

# Synopsis of FORMAT SIZE IN DIGITAL PHOTOGRAPHY

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## INTRODUCTION

This is a synopsis of the principal topics covered by the tutorial article, *Format Size in Digital Photography*. Readers should be aware that, of necessity, this synopsis overlooks many important “if’s, and’s, and but’s”, and I have taken certain liberties with technical precision in the interest of conciseness. Readers wishing additional, more detailed, or more rigorous information on these topics should consult the article proper.

## FORMAT SIZE

“Format size” refers to actual physical dimensions of the film frame or digital sensor which receives the image in a camera. These dimensions influence several aspects of camera behavior. A wide range of format sizes is encountered among modern digital cameras.

## FIELD OF VIEW

“Field of view” refers to the “amount of the universe” which is captured by the camera’s image. We can describe the size of the field by stating the angle embraced—in the vertical, horizontal, and/or diagonal directions, as best suits our interests.

The field of view of a camera is determined by the format size and the focal length of the lens in use. The field of view increases with increasing format size, and decreases with increasing focal length.

Most photographers do not think of field of view in terms of its angular embrace. Rather, they learn, for their particular camera, which focal lengths produce what “visual photographic results”.

To allow this “knowledge” to be transferred between different cameras (that is, cameras with different format sizes), it has become common to describe field of view in terms of the result produced by a lens of a stated focal length used on a particular type of camera: the full-frame 35-mm film camera. Thus, for any lens, as used on a camera with a certain format size, we may state the “35-mm equivalent focal length—the focal length of a lens which, if used on a 35-mm camera, would give the field of view that “this” lens gives on “this” camera.

To calculate the 35-mm effective focal length, we multiply the focal length of our lens by the “equivalent focal length factor” for our camera’s format size. This factor is the ratio of any dimension of the format of a 35-mm camera to the same

dimension of the format of our camera. It has many names other than the one I just mentioned. One name commonly used is “field of view crop factor”, a term I do not consider attractive.

The “35-mm equivalent focal length” reckoned for our lens is not a focal length of the lens under any circumstances. It is only the answer to the question, “What focal length lens, used on a 35-mm camera, would give the same field of view as this lens gives on this camera.”

### **A misconception about focal length**

A widely-held misconception is this: “On an interchangeable lens suitable for use on a 35-mm camera, the focal length marked is that which the lens would have when mounted on a 35-mm camera.<sup>1</sup> When we mount it on a smaller-format camera, it takes on a greater focal length, which we can determine by multiplying the marked focal length by the *equivalent focal length factor* for the smaller-format camera”.

This is not true. The focal length of a camera is a basic physical property, like the outside diameter of the lens barrel. It does not vary depending on which camera (if any) the lens is mounted on at the moment, and it is not stated in a way predicated on any particular type of camera.

The number we get by multiplying a lens’ focal length by the *equivalent focal length factor* for our camera is just the answer to the question, “What focal length lens, used on a 35-mm camera, would give the same field of view as this lens gives on this camera.”

### **DEPTH OF FIELD**

When a camera is focused at a certain distance, objects at greater or lesser distances are imaged imperfectly, with “blurring”. If we establish some objective measure of how much blurring we are willing to ignore, we can then calculate the range of distances over which an object may be placed and still be imaged with what we will consider “negligible blurring”. This range of distances is called the “depth of field” for that particular camera setup.

The depth of field is determined by the focal length of the lens in use, the distance at which the camera is focused, the aperture (f/number) used, and our numerical criterion for how much blurring will be neglected.

We are often interested in, as we move from a camera with one format size to one of a different format size, “all other things being equal”, how depth of field is affected. We can of course only answer that if we define what “all other things being equal” is to mean.

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<sup>1</sup> This is sometimes said as, “The marked focal length is in 35-mm camera terms.”

One reasonable set of conditions is:

- We have lenses on the two cameras whose focal lengths give the same field of view (that is, are usable the same way from a photographic “composition” standpoint).
- We use the same aperture (f/number) on both cameras.
- Our definition of the amount of blurring that will be considered negligible is consistent on the basis of how great the blurring would be on a consistent size presentation of the image (print, for example).

Under those conditions, the larger-sensor camera will exhibit smaller depth of field.

### **SHUTTER SPEED AND “CAMERA SHAKE”**

If a camera is hand held, then there will be a random shift of the direction in which the camera is pointed. The amount of this shift over the time that the shutter is open will cause a certain displacement of the image and thus certain degree of “motion blur” in the completed image.

A guideline widely followed in the 35-mm camera world suggests that in hand-held photography, one should not use a shutter speed slower than one over the focal length of the lens in millimeters. This is terribly arbitrary, and of course can take no account of the degree to which the photographer can hold the camera steady in a particular case. It is also based on an arbitrary view of how much “motion blur” can be considered negligible.

Nevertheless, if we are willing to accept the guideline as useful, the question arises as to whether it must be modified for use on cameras of different format size, and if so, how.

Just as with depth of field, it is reasonable to interpret our criterion of “negligible” blurring to be in terms of a certain amount of image displacement as measured on the entire image presented at a certain consistent size for viewing. In that case, on a camera with a smaller sensor size, keeping the guideline (such as it is) intact calls for us to reckon the shutter speed limit as one over the 35-mm equivalent focal length of our lens.

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