

**DEDICATED  
FLASH  
OPERATION**

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This workshop will progress along the lines of the development of electronic flash units. I will not go back to flash powder and flash bulbs. The initial electronic flash units are important to understand since most of the principles used with these units still holds today in some modes of operation.

## Manual Flash

The first electronic flash units were not coupled to the camera with the exception of the PC cord that allowed the flash unit and the shutter to be synchronized. This occurred with a set of contacts in the camera that triggered the flash unit. Some of these units are still in use today as they are very inexpensive.

In an SLR shutter with two curtains the light from the flash has to be timed so that it occurs when both shutter curtains are fully open. If not you get a black or darkened part of your image when a shutter curtain blocks the light from reaching that portion of the film. That is why you have a top shutter sync speed for each camera model.

You determined the correct f-stop exposure with a Guide Number published for the flash unit. The Guide number was dependent on the ISO value of the film being used. The f-stop was calculated by dividing the Guide Number by the distance from the film plane to the subject assuming the flash unit is at the film plane. You could also determine the exposure using an incident flash meter.

The Guide number was based on a given subject reflectance value, 18%, and adjustments had to be made for light and dark toned values.

Fill flash with different flash fill ratios was possible but mountains could erode by the time you finished the calculation. A flash fill ratio is the amount of flash illumination compared to ambient light. A 1 to 1 fill ratio is equal amounts of flash and ambient light. A ½ to 1 flash fill ratio is one half unit of flash illumination to one unit of ambient light. A 3 to 1 flash fill ratio is 3 units of flash illumination to 1 unit of ambient light.

## Automatic Flash

The next advance was an automatic flash that still was coupled to the camera identically to the manual flash units, only by the PC cord.

A thyristor, an electronic device whose resistance changes with the amount of light striking it, was added to the flash to sense the amount of light reflected from a subject. The way this flash operation works is a constant light level is emitted by the flash unit and the thyristor will shut off the light (quench) when it senses the correct amount of light. This incidentally created high effective shutter speed in the flash unit since the duration of the flash burst might be in the order of a 10,000<sup>th</sup> of a second.

In this operation you told the flash unit the ISO value of the film and the f-stop being used and the flash unit shut off the light when the correct amount of light was sensed by the thyristor. You now no longer had to estimate or measure the distance from the camera to the subject to calculate the f-stop for correct exposure.

Fill flash had the same problems as the manual flash units in attempting to calculate the shutter speeds and f-stop to use.

## Dedicated Flash Units

The next major advance in flash units occurred when the flash unit and the camera were very tightly coupled by having the light measurements taken by the camera and not the flash unit. That and the introduction of microprocessors allowed all the magic that takes place today.

There are two general methods of measuring the light emitted by the flash unit in today's top of the line cameras. One is to measure the amount of light reflected off the film plane when the shutter is open. The light is measured by Off The Film (OTF) sensors. Another method recently introduced is to emit a beam of light before the shutter is opened and before the mirror swings out of the way using the main metering system of the camera to calculate the correct exposure. The camera simply remembers this calculation when the shutter is tripped.

I will now discuss the main characteristics of the Canon flash system based on an EOS5D and a 550EX flash unit and hope other systems follow these attributes closely. The advent of microprocessors and programmers makes it extremely difficult to describe all systems in general.

## Exposure Calculations

The correct exposure is calculated depending on the shooting mode of the camera you select; Program, Aperture priority, Shutter priority or Manual. These calculations are performed by complex algorithms run in a microprocessor and you need to understand the basics of each mode because they are different. There are three variables in determining the correct flash exposure; shutter speed, aperture and fill ratio (the blend of ambient and flash illumination). The different camera modes offer you control over all three or none of these variables. Take your choice.

The Canon 5D camera and the 550EX flash unit use the main metering system of the camera and a preflash of light from the flash unit to calculate the flash exposure before the mirror swings out of the way. You can see this preflash in the viewfinder.

## Aperture Priority mode

In the Aperture priority mode you set the aperture and the camera selects the shutter speed and the fill ratio. The camera always attempts to set the shutter speed and aperture for a correct exposure of the ambient light. In this mode the camera will warn you if a correct ambient exposure cannot be obtained for the f stop that you select but will take the picture.

Beware in this mode the shutter speed may be set to a value not suitable for hand held or subjects in motion operation. If you are indoors and set a small aperture value you may find that your shutter speed is in the seconds range.

If a correct ambient exposure can be set then the following applies. The fill ratio of the flash will be set depending on the level of light. In low light conditions the fill ratio will be set to 1 to 1. You can see this if you take an ambient exposure reading with the flash off. Then turn the flash on and you will see the exposure reading decrease by one f-stop to compensate for the equal amount of flash illumination. This change in exposure setting is necessary to prevent overexposure from adding an equal amount of flash illumination to the ambient light. If the background is far from the main foreground subject it will be 1 stop underexposed. In bright conditions the exposure setting of the camera is not changed from its ambient light reading but the fill ratio is controlled to prevent overexposure from the flash. The amount of flash reduction is limited to 1 ½ stops, a fill ratio approximately 3 ambient to 1 flash, remember each stop of light halves the light. You cannot control the amount of this reduction and cannot determine how much reduction is being applied you just have to trust the camera to make the correct decision.

If a correct exposure cannot be obtained for the f-stop selected the exposure will be determined by the flash disregarding ambient light.

In the aperture priority mode you will have to manually compensate for the tonality of both the ambient and the flash illumination.

**Summary** – You control the depth of field by selecting the aperture. The camera and flash are working to create a reasonably exposed foreground and background if a correct exposure for the ambient light can be obtained. In the worst case a 1 stop underexposure of the background will occur. If a correct exposure setting for the ambient light cannot be obtained then the light from the flash will be used for the exposure. Be careful of calculated shutter speeds to ensure they are appropriate for the conditions, they can produce blurring and ghosting in the image. Also watch for underexposed backgrounds and that harsh flash look in low light conditions

## Shutter Priority

The operation of the flash in Shutter priority mode is identical to that in the Aperture mode with two exceptions

- You set the shutter speed and the camera will set the aperture based on the ambient light and the fill ratio. This mode should be used instead of the aperture priority mode if camera shake or subject movement is an issue
- Camera calculated f-stops should be checked to ensure depth of field is satisfactory

## Program Mode

In Program mode the camera selects the shutter speed, the aperture and the fill ratio. The shutter speed is set between 1/60 of a second and the maximum sync speed of the camera. After the camera calculates the exposure you will have to check the ambient exposure to determine its setting. It is very possible that the ambient light will be underexposed. If the flash illumination does not reach the background the background will be underexposed. In low light situations flash illumination is used primarily for the exposure, especially since the shutter speed will not be set slower than 1/60 of a second.

In bright light conditions the calculations are biased towards attaining a 1 to 1 fill ratio. You have very little creative control in this mode but is good for grab shots where you have to operate fast. It is a mode that is reasonable for fill flash in high ambient illumination. The camera is working very hard to allow hand held shooting (but be careful it is assuming a 50mm lens for the 1/60 shutter speed) with the use of equal amounts of ambient light and flash illumination if possible with the restricted shutter speeds.

You have very little creative control in this mode.

In the program mode you will have to manually compensate for the tonality of both the ambient and the flash illumination.

**Summary** – Good for quick grab shots in bright light where you want to reduce shadows or add highlights and don't have the time to use Manual mode.

## Manual Mode

In Manual mode you set the shutter speed and the aperture and also control the flash fill ratio.

If you set the shutter speed and aperture for the correct ambient exposure and then set the Flash Exposure Compensation at 0 you will get equal amounts of ambient light and flash illumination and a 1 stop overexposure. You can easily control the fill ratio by setting the setting the ambient light at any level you desire. You can also control the flash fill ratio with the Flash Exposure Compensation described below.

In the manual mode you have the maximum creative control of the exposure.

**Summary** – Allow the most control over ambient and flash exposures. You can easily eliminate that harsh flash ugly lighting in this mode. You can very easily set the amount of fill light provided by the flash to eliminate shadows or to add highlights.

### Flash Exposure Compensation

Both the camera and the flash can set the flash exposure compensation in 1/3 stops. You can use this compensation adjustment for two purposes.

If you want to set the flash fill ratio to 2 (ambient) to 1 (flash) then simply set the flash exposure compensation to minus 1 stop.

If the subject is not middle toned, 18% reflectance, you can adjust the flash illumination for the higher or lower reflectance just as you would adjust the camera ambient meter for the tonal values. If you have a black subject that you are photographing in the camera Manual Mode you can subtract two stops of flash light for the black subject. Adjust in the opposite direction for light toned subjects

The Flash Exposure Compensation works by quenching the duration of the flash from that called for by the exposure settings on the camera.

## Flash Unit Modes

The 550EX flash can be set into three modes; ETTL, Manual and Multi. In the ETTL mode the camera will automatically perform the exposure calculations. In the Manual mode of the flash you are responsible for performing the exposure calculations.

### *ETTL Mode*

The EX series of flash units in conjunction with an EOS1V and all digital models from Canon use a new metering method in all automatic modes. They use the main meter in the camera not OTF sensors for determining flash exposure. The way this works is that the flash unit emits a pre-flash prior to the shutter being tripped. This pre-flash reflected from the subject is measured by the main camera meter before the mirror swings out of the way and before the shutter is tripped. One benefit of this operation is that either meter mode Evaluative or Average can be used to perform the calculation.

### *Manual Mode*

In the Manual mode of the flash the camera does no exposure calculations and you must perform them using the flash guide number or a flash incident light meter.

To calculate the correct flash exposure using the Guide Number divide the Guide Number by the camera to subject distance, assuming that the flash is at the camera. Since the flash head will zoom, between certain limits (24 to 105 mm) depending on the zoom of the lens you are using, and this zoom operation will change the Guide Number of the Flash. You must use the Guide Number for the flash head zoom position. If the flash is not at the camera the distance calculation gets a little more complicated.

To determine exposure using the flash incident meter just fire the flash and read the exposure on the meter.

### *Multi Mode*

A stroboscopic flash mode that is specialized and you probably need to read the manual each time before you use it because you will not use it very often. I will not describe this operation.

### *Special Features*

This unit also has a special High Speed Sync mode that allows the camera to sync with the flash up to 1/8000 of a second. That is accomplished by a series of short bursts emitted by the flash as the shutter curtains are traveling across the sensor.

The 550EX also supports flash exposure bracketing up to 3 stops and modeling flash. It also supports wireless slave flash operation.

A modeling light is also available by pressing the depth of field preview button

The built in wide panel can be extended from the flash and with the flash head pointed straight up nice catch lights and soft fills can be obtained

## Bounce Flash

Bounce flash can be used to avoid that head on flat flash look in an image and possible red eye. In any ETTL mode the camera will perform the flash calculation using bounce flash. You need to be aware of two issues. First ensure that enough flash illumination will reach the subject due to the increased distance that the light must travel. Also be wary of undesirable color casts from the surface the light is being reflected off. In my estimation it is better to use a remote cord although more cumbersome.

## Remote Cord

You can purchase a remote flash cord that will allow you to remove the flash unit from the camera but still have it electrically connected. You can then hold the flash unit to the side of an object creating more shadows and eliminating that head on ugly flash look. It will also eliminate red eye that occurs when the flash illumination strikes the back of the eye and is reflected off that surface. Red eye is more prevalent in blond and red-headed people.

## Projector Flash

A projector flash can be used especially with a long lens when you need to extend the working distance of the flash unit. The projector flash employs a fresnel lens that concentrates the light and extends it further. You physically attach the projector flash to the front of the flash unit.

## Incident Flash Light Meters

Do not attempt to use an incident flash meter to measure flash exposure if you are operating the flash unit in a mode that will allow it to quench the light, a mode other than Manual on the flash unit. Quenching occurs in any ETTL mode and shuts off the flash unit when the camera senses the correct amount of light for the exposure settings. The problem is that the incident flash meter is not designed to evaluate these short bursts of light and you get some very strange readings. You can use the meter if the flash unit is set to Manual. In that mode the flash will not be quenched and will emit a full light burst dependent on the power level set in the flash. Do not confuse the flash and camera Manual modes. I am referring here to the flash Manual mode. Even though the 550EX emits a pre flash it does not appear to be strong enough to affect the incident light meter reading.

## Auxiliary Power

If you are going to be doing a lot of flash photography where recycle time of the flash becomes an issue you might want to consider an auxiliary power source such as a Quantum battery. The recycle time is almost instantaneous. The newer batteries are no longer lead acid cells they are Nicads. Quantum claims that they do not exhibit memory problems but they do lose a charge when they sit for a while unlike the older lead acid cells

## Sync Shutter Speed

The top sync speed or the highest shutter speed that you can use that will synchronize the flash illumination and shutter is set by the camera. The newer cameras are generally 1/200 or 1/250 of a second as top sync speed. The use of large studio units can reduce this sync speed however and may drop it one shutter speed stop. I believe this is due to the fact that the large studio flash units get more light output by extending the duration of the flash. The camera will sync with the flash at any shutter speed slower than the top sync speed.

## Non Dedicated Flash Precautions

If you are going to plug a flash unit into the PC terminal of the camera beware. The Canon 1N will not support a flash unit whose open circuit voltage is greater than 6 volts. If you exceed that limit you stand the possibility of burning out the flash contacts in the camera body. In the Canon 1V and 10D you have to ensure that the flash polarity is correct. So if you blithely plug your camera into a flash setup at a workshop or conference beware you could be in trouble.

You also do not want to plug in a flash unit from another camera manufacturer into the camera hotshoe. The circuitry is totally different and damage could result. This precaution does not apply to after market flash units if they are made to work with your camera.