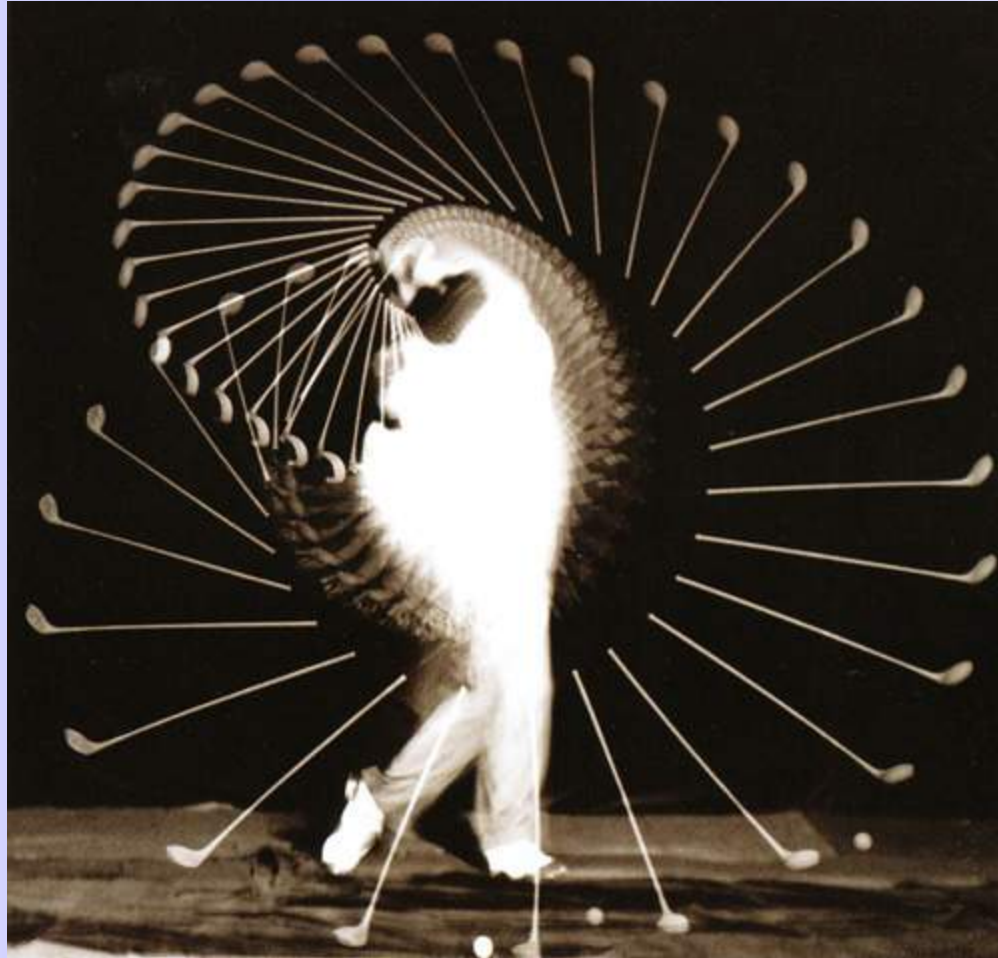


# FLASH IN STEREO



*"Golf Legend Bobby Jones Taking a Swing", photo taken by Dr. Harold Edgerton, the inventor of electronic flash in 1938, using stroboscopic flash photography.*

**A Presentation by George Themelis**

**NSA / July 2010**

# Outline

- **Why Flash?**
- **Flash Advantages in Stereo**
- **Short History of Flash Photography**
- **Flash Bulbs vs. Electronic Flash**
- **Flash Synchronization**
- **Flash Exposure**
- **Issues when using flash**
- **Special Flash Techniques**
- **Flash in Slide Bar (Single camera) Stereo**
- **Flash with Vintage Stereo Cameras**
- **Flash with compact digital stereo cameras**
- **Flash with twin cameras**

# Why Flash?

When the existing light is dim, there is a need for artificial light in order to get **good exposures**. Example: **In a well-lit interior space a typical exposure using 100 ISO is f8 at 1 second**. Compare this to a “sunny day” f16 1/100,  $2+7 = 9$  f-stops less light. Hand holding the camera or taking pictures of people at these long exposures is impossible. Hence flash is a necessity for taking pictures indoors.

Without extra light, the photographer has three options: 1) **Open up the aperture** (f-stop), 2) **Increase the time of the exposure**. 3) **Increase sensitivity (ISO)**. These methods have disadvantages & limitations:

- Opening up the lens aperture reduces the depth of field (can be a problem in stereo) increases lens aberrations, plus there is a limit (lens maximum aperture)
- Theoretically, there is no limit in increasing exposure time, but in practice 1) film reciprocity, 2) digital noise, 3) blurry pictures without solid support, 4) subject movement.
- Increased sensitivity leads to film grain or digital noise.

In addition to exposure considerations one might want to use flash light because of its color balance, to freeze motion, special effects, etc.

# Flash Advantages in Stereo

- Flash works particularly well for stereo because its short duration will freeze action and result in sharper pictures.
- Also, the light from the flash is more effective for the closer to the camera objects, which in stereo carry most of the depth. Flash light is perfect for close ups and macro stereo photography.
- Flash works well outdoors too for filling-in the shadows and putting an extra punch into the close to the camera objects, even if there enough available light.

**The bottom line is that flash is almost a necessity in stereo photography and proper use of flash can improve our stereo pictures.**

It seems that the use of flash remains a challenge for many stereo photographers today and I hope this workshop will help understand the challenges and the solutions.

# Flash Powder (1880-1930)

- In the early days of photography the only source of light was the sun. First artificial light photography dates as far back as 1839. Studio arc-lamps helped reduce exposure to 2-3 seconds for a carte-de-visite, in 1880s. First portrait taken using magnesium powder in 1864.
- **Flash powder:** Mixture of magnesium powder and an oxidizing agent (potassium chlorate) put on a plate and ignited by a spark from a flint wheel. Used from 1880s to 1930s
- Early flash photography was not synchronized, which means that the photographer had to put the camera on a tripod, open the shutter, trigger the flash, close the shutter. This technique is known as “**open flash**”.



*2009 photo by Race Gentry in flickr.  
1909 Victor flash lamp and a 1903 View camera.*



# Flash Bulbs (1930-1970)

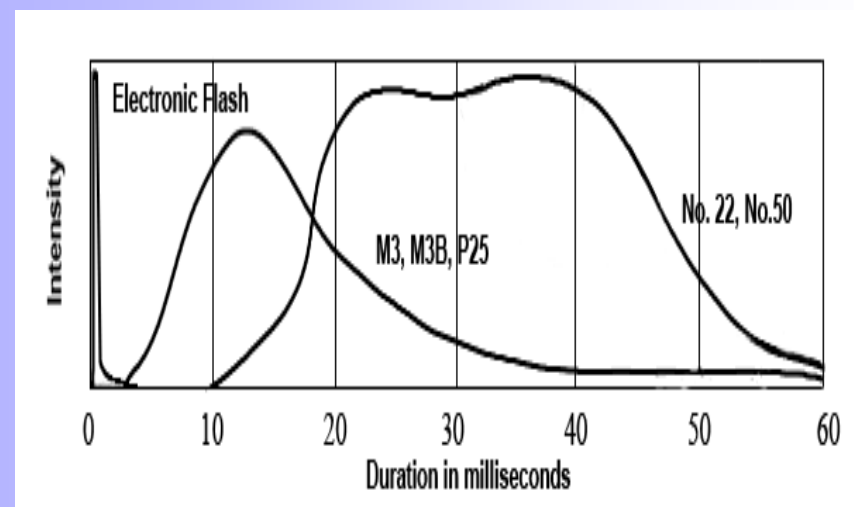
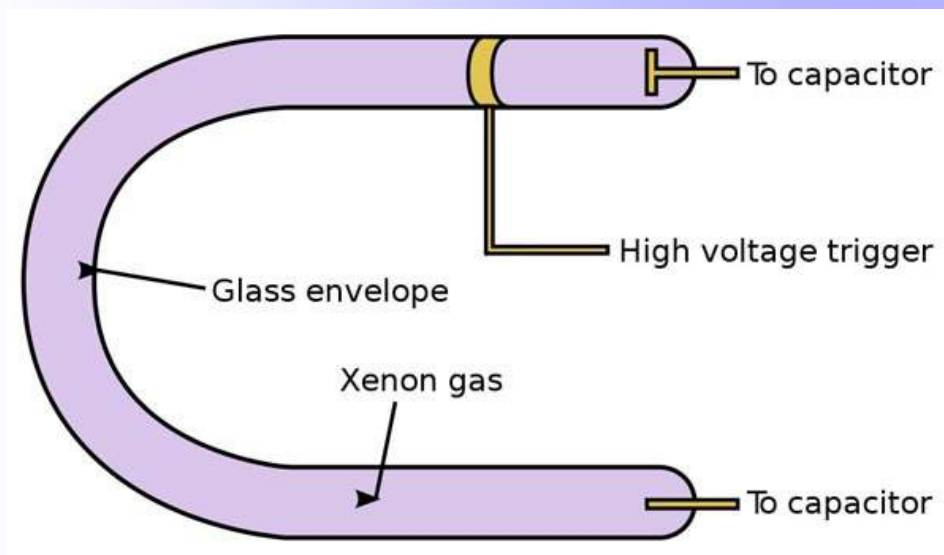
- Flashbulbs were first produced in the 1930s as a replacement for flash powder. The glass envelope makes them safer to use and gets rid of the smoke problem. Originally expensive, they increased in popularity because of their convenience and safety, until they were eclipsed by the electronic flash.
- Flashbulbs have a piece of tungsten or zirconium filament between their terminals. This wire is covered with an explosive primer paste. When current is applied, the wire heats up, igniting the paste, which then ignites the tin, aluminum or (in later years) aluminum wire (or wool). An oxygen atmosphere increases the brilliance of the flash. Blue coating is used for color correction with daylight films.
- Still used because 1) they are more **powerful** than compact electronic flash, 2) burn slower and do not freeze motion. Today, flashbulbs are in high demand by cave photographers. Many large cave passages and chambers could never be adequately or effectively illuminated without the use of photoflash bulbs.



Top: variety of flash bulbs (wikipedia)  
Bottom: from [www.darklightimagery.net](http://www.darklightimagery.net)

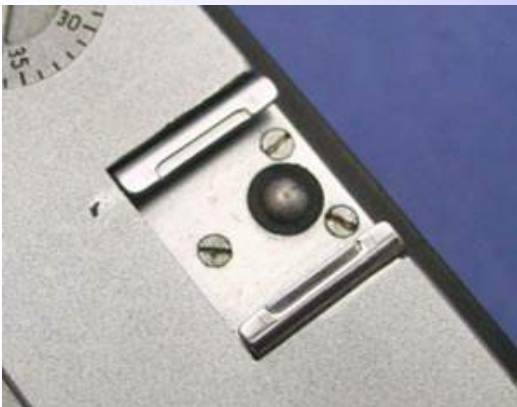
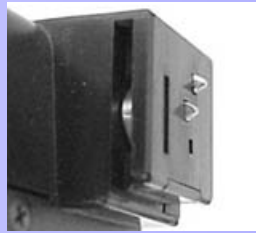
# Electronic Flash (1970-Today)

- Result of the pioneering work of **Harold “Doc” Edgerton** in MIT in the 1930s.
- Electric energy from batteries is converted to high voltage (300 volts or more) and is used to charge a large capacitor. *The converter often makes a high-pitch sound, which you can hear when the unit is charging.* The capacitor is permanently connected to two electrodes in a glass tube filled with **xenon gas**. When the flash is fired, a second small transformer generates a pulse of very high voltage, which causes the xenon gas in the glass tube to ionize. Ionization makes the gas conductive, and the big capacitor starts to discharge through the xenon gas.
- **Bright light** is emitted by the xenon gas during this process. The discharge is rapid. About 1/1000 - 1/200 seconds later the capacitor is essentially empty, and the voltage has dropped so low that the xenon stops to conduct electricity. At this point, the process can be started from the beginning.



# Flash Synchronization

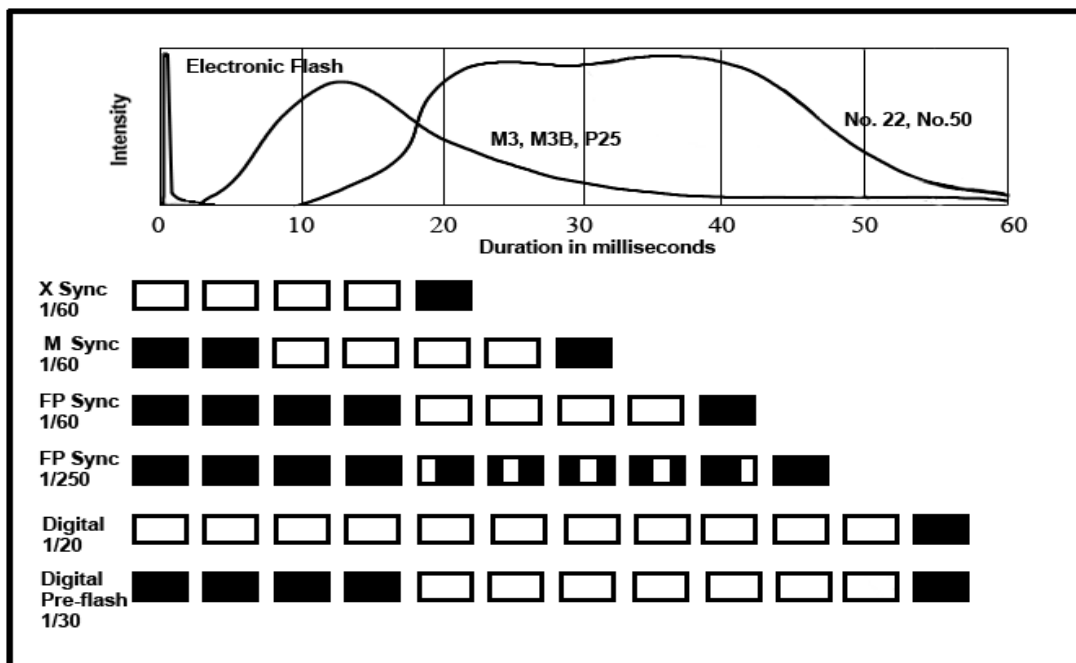
- How to fire the flash when the shutter is open or the sensor ready to accept the light.
- **Mechanical Cameras:** Electrical contact made when the shutter is open. Electrical connection between flash and camera is made by a PC (Prontor/Compur) plug or a flash mount (not shoe)
- **Digital cameras:** Programmable electronic timing circuit.





# Flash Synchronization II

- **M, F, FP and X synch:** Cameras designed for flash bulb use had M (medium), F (fast), FP (focal plane) synchronization, while cameras designed for electronic flash use had X (xenon) synchronization. The main difference is a delay from the time the bulb/flash fires until the shutter is fully open. X synch has no delay.
- **(Maximum) Synch Speed.** Leaf shutters (Stereo Realist, etc) allow flash synch across all shutter speeds (up to 1/1000 in some cameras). Focal Plane shutters (SLR) must use shutter speeds slow enough for the entire shutter to be open at once (typically 1/60). Digital cameras use electronic shutters which usually allow high x-synch speeds.
- **Wireless Synch:** Optical (slave flash), Radio.



Top: This happens when flash is used with an SLR camera with shutter speed faster than the synch speed (usually 1/60 or 1/125)

# Flash Exposure

- How to set the camera (f-stop, shutter speed) to get a good exposure with flash.
- **Shutter speed has no effect on flash exposure** (it only affects ambient light). Only the aperture (f-stop) affects flash exposure.
- **Guide Number (GN):** A measure of the strength of a given flash.  $GN = f\text{-stop} \times \text{distance}$  (at given film speed). GN = 80 ft at 100 ISO will give good exposure at f8 and 10 ft.
- **Manual Flash.** Flash fires entire charge (amount of light). The photographer controls exposure by changing f-stop, depending on subject distance.
- **Automatic Flash:** User sets a given (specified from flash unit) f-stop. Sensor (on flash) measures reflected light and stops discharge when exposure is satisfied.
- **TTL Mode:** During exposure amount of reflected light is measured by the camera. When exposure is satisfied, camera signals flash to stop exposure.



# Flash Meters

- Will measure flash exposure, take into account ambient light, determine exposure with multiple flash units, etc.
- Modern digital exposure meters will measure both ambient and flash light.
- Worth investing for anyone using flash even in the digital era.



# Issues with Using Flash

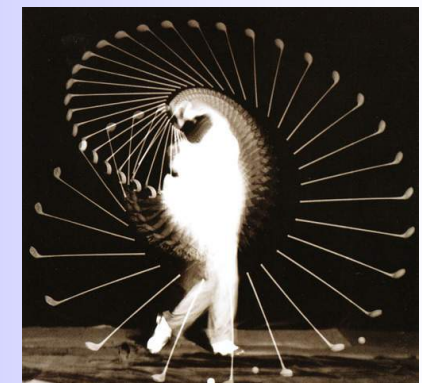
- **Low intensity** (for compact commercial units)
- **Quick Light drop off** ( $\sim 1/d^2$ ) for point light sources causes near objects overexposed & far objects underexposed. Not the case for big umbrella reflectors or collimated spot flashes.
- **Harsh Shadows:** This happens when the relative size of the light source (as seen by the subject) is very small. To reduce contrast 1) Increase size of light source, 2) Add secondary reflections to fill-in the shadows. Solutions: Increase flash coverage: 1) Use wide angle panel (extreme: “bare bulb” flash), 2) Bounce flash, 3) Diffuser attachments.
- **Red Eye:** Flash highlights the blood vessels on the back of the eyes. Effect is reduced or avoided by putting the flash far away from the optical axis of the lens (using a flash bracket)





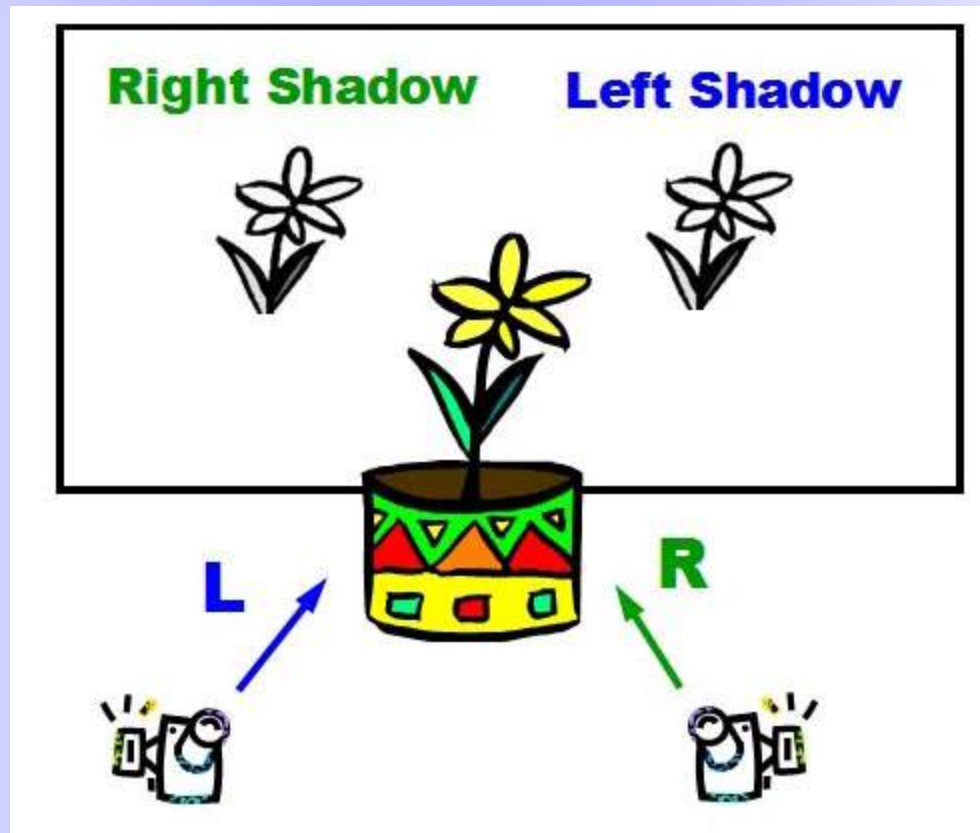
# Flash Techniques

- **Flash Ghosting:** Use of slow shutter speed and flash to illuminate a moving subject. Use flash with zooming and panning.
- **Flash Outdoors:** Soften harsh shadows from sun. Results in more pleasing portraits. Add a catchlight: Even at long distances flash can add a hint of light to a person's or animal's eyes.
- **Flash Indoors:** Balancing ambient & flash exposures.
- **Colored reflectors/gels:** Use with flash for creative effects.
- **Tunnel Flash:** Use telephoto panel to focus flash light for creative effects.
- **Freeze rapid motion:** Duration of flash burst can be as short as 1/10,000 (using consumer flash with a fraction of full power, 1/16, 1/32) which will freeze motion better than fastest shutter speeds of most cameras. Specialized units can have much shorter duration. Sound or motion sensors can be used to fire the flash.
- **Multiple Exposures:** Fire flash several times in the dark with the shutter open and without advancing the film. Can be used for trick stereo photography. Also, flash light painting. Stroboscopic photography: flash fires at constant rate to record motion in one frame.

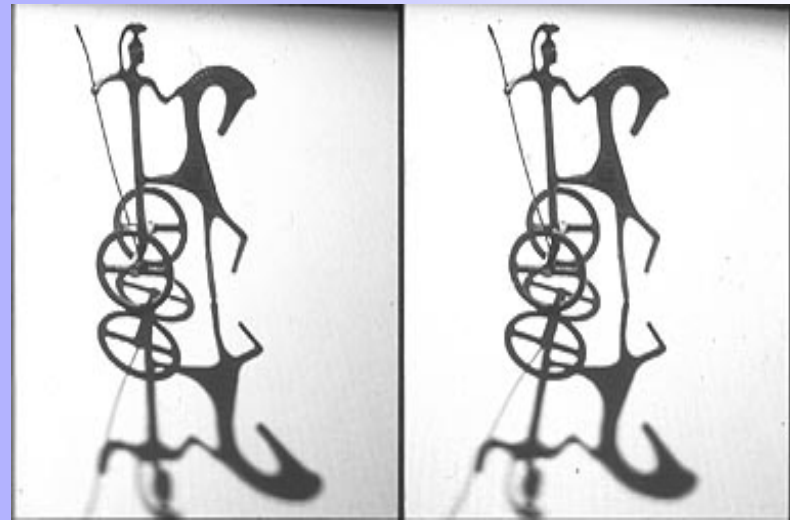
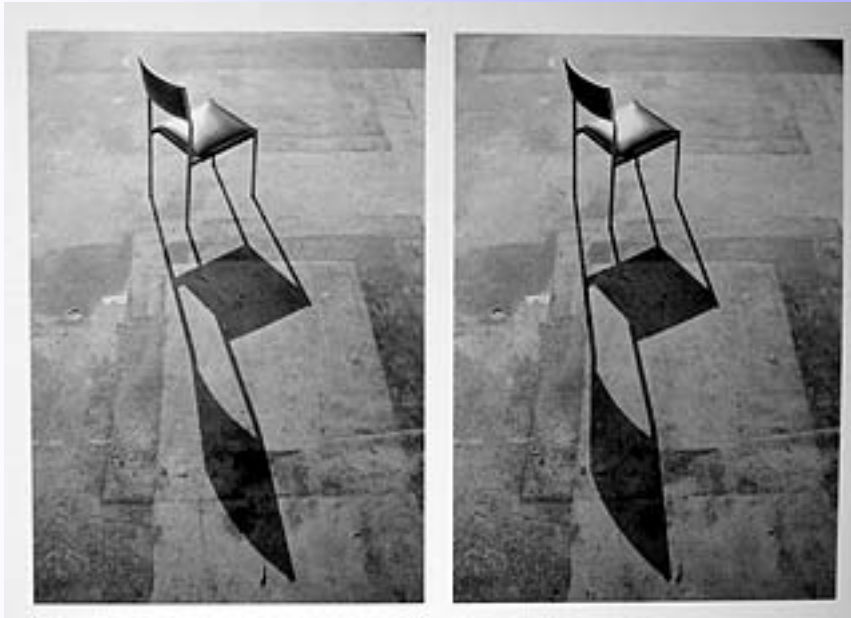


# Flash in Slide Bar Stereo

**Flash must stay stationary! Do not move with camera.**  
If moved with camera, then shadows will appear pseudoscopic!



# Fun with Slide Bar Flash Stereo



**Instead of shifting the camera, shift the flash.**

Result: Subject flat, shadows in 3D! Or, move both!

Left: From Hans Knuckhel's book "STEREO". Right: My version of the same concept.



# Flash with Vintage 3D Cameras

## 1) Flash Connection

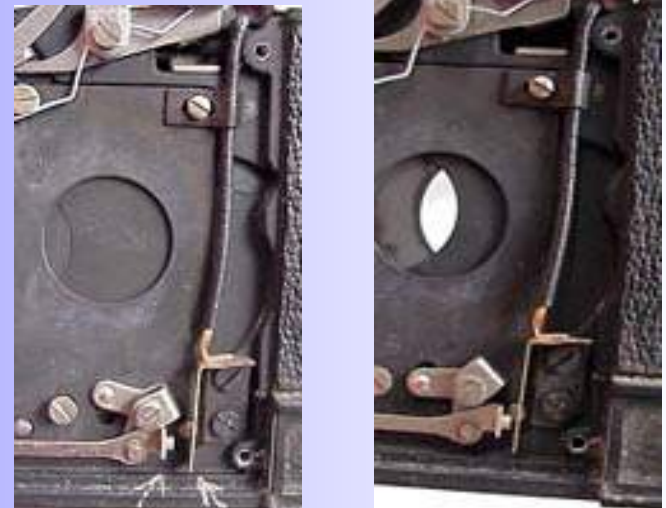


Many vintage stereo cameras (Realist, Revere, TDC) have a hot shoe with a “bump”. Solutions: 1) Put a groove in flash. 2) Modify a flash adapter.

Some stereo cameras do not have a hot shoe, instead unusual flash connections (Kodak ASA, TDC Vivid, VM Personal.) Use an adapter. Some technicians install a PC Plug



## 2) Flash Synchronization



For Realist: Bending a metal contact will convert the M (flash bulb) synchronization to X (flash) where the flash fires when the shutter is fully opened.

Flash bulbs can still be used with slower shutter speeds.



# Flash Advantage w/Vintage Cameras



## Example: Vivitar 283

- When the flash is set in one of the automatic modes, the sensor in the front detects the reflected light and stops the flash burst when the exposure is satisfied.
- For example, in the “blue” automatic setting, set the camera aperture at f8 (with 100 ISO film, the camera’s shutter speed is irrelevant if the flash exposure overpowers the available light)
- Use the camera as if it is was in auto exposure. You only need to worry about focusing. So the manual vintage camera is converted to an automatic camera when flash is used.

# Flash Troubleshooting

Most film camera flash problems (flash does not fire or fires intermittently) can be solved with a **resistance meter**.

- 1) **Make sure that the flash is working properly** (short contacts, use with another camera, etc)
- 2) **Measure resistance between the camera contacts with the shutter closed.** This should be **infinite**. If it is zero or has a small value (indicating a short, two wires touching), you must open the camera to find where this short occurs. (If the two contacts are shorted, then the flash will not fire continuously as some people might think, it will just NOT fire). The problem often is right under the flash contact.
- 3) **Measure resistant with the shutter open** (put the camera in B or T and fire the shutter). This should be **zero**. If it is infinite then the contact that will fire the flash is not made. You must open the camera to see why this is happening.
- 4) If the camera passes tests 1-3, then **the problem must be with physical/electrical connection between the camera and the flash** (maybe flash is not inserted all the way in, or it goes past the contact, or a faulty adapter is used.)

# Favorite Flash Units



## Vivitar 283

- A true workhorse and long time favorite of stereo photographers.
- Simple and reliable.
- 5 automatic modes, plus manual
- Not “dedicated” to any particular camera

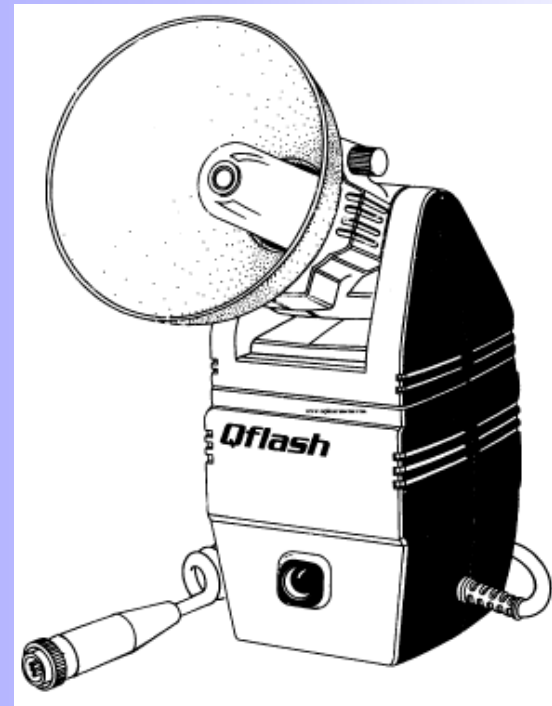


## Metz 34 CS

- Compact
- Packs a lot of power for its size
- Simple, non-dedicated
- 3 Auto modes plus manual
- Can be used as slave flash



## Metz 40Z






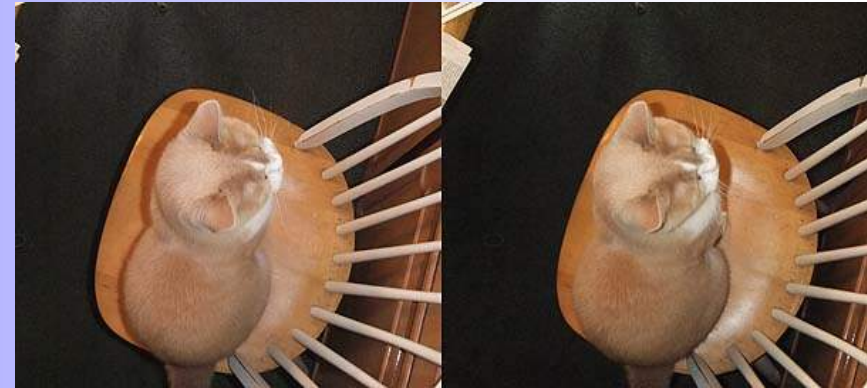
## Quantum QFlash



# Flash with Digital 3d Cameras



Mode
AUTO (auto)
 AUTO (auto with red-eye reduction)
 (fill flash)
 (off)



**Distracting shadows:** Because the flash is centered between the lenses, it casts shadows where the left eye sees the left shadow, and the right eye sees right shadow. In real life light never comes between the eyes. It comes from above, forming shadows in the same side.

**Dust Halos & Red Eye:** Because the flash is very close to the line of sight of the lenses, small particles in the air will be recorded as out of focus distracting areas, known as "dust halos". Also, red eye more of a problem.



**Direct Light is Unflattering:** Lack of shadows.





# Solutions for Fuji etc

**Use External Flash:** Without any provision for external connections, the only solution is **slave flash**.

Fuji flash uses “preflash”, so instead of one flash burst, you get two. The first one is used to determine exposure and adjust “white balance”. Only the second flash is used to illuminate the scene. There is no way to turn the preflash off. The first flash will trigger the slave flash. Solutions: **1) Use a digital slave with preflash/delay, 2) Use regular flash in “weak” auto mode**

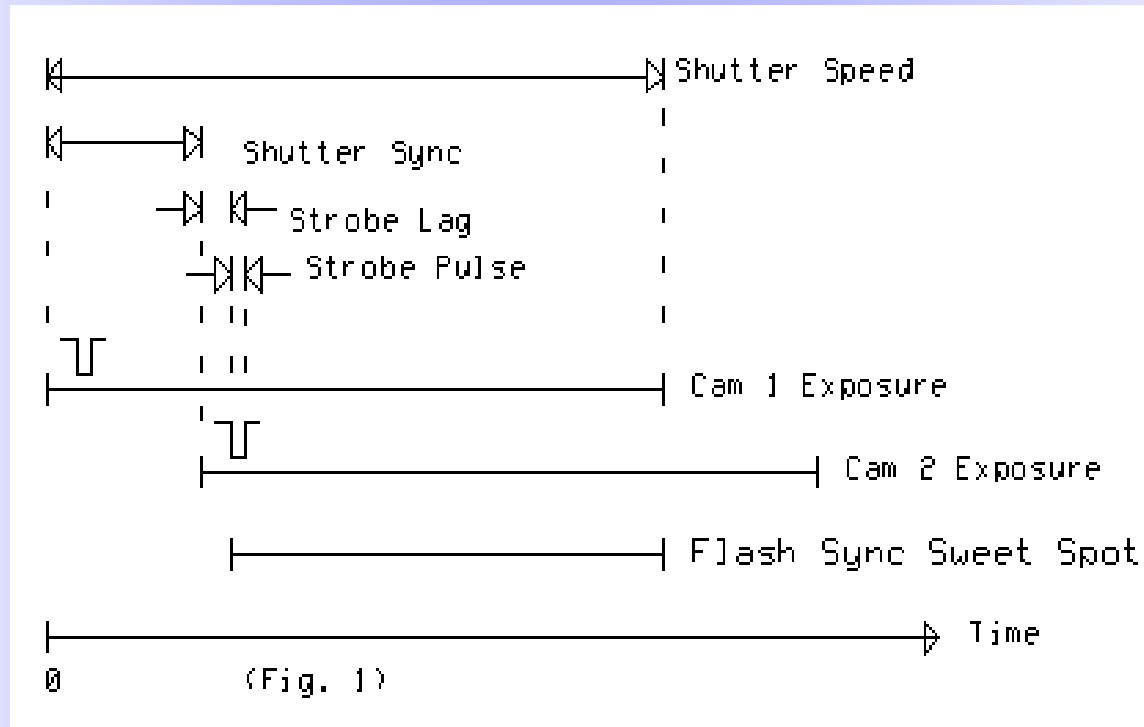
Tip: To eliminate Fuji’s flash completely, but still fire the slave, cover the flash with a piece of exposed film. This stops the visible light but lets IR go through, and this can still trigger slave flash.

Alternative: Use a constant bright light source instead of flash. This is useful for 3d movies but can also be used for still photography without the hassle of synchronizing the flash with the camera.



# Flash with Twin Cameras

**The Challenge:** Synchronize the camera exposures of both cameras and the flash exposure.

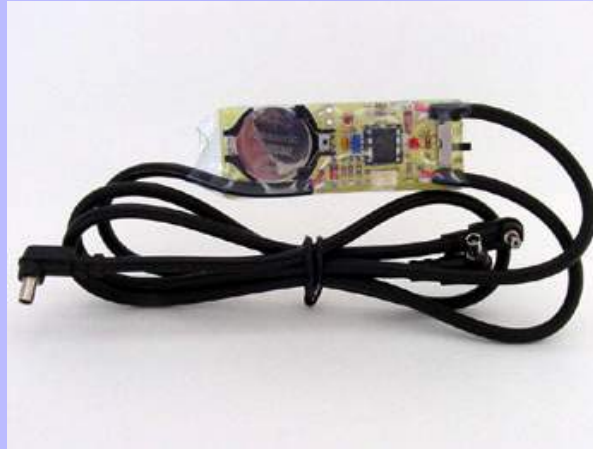
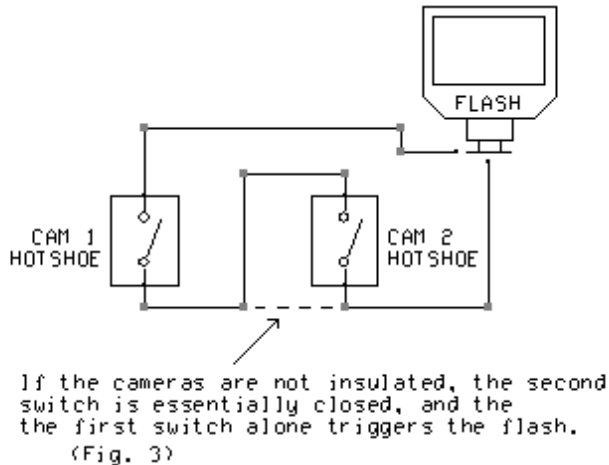


From Rob Crockett ([www.ledametrix.com](http://www.ledametrix.com))

## Possible courses of action:

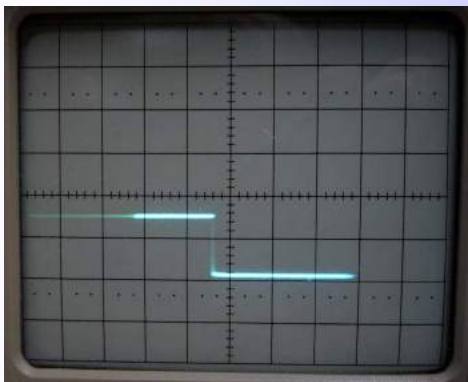
- Use two flashes, one on each camera (*not recommended*)
- Use one flash attached/connected to one camera (*which one?*)
- Use one flash connected in series to both cameras
- Delay flash trigger to make sure it fires when both shutters are open

# Series Twin SLR Camera Trigger



Left: Basic idea.

Right: “Magic Flash” twin camera adapter by Rob Crockett.



## Delayed Flash Trigger

Flash trigger is delayed to make sure that the flash fires when the shutters are open. In this oscilloscope screen capture (courtesy of Co Ekeren), every square on the oscilloscope screen is 2 msec. The shutter opens at 5.6 msec and the flash fires at 9.2 msec. The total shutter time is 10 msec (1/100 sec)

## Flash with SDM cameras

- 1) Use of on-camera flash: Left camera flash is dimmed 4 f-stops. Only right camera is used. This can be synchronized up to 1/500.
- 2) External flash via the use of slave flash or delayed flash trigger.





# Summary

- Portable electronic flash is more than just a photographic accessory. Many indoors pictures are impossible without flash & many outdoors pictures can be improved with flash.
- Advantage of flash in stereo include 1) allowing use of smaller f-stops (increased depth of field), 2) freezing motion (sharper pictures), 3) illuminating the foreground which carries most of the stereo information, 4) macro stereo photography (impossible w/out flash).
- Flash exposure depends only on the aperture, not the shutter speed. Most flash units have information in the back to assist in setting the proper aperture for good exposure.
- Harsh shadows from flash can be reduced by using various bounce/diffusion methods.
- In addition to providing needed light for indoor photography and reducing shadows in fill-in outdoor photography, many special/unusual effects are possible by using a flash.
- In slide bar stereo, the flash must stay stationary and not move with the camera.
- Vintage stereo cameras can fire an electronic flash, once the details of the physical and electrical connections are worked out.
- Slave external flash can be used with modern compact 3d digital cameras to improve flash exposures.
- Twin cameras can use flash connected in series to both cameras or a flash trigger delay.

**Try flash with your stereo camera today!**