

# Costuming With EL Wire

## Introduction

Electroluminescent (EL) wire is a versatile material for adding glowing, neon-like lines to your costumes and accessories. EL wire is lightweight, flexible, and can run for many hours off of standard batteries or a USB battery pack.

## How EL Wire Works

EL wire works by using a rapidly changing electrical current to knock the electrons of a phosphor coating to a higher energy state. As those electrons fall back down into a lower energy state they emit a photon - light!

You may have heard the term alternating current (AC) when talking about wall outlets, and it's also the kind of electrical current needed to drive EL wire. Because of this, the little battery packs that make EL wire work have to contain a circuit called an inverter that turns the batteries' direct current (DC) into AC.

A standard pocket EL wire inverter takes the 3 volts (V) DC that 2x AA batteries provide and turn that into 100V of AC that changes direction 2000 times a second (hertz - Hz). Since 2000Hz is within the range of human hearing, if you get very close to a running EL wire inverter you'll often hear a high pitched hum.

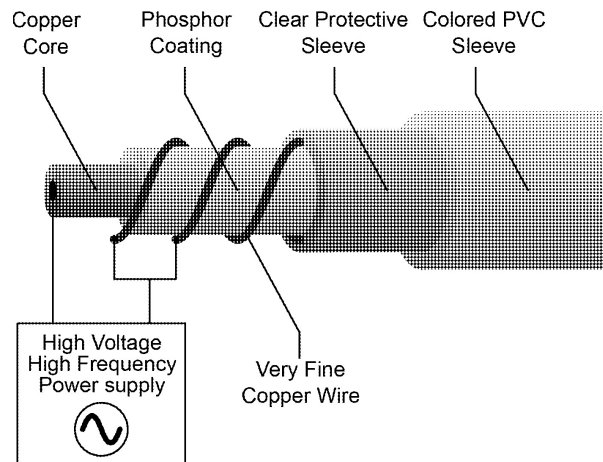


Because of how EL wire inverters work, you should never run one without at least about 12" (30cm) of EL wire attached. Doing otherwise can damage the inverter. On the flip side, if you try to run too long of a run of EL wire with a single inverter, it will start quickly dropping in brightness. A standard pocket inverter can drive around 8' (2.5m) before it starts to dim.

There are other kinds of EL wire inverters that are rated for different lengths of wire. In addition, there are specialty inverters that add features like sound reactivity and multi-strand animation.

A single strand of EL wire is always a single fixed color and can not be dimmed - it's either on or off. EL wire that's taken care off will generally operate at a half life of 3000 hours. Meaning, after 3000 hours the wire will be about as half as bright as when it was new.

## EL Wire Construction



EL wire consists of concentric layers. The inner most layer is a solid core wire that's coated in phosphor. Spiraling around the core are two very thin "corona" wires. Finally, surrounding the corona wires is a clear and/or tinted PVC coating that protects the wire and gives it its final color (the bare phosphor can vary, the brightest being cyan in color).

The phosphor coating on the core wire is a dried powder that can flake off of the core wire if bent at too sharp an angle. The sharpest advisable radius is about that of a standard pencil. The phosphor will also flake off if the EL wire strand is repeatedly bent at the same spot. Flaked phosphor will result in a dimmed or dead area of the wire.

Sharp bends can also sever the corona wires - this kills the wire after that point. One bit of good news is that it's often possible to cut and re-solder broken EL wire.

## Attaching EL Wire

EL wire can be attached to a costume or prop in four primary ways - weaving, stitching, gluing, or through channels.

### Weaving

Weaving or tying EL wire to something is the easiest method and has the benefit of being removable. This can be important for costumes as EL wire is neither washing machine nor dry cleaning safe.

### Stitching



Stitching EL wire to something can be done using a whipstitch of thin monofilament fishing line. The EL wire will shine through the fishing line and thus the fishing line will be

essentially invisible from a very short distance. This technique is very secure, but again, will require that the object in question only be gently spot cleaned.

### Gluing

EL wire can be glued to some types of materials. However, this method can be hit or miss because the PVC that makes up the outer coating of EL wire is notorious for being difficult to glue. Hot glue generally works okay with most surfaces. Gel-type superglues seem to work particularly well if attaching EL wire to soft plastics like craft foam. This seems to be more like a chemical weld rather than normal gluing, possibly because of the acid present in the glue that extends its drying time.



### Channels

If EL wire is to be used in larger, more complex costume pieces a really excellent technique is to sew small hem-like channels of translucent fabric for the EL wire to run through. This allows the EL wire to be removed so the costume can be machine or dry cleaned as needed.

## Attaching EL Wire

Because EL wire that's bent too sharply or repeated will dim or break, it's important to think through how you'll be attaching it to an object or costume. EL wire should not be attached in such a way that it would be bent repeatedly - such as across a major joint of the body like the knees. Instead, it's best to attach EL wire down the long bones of the

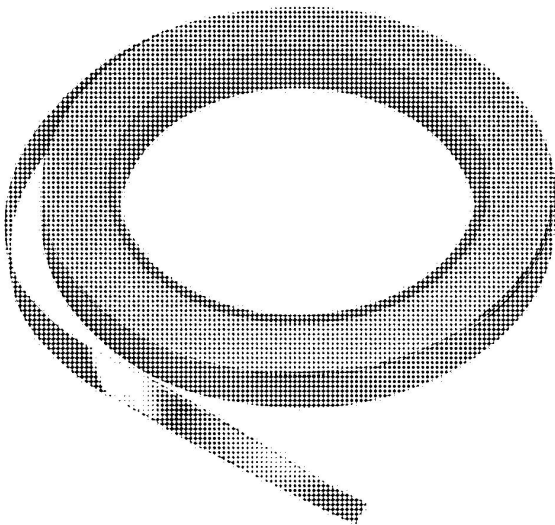
body or large non-bending areas such as the chest or back.

If EL wire needs to cross a joint of your body, it's better to cross the joint with a pair of standard multi-stranded wires and then a separate section of EL wire. To do this, you'll need to learn how to solder EL wire.

## Soldering EL Wire

The goal of soldering EL wire is to attach 2 thin, stranded wires - one to the core wire and one to the corona wires, so that it can be attached to an inverter or another section of EL wire.

Because the corona wires are so thin, a common technique is secure those wires to a ring of copper foil tape that encircles the wire. This technique starts by stripping off the PVC on the end of the wire. Usually 1/2 to 3/4". Then a small section of copper tape is stuck around the wire just before the stripped section.

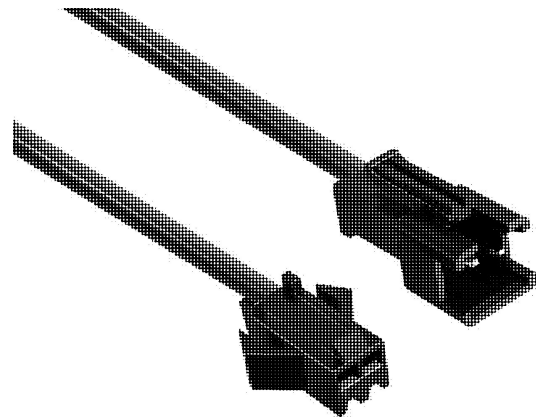


The corona wires are then bent back and soldered to the copper. One of the stranded connecting wires is then soldered to the copper as well. Finally the tip of the core wire has the phosphor scratched off of it and the second stranded wire is soldered to it. Heat shrink tubing is then used to protect the solder joints.

You can attach multiple strands of EL wire in parallel or serial fashion to a single inverter. Just make sure your inverter can handle the total length of wire.

Note that because EL wire uses alternating current, it doesn't matter which wire connects to which wire between the EL wire and inverter. That said, you should be careful while soldering EL wire to make sure its disconnected from the inverter. If you short an operating EL wire by touching both the core wire and a corona wire you will get shocked and it can really sting!

It's common to use 2-pin inline JST connectors to connect EL wire sections and EL wire to inverters. These connectors have the benefits of being fairly small and locking firmly. You can purchase these connectors with wires already attached and ready for use.



## Attaching the Inverter

Once you have the EL wire attached to an object you also need to figure out how to attach the inverter. If possible, keep inverters down low away from your ears as otherwise you may hear their high-pitched hum. If you're using EL wire for something like a hat where this isn't possible, you can dampen the hum by surrounding the inverter with a dense foam.

The inverter will need to be attached securely which can be done with the clip that often comes on them, or by placement in an existing or specially-made pocket.

Because you won't want to accidentally hit the button on the inverter and turn your light off, note what could push on the inverter and protect its button accordingly. On the flip side, you'll want to make sure that the button is easily accessible to you so you can turn the EL wire on and off as needed.

If you are using a sound reactive inverter make sure you place it in such a way that its microphone is able to clearly hear the sound in your environment. You'll have to balance damping its possible hum with allowing it to hear.

## Conclusion

As long as you work within its limits, EL wire offers many benefits for those looking to add a glowing element to their costumes. It's inexpensive, glows brightly in a range of colors, and can be attached to costumes and props in a number of ways.

## Additional Resources

### Working with EL Wire

<https://learn.adafruit.com/el-wire/>



### No-Sew EL Wire Luna Moth Wings Tutorial

<http://www.ladyada.net/make/el-wings/>



### TRON Bag Tutorial

<https://learn.adafruit.com/tron-bag/>



### EL Wire Stocking Tutorial

<https://learn.adafruit.com/el-wire-stocking/build-it>



### EL Wire Sign Tutorial

<https://learn.adafruit.com/el-wire-sign>

