

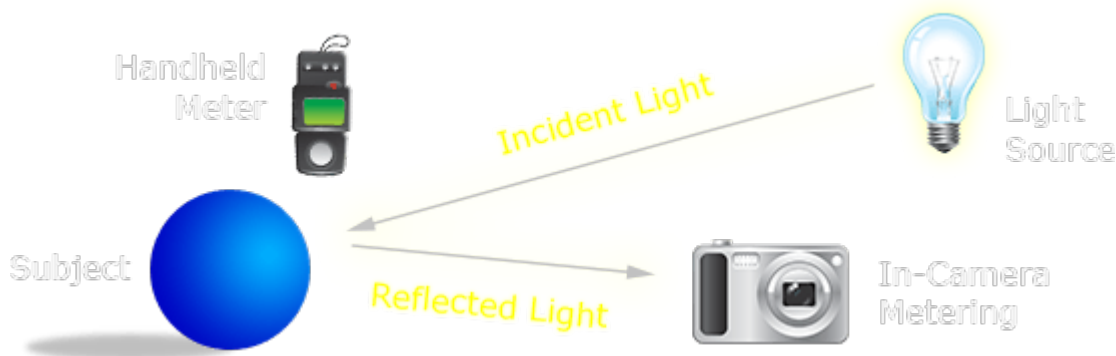
## CAMERA METERING & EXPOSURE

Knowing how your digital camera meters light is critical for achieving consistent and accurate exposures. Metering is the brains behind how your camera determines the shutter speed and aperture, based on lighting conditions and ISO speed. Metering options often include partial, evaluative zone or matrix, center-weighted and spot metering. Each of these have subject lighting conditions for which they excel — and for which they fail. Understanding these can improve one's photographic intuition.

Recommended background reading: [camera exposure: aperture, ISO & shutter speed](#)

## BACKGROUND: INCIDENT vs. REFLECTED LIGHT

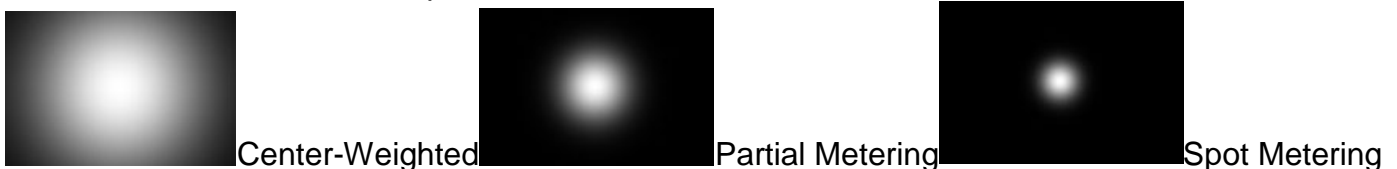
All in-camera light meters have a fundamental flaw: they can only measure reflected light. This means the best they can do is guess how much light is actually hitting the subject.



If all objects reflected the same percentage of incident light, this would work just fine, however real-world subjects vary greatly in their reflectance. For this reason, in-camera metering is standardized based on the luminance of light which would be reflected from an object appearing as middle gray. If the camera is aimed directly at any object lighter or darker than middle gray, the camera's light meter will incorrectly calculate under or over-exposure, respectively. A hand-held light meter would calculate the same exposure for any object under the same incident lighting. An in-camera light meter can work surprisingly well if object reflectance is sufficiently diverse throughout the photo. In other words, if there is an even spread varying from dark to light objects, then the average reflectance will remain roughly middle gray. Unfortunately, some scenes may have a significant imbalance in subject reflectivity, such as a photo of a white dove in the snow, or of a black dog sitting on a pile of charcoal. For such cases the camera may try to create an [image with a histogram](#) whose primary peak is in the midtones, even though it should have instead produced this peak in the highlights or shadows (see [high and low-key histograms](#)).

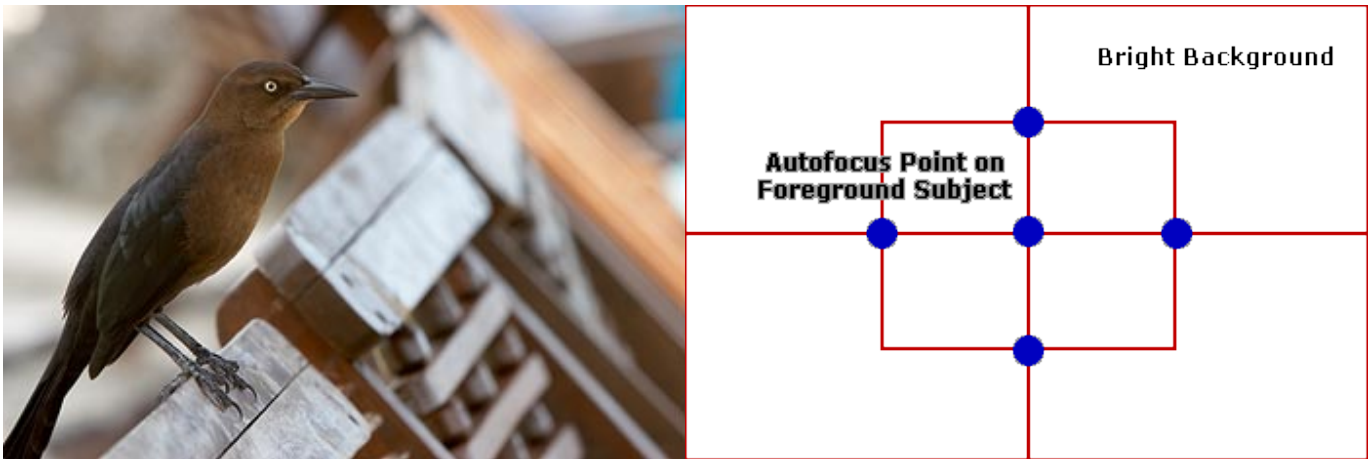
## METERING OPTIONS

In order to accurately expose a greater range of subject lighting and reflectance combinations, most cameras have several metering options. Each option works by assigning a relative weighting to different light regions; regions with a higher weighting are considered more reliable, and thus contribute more to the final exposure calculation.



Partial and spot areas are roughly 13.5% and 3.8% of the picture area, respectively, which correspond to settings on the Canon EOS 1D Mark II.

The whitest regions are those which contribute most towards the exposure calculation, whereas black areas are ignored. Each of the above metering diagrams may also be located off-center, depending on the metering options and autofocus point used.



More sophisticated algorithms may go beyond just a regional map and include: evaluative, zone and matrix metering. These are usually the default when your camera is set to auto exposure. Each generally works by dividing the image up into numerous sub-sections, where each section is then considered in terms of its relative location, light intensity or color. The location of the autofocus point and orientation of the camera (portrait vs. landscape) may also contribute to the calculation.

**Exposure compensation is ideal for correcting in-camera metering errors caused by the subject's reflectivity.** No matter what metering mode is used, an in-camera light meter will always mistakenly under-expose a subject such as a white dove in a snowstorm (see [incident vs. reflected light](#)). Photographs in the snow will therefore always require around +1 exposure compensation, whereas a [low-key image](#) may require negative compensation. When shooting in RAW mode under tricky lighting, sometimes it is useful to set a slight negative exposure compensation (0.3-0.5). This decreases the chance of [clipped highlights](#), yet still allows one to increase the exposure afterwards. Alternatively, a positive exposure compensation can be used to improve the [signal to noise ratio](#) in situations where the highlights are far from clipping.

Reference - [http://en.wikipedia.org/wiki/Metering\\_mode](http://en.wikipedia.org/wiki/Metering_mode)

### Spot Metering

With spot metering, the camera will only measure a very small area of the scene (between 1-5% of the viewfinder area). This will typically be the very centre of the scene, but some cameras allow the user to select a different off-centre spot, or to recompose by moving the camera after metering.

Spot metering is very accurate and is not influenced by other areas in the frame. It is commonly used to shoot very high contrast scenes. For example, if the subject's back is being hit by the rising sun and the face is a lot darker than the bright halo around the subject's back and hairline (the subject is "backlit"), spot metering allows the photographer to measure the light bouncing off the subject's face and expose properly for that, instead of the much brighter light around the hairline. The area around the back and hairline will then become over-exposed. Spot metering is a method upon which the [Zone System](#) depends.

Another example of spot metering usage would be when photographing the moon. Due to the very dark nature of the scene, other metering methods tend to overexpose the moon. Spot metering will allow for more detail to be brought out in the moon while underexposing the rest of the scene.

**More commonly, spot metering is used in theatre photography, where the brightly lit actors stand before a dark or even black curtain or scrim. Spot metering only considers the actors in this case, while ignoring the overall darkness of the scene.**

## Center-weighted average metering

In this system, the meter concentrates between 60 to 80 percent of the sensitivity towards the central part of the viewfinder. The balance is then "feathered" out towards the edges. Some cameras will allow the user to adjust the weight/balance of the central portion to the peripheral one. One advantage of this method is that it is less influenced by small areas that vary greatly in brightness at the edges of the viewfinder; as many subjects are in the central part of the frame, more consistent results can be obtained.

## Average metering

In this metering mode the camera will use the light information coming from the entire scene and averages for the final exposure setting, giving no weighting to any particular portion of the metered area.

## Partial metering

This mode meters a larger area than spot metering (around 10-15% of the entire frame), and is generally used when very bright or very dark areas on the edges of the frame would otherwise influence the metering unduly. Like spot metering, some cameras can use variable points to take readings from, (in general autofocus points), or have a fixed point in the centre of the viewfinder. Partial metering is found mostly on Canon cameras.

## Multi-zone metering

This mode is also called *matrix*, *evaluative*, *honeycomb*, *segment metering*, or *esp* (electro selective pattern) metering on some cameras. This metering mode was first introduced by the [Nikon FA](#), where it was called Automatic Multi-Pattern metering. On a number of cameras this is the default/standard metering setting. Here the camera measures the light intensity in several points in the scene, and then combines the results to find the settings for the best exposure. How they are combined/calculated deviates from camera to camera. The actual number of *zones* used varies wildly, from several to over a thousand.

Many manufacturers are less than open about the exact calculations used to determine the exposure. A number of factors are taken into consideration, including the following: [Autofocus](#) point, distance to subject, areas in focus or out of focus, colors/hues of the scene, and backlighting. Multi-zone tends to bias its exposure towards the autofocus point being used (while taking into account other areas of the frame too), thus ensuring that the point of interest has been exposed for properly, (this often means the subject area being exposed for as a mid-tone). A database of many thousands of exposures is pre-stored in the camera, and the processor can use a *selective pattern* to determine what is being photographed.<sup>[2]</sup>

Some cameras allow the user to link or unlink the autofocus and metering, and allow the option of locking exposure once AF confirmation is achieved, *AEL*, (auto-exposure lock). Using manual focus, and on many compacts/bridge cameras, the AF point is not used as part of the exposure calculation, in such instances it is common for the metering to default to a central point in the viewfinder, using a pattern based on that area. There is considerable variation from different manufacturers as to how multi-zone metering is implemented, and even from the same maker in their model range, and how much "priority" is given to the AF point itself. Some "Scene" modes, such as sunset, sports, night exposures etc., also often affect the calculations of this metering pattern.

## Highlight Weighted Metering

[Clipping](#) is reduced by using a high resolution metering sensor and analyzing each area for blown highlights or [underexposed](#) shadows.<sup>[4]</sup> Although there are some similarities with Multi-zone, Matrix or evaluative metering, this mode uses a high resolution sensor for detailed detection and gives more *weight* to reduce clipping.