HOLOGRAM KIT Litiholo

Hologram Kit Contents

- Holographic Laser System Box
  - Laser Diode
  - Battery Pack
  - Batteries (2)
  - Connectors (2)
  - Special Clip
- "Instant Hologram" Film Box
  - 2"x3" glass plates (20)
- Laser-cut Holographic Plate Holder
- Laser-cut Laser Mount
  - (with two diode mounting pieces)
- LED Darkroom Light
  - (For seeing in the dark without exposing the film.)
- Object for Hologram
- Black Card (for use as shutter)
- White Card (for aligning laser light)
- Uncoated Film Plate (for aligning laser light)
- Basic Concepts Guide
- Kit Contents and Important Tips
- Hologram Kit Step-by-Step Instructions
- Quick-Start Guide

Important Information and Tips

Vibration is the enemy of holograms. So pick a solid surface on which to make your holograms, like a kitchen table, kitchen countertop, bathroom sink, desk, solid floor, etc. Poor surfaces for holograms would be on a bed, directly on a carpet floor, on a wicker chair, or a hammock. When making your hologram, follow these tips: no talking during hologram exposure; do not touch table or surface during hologram exposure; do not move around or tap your toes; turn off the air conditioner/heater, the washing machine, and the dish washer. While the Litiholo Hologram Kit has been created to minimize vibration issues, follow these tips for better success.

If at first you don't succeed, overexpose. The Litiholo "Instant Hologram" Film is very different from traditional film. If you are unable to get a hologram with a certain exposure time, try increasing the time. The Litiholo Film develops as it is being exposed, so additional laser exposure will have only a minor effect after the film has used up all of its exposure capacity. After you have established an exposure time that works, you can start to back off the exposure time for fine tuning. The possible need for a longer exposure time is due to the lasers, which do not have exactly the same output for every system.

Holographic objects are everywhere. However, not all objects will make good holograms. We highly recommend that you use the supplied Object in your kit for your first hologram, to help ensure success. (In many kits, the Object that is supplied is a die cast car. Provided you have picked a solid, level surface for making your holograms, the fact that the car is sitting on wheels will not affect your hologram. If you prefer, you can place the die cast car on its side or upside-down for your first attempts.) Other good objects include die cast metal objects, pewter objects, ceramic figurines, rings or jewelry, coins, keys, etc. Poor objects include people, plants, paper objects, liquids, and some plastic objects. Also remember that the laser beam is red, so only red, white, or reflective objects will show up well. Objects that are primarily green or blue will absorb the red light instead of reflecting it, making a very poor hologram.

Lasers are safe. Litiholo is very concerned about safety when it comes to lasers. Litiholo has chosen lasers that have a safe power level, yet sufficient to make your holograms. Your natural "blink reflex" is sufficient for protection at these laser powers. Of course, if used improperly, any laser can cause problems. Never place a laser directly up to your eye, or point a raw laser beam into your eye while forcing your eyes open. This would be like staring at the sun. Don't do it!

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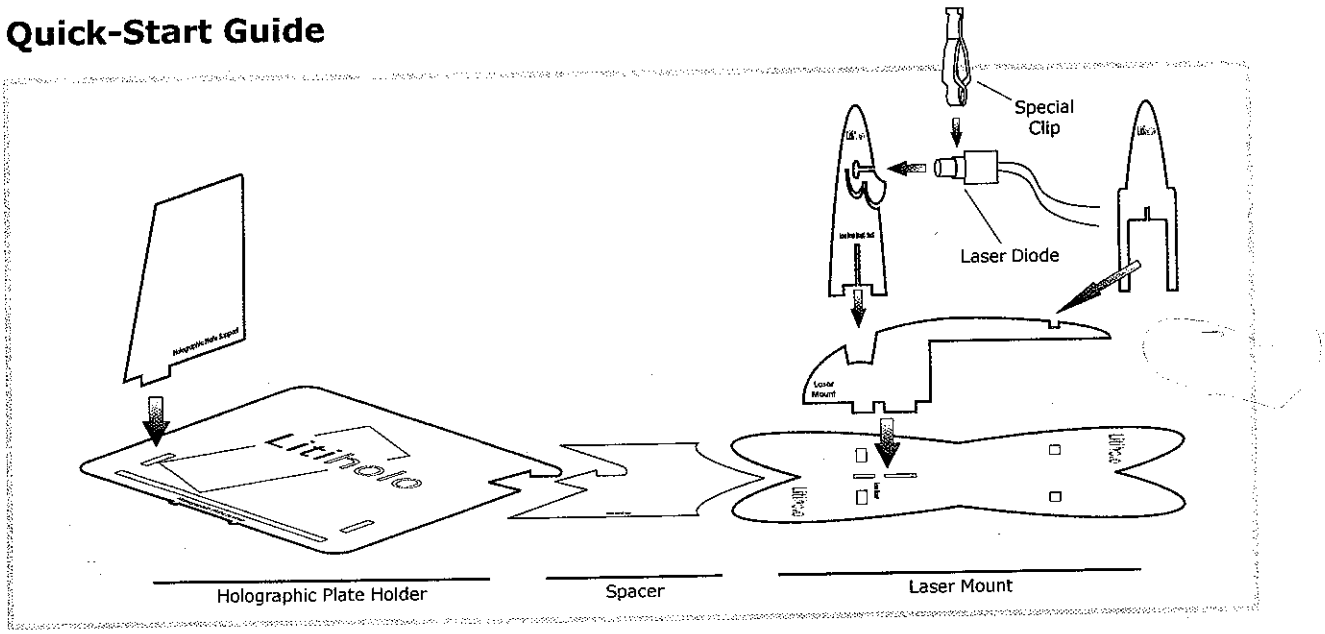
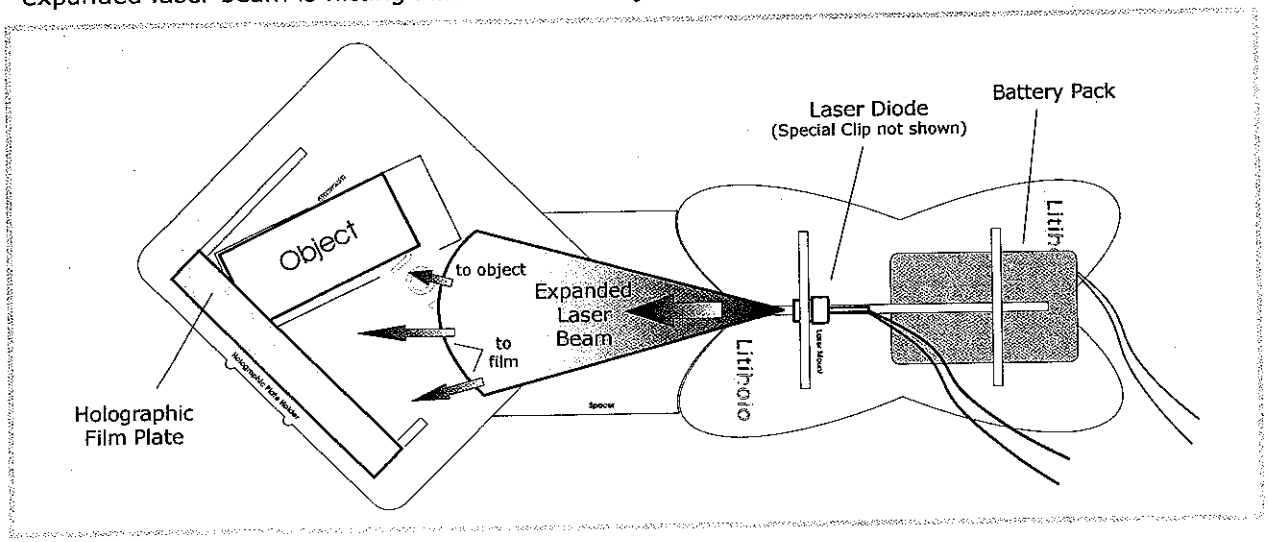
Quick-Start Guide



1. Assemble Holographic Plate Holder, Spacer, and Laser Mount (using "Small" Laser Diode Mount). Unscrew front barrel of Laser Diode, removing front barrel, lens, and spring. Place Laser Diode into Laser Diode Mount. Attach the Special Clip to the rear barrel of the Laser Diode.
2. Load Batteries into Battery Pack, and slide into rear of Laser Mount. Connect Laser Diode to Battery Pack with connectors, and turn on. Allow 5 minutes to warm-up before making hologram.
3. Place Uncoated Film Plate and Object as indicated below. Using the White Card, verify that expanded laser beam is hitting Film Plate and Object as indicated. Adjust as necessary.



4. Place the Black Card just after the Laser Mount so that it blocks the laser light (Black Card should be folded to stand on edge).
5. Turn off ALL LIGHTS except for the LED Darkroom Light. Remove an "Instant Hologram" Film Plate from the box and inner bag. Place it into the Holographic Plate Holder.
6. Wait about 3-5 minutes. TOTAL SILENCE IS IMPORTANT. DO NOT TOUCH TABLE.
7. Gently lift Black Card to expose hologram. Expose for approximately 10 minutes (or up to 15 minutes). TOTAL SILENCE IS IMPORTANT. DO NOT TOUCH TABLE.
8. Replace the Black Card momentarily. Remove your object. Then remove the Black Card again to view your hologram! Look through the Film Plate to see holographic object.

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Troubleshooting Guide

If you are having trouble making holograms with your kit, the steps below will help identify the source of the problem and the proper solution. It is important to know that Liti Holographics is dedicated to helping you become holographic, so that you too can enjoy the thrill of making holograms. If you continue to have difficulties after following the Troubleshooting steps below, please send an e-mail to techsupport@litiholo.com, or call us at 757-873-6460.

Step-by-Step Troubleshooting

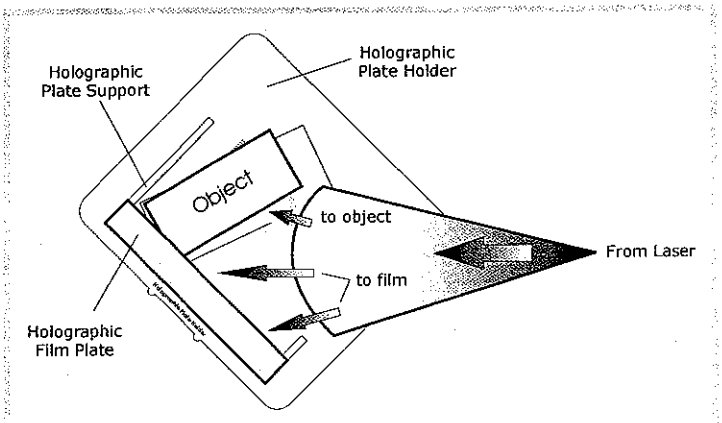
1. Do you have a vibration or movement problem with your kit?

Make sure that the hologram kit is set up directly on a solid surface like a table, desk, countertop, etc. Do not set up the kit directly on the carpet or on a bed, and do not put any other material between the kit components and the solid table surface (i.e. do not set up the kit on a small board which is then placed on the table). If the kit is not set up directly on a solid surface, the holograms may be dim or not visible at all. Also, use the Object included with your kit until you are making holograms consistently, as other objects may not be stable enough.

2. Have you set up the kit properly?

Take a look at the diagrams on the Step-by-Step instructions, and make sure that your kit looks exactly the same.

a. Make sure that the expanded beam coming from the laser is similar to the diagram below, and that the expanded beam is hitting both the film plate and the object.
b. Remove the object, and place the white card in the slot on the Holographic Plate Holder where the film plate is usually located. The expanded laser beam should be centered vertically on the white card area, and should be significantly wider in the horizontal direction.
c. Now remove the white card and put the Uncoated Film Plate in its place. Position the Object inside the rectangle that is etched onto the surface of the Holographic Plate Holder (see diagram). This rectangular area represents a "safe" area that should produce holograms consistently. About 70% of the expanded laser beam should still be going directly to the Film Plate area without being blocked by the Object (the Object may block a small amount of light going to the corner of the Film Plate near the Plate Support), while about 30% of the expanded laser beam should now be scattering off the side of the Object.
d. Make sure you can see laser light scattering off the side of the Object when you look through the Uncoated Film Plate. Do not place the Object directly behind the Film Plate in such a manner that it will block all or most of the laser light from reaching the Film Plate directly.



Holograms are formed by a combination of light coming directly to the Film Plate and light reflecting off the Object. The Film Plate areas that receive laser light from both of these beams (light directly from the laser and light reflecting from the Object) are the areas where the hologram is created.

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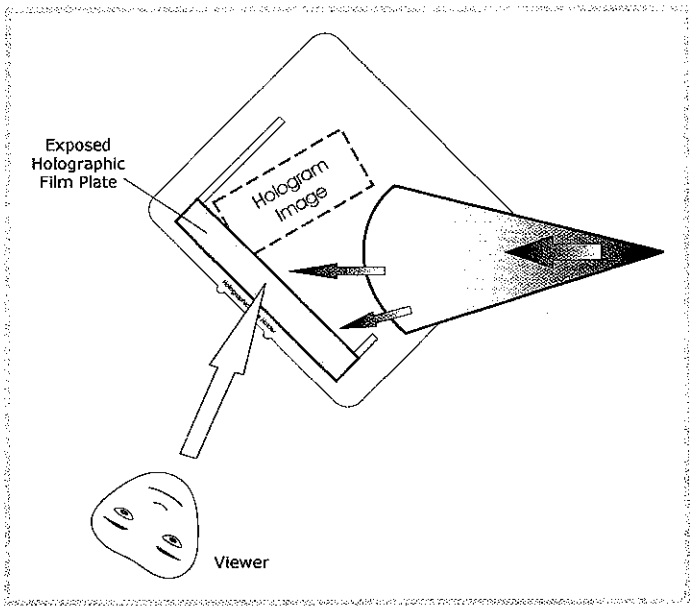
Step-by-Step Troubleshooting (cont.)

3. Are you exposing the hologram for long enough?

The Litiholo "Instant Hologram" Film has a significant blue tint before it is exposed. Immediately after exposing the hologram, you should notice that the Film Plate areas receiving laser light directly from the laser are now clear, while other areas near the corners of the Film Plate or areas blocked by the Object remain blue. If you do not see a large area of the Film Plate that is clear after your exposure, the Film Plate is most likely not receiving enough light. Increase your exposure time, up to 20 minutes. The Litiholo "Instant Hologram" Film is very different from traditional film materials, and can be significantly overexposed without harm.

4. Are you viewing the hologram correctly?

To view your hologram, the exposed Film Plate with your hologram should be in the same position on the Holographic Plate Holder as when you were making the hologram. Make sure that the expanded laser beam is hitting the exposed Film Plate and remove the Object. Lower your head close to the level of the exposed Film Plate, and look through the glass as if it were a window. You should see a hologram image of the Object in the same location from which you just removed the real Object. It may be helpful to dim the room lights to see the hologram image for the first time.



5. Is there a problem with the film or the laser?

If you are still unsuccessful, it is time to check the operation of the film and the laser.

a. First check the batteries. New batteries may increase the laser power.
b. Also make sure that you are using the Special Clip on the barrel of the laser, which prevents the laser from overheating and losing power.
c. Next, remove a new Film Plate from the film box (in the dark) and then turn on the room lights to examine it. Take the white card and fold it in half, slipping the folded card over the edge of the Film Plate so that it is blocking both the front and back of part of the Film Plate. With the white card in place, hold the Film Plate 2-3 inches away from a light bulb for 2 minutes. Remove the white card and examine the Film Plate. You should see a difference between the area that was uncovered (it will be clear) and the area that was covered by the white card (it will be light blue). If you do not see any difference between the covered and uncovered sections of the Film Plate, the film may have been damaged and may need to be replaced.
d. If the Film Plate does show a difference between the covered and uncovered areas, you will need to test the laser performance using the Hologram Kit. Place a new Film Plate into the Hologram Kit setup (in the dark again), but remove the Object so that the laser light is only hitting the Film Plate. Expose the Film Plate for 15 minutes. The Film Plate area that is receiving light directly from the laser should now be clear. If the Film Plate has turned clear after being exposed to the light bulb, but not after being exposed to the laser light, the laser may have been damaged and may need to be replaced.

Step-by-Step Instructions Guide

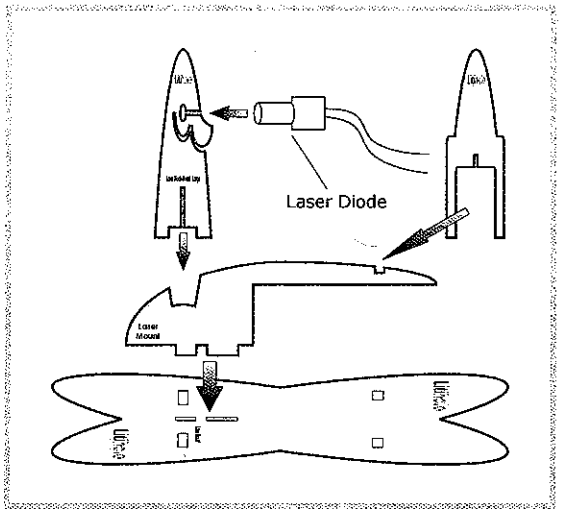
These instructions will guide you through each step in assembling your hologram kit and making your first holograms. Read each step carfully and examine the diagrams closely to ensure your hologram success. If you have any difficulties after several attempts, be sure to consult the Troubleshooting Guide for help.

Step-by-Step Instructions - Laser Light

1. Find a solid surface to set-up the kit, where you can turn off all of the lights when making your holograms. A counter top, desk, kitchen table, bathroom sink, or dresser top are generally solid surfaces.

2. Open box and lay out all of the Hologram Kit contents.

3. Open the bag labeled "Laser Mount," and remove all 5 pieces. Lay the largest piece, labeled "Base," flat on the table with the Litiholo logo facing up. Take the "Spine" piece, and place its two tabs into the two slots in the middle of the Base, pressing firmly. Next, take the "Large" Laser Diode Mount and slide it over the wide notch in the Spine, inserting the tabs on the bottom into the two slots on the Base. Finally, place the Battery Holder piece over the small notch in the Spine and insert the two legs into the corresponding slots in the Base. (The "Small" Laser Diode Mount is not used yet.)



4. Open the box labeled "Holographic Laser System." Remove the Laser Diode from its pink anti-static bag and insert the metal barrel into the Large Laser Diode Mount piece with the small circuit board oriented vertically. Remove the Battery Pack and the Batteries from the box, and load the Batteries. Slide the Battery Pack under the Battery Holder piece on the Laser Mount with the wires facing toward the back. Remove the Connectors from the box, connecting the black wire on the Laser Diode to the black wire on the Battery Pack, and the red wire on the Laser Diode to the red wire on the Battery Pack.

5. Find the Black Card supplied in your kit, which should be folded in half. Open the fold about halfway and place the Black Card on its edge in front of the Laser Mount so that it will block the laser beam coming from the Laser Diode. With the Black Card placed a few inches in front of the Laser Diode, turn on the switch on the Battery Pack (for information on the safe handling of the Laser Diode, see the Kit Contents and Important Tips). You should now see a red "dot" of laser light on the Black Card. Place your hand in front of the Black Card so that the laser beam hits your hand, and notice that the laser power is very low and safe to touch. If you would like to see the laser beam traveling through the air, dim the lights and spread a very small amount of baby powder in the air between the Laser Diode and the Black Card (be careful not to get any on the Laser Diode itself or the Laser Mount). You can also use chalk dust, bathroom air freshener spray, or aerosol deoderant spray.

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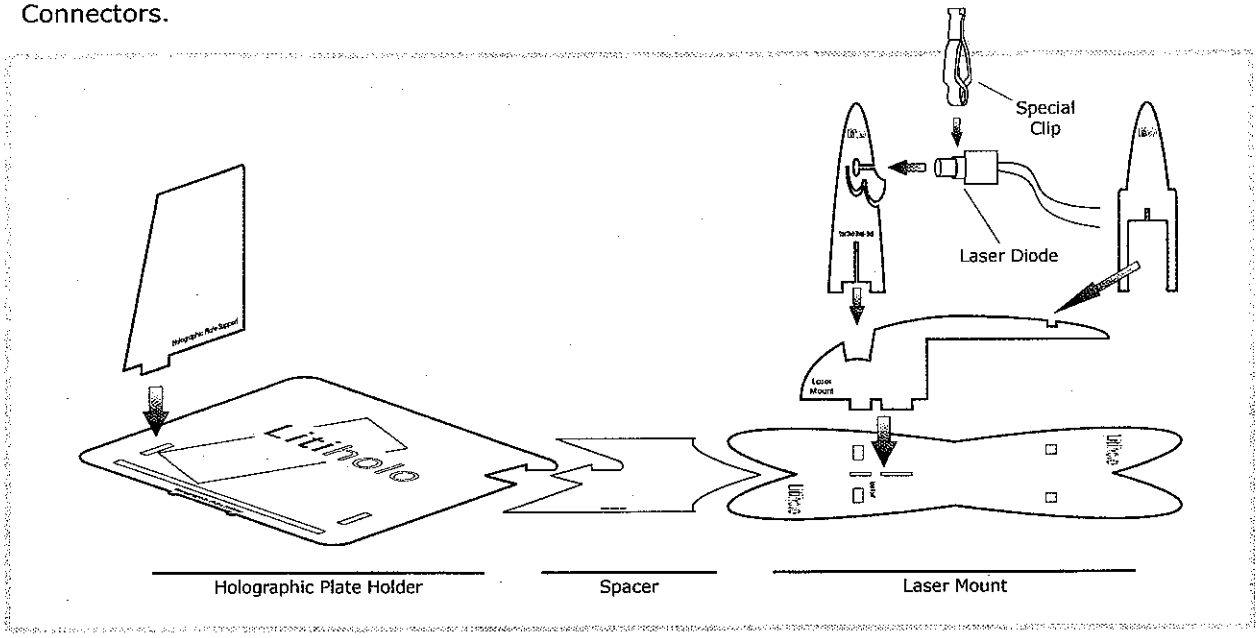
Step-by-Step Instructions - Hologram Set-up

6. Now its time to start setting up for your first hologram. Turn off the Battery Pack so that the Laser Diode is no longer operating. Disconnect the Laser Diode from the Connectors, and remove the Laser Diode from Large Laser Diode Mount, setting it aside temporarily. Remove the Large Laser Diode Mount from the Laser Mount Base (as installed in previous steps), and replace it with the Small Laser Diode Mount.

7. Pick up the Laser Diode and gently unscrew the front metal barrel from the rear barrel section, being careful not to twist the circuit board. Remove the front barrel, lens, and spring, and place them back in the pink anti-static bag. Insert the smaller threaded section of the Laser Diode into the Small Laser Diode Mount piece with the circuit board oriented vertically. Take out the Special Clip, and attach it to the thicker barrel of the Laser Diode just in front of the circuit board (make sure that the Special Clip does not touch any part of the circuit board). Reconnect the red and black wires of the Laser Diode with the red and black wires on the Battery Pack using the Connectors.



8. Open the bag labeled "Holographic Plate Holder." Remove the large piece, labeled "Holographic Plate Holder," and place flat so that the Litiholo logo is facing up. Remove the Spacer piece and fit the protruding arrow into the arrow-shaped cutout on the Plate Holder. Position Plate Holder and Spacer assembly so that the curved end fits together with the end of the Lens Mount. Remove the smaller piece marked "Holographic Plate Support" from the bag, and align the tab with the small slot on the Plate Holder that is farthest from the Laser. The point of the Holographic Plate Support should be facing the long slot in the Plate Holder. Press the pieces firmly together.

9. Turn on the Battery Pack so that the Laser Diode is operating, and allow the Laser Diode about 5 minutes to warm up before making a hologram.

10. Find the glass Uncoated Film Plate (in the same bag with the White and Black Card) and place it in the long slot on the Plate Holder, so that one edge leans against the Plate Support. Find the Object for your hologram (use the one supplied in your kit until you are comfortable making good holograms) and place it inside the rectangular area etched on the Plate Holder surface.

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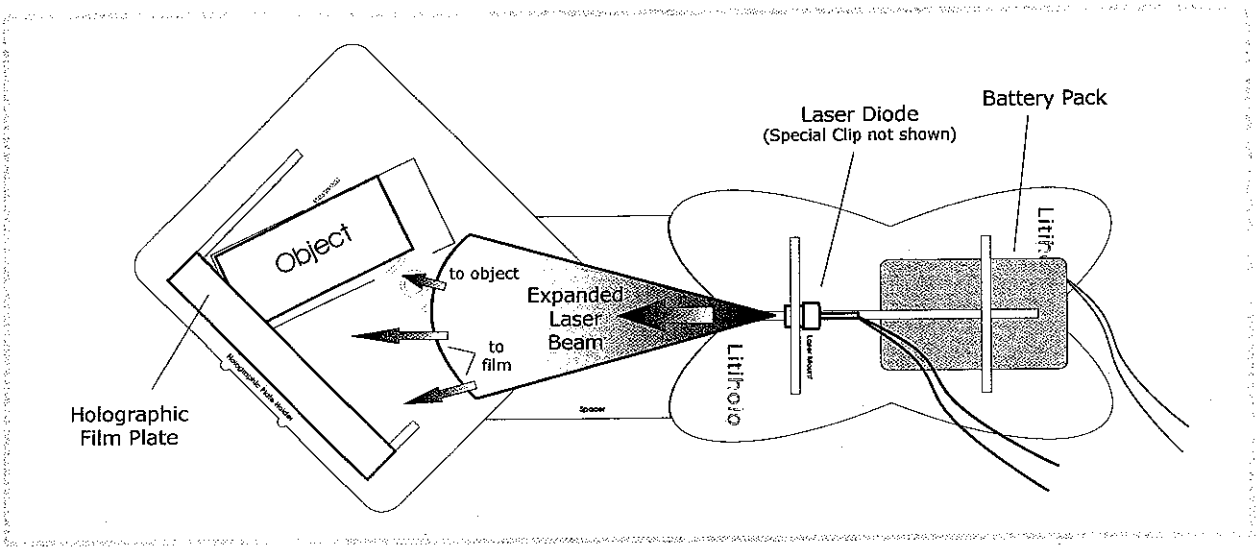
Step-by-Step Instructions - Hologram Set-up (cont.)



11. Using the supplied White Card to see where the expanded laser beam is projected, you should see that the beam is spreading toward the object and the Uncoated Film Plate. Now place the White Card together with the Uncoated Film Plate in the long slot on the Plate Holder to see how the laser beam will illuminate the film area. To adjust the laser light up or down on the White Card, hold the Laser Mount Base with one hand while using the other hand to tip the top of the Laser Diode Mount piece forward or backward. The brightest part of the spread laser beam should be roughly halfway up the White Card, and filling the width of the White Card. Now remove the Uncoated Film Plate and White Card from the Plate Holder and examing the Object to make sure it is being illuminated by the spread laser beam. Adjust the beam up or down again if the Object is not illuminated very well. Recheck the laser beam illumination at the film area again, if necessary. When you are finished aligning the laser beam, the spread laser light should be illuminating both the Object and the film area simultaneously. If the Object is positioned directly behind the Film Plate such that it blocks most or all of the light from reaching the Film Plate, you will not get a hologram. It is not necessary for the laser beam to fill the entire Film Plate or the entire Object for your first holograms. Later, you can remove the Spacer and place the Plate Holder farther away to fill more of the Film Plate and Object (and probably increasing the exposure time). This step is best performed in low lighting, so that you can see the expanded laser light clearly. When you are finished aligning the laser beam, remove the Uncoated Film Plate and the White Card.

12. The Black Card will act as a simple shutter to block and unblock the laser light during the hologram exposure. As before, open the folded Black Card about halfway so that it will stand on its edge, and place the Black Card on top of the Spacer piece so that no laser light reaches the Film Plate or the Object.

13. At this point, you are almost ready to make your hologram. But first, make sure that the Laser Diode has been on continuously for at least 5 minutes. If the Laser Diode is not sufficiently warmed-up, you will not get a good hologram. It would also be a good idea to read the Important Information and Tips at this time.

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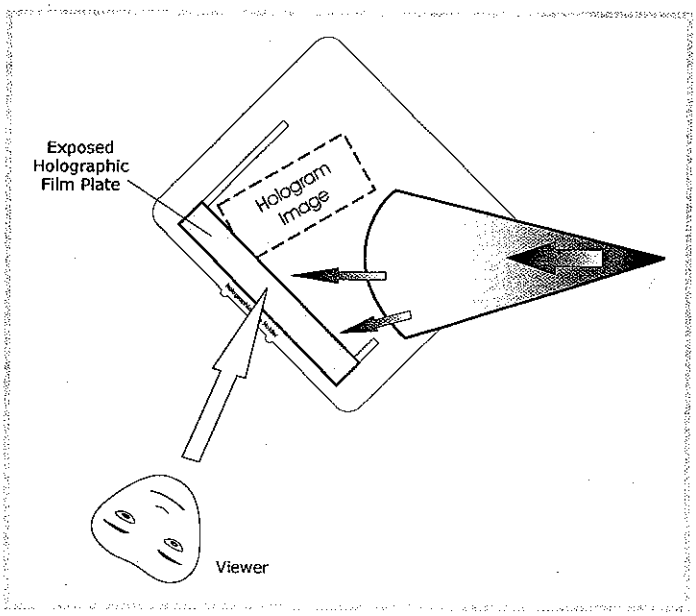
Step-by-Step Instructions - Holograms!

14. Remove the supplied LED Darkroom Light (green or blue) from its package. Turn on the LED Darkroom Light, and TURN OFF ALL OTHER LIGHTS. A small amount of light coming under a door or from star light will probably not harm your hologram, but total darkness is best (using the LED Darkroom Light will allow you to see quite well in the dark without harming the film, since the film is only red-sensitive).

15. WITH ALL THE LIGHTS TURNED OFF, open the Litiholo "Instant Hologram" Film box and remove one Film Plate. Discard any of the white paper separators that you might have removed with the Film Plate. Leave the remaining Film Plates in the box, and close the box. (You may also notice that the Film Plate has a thin, clear coversheet on one side. Do not remove this clear coversheet. If possible, place the Film Plate so that the coversheet faces away from the object.) Place the Film Plate in the Plate Holder, similar to the previous tests with the Uncoated Film Plate. The Film Plate should rest securely in the bottom of the long slot on the Plate Holder, with one edge leaning against the Plate Support. If the Film Plate is not stable, your hologram will be dim or will not appear, so make sure the Film Plate is positioned well.

16. Now that everything is in place, you must wait for any remaining small vibrations or movements to die down. We suggest that you wait for at least 3 minutes. Because vibrations are the enemy of holograms, DO NOT TALK while you are waiting, REMAIN AS STILL AS POSSIBLE, and make sure YOU ARE NOT TOUCHING THE TABLE. If there are any loud noises that you can hear, wait for them to die down.

17. Gently lift the Black Card so that it no longer blocks the laser beam. Expose the hologram for about 10 minutes (or up to 15 minutes). Again, DO NOT TALK, REMAIN AS STILL AS POSSIBLE, and DO NOT TOUCH THE TABLE or anything on the table. DO NOT PLACE THE BLACK CARD ON THE TABLE DURING THE EXPOSURE.



18. Gently replace the Black Card so that it blocks the laser beam again. (You can now turn on additional lights, although your hologram will be best viewed in dim lighting initially.)

19. Without moving the Film Plate, remove the Object and set it aside away from the laser beam. Remove the Black Card so that the laser light now hits the Film Plate again. Looking THROUGH the Film Plate toward the area where the Object was originally located, you should now see a holographic image of the Object sitting in the same location.

20. CONGRATULATIONS! YOU JUST MADE A HOLOGRAM. To remove any remaining blue color, remove the Film Plate and hold it about 2-3 inches away from a light bulb for 2 minutes until the bluish color is bleached to clear. Replace the Film Plate in its original position. You can also view your hologram with the LED Darkroom Light instead of the Laser. Place the LED Darkroom light in the same position as the Laser (simply move the Laser Mount out of the way), and you see your holographic image in a new color. You may need to move the LED Darkroom Light around a little to get the best angle.

Basic Concepts Guide

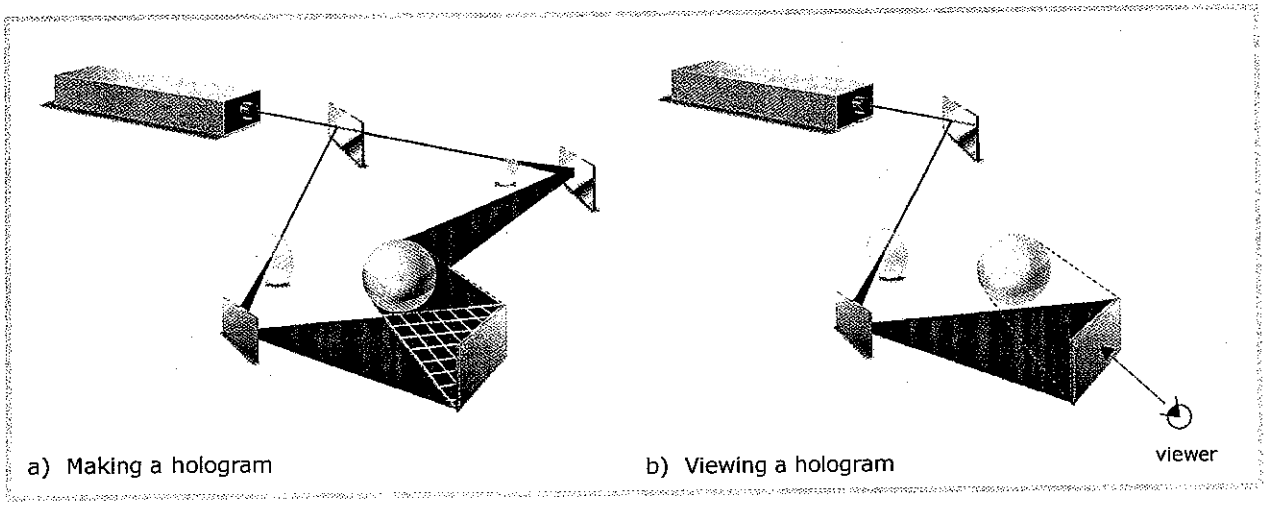
Holograms

For most of us, a hologram is a three-dimensional image that looks like a real object because the image has depth. However, a hologram is not required to be 3D, and some 3D images are not holograms at all.

In technical terms, a hologram is the captured intensity and phase information produced by the interference of two or more beams of light. Not exactly easy to understand, is it?

We all know that a regular two-dimensional picture has no depth, and is simply a recording of intensities of an image, or the shades of brights and darks in an image. A hologram is unique because it records not only the intensity of the light, but also the direction that the light was traveling when it hit the film. It is this extra information of direction that allows you to see the images in 3D, or to "look around" the objects as if they were really there. A hologram captures the intensity and direction information by recording the interference pattern of the light that hits the film.

A simple layout for making a hologram is shown in the image below. The laser beam exits the laser and is divided into two beams by a beamsplitter. One beam is expanded and then reflects off of the object, with the reflected light scattering onto the film. This is often called the "object beam." The second beam is also expanded, but goes directly to the film, and is called the "reference beam." The object beam (light scattered from the object) and the reference beam create an interference pattern on the film, which is the hologram. To view the hologram, the film is developed (in the case of Litiholo "Instant Hologram" Film, there is no developing), placed back in its original position, and illuminated with only the reference beam. When the viewer looks through the film (from the side opposite the object) a holographic three-dimensional image can be seen where the object was originally located.



a) Making a hologram b) Viewing a hologram

The layout for the Litiholo Hologram Kit is a little different from this image. The hologram kit uses only one beam of laser light, with part of the beam hitting the object and the other part hitting the film directly. This layout allows the hologram to be more resistant to vibrations, which means you can make holograms even on your kitchen table.

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Basic Concepts Guide (cont.)

"Instant Hologram" Film

Well, you may not know it, but making holograms was not always this easy. Usually, after creating your hologram with the laser, you still had one of the hardest parts ahead of you: the developing. For years and years, holograms have typically been made on silver-halide emulsion film, very much like a higher resolution version of the film in traditional cameras. Developing these holograms involved a complex process of several different chemical baths, all in the dark, of course. Before that, some holograms were made on DCG, or Dichromate Gelatin, the development for which included dipping the holograms into boiling alcohol.

But not you! You are now a member of an elite generation that can make holograms instantly. With Litiholo "Instant Hologram" Film, the hologram forms and develops at the same time, allowing your images to viewed immediately. No waiting. No chemicals.

Laser Light

Almost all holograms are made with laser light, because it is a convenient source of highly ordered and controlled light. You probably already know that all light is made up of waves (and particles called "photons," of course). The distance between the peaks of the waves is called the "wavelength" of the light, and this determines the different colors of the light we see, with red being a longer wavelength, blue being a shorter wavelength, and green in between. So what's the difference between laser light and regular light? A nice mental picture is to think of a parade. Regular lights, like the ones in your home, are like a wild parade with people running in all directions, lots of noise, and lots of party favors being thrown everywhere. So regular light still has waves, but there are lots of different wavelengths (colors) going in lots of different directions, all at the same time. Laser light, on the other hand, is like a military parade with everyone marching in the same direction, stepping perfectly together to the music. Laser light only has one wavelength (color), and all of the waves come out of the laser with the waves lined up in step with each other. This highly ordered light makes it much easier to create an interference pattern with the light, which is what we need to make a hologram.

Interference Pattern

A hologram is really an interference pattern of light that is captured on film. Enough said, right?

Okay, maybe a little more would be helpful. When two waves come together, such as two waves from two beams of laser light, they combine to make one wave pattern. If the peak of one wave combines with the peak of another wave, you get a wave twice as big (this is an example of "constructive interference"). If the peak of one wave combines with the valley of another wave, you get no wave at all (and this is an example of "deconstructive interference"). The combination of all of the constructive and deconstructive interference creates a microscopic pattern of bright (constructive) and dark (deconstructive) lines on the film that are about 50 times smaller than the thickness of one piece of hair. All of these microscopic bright and dark lines make up an interference pattern, which is the information of your hologram.

continued...

Basic Concepts Guide (cont.)

Diffraction

If you've ever seen the rainbow on the bottom of a CD or DVD, you've seen diffraction. Diffraction is when light bends from passing through (or bouncing off of) very closely spaced lines. In the case of a CD or DVD, the closely spaced lines are the tracks on the disc and the space between each of the tracks. The light diffracts off of this pattern bending the light into a rainbow, since each of the colors (or wavelengths) bends a different amount.

When a hologram is made, it records a microscopic pattern of bright and dark lines in the film due to the interference of the light beams that created the hologram. To see the hologram, light is passed through the hologram again, and now the light diffracts off the captured pattern, bending the light to look like the original object is still there.

Vibration

The enemy of holograms is vibration. Not just vibrations from airplanes passing over your head or loud music from a car. But also the vibrations made every time you step on the floor. Or the vibrations created from air currents passing through the room coming from the air conditioner. A pretty good example is the fact that you cannot make holograms of plants with this kit, because the plant will actually grow too much during the making of the hologram, causing movement.

Remember, holograms are made from interference patterns, with bright and dark lines that are about 50 times smaller than the thickness of one hair. Even the smallest of vibrations can destroy this pattern. And this is not like a photograph, where movement makes the picture a little blurry. If vibrations happen during the time that the hologram is being made, the tiny interference pattern is wiped out, leaving you with a completely blank hologram.