circuit. This is a string of diodes and capacitors in a succession of voltage doubling circuits. See the figure below. The diodes and ceramic disc capacitors are readily available components with a high long term reliability.

NOTE: this project MUST be mounted in a suitable plastic enclosure or box for THREE reasons:

- the first is that it is mains powered. It must be kept protected from people accidentally touching it. The mains cable must be firmly secured by the usual means.
- second, is that it has a chain of voltage doubling circuits. At the end of the chain (at C30) you do not have to touch a component to get a shock. A spark will jump across about 3mm to get you. (The shock is really just a tickle and it is more a surprise than anything else.)
- third, the final stage of the ion generator - the three resistors & the pin farm - must be suspended in the air and not near or touching a solid surface. Ions are funny things. At the high voltages but very low currents available the ions will collect on particles (dust) and solid surfaces. If the pin farm & protection resistors are on a surface (plastic, newspaper) the ions will not be generated.

Also note that if you are sitting in a well insulated, dry chair then there is no shock if you accidentally touch the pins on the pin farm when the generator is in operation. You do not have to worry that when you listen to the ions being generated that you will get a huge shock if you accidentally touch a pin. We are not suggesting you deliberately start feeling the pins. And do not touch the components in the doubling chain what ever you do.

The circuit as presented is designed to generate negative ions. However, by simply reversing all the diodes, D1 to D30, in the ladder you automatically make it into a positive ion generator. This gives you an easy way to test for yourself whether negative ions and/or positive ions affect mood, performance etc. You may buy two of these kits and construct one as a negative ion generator and the other as a positive ion generator. Then put them in different situations either with or without people knowing. Leave them on for several days and note any changes or alteration in behaviour.

Design

Commercial designs usually use a transformer to raise the initial voltage from either mains or battery voltages up to about 1KV. Then they have about 5 voltage multiplier stages feeding a pin farm of 3 or 4 pins.

We chose the design shown in the Figure because it uses more readily available components. There are 30 diodes and 30 capacitors. A 0.1A fuse is included in the event of component failure in the chain. A neon is provided to show when the unit is on. The resistor R2 rapidly discharges the chain when the power is turned off. It is important to realize that nothing like the theoretical voltage of the chain is achieved in practice. The regulation is poor & the impedance is high. The final three resistors leading to the pin farm are for safety if you touch the emitting pins.

Construction

Must be constructed by a suitably experienced adult. The most important thing to watch is that all the diodes are put in the correct way. Follow the overlay pattern to make a negative ion generator. Reverse all the diodes to make a positive ion generator. Use some of the cut off legs from the capacitors for the 5 pins in the pin farm. The efficiency of the pins can be increased by filing their tips to a point.

You must mount the PCB in a suitable box. The pins should be positioned so they almost stick out from the box into the air. No solid surfaces (like plastic) should be near or next to the track leading from C30 to R3 R4 & R5 & the pin farm. Any solid surfaces touching this output will reduce ion generation efficiency. You can put silicon gel on the bottom layer if you have it.

Since ions are generated from sharp points it is a good idea to check the soldering of the resistors & pins in the output track. Make sure the solder joint is rounded and covers the cut-off ends of the resistors & pins.

Testing - Proceed with Caution - Electric Shock Risk!

When power (either way around) is connected the neon will light and after a few seconds (4 to 10 seconds) you will hear a faint hiss from the pins. This is the ions being injected into the air. As mentioned it may not work if the board is sitting on plastic, wood or newspaper. The output track must be isolated. If you wet your finger and place it near the end of the pins you will also feel the ion wind.

You will **not** get a shock if you accidentally touch a pin. But make sure you are on an insulated surface. Remember how a nylon shirt will crack sparks if you rub it with wool in the dark. There are thousands of volts being made there and the sparks are being made on you yet you feel no shock. The volts are there but not the current.

If you are tempted to try multimeter voltage measurements of the chain you will quickly find it does not work. The

Positive / Negative Ion Generator Kit (Order Code 3057)

voltages are but there is too little current to power the meter.

If It Does Not Work. Check that the diodes are all in the correct way. Are the resistors in the right places. Did you put the fuse in. Use a multimeter to check each diode & a capacitance meter to check each capacitor.

Ozone. After a few hours operating in a small room you may find that there is a funny smell present. You may recognise it as a 'machinery' smell. This is ozone gas. It is produced in high voltage switching machinery such as generators. It is also given off by rotting seaweed. (Indeed in the last century people in England used to flock to the seaside to smell the ozone. It was thought to be good for you.) If the ion generator produces too much ozone then we suggest you jumper the pin farm track from C30 to C28 or C26. That is you cut out the last one or two voltage doubling stages.

Are Negative Ions of Benefit to You? Quite a bit of research has gone into this topic. Research ranges from the quack pseudo-scientific to the reputable. A list of some papers from the latter group is given here. In summary, there is no evidence that negative ions have any effect on well being however it is defined. The claims by commercial producers of negative ion generators that their products enhance efficiency, increase productivity and contribute to personal health are unsupported by scientific evidence. However, if you think something is going to do you good then it may in fact do so; this is the placebo effect. And alot of research in the 1990's has gone into it. But that is another story.

Baron, Robert A. (1987). Effects of Negative Ions on Interpersonal Attraction: Evidence for Intensification. *Journal of Personality & Social Psychology*, **52** (3), 547-553.

Baron, Robert A. (1987). Effect of Negative Ions on Cognitive Performance. *Journal of Applied Psychology*, **72**, 131-137.

Dolezalek, Hans. (1986). Atmospheric Electricity, Ions, and Pseudoscience. *The Skeptical Enquirer*, 11, 56-60. See follow-up article by James Rotton in the same journal (1987) **11**, 305-306.

Web

Google 'ion generator' and you will come up with many commercial and semi-scientific references to them. They make interesting reading.

COMPONENTS

uF ceramic capacitor	30	
1N diode	30	
2 pole terminal block		1
Fuse	1	
Fuse holder & cap		1
Neon		1
Resistors:		
3M3 orange orange green		4
100K brown black yellow		1
3057 PCB		1