



## The 4EVER Group

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## Camera Command



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by Dan Strickler & Dave Hall  
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### SUPPLEMENTAL INFORMATION

**DEFINITION OF FOCAL LENGTH:** Focal length is defined as the distance from the optical center of the lens to the film plane (CCD) when focused at infinity.

**DEFINITION OF F-STOP:** The F-stop number is derived by dividing the focal length by the aperture or opening of the lens.

**IMAGING AREA AND FILTER SIZE:** In video cameras, there are several sizes of CCD's, ranging from the very small new Sony with 1 / 4.7" CCD's, up to the 2/3" size of the Sony DSR-500. Here is a list of popular camcorders and their imaging area, as well as the size of their screw-on filters:

Canon XL1S	1/3"	72mm
Canon GL2	1/4"	58mm
JVC DV300	1/3"	52mm
JVC DV500 (standard lens)	1/2"	62mm
Panasonic DVC200 (14X)	1/2"	62mm
Panasonic DVC200 (16X)	1/2"	72mm
Panasonic DVX100	1/3"	72mm

Sony PDX10/TRV950	1/4.7	37mm
Sony PD100/TRV900	1/4"	52mm
Sony DSR200A/VX1000	1/3"	52mm
Sony PD150/VX2000	1/3"	58mm
Sony DSR250	1/3"	58mm
Sony DSR300 (18/19X lens)	1/2"	82mm
Sony DSR500* (18/19X lens)	2/3"	82mm

\*full 2/3" size is only utilized in 16x9 mode. In 4x3 NTSC mode, the DSR-500 utilizes only 1/2" of it's chips

**“NORMAL” FOCAL LENGTH VS. IMAGING AREA:** Normal focal length is defined as the angle-of-view from a camera that is equivalent to the view of a human eye. For example, on a 35mm camera, the “normal” focal length is about 48mm. Here is a list of the approximate “normal” focal length for various sized CCD's:

CCD Size	Normal focal length
=====	=====
1/4.7"	3.6mm
1/4"	4.8mm
1/3"	6mm
1/2"	7mm
2/3"	9mm

**SHUTTER SPEEDS:** If you want to freeze fast-moving action, it really depends on the speed of the subject moving through the frame. But as a general rule, for high speed action, you should use a shutter-speed of 1/250 or 1/500. When you increase the shutter-speed from the standard 1/60<sup>th</sup> of a second to 1/250<sup>th</sup>, in order to maintain the same exposure, you will need to compensate by opening the iris by two f-stops. A shutter-speed of 1/500<sup>th</sup> requires three f-stops.

**GAIN SETTINGS VS. F-STOPS:** When you apply gain to a scene, you are increasing light sensitivity while adding additional signal noise. Gain settings relate directly to F-stops; one f-stop for every 6db of gain. See the chart below.

Gain setting	F-stop decrease
=====	=====
+3db	1/2 stop
+6db	1 stop
+9db	1 1/2 stops
+12db	2 stops
+15db	2 1/2 stops
+18db	3 stops
-3db	1/2 stop INCREASE

## THE FACTORS AFFECTING DEPTH OF FIELD (DOF) :

**D** = Distance from camera to subject. The closer the subject is to the camera, the shallower the depth-of-field.

**O** = Opening or F-stop. As you open the aperture, depth-of-field decreases.

**F** = Focal length. As you lengthen the focal length (more telephoto), depth-of-field decreases.

**F-STOPS AND THE AMOUNT OF LIGHT FALLING ON THE CCD:** Each f-stop narrower allows half as much light to reach the CCD. Here is a chart:

Original F-stop ( <i>fully open</i> ):	Full light reaches CCD
1 stop narrower:	1/2 the light reaches CCD
2 stops narrower:	1/4 the light reaches CCD
3 stops narrower:	1/8 the light reaches CCD
3 stops narrower:	1/16 the light reaches CCD
4 stops narrower:	1/32 the light reaches CCD
5 stops narrower:	1/64 the light reaches CCD

**BUILT-IN NEUTRAL DENSITY (ND) FILTERS FOR THE SONY DSR-300:** Filter wheel setting “2” is labeled 1/8 ND and filter wheel setting “4” is 1/64 ND. What exactly does this mean? From the above chart, you can see that 1/8 is equivalent to closing down the aperture by three f-stops and filter wheel “4” by five f-stops.

**SCREW-ON ND FILTERS EXPLAINED:** Different ND manufacturers use different nomenclature to describe the degree to which their filters reduce the amount of light entering the lens of the camera. For example, Hoya filters use “2” and “4” to describe two of their filters. You might assume that this would mean two or four f-stops of ND, but this is not true. A Hoya “2” ND filter is *one* stop of neutral density, and a Hoya “4” is *two* stops of ND. Think of the numbers as reciprocals, and it becomes clearer. It’s time to remember that high school math. The “2” filter represents one-half of the light, which from the above chart means one f-stop. The “4” filter represents one-quarter of the light, which means two f-stops.

Other manufacturers use a different system. You may see a ND filter shown as a “0.3” or “0.6” or “0.9”. These numbers represent one, two, or three stops of ND. The reasoning is technical, but it involves the log of two, and the actual density of film negatives. Confusing? The point is, make sure you know how many f-stops of ND you’re adding when you buy your filters.

## EVALUATING LENSES

Lenses are subject to various defects and aberration. When looking to purchase a lens, test it at all it’s various focal lengths and f-stops. Be on the lookout for spherical and chromatic aberration as well as barrel and pincushion distortion.

### SPHERICAL ABBERATION



When a lens exhibits spherical aberration, not all objects from a single distance to the camera are uniformly in focus.



Notice the outer regions of this lens are not as sharp as the center. This is caused by the fact that the thickness of the lens varies. It is often minimized by the use of multiple lens elements.

### CHROMATIC ABERATION



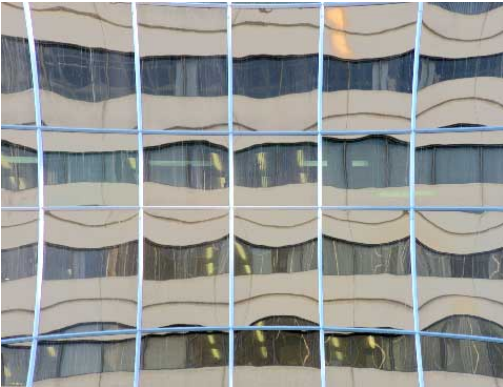
Note that the bottom picture exhibits color fringing due to chromatic aberration. This is caused by the fact that rays of varying length have a different refraction index, they bend at slightly different angle when they pass through the lens and consequently, do not all arrive at the same point on the image plane. This is corrected by the use of multiple lens elements and special lens coatings.

#### BARREL DISTORTION



The wider the angle of view, the greater this effect. However, lenses with the same angle of view may exhibit this bowing to a greater or lesser extent.

#### PINCUSHION DISTORTION



The vertical lines in this picture should be straight. This defect is noticeable in some telephoto lenses.

#### STOPPING DOWN THE LENS

Be aware that some lenses that exhibit these defects in extreme telephoto with the lens wide open, can have the image improved considerably by stopping down to a smaller aperture. In fact, sometimes closing the lens opening by one f-stop will sharpen the image significantly.

## WHITE BALANCE

**“White balance (WB) is the process of removing unrealistic color casts, so that objects which appear white in person are rendered white in your photo.”**

There are times when you absolutely need to perform a manual white balance in order to accurately render the colors in a scene. And when you perform this white balance, know that you want to take the reading on something that should *appear* white in the scene and not necessarily an object that is literally white. For instance, if a bride is sitting in front of a fireplace, you don't want to perform the white balance on her dress (even though it is white) because you want it to have an orange cast. After all, the fire is illuminating it. In that instance, white balancing on the dress will render the scene with a bluish cast.

### WARMING CARDS

Sometimes, warming and cooling cards can be useful in fooling the camera's circuitry so that the scene will be warmer or cooler than it would be rendered if you were to white balance on something white. Just keep in mind that when you use manual white balance, the camera pushes its circuitry toward the opposite of whatever color is on the card.

**COLOR TEMPERATURE** is measured in degrees of Kelvin that sets zero at  $-273.15$  degrees Celsius, the point where there is no detectable heat (absolute zero). This scale is used by photographers and lighting designers to measure the amount of orange or blue in a scene, depending on the various light sources. The hotter the source, the bluer the light will be. This is counter-intuitive. We think of orange as a “warmer” color than blue but in terms of color temperature, blue is actually warmer.



You can see that the part of the flame that is closest to the wax is burning the hottest. It is blue. The tip of the wick is cooler and it is red. And coolest yet is the flame that is vaporizing into the atmosphere.



**Learn more about controlling  
your camera by purchasing  
the Camera Command DVD.  
It is now available at the  
4EVER Group on-line store.**