How To Take Great Photos of Your Projects

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https://learn.adafruit.com/how-to-take-great-photos-of-your-projects

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Overview

This tutorial by John De Cristofaro () (johngineer ()) aims to teach you how to take photos of your hacks and projects for sharing on the web, and perhaps even in print. It focuses on smaller items, less than 6”x6”x6” in size. Bigger projects present their own unique problems that are beyond the scope of this article. However, you can always “scale up” the methods presented here to take pictures of larger subjects, at least to a point.

I’ve divided it into two parts: The first part details how to build a small, inexpensive cyclorama (shooting platform) and the second covers setting up the lights and taking the photos. It assumes you are starting with little more than a camera and a subject to take pictures of. I’ve tried to address a number of questions I’ve received from folks regarding things that are unique to photographing electronics. These include how to photograph lit LEDs and how to make the stamped text on IC packages appear clearly in photos without being washed out.

I’m going to introduce two lighting setups. The first one uses two light sources, and the second one uses one light source and reflectors. The two-light setup is simple, and is good for things like documenting your project as you build it, time-lapse assembly stuff, and general documentation. The one-light setup is more complicated, but also more creative, and is useful for taking final project photos. It also cures baldness, makes you more attractive, and builds self-esteem. Awesome!

I will not be discussing shooting tents in this article. These are already well-documented and ubiquitous all over the web, and in my opinion they don’t teach you

a great deal about creative lighting. That isn't to say they aren't useful, or produce bad results. They have their place, and for many things they do work amazingly well. That said, the main goal of this article to provide the reader with a basic photo skillset, and I think a shooting tent just hands you the solution instead of teaching you how to solve the problem.

Ok, now that that we've gotten the philosophical stuff out of the way, let's get to work!

What You'll Need

The cyclorama is a separate project, and has it's own list of ingredients. However you will need the following items to take pictures regardless of whether you build the cyclorama or not.

Camera — A digital point-and-shoot is fine, as long as you can turn the flash off and it has a macro (close-up) mode. An SLR camera is better, but not necessary. A film camera is fine too, if that's all you have, though shooting on film may cause some color balance problems if you use incandescent lights. I am using a Canon PowerShot G5. The Canon "G" series provides a great deal of control and older models can be had cheap on eBay. Note: the G7 does not support RAW image capture out of the box, but you can use CHDK () to enable this functionality (thanks to Moritz for the tip!)

Lights — You need two, and it's best if they are identical. You can use work lights from the hardware store if you have to, but I recommended investing in "professional" photo lights from a photo supplier (see list at the end of this document). Often these come up pretty cheap on auction sites or at photo flea markets (~$25, as of

mid-2010), and they are a good investment if you plan to use them regularly. If you're going the work light route you should get the ones marked for 300W lamps. These have a heavy-duty cord and ceramic socket. You should not attempt to use the cheaper low-wattage lamps with a higher rated bulb — even if the cord can handle the current, the plastic base probably won't be able to handle the heat of the bulbs.

Light Bulbs — In photo and theater-lighting speak these are simply called "lamps". You should get proper photoflood lamps from a photo supplier, rather than using the 300W lamps from the hardware store. Two common types are ECA (250W) and ECT (500W) — both of these burn at a color temperature of 3200 Kelvin, which is the standard color of photographic tungsten lights. Some people like to use daylight-balanced CFL lamps, but there is a tradeoff. The lights don't generate as much heat, but their color rendition is poor compared to tungsten lamps. For any of the science-minded who may dispute this, I suggest you look at the spectral output of both: CFLs are a pretty much a picket fence, while incandescents are mostly continuous (though admittedly biased toward IR). The high-powered fusion of the sun puts out a mostly continuous spectrum, overlayed with Fraunhofer spikes, and this is what our eyes (and our camera sensors) are designed for. Gaps in the output spectrum of CFLs cause some colors to be rendered unnaturally, so it's better to use a continuous-spectrum source.

Tripod — You can work without one if you must, but it is strongly recommended that you use one for critical shots. It helps ensure your photos are consistent and without blur. The heavier the tripod, the better — the greater mass helps dampen vibrations.

Physical Space — You need some space to take your photos, as well as a sturdy table on which to set everything up. You also need room around the table to set up your lights and to move around. The cyclorama shown here has a footprint of about 2×2 feet — keep that in mind if you decide to use it.

Part I - Cyclorama

A cyclorama is a surface that provides you with a uniform background. A cyclorama (also called a cyc, rhymes with "bike") can vary in size from a tabletop (such as this one) to a warehouse (used for cars and other large objects). It's really nothing more than a concave surface of uniform texture — it's horizontally flat in the front and curves up to vertical in the background. The one we're going to build here uses a lightweight frame of PVC pipe and a sheet of poster board, along with a few thin panels of MDF for extra rigidity. It costs about $20 in parts. If you are using a table that sits up against a wall, you can skip the PVC frame and simply tape the poster board to the wall and table in the appropriate shape. However, you may find the PVC

frame gives you more flexibility because you can move around it. The added bonus is that it's a good excuse to use power tools.

Parts List:

1. 12ft of 3/4" Schedule 40 PCV pipe
2. 6 90° elbows (3/4" sch. 40)
3. 2 tee joints (3/4" sch. 40)
4. 2'x4' panel of 1/4" MDF (or 3/16" hardboard)
5. 1 sheet of white posterboard (22"x28") — get a few extra if you can.
6. 2 small binder clips

Cut the PVC into seven segments of 18" in length. Cut the remaining pipe into two pieces of 3" each. Follow the photo for assembly instructions. It really doesn't matter in what order you put the pieces together as long as you square it up when you're done. You can use pipe cement too if you want, but there's really no need. If you leave the pieces loose, then you can take it apart later for storage.

Now it’s time to cut the MDF panel. You’re going to cut two pieces, one 16”x24” and the other 20”x24”. Lay the 16” piece across the bottom and lay the 20” piece up against the back as shown.

If you want to, you can secure the back piece to the frame, though you can just lean it against the back. Take the posterboard and install it as shown, shiny side up.

Clip it to the front edge of the MDF with binder clips and form the curve (an arc of about 3” radius). Once you have the curve the way you like it, tape it to the back board with masking tape.

If all went well, your cyclorama should look like the one in the photo. Congratulations!

Part II - Taking Photos

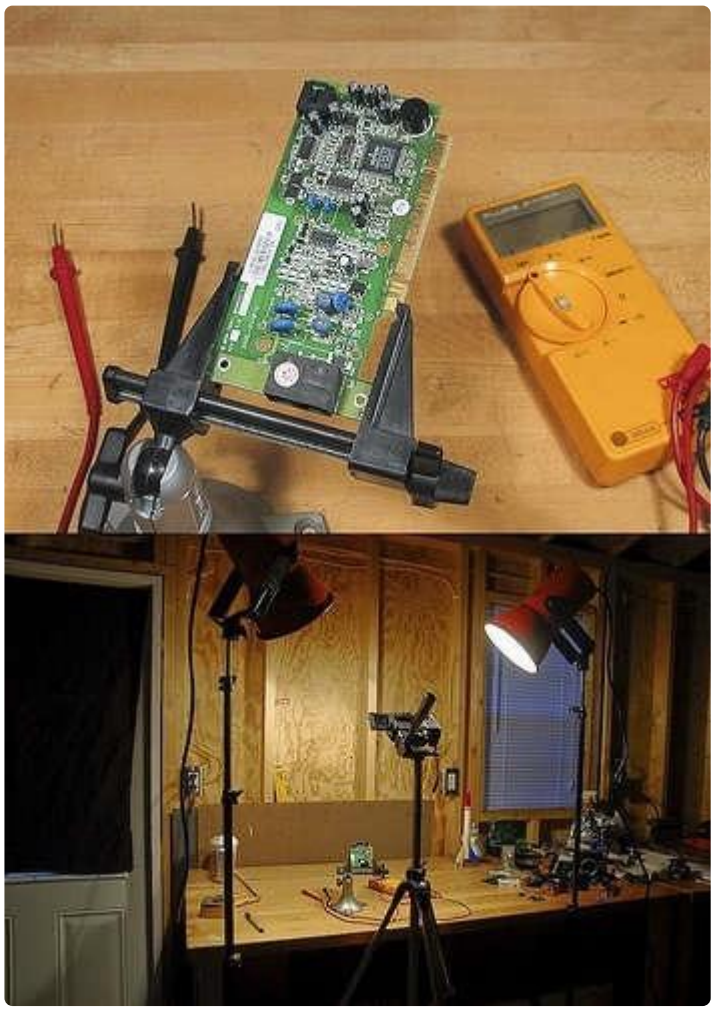
Ok, so you’ve got your cyc all set up (or not) and you’re ready to take some pictures. There’s no trick to it, it’s just a simple trick. In short, it really doesn’t matter what camera you have, because it’s all about lighting. Your control of the light has the biggest impact on the final product. Composition is important too, but if you have good lighting, the right composition tends to become self-evident. Further, good lighting allows you to show all the details in your work with equal clarity.

The most important thing to remember with lighting is control. You need all the control you can get. This first translates, in this case, to working in a darkened room, preferably at night. The only lights you want falling on the subject are the lights you can control. Light coming in through a window can be very beautiful, but you don't have a whole lot of control over it, so draw the curtains.

Before you set up the lights, you should place your subject in the middle of the scene. If you're using the cyc, you want to place it about 4-6" back from the front edge, and centered left to right. It helps if your project can stand on its own. If it doesn't, you can use adhesive puddy (Fun Tak), to help prop it up to the angle you like. Please note that from this point on, I will be referring to the placement of lights and reflectors as being in position around a clock, with the subject at the center.

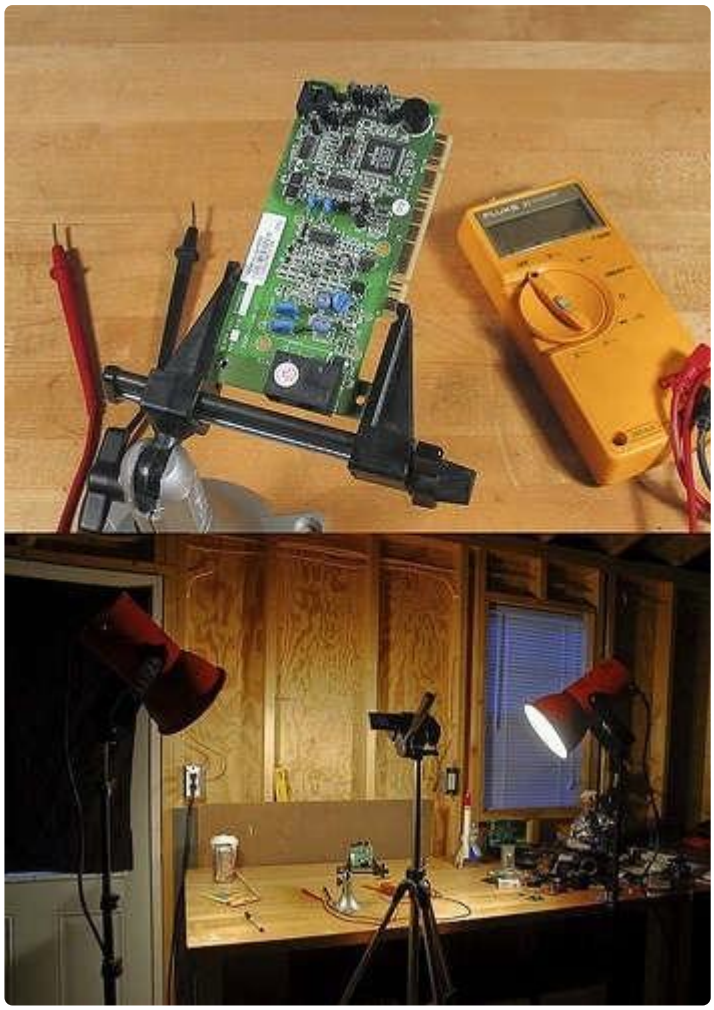
Two-Light Setup

In this first configuration we're going to use two lights. There's not much to talk about here — this is a very basic, functional setup that works well with documentation photos — that is, pictures you take of your project as you're working on it. It doesn't work so well for shooting "finished" projects, because it produces some confusing shadow patterns that can be distracting. However, for shooting while you work, it's the best compromise between quality and expediency.

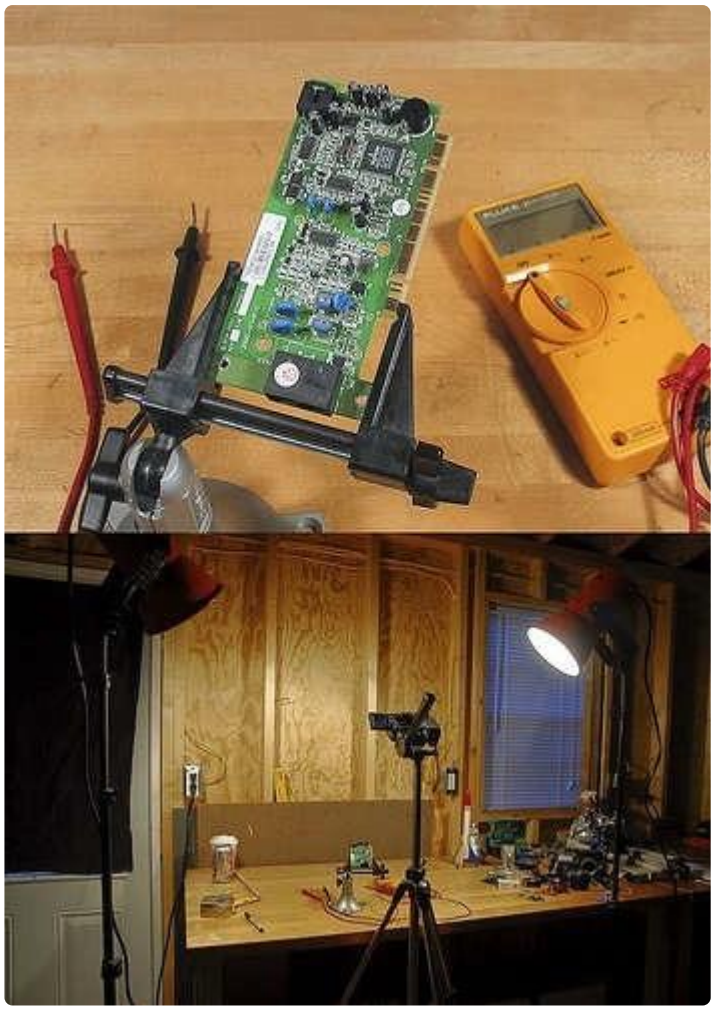


You should have two matching lights, with bulbs of equal output. Some folks like to put diffusion material over the lights. You can do this if you like, as it does soften the shadows a bit. If you do this, remember that the diffuser absorbs some light, so your exposures will be longer. Also, be mindful of the heat produced by the lamps — you don't want the material to melt. Try to use heat-resistant diffusion gels, such as those sold by Rosco.

For your start position, set both lights at the same height, about 3 feet above the table surface, and pointed at the subject.



Imagine a line connecting the center of the light bulb to the subject, and another line parallel to the front edge of the table that runs through the subject. These two lines should intersect at an angle of about 45 degrees. This is a good starting point, because it eliminates shadows as much as possible. You will still see some shadows, of course, but we'll take care of those in editing later. Looking at things from overhead, the lights should be at about 4 and 8.



The camera is at 6 o'clock. The distance from the camera to the subject varies depending on what you're taking pictures of, but 18 inches away is a good starting point. Bear in mind that it is not necessary to fill the frame with the subject, as you can crop it later. In fact, it's not advisable to be right on top of the subject with your camera, as it makes it more difficult for you to work (directly under the lights), and it can cause focusing problems. Plus, by moving further away you increase your depth of field, helping everything to be in focus.

If you have your lights set up properly, you should be ready to take some photos. The next section provides some details and hints about using the camera.

About the Camera

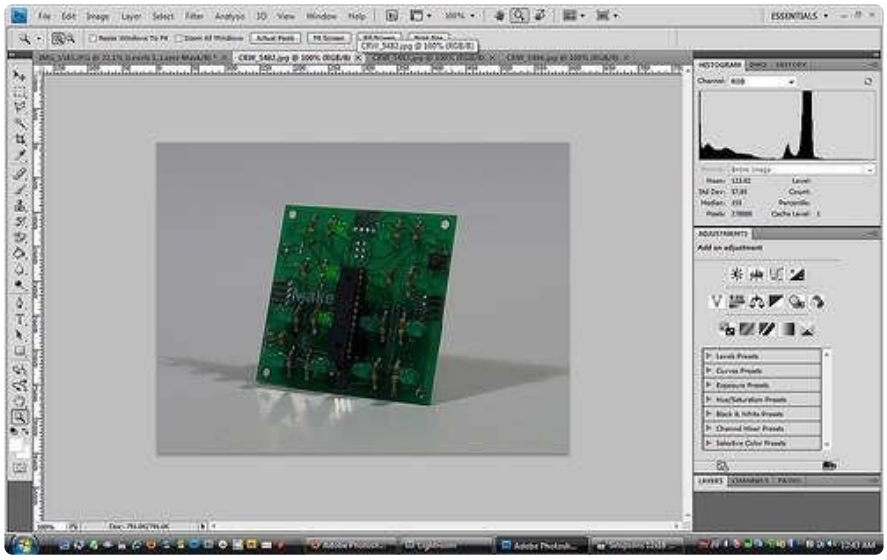
Before we continue, I'd like to mention some things about the camera. These are given generally, and you may need to consult the camera manual to learn how to make these changes on your particular camera:

1. Use a tripod.

2. Flash: Turn it off because you won't need it. It's usually controlled by a button with a lightning bolt on it. The screen will display a "no" symbol (as in "no smoking") with a lightning bolt inside it.
3. ISO: Set your camera's ISO (film speed) to the lowest possible setting. This is usually 50, 100, or 200. Avoid using the AUTO setting. Different cameras have different ways of doing this, refer to "ISO" in the manual.
4. Aperture-priority mode: Put the camera in Aperture-priority mode. For SLRs and advanced point-and-shoots, this is usually accomplished by turning a dial on the top or back of the camera, and is denoted by an "A" or "Av". For starters, set your aperture to 4.5. Once you get a feeling for how changing the aperture affects the picture, you can change it to suit your tastes. The aperture affects what is called "depth-of-field", which is the area from nearest to farthest that is in focus. For most picture taking with point-and-shoots, this isn't much of a concern. However, when you are shooting close-up you need give it some thought. The higher it is (the greater the depth of field) the more of the image will be in focus. For things that are very close up (less than 12 inches), you should set it to maximum. If you still can't get everything into focus, try moving the camera back a bit and then cropping later in an editing program.
5. Image quality: Set your camera to the largest image size available, and with the lowest compression setting (i.e. the largest file size) — this is usually called "fine" or "superfine". If your camera supports RAW output, you can use that. RAW images store the full output of the camera sensor and are more suited to later editing. For the purposes of this tutorial, I'm going to be working with JPGs from the camera. There are plenty of resources available regarding RAW image workflow if you are interested in that.
6. White balance: Set it to incandescent (aka "tungsten"). This is usually indicated by a little light bulb icon. This sets the color balance of the camera to a color temperature of 3200K, which is the color temp of the light's we'll be using. I won't go in to what color temperature is or how it's calculated, because it's a bit involved. Suffice it to say it's based on one of those ideal theoretical constructs physicists are so fond of.
7. Focusing mode: For most stuff you can use the camera's autofocus mode. Manually focusing a point-and-shoot is often more trouble than it is worth. It's quite easy to do on an SLR, but most modern AF systems work so well that it's doubtful you'll be able to improve upon things. That said, there are some things to keep in mind when using Autofocus. AF systems require contrast to focus properly, so pointing the focusing window at a broad expanse of solid color will cause problems. Try moving the object or camera a little to give the camera something "busy" to look at. Flashing LEDs can also seriously throw off an autofocus system. If you see the camera oscillating in and out of focus, and you have flashing LEDs, try moving things around as above, or change the LEDs to a steady pattern. If that doesn't work, you may have to manually focus the camera.

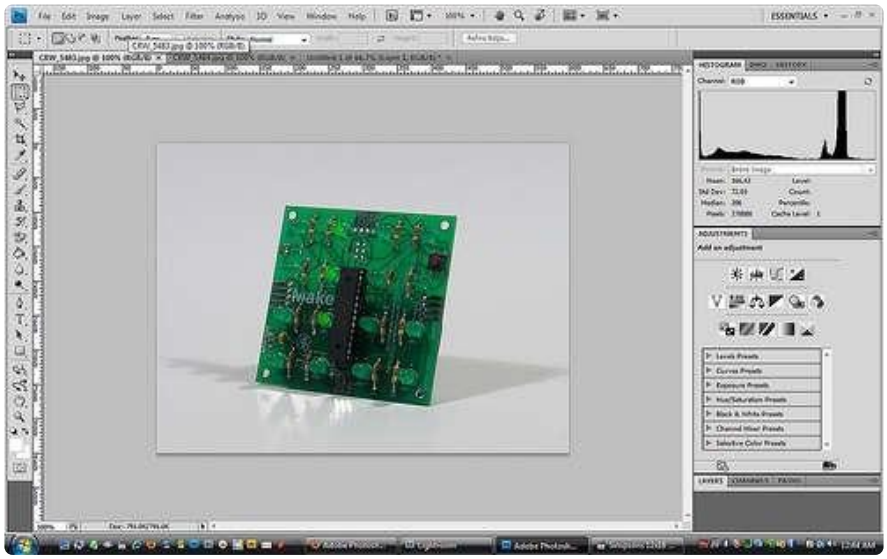
8. Macro mode: Many cameras have a “macro” mode, which is engaged by a little button with a flower icon. Macro mode allows the camera to focus on subjects very close up. This mode usually works best when the lens is zoomed all the way out (wide angle), and zooming in past a certain point may actually turn the mode off. If you find that macro mode keeps turning off, this is probably why. However, you might find you prefer moving the camera back and zooming in as opposed to getting in real close. This tends to “flatten” the field of view a bit, whereas getting up close with a wide angle can result in an exaggerated perspective. The other nice thing about zooming in from further back is that you constrain the field of view to an area where you have full control of the light, resulting in a more even lighting in the photo.
9. Self-timer or Remote: Most cameras have an adjustable self-timer, and some have remote trigger as well. These are both very handy features to have, and you should use them if you have them. The reason is because when you are holding the camera and pressing the button, you introduce some vibration through your arm which can cause the photos to be blurry. By either delaying the shutter until your hand is away, or firing the camera remotely, you can eliminate this problem. On a related note, be sure that the floor isn’t vibrating when you take the picture (i.e. don’t walk around near the tripod), as this can also cause blurry photos.
10. Use a tripod. This tip is similar to tip #1, except I really mean it this time.

Tips for Taking Pictures

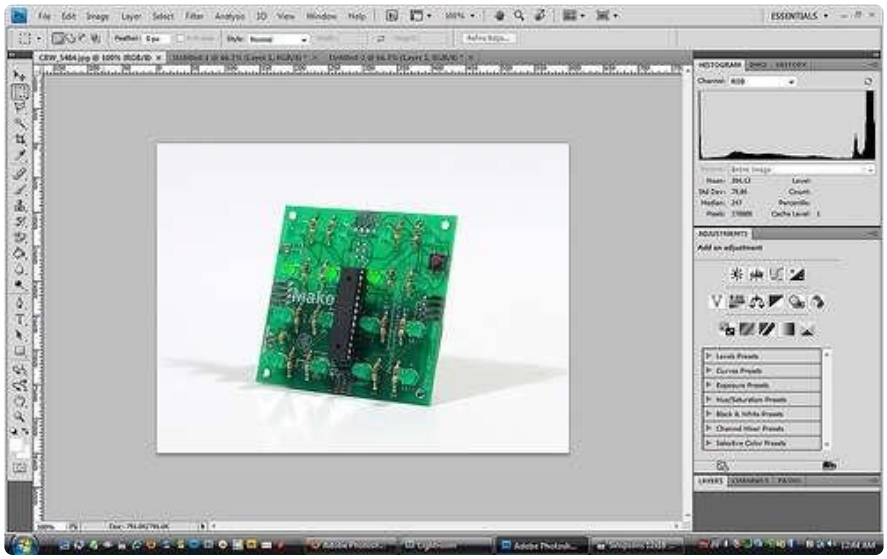


Ok, so now it’s time to take the photos. Assuming you’ve followed the tips above, you should be able to take a picture of your subject. The only thing remaining is to check the exposure. For feedback on this, we need to look at the histogram. The histogram looks sort of like a spectral graph (like in a spectrum analyzer for your stereo), and it shows you how much of each tonal value is in the photo. Most of the time, it

resembles a sort of mountain range. The position of the histogram is related to the brightness of the image. If it's shifted to the left, that means most of the values in the image are dark, and if it's shifted to the right, it means most of them are lighter. The best place for the histogram to be, in most cases, is in the middle. This means we have an average tonal distribution with some highlights and shadows. See the photos for examples.



If your histogram is shifted far over the right or left, you need to adjust the exposure. Assuming you are in aperture-priority mode, you want to look for the exposure adjustment controls. This is usually indicated by a "+/-" symbol. When you press this button (sometimes you have to hold it down while you make adjustments), you'll see a scale going from plus to minus in indexed increments. Often, exposures are thrown off by the background. If you're using the cyclorama, you're shooting on solid white and so the camera thinks it's brighter than it really is. To remedy this, you need to set it to more exposure.



You do this by moving the pointer over towards the “+” symbol, usually by about 2 or 3 index points. If you’re shooting on a black (or dark) background, you need to do the opposite.

The histogram is the best indicator of good exposure — don’t go by what the picture looks like on the LCD, because it’s always wrong. ALWAYS. It’s only there to give you a general idea of the composition and focus. Don’t bother using it for anything else.

One-Light Setup

No reflectors

The next configuration we’re going to use requires one light and a few reflectors. While this sounds limiting, it’s actually got a lot of flexibility. The natural world is, after all, basically one light (the sun) and a reflector (the sky). The reflectors are the key. Much of the light radiated by a light source is wasted, traveling in directions that contribute nothing to the photo. Reflectors help bounce (and sometimes diffuse) that light back onto the subject, filling in shadows and highlighting critical areas.

There are two reflector types we’ll be using, and they each do different things.

White panel reflector (off to right)

The first is a diffused panel, which is basically a piece of white cardboard or foamcore.

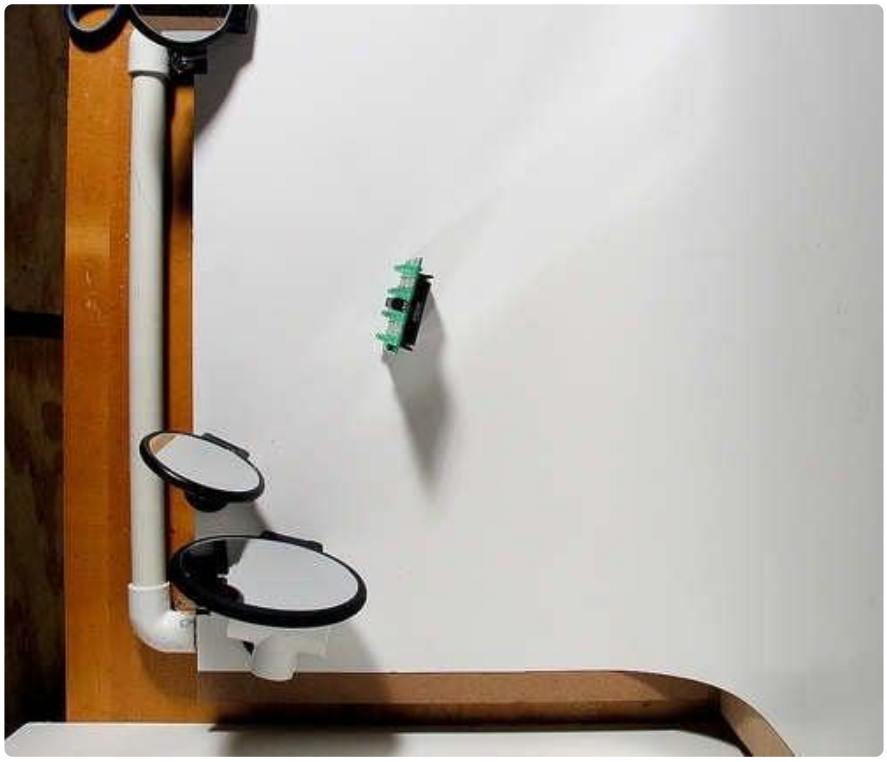
The second is a mirror. We use each of these reflectors for a different purpose, but rather than detail each purpose now, I'll explain them individually as we introduce them to the set up.

First, the light. Place the light at about 3 feet above the surface of the table. Set it 4 feet away and at the 9 o'clock position (off to your left), and pointed at the subject. Leave enough room to move it ±1ft towards or away from you later.

There's always the temptation to put the light as close as possible to the table. While this does increase the amount of light, it is very uneven illumination — the gradation from light to dark across the background (and even the subject) can be very noticeable. This is due to the nature of light as electromagnetic radiation, which means it is governed by the inverse square law. I won't go in to calculations here, but it's best to remember that the closer the light is to the subject, the higher the contrast between light and shadowed areas. When you move the light away a bit, things tend to "even out" a lot more — it also makes it easier to work because you don't have a hot, high-wattage incandescent light right in your face.

If you look at the overhead photos, you'll see where each reflector is placed for this particular setup. Naturally, every subject will require a different placement of the mirrors, and some may not require you to use all three. There's a lot of trial and error

here. Set up your subject in the “pose” you like, light it, and then add and move the reflectors around until you get what you like.



White panel reflector

With the light in position, we’re going to introduce the reflectors. The first reflector is a diffusion panel (sometimes called a white card). 1/4” white foamcore works great for this best because it’s lightweight and rigid, but you can use any sort of white panel. You’re going to prop it up on the right side of the subject, about 12” away. If you’re using the cyc, you can just lean it against the side as in the photo. Watch the shadows cast by the subject darken and lighten as you remove and replace it in position. Our goal with the reflectors is to lower the contrast ratio, which is the proportion of the lightest part of the scene to the darkest part. Digital cameras have problems resolving higher contrast scenes, and so we need to bring the contrast down to a level where it can record everything. If you move the reflector away from the subject, the contrast increases, while moving it closer causes it to decrease.

White panel + 1 mirror

White panel + 2 mirrors

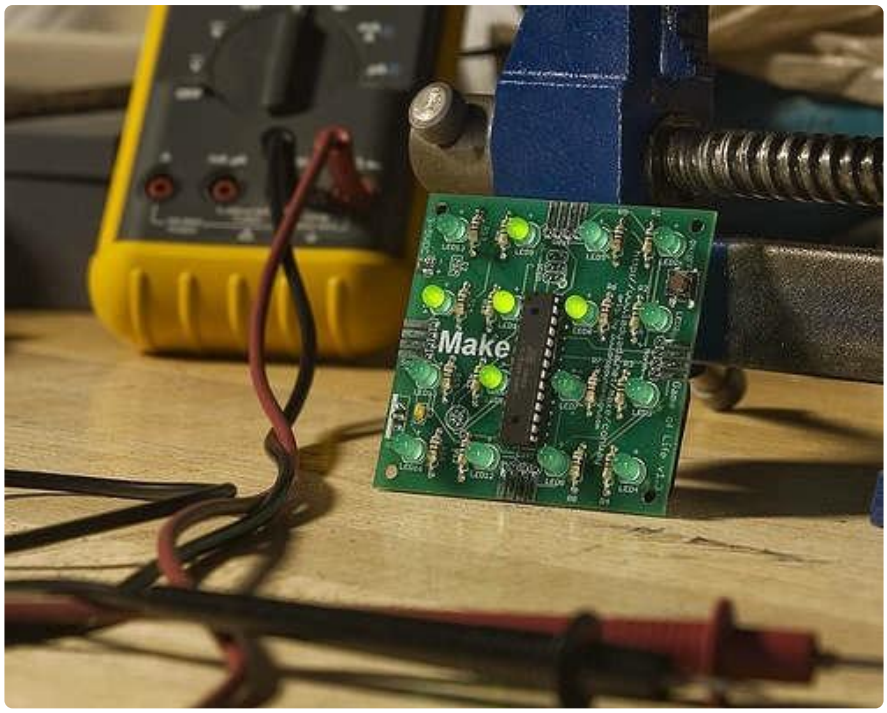
White panel + 3 mirrors

Next we'll introduce the mirrors. I have three mirrors, one big one (5") and two small ones (3"). These are the kind you can get at a discount store — make-up mirrors with a collapsible handle that allows you to stand them up on a table. They usually have mirrors on both sides — one is flat and the other is concave. The small ones cost about $3. Buy them in black if you can.

Where the mirrors go in your setup depends on the subject. You want to look for spots on the subject that look particularly dark, and use the mirrors to fill them in. Start with the largest mirror. Think of this as starting with a broad brush and working your way down to a fine tip for the details.

Looking at the photo with just the white panel, we see that the lower-right side of the subject is still much too dark. We need a significant amount of fill here, so we use the large 5" mirror to bounce some light back onto our subject. (photo & overhead #3).

Now we've lightened up the lower right a bit, but the area around the chip is still too dark, so we add another reflector off to the left of the camera to throw some light in that area. Note that this mirror is set at a rather shallow angle, in order to catch the light from the source and reflect it to where we need it. (photo & overhead #4)



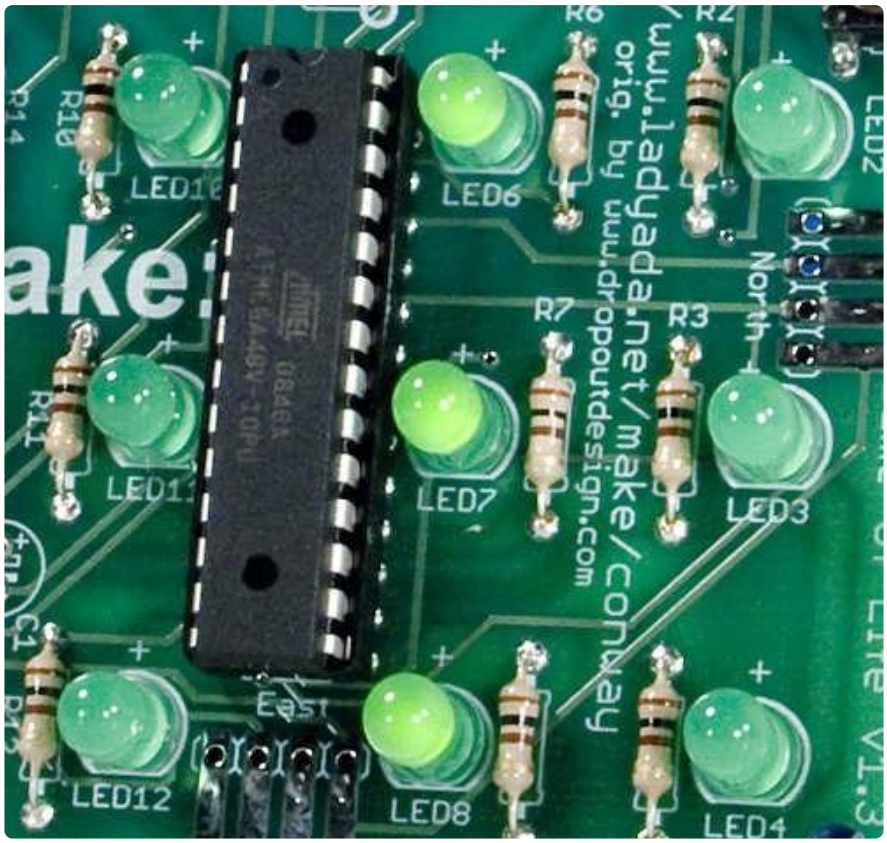
I shot this on my workbench with one light off to the left, and two reflectors (mirrors) filling some of the shadows.

Finally, we still need some light to the right of the microcontroller, around LED7. So we put the last small mirror to the left of the big one and lighten this area up a bit (photo & overhead #5). Then we take the photo, and we're done!

See the whole thing in action:

Just one note: like anything worthwhile, it takes a while to get good at doing this. You need to practice and change things up now and then in order to learn what looks good and what doesn't. And you don't have to stick to the cyclorama as a background either — you can use any tabletop/background, provided you have the room to move the lights and reflectors around. Take a look at the last photo in this section. I did that one on my workbench with one light and two reflectors. I actually like it more than most cyc shots, because it has context. So don't be afraid to play around and find what you like.

Tips for LEDs



One thing you'll notice in the pictures above is that the LEDs are rather well balanced with the rest of the picture. One of the advantages of using the lighting method presented here is that there is plenty of illumination available to light up the rest of the PCB and components, allowing them to "match" the brightness of the lit LEDs. There's an added advantage in the above example because the LEDs on the Game of Life board are diffused, which cuts down on their output a bit. That said, every LED is different — some are diffused, some are clear, and they have different levels of output. If you're trying to shoot a project and the LEDs are just too bright, there's a few things you can try:

1. Try using brighter bulbs in your light sources. If you're using 250W bulbs, for example, try switching to 500W.
2. Move the lights a little bit closer to increase the brightness of the scene. This will have an affect on the shadows and contrast too, though, so don't be too extreme in your adjustments.
3. Add another light. It might surprise you to learn that two lights is brighter than one light!
4. Reprogram the circuit to put out a lower LED level. This only works if you have PWM control over the LEDs, but it works quite well.