

# *The Basics of Interchangeable Lenses*

# Relationship between SLR Camera Structure and Lens

Figure-1

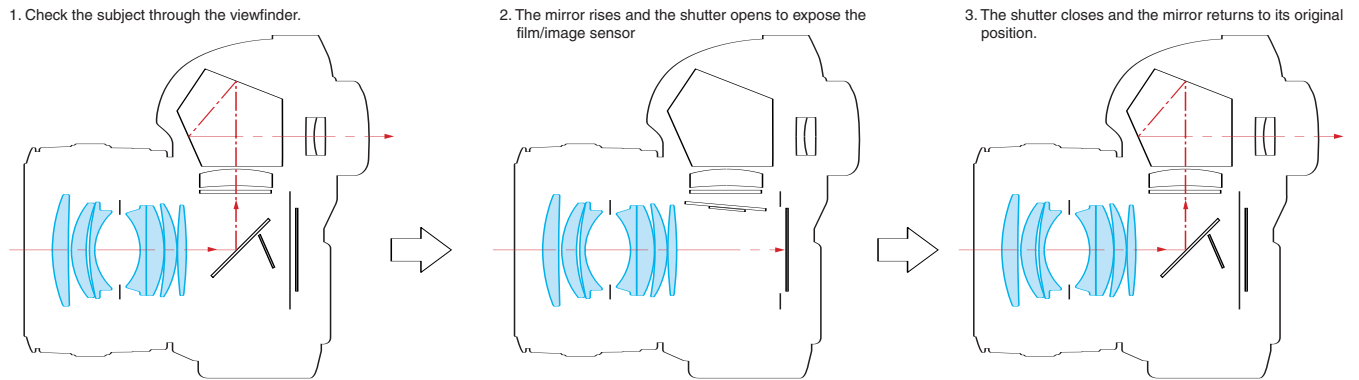
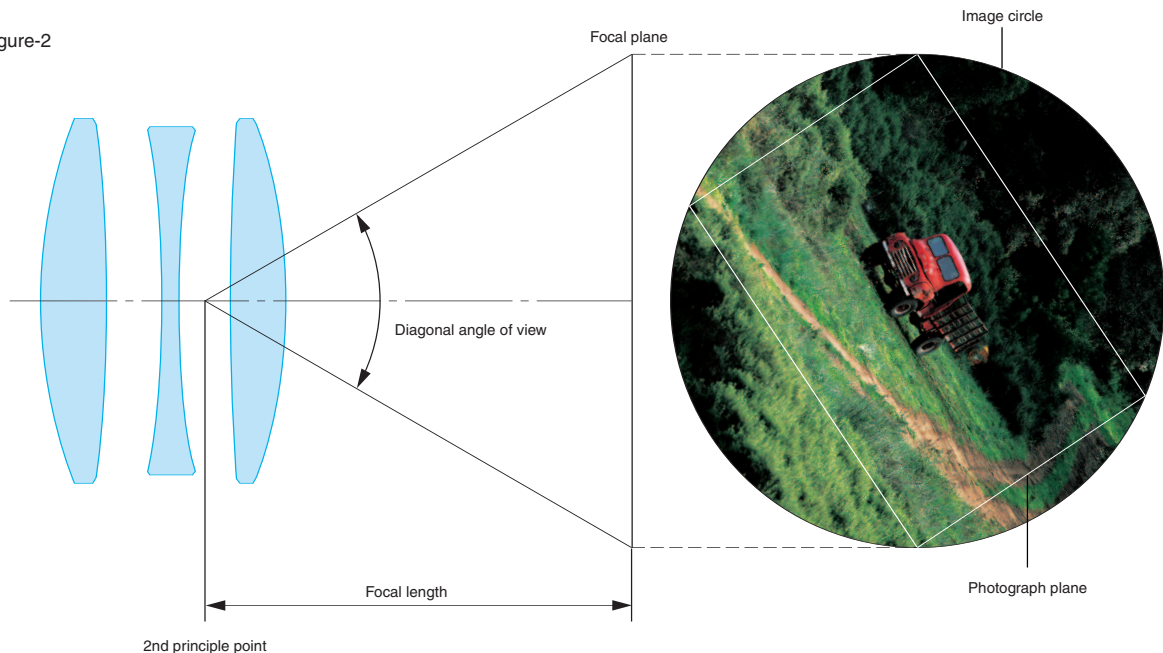


Figure-2



## What does the world look like through a lens?

### Construction and characteristics of the SLR camera.

The single-lens reflex (SLR) camera construction makes it possible to use a wide variety of interchangeable lenses to build the optimum system for photography. This is the attraction of the SLR camera. The major characteristic of this camera is the viewfinder system. Because the image that actually reaches the focal plane is displayed in the viewfinder, the image that will be captured digitally or on film can be checked in advance.

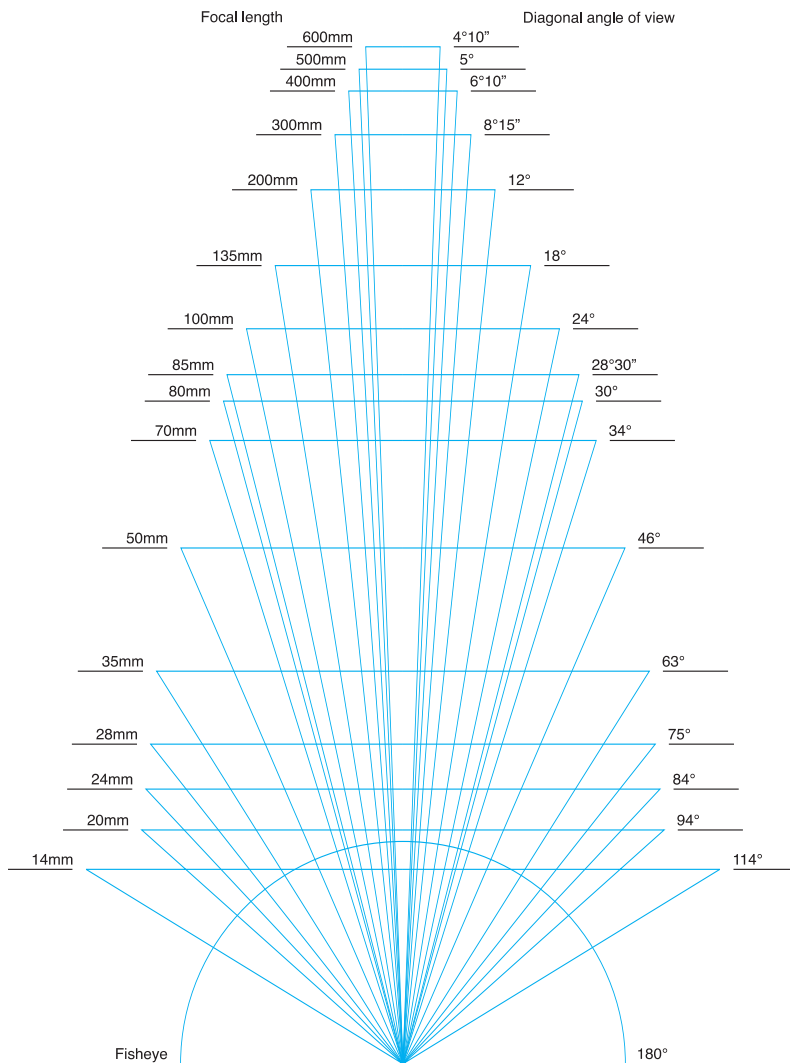
The light rays that pass through the lens are deflected upward by a mirror in front of the lens to show the image in a focusing screen that is equidistant with the focal plane. A pentaprism is then used to correctly orient and project the

image before it is seen through the eyepiece. When the shutter button is pressed, the mirror rises up and the shutter opens to expose the film or image sensor. When the shutter closes, the mirror returns to its original position (Figure-1). This makes it possible to accurately frame images without being affected by parallax, a problem with compact cameras, which have different light paths for the shooting lens and the viewfinder.

### How different focal lengths can change your shots.

The impression given by a photograph can be greatly changed by using a variety of different lenses for different purposes. In particular, differences in lens focal length greatly change the range (angle of view), perspective, and depth of field of the

Figure-3



subject being photographed.

The angle of view is expressed as the angle of the range being photographed, so it is generally shown as the angle of the diagonal direction. Naturally, the image captured by the lens is circular—not a rectangle the size of the focal plane—and this image is called an “image circle.” The image that is actually photographed is taken from the center of the image circle (Figure-2).

In the case of a 35mm camera, the angle of view (diagonal view angle) is 180° using a 15mm fisheye lens, 46° using a 50mm lens, 24° for a 100mm lens, 12° for a 200mm lens, and about 4° for a 600mm telephoto lens, so the longer the focal length, the narrower the angle of view (Figure-3). The angle of view becomes approximately 1/2 when the focal length is x2

Photo 1

Photographed using an EF 28-135mm f/3.5-5.6 IS USM



28mm



50mm



135mm

and the photographed area becomes 1/4.

Photo 1 shows photographs taken using 28mm, 50mm, and 135mm focal lengths. The composition changes dramatically from a wide view showing the table and surrounding area to a close-up of the subject.

# Screen change in accordance with focal length

15mm (fisheye)



14mm



28mm



35mm



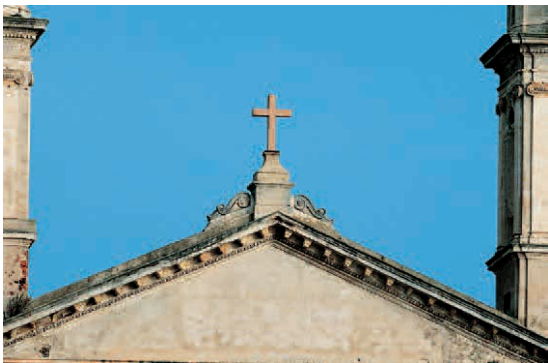
100mm



135mm



400mm



600mm





20mm



24mm



50mm



85mm



200mm



300mm



### Understanding focal length allows you to select the appropriate lens.

This series of photographs shows how lenses with different focal lengths photograph the same location.

The shorter the focal length of the lens, the wider the scene coverage, and the longer the focal length, the narrower the scene coverage.

As was mentioned on the previous page, when the focal length is 2x, the area of the photographed image is 1/4, so it is useful to remember the degree of change, especially for the lenses you normally use. For example, being able to imagine that the dome, which is the main subject using 50mm, gradually appears closer when using 100mm, 200mm, and 300mm without looking in the viewfinder is useful when selecting lenses.

## Perspective/Depth of field

f/1.4



f/22



f/2.8



f/5.6



f/11



**The depth of field is the range that is in focus.**

**The smaller the aperture, the deeper the depth of field.**

The depth of field is the range in front of and behind the subject that is in focus. The depth of field is greatly changed in accordance with various conditions that include the lens' focal length, aperture setting, position in focus, photographing distance, and the difference in distance between the main subject and the background.

Photo 5 shows that under the same shooting conditions, the smaller the aperture is made, the wider the depth of field becomes. In addition, the range in focus is a ratio of approximately 1:2 with the range being shallower in front and deeper behind the actual focusing distance.

Further, the "blurring" of the area away from the depth of field produces different photographic effects depending on the lens that is used, so it is important to use this effect skillfully

to produce works that have a sense of perspective.

In addition, at the same aperture setting, the depth of field can be made shallower by decreasing the photographing distance or deeper by increasing it. Also, shortening the lens focal length makes the depth of field deeper, and increasing the focal length makes the depth of field shallower at any given distance. The distance between the subject and the background also greatly affects the depth of field. For example, even when a wide aperture telephoto lens is used to shoot a portrait, if there is no distance between the person and the background, the background cannot be blurred, and even when a wide-angle lens with a deep depth of field is used, blurred backgrounds can be created during close-up photography.



16mm



24mm



50mm



200mm



135mm



**Perspective is the visual effect of the photographic world.**

Effectively using perspective, such as for creating dynamic wide-angle photos and compressed effects with telephoto lenses, makes it possible to produce expressive photographs with impact. Perspective is the visual effect that determines how close or far away the background appears to be from the subject. The shorter the focal length of the lens, the more this effect is expressed, and the longer the focal length of the lens, the less this effect is expressed and the more compressed the photograph looks.

Looking at a series of images photographed by changing the shooting distance while keeping the subject the same size makes this effect readily apparent. It is easy to see how the perspective is greatly changed depending on the focal length. Compare the above 16mm and 200mm photographs, with the wide angle lens, it looks like the background is stretching out

far behind the subject. Conversely, using a telephoto lens there appears to be very little distance between the two, which gives the photograph a compressed feeling.

In other words, comparing the apparent distance between the subject and the background as the focusing distance and the focal length of the lens are varied shows how perspective is created. For this reason, even when you want to keep the person the same size, use a wide-angle lens when you want to have a panoramic background, and a telephoto lens when you want to adjust the background to emphasise the subject. This is why it is important to differentiate between which lenses to use depending on the desired photographic effect.

## Special characteristics of EF-S lenses

EF-S 60mm  
f/2.8 Macro USM



EF-S 10-22mm  
f/3.5-4.5 USM



EF-S 17-55mm  
f/2.8 IS USM



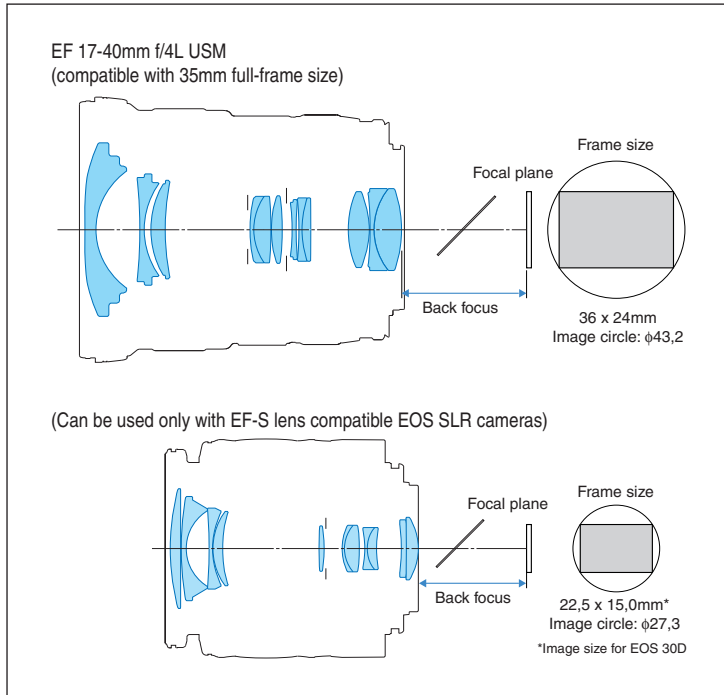
EF-S 17-85mm  
f/4-5.6 IS USM



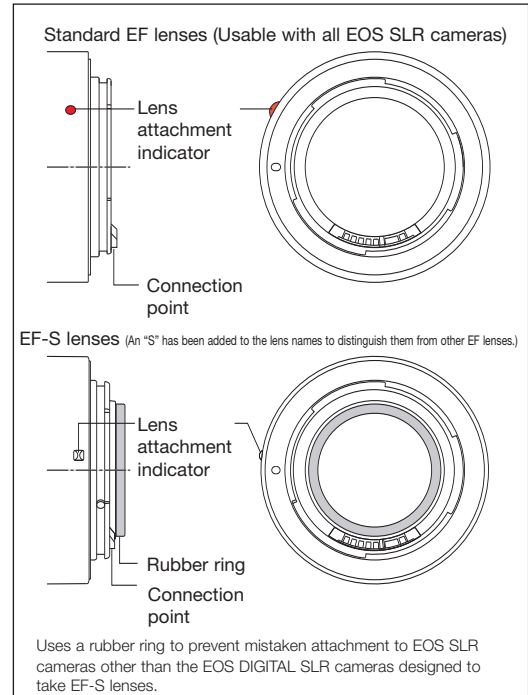
EF-S 18-55mm  
f/3.5-5.6 II USM  
EF-S 18-55mm  
f/3.5-5.6 II



Optical System of the EF-S Lenses



Comparison of Rear Portions of Lenses



**The increasingly comprehensive EF-S line-up now includes a single focal length macro lens, an ultra-wide-angle zoom and an image-stabilizer standard zoom.**

Our EF-S lenses feature optical systems and lens mechanisms designed specifically for digital SLR cameras employing sensors of the APS-C frame size, which is smaller than that of the 35mm format. In addition to possessing a smaller image circle than other EF lenses to match the smaller frame size, they also allow adoption of short back focus (distance from the rear of the lens to the focal plane) made possible by the compact quick return mirrors in the camera bodies.

The APS-C sized sensor gives the camera a 1.6x focal length conversion factor over the 35mm film format, resulting in an angle of view biased towards telephoto. Canon created the large-diameter EF-S 17-55mm f/2.8 IS USM, image stabilizer-equipped EF-S 17-85mm f/4-5.6 IS USM, and compact, lightweight EF-S 18-55mm f/3.5-5.6 II USM as versatile standard zoom lenses capable of serving all photographic needs from wide-angle scenery shots through normal snapshots to telephoto portraits.

Additionally, the EF-S series now includes the ultra wide-angle zoom EF-S 10-22mm f/3.5-4.5 USM lens to complement the standard zooms, and the excellent telephoto macro EF-S 60mm f/2.8 macro USM lens.

\* Some of the EF-S lenses does not employ a short back focus optical system.

\* EF-S Lens Compatible EOS SLR Cameras

EOS 30D, EOS 20D, EOS 20Da/EOS 400D DIGITAL/EOS 350D DIGITAL/EOS 300D DIGITAL (as of September 2006)

**Design that prevents inadvertent attachment to EOS cameras other than those supporting EF-S lenses, and damage to the camera body.**

The EF-S lenses are designed in such a way that their mechanism fits completely only into the bodies of EOS SLR cameras that support EF-S lenses, and are fitted with a rubber ring at the rear of the lens to prevent damage to the camera body in the event of mistaken attempts to attach them to incompatible EOS SLR cameras. EF-S lenses also feature both a different attachment position and a white rectangular lens mounting index that differs in shape and colour from other EF lenses to help prevent inadvertent attempts to attach these lenses to incompatible EOS SLR cameras.



**60mm** (equivalent to 96mm in 35mm format)



EF-S 60mm f/2.8 Macro USM

**10mm** (equivalent to 16mm in 35mm format)



EF-S 10-22mm f/3.5-4.5 USM

**85mm** (equivalent to 136mm in 35mm format)



EF-S 17-85mm f/4-5.6 IS USM

**A rich lineup of lenses covering from life-size macro to medium range telephoto photography.**

#### ■ EF-S 60mm f/2.8 Macro USM

With a focal length equivalent to approximately 96mm in 35mm format, this medium telephoto macro lens is able to cover in-focus shooting from life-size macro photography to infinity. It can handle a broad range of subjects including not only macro shots of flowers, insects and small animals, but also scenery, portraits and snapshots.

#### ■ EF-S 10-22mm f/3.5-4.5 USM

Featuring a 35mm-equivalent focal-length coverage of 16-35mm, this ultra wide-angle zoom lens dramatically expands the field of view beyond the range of human eyes. This capability makes it perfect for shooting expansive seascapes or zooming in on large fields of flowers.

#### ■ EF-S 17-55mm f/2.8 IS USM

This large-diameter zoom lens covers a focal length range equivalent to 27-88mm in the 35mm format. Its f/2.8 maximum aperture with circular diaphragm achieves beautiful background blur, and a mechanism for camera-shake blur compensation makes it ideal for use in a wide variety of shooting conditions, including portrait shots in natural lighting.

#### ■ EF-S 17-85mm f/4-5.6 IS USM

This 5x zoom lens with a focal length range equivalent to 27-136mm in 35mm format covers from wide angle to telephoto photography. Its high zoom range makes it a highly versatile lens for almost all shooting needs – from landscape and group photos to snapshots and portraits.

#### ■ EF-S 18-55mm f/3.5-5.6 II USM / EF-S 18-55mm f/3.5-5.6 II

With a focal length range equivalent to 29-88mm in 35mm format, these lightweight, compact zoom lenses are versatile enough for all kinds of photography, from wide-angle large group shots to standard-range street corner snapshots and telephoto portraits that make use of the exquisite background blur.

#### 35mm Format Focal Length Equivalents

	16mm	27mm	35mm	50mm	88mm	136mm
EF-S 60mm f/2.8 Macro USM					96mm	
EF-S 10-22mm f/3.5-4.5 USM	16mm	35mm				
EF-S 17-55mm f/2.8 IS USM		27mm		88mm		
EF-S 17-85mm f/4-5.6 IS USM		27mm				136mm
EF-S 18-55mm f/3.5-5.6 II USM EF-S 18-55mm f/3.5-5.6 II		29mm		88mm		



## *Correspondence of EF Lens to Digital Photography*

## Image size and lens selection

35mm full size and digital shooting range image size (picture dimensions) and lens selection



— EOS-1Ds Mark II / EOS 5D    — EOS-1D Mark II N    — EOS 30D\*



EOS-1D Mark II N



EOS 30D\*

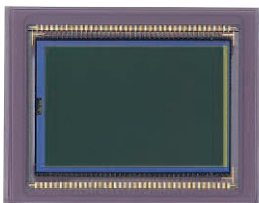
### Differences in image size

Digital SLR cameras contain CMOS or CCD image sensors instead of film. The size of the sensor determines the size of the image (picture dimensions), which varies depending on the camera body. Canon digital SLR cameras have images in the following three sizes.

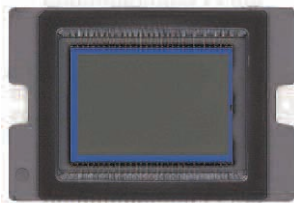


36.0 x 24.0mm (EOS-1Ds Mark II)

\*Image size for EOS 5D : 35.8 x 23.9mm.



28.7 x 19.1mm (EOS-1D Mark II N)



22.5 x 15.0mm (EOS 30D)

\*Image size for EOS 400D DIGITAL SLR:  
22.2 x 14.8mm.

### Image size and effective angle of view

Differences in image size affect the actual area that appears in the photograph, or, put another way, the effective angle of view. The EOS-1Ds Mark II/EOS 5D has an image size equivalent to that of 35mm film, while the EOS-1D Mark II N has a smaller image size, and the image size of the EOS 30D\* is even smaller. The smaller the image size, the smaller the effective angle of view becomes at any given focal length. As the above image size comparisons show, using a 100mm lens with the EOS-1D Mark II N and EOS 30D will produce photographs with effective angles of view approximately equivalent to photos taken with a 130mm lens and a 160mm lens, respectively, on the EOS-1Ds Mark II/EOS 5D. In other words, the focal length conversion factor for the EOS-1D Mark II N is about 1.3 times that of regular 35mm film image, and about 1.6 times for the EOS 30D.

This effect can be used to your advantage to increase the effect of using a telephoto or macro lens in order to bring the subject in even closer. On the other hand, wide-angle photography will require an even wider lens.

\* The EOS 400D DIGITAL SLR camera have similar image size as the EOS 30D.

### Selecting a wide-angle lens

For the EOS 30D, for example, shooting in the focal length range of 16mm can obtain the same angle of view as that shot with a 25mm focal length range by a 35mm full-size camera. The perspective is determined by the shooting distance, so Photo 1 and Photo 2 will have the same perspective. In other words, to obtain the same angle of view as when shooting at



## 35mm full-size camera with 16mm focal length



— EOS-1Ds Mark II / EOS 5D — EOS 30D\*

## Photo 1



35mm full-size camera with 25mm focal length

## Photo 2



EOS 30D\* with 16mm focal length

Equivalent angle of view

35mm full size with an EOS 30D, a wider lens must be selected. The EF lens series contains a full line of wide-angle zoom lenses and wide-angle single focal-length lenses, including the EF 16-35mm f/2.8L USM, EF 17-40mm f/4L USM, EF 24-70mm f/2.8L USM, and EF-S 10-22mm f/3.5-4.5 USM to allow you to select the lens that matches the camera body's screen size.

**Depth of field and perspective**

The EF 85mm f/1.8 USM lens is effectively a 136mm f/1.8 lens in terms of angle of view when attached to the EOS 30D. Looking at these specs, it would seem possible to take a photograph with a shallower depth of field than if the EF 135mm f/2L USM were used with 35mm film, but this is not the case. Since the focal length does not actually change, the depth of field in terms of the sensors and the blurred image in the out-of-focus area remain the same for the EF 85mm f/1.8 USM. And if the image is enlarged to the size of an A3 print (approx. 11 x 14 inches), the amount of enlargement required by the EOS 30D is greater than that for 35mm film size, because its screen size is smaller. Nevertheless the depth of field on the print will be shallower for the latter combination, creating greater blur in the background. This means that if you want to achieve more blur in the background using the EOS 30D, you will have to shoot at a larger aperture. Furthermore, perspective is related to angle of view, so even if the focal length is different for each particular lens, if the resulting angle is the same due to the difference in image size, as in the photographs shown above, the perspective will remain unchanged, too.

**Selecting a lens from our broad line-up**

The differences in angle of view for each screen size might cause confusion when you first use a digital SLR camera. However, once you get used to this new aspect, you will be able to use these differences to your advantage in creating new angles of view and depths of field for each lens. Part of the appeal of the EF lens series lies in the wide range of selection they offer you with a line-up of over 50 lenses, allowing you find just the right lens for your needs.

## Full lineup of EF lenses

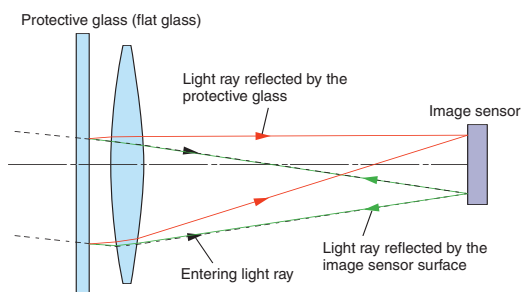


# How to deal with flaring and ghosting particular to digital photography

For flat protective glass



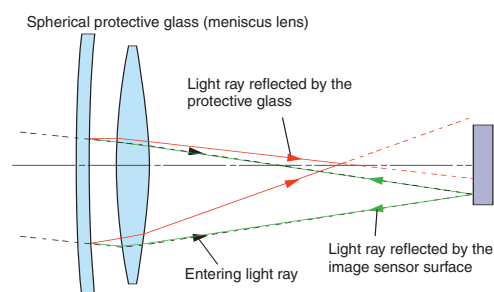
In lenses employing flat protective glass, a reflection occurs between the image sensor and the protective glass, which causes the subject to be photographed in a position different from the actual position.



For a meniscus lens



In lenses employing a meniscus lens, no reflection like that seen to the left occurs.



## Reflective characteristics of image sensors

The reflective characteristics of the image sensors in a digital camera differ from those of film in that they possess a higher reflectivity as well as a characteristic known as regular or “mirror” reflection, which has the effect of creating flaring and ghosting inside the lens when light from a bright source enters the lens and reflects back to the image sensor. In order to resolve this problem particular to digital cameras, a new approach to optical design has already been adopted, with the goal of bringing the outstanding imaging performance of EF lenses to digital photography. This is, after all, the mission of EF lenses in the digital age, because they occupy the core of the EOS system, whether film or digital.

## Use of meniscus lenses

Players in a stadium or racecars whizzing round the circuit. All are lit up by the bright lighting in the stands, or the headlights on the cars, creating numerous bright light sources. Ordinary super-telephoto lenses have protective glass in front of the first lens unit. If this glass is flat, any light entering the lens from a bright light source will be reflected off the image sensor and back onto the inside of the protective element, causing spot-shaped ghosting.\* To prevent this, meniscus lenses are used as the protective glass on all of Canon's large-aperture IS super-telephoto lenses. Meniscus lenses are spherical lenses which have the same curvature on both sides of the lens. By using these lenses as the protective glass, the light reflected off the image sensor forms an image in front of the image sensor and then disperse. Since almost all the light

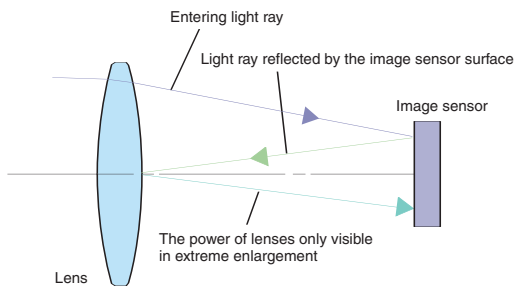


Many telephoto lenses, including the EF 300mm f/2.8L IS USM employ a meniscus lens to suppress internal reflection of the image that occurs in digital cameras.

Lens for which the lens shape and coating have not been optimised



Flaring and ghosting occurs with lens for which the lens shape and coating have not been optimised.



which is dispersed does not hit the reflective elements, this prevents ghosting while at the same time achieving high contrast for the resulting image.

Large-aperture IS super-telephoto lenses used in sports stadiums and racing circuits can now deliver the expressiveness needed by professional photographers using digital SLR cameras thanks to their outstanding imaging performance.

\* When a filter is mounted on a regular lens, ghosting can occur above the same spot where there is a strong light source inside the frame. When this occurs, remove the filter to photograph.

### Super-telephoto lenses using meniscus lenses

- EF 300mm f/2.8L IS USM ●EF 500mm f/4L IS USM
- EF 400mm f/2.8L IS USM ●EF 600mm f/4L IS USM
- EF 400mm f/4 DO IS USM

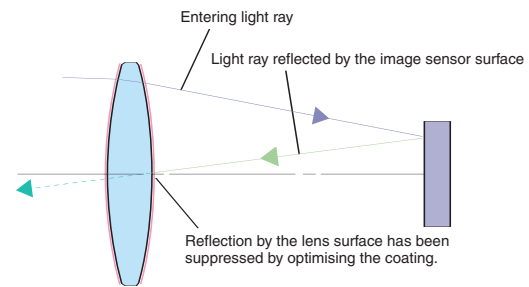
### Optimum lens shape and coating

Even when using lenses without built-in protective glass, the particular photographic conditions might mean that using a digital camera will result in more flaring and ghosting than if a film camera were used. If a strong light source is present inside the frame, the light reflected off the image sensor can create complex reflective patterns inside the lens, resulting in flaring and ghosting. To prevent this effect particular to digital photography, we have optimised the shape and coating of

Lens for which the lens shape and coating have been optimised



Flaring and ghosting are suppressed with lens for which the lens shape and coating have been optimised.



f/2.8L zoom series, including the EF 16-35mm f/2.8L USM, and other models such as the EF 17-40mm f/4L USM. Specifically, each lens element has a different design, in order to reduce the amount of repeated reflection inside the lens. Further, the lens surface, which has a large effect on reflectivity, is treated with a special multi-layer coating with high transmittance. This allows any light reflected off the image sensor to escape out of the lens in the direction of the subject, thus reducing flaring and ghosting. And Canon's legendary colour balance is not compromised, thanks to an exact balance between multi-layer and single-layer coatings.



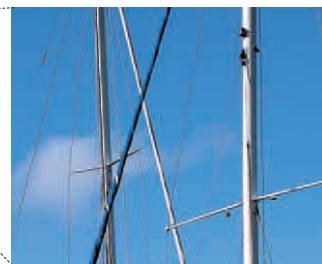
An optimised coating is used for the EF 16-35mm f/2.8L USM and other lenses to suppress the flaring and ghosting that occurs easily with digital cameras.



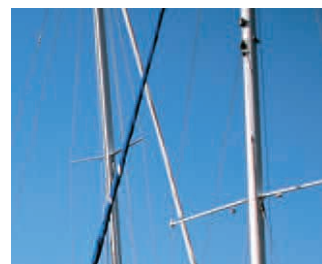
## The power of lenses only visible in extreme enlargements



When the lens has high resolution



When the lens has low resolution



Even when combined with a digital camera, an EF lens has high potential. In this photo of a harbor crowded with yachts, high resolution reveals the fine detail in individual boats. Photographing images with detailed subject matter, such as landscapes, is possible without having to differentiate between a digital camera and a 35mm film camera.

### The fun of extreme digital enlargements

Thanks to the improved performance of ink-jet printers, some models can achieve quality equal to that of gelatin silver prints. Add to this the lower cost of printing afforded by a printer and the ability to manipulate the image on a computer, and you are close to realising an ideal in image reproduction. It is for these and other reasons that there will likely be more and more chances to experience the fun of enlarging digital images to sizes of up to A4 and A3 (approximately 8.5 x 11 and 11 x 14 inches, respectively).

### Choosing a lens with high resolution

While the same can be said about gelatin silver prints for film cameras, when enlarging a digital photograph many times, the power of the work is largely determined by the sharpness of the image. Shooting with a high-resolution lens produces more impressive shots when enlarging digital images to sizes of up to A4 and A3. The EF lens series contains a broad line-up of high-resolution lenses, including the L-type lenses, which deliver an extremely sharp result for enlargements of digital photographs.

### Choosing a lens with little colour aberration

Axial colour aberration often found in telephoto lenses and the chromatic difference in magnification often caused by wide-angle lenses appear in photographs as colours which run over dividing lines in the subject. This type of colour running is more noticeable the larger the size of the print, causing a deterioration in the overall quality of the image.

The L-type lenses in the EF lens series employ fluorite, UD, and super UD lens elements to correct the aberrations mentioned for telephoto and wide-angle lenses. The EF 400mm f/4 DO IS USM and EF 70-300mm f/4.5-5.6 DO IS USM have DO lens elements, which are very effective in suppressing strong colour aberration. The effects of these special optical materials and the DO lenses are most evident when a photograph is extremely enlarged. And since less colour aberration means greater overall image sharpness, the result is very good even for very big enlargements.

### Image stabilizing IS lenses

Another factor that increases in visibility with larger print sizes is blur caused by hand movement when taking the photograph. This is a small factor, but can ruin an otherwise excellent photograph.

The effects of hand movement can appear more pronounced depending on the size of the image in the digital camera. For example, since the image in the EOS 30D is smaller than in a 35mm film camera, making a print of the same size involves enlarging the original image to a greater degree. And since the more a photograph is enlarged, the more blur becomes evident, a similar amount of hand movement will be more

When the lens corrects the magnification colour aberration



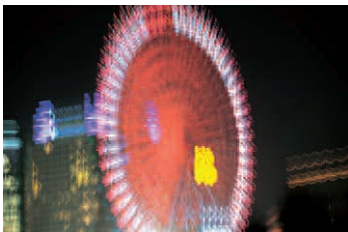
When the lens does not correct the magnification colour aberration



Axial chromatic aberration (also called "chromatic difference of magnification") occurs because of variations in the wavelength or frequency of light reflected from the subject. This phenomenon not only reduces photo sharpness, but it can also create borders of colour, which should not be present, at the edges of subjects in the image. EF lenses designed to counter chromatic aberration make it possible to achieve uniform sharpness and correct colour reproduction from the center of a photo to its edges.

noticeable with the EOS 30D.

The current EF lens series contains a line-up of 16 IS lenses, covering the spectrum from wide-angle to super-telephoto. Using the right IS lens for the scene can allow you to achieve sharp image performance with little evident blur even when making large prints.



IS OFF



IS ON



#### IS Lens Series Line-up

- EF 300mm f/2.8L IS USM
- EF 300mm f/4L IS USM
- EF 400mm f/2.8L IS USM
- EF 400mm f/4 DO IS USM
- EF 500mm f/4L IS USM
- EF 600mm f/4L IS USM
- EF 24-105mm f/4L IS USM
- EF 28-135mm f/3.5-5.6 IS USM
- EF 28-300mm f/3.5-5.6L IS USM
- EF 70-200mm f/2.8L IS USM
- EF 70-200mm f/4L IS USM
- EF 70-300mm f/4-5.6 IS USM
- EF 70-300mm f/4.5-5.6 DO IS USM
- EF 100-400mm f/4.5-5.6L IS USM
- EF-S 17-55mm f/2.8 IS USM
- EF-S 17-85mm f/4-5.6 IS USM



## Colour reproduction in digital cameras

When photographing subjects under fluorescent light using AWB (Auto White Balance)



The true colour can be reproduced even when under fluorescent lighting.

When photographing subjects under fluorescent light using the white balance mode (sunlight)



The correct colour cannot be recreated such as when using "daylight type" colour film.

### Factors involved in colour reproduction

In the case of gelatin silver photographic prints, it is generally believed to be the lens and film which determine the colour reproduction. However, in the case of digital cameras, it is not only the lens, but rather the process of how the light received by the image sensor is turned into an image that makes the difference in colour reproduction. It is also possible to fine-tune the colour reproduction, the white balance setting and the colour matrix selection.

### White balance setting

There are two types of general silver chloride colour film. One is the "daylight type," which provides the correct colour balance under sunlight, and the other is the "tungsten type," which provides the correct colour balance under tungsten lamp light. In addition, under fluorescent light, the correct colour cannot be obtained without using a gelatin filter, etc., to correct the colour temperature.

Digital cameras, however, do not require such methods. Instead of choosing film types for different light sources and filters for colour warmth, the white balance is set beforehand to match the lighting conditions. The digital EOS series offers preset white balance modes which can be selected for natural light, shade, cloudy conditions, incandescent lighting, fluorescent lighting, and flash photography. Not only that, but the white balance can be adjusted manually or automatically. The blue shadow-like effect seen in portraits taken in the shade using daylight-type colour film is no longer a problem, thanks to the white balance adjustment offered by digital photography.



Colour Matrix 3



This photograph was taken using Colour Matrix 3 with a high saturation setting to reproduce the fresh colours of the flowers.  
TS-E 45mm f/2.8-1/1000sec: f/2.8

Colour Matrix 1



This was photographed using Colour Matrix 1, which is the standard setting.

### Colour matrix selection

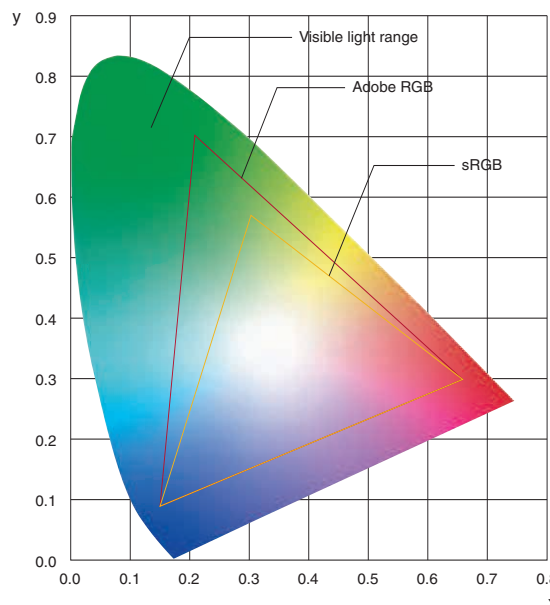
Different brands of daylight-type gelatin silver colour film are often advertised as being suitable for reproducing skin colours or the bright colours of flowers, so photographers choose film depending on their purpose.

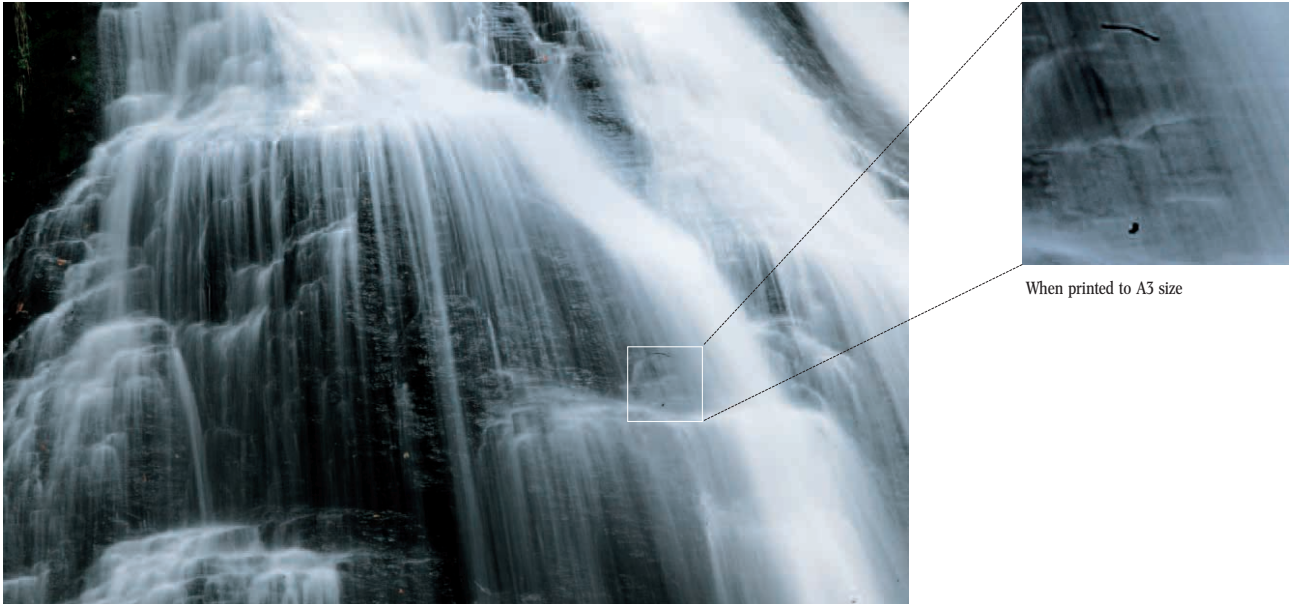
In the same way, the EOS-1Ds Mark II and EOS-1D Mark II N allow you to select from a variety of colour matrices. A colour matrix is composed of three properties: hue, saturation, and brightness. Digital camera terminology includes another term: colour space, which refers to which part of the region of visible light can be reproduced. The most common colour space is sRGB. Since it contains four hues, it is possible to select colour reproduction characteristics as though you were choosing film. It is also possible, if the situation demands, to choose Adobe RGB, which is a colour space that can reproduce a wider range.

### Lens colour balance

It is often thought that if you can adjust the settings on a digital camera and check the result, you can adjust the colour balance of the lens. However, SLR cameras are founded on the assumption of being able to change the lens. Whether you are using a film or digital camera, it is very important that the colour reproduction (colour balance) of all the lenses be standardised. The traditional standardised colour balance that Canon lenses are renowned for is also a vital element in providing an exceptionally convenient photographic environment — even for digital cameras.

xy chromaticity diagram





If there is dust on the image sensor, it will be recorded in the photograph. This will especially stand out in large prints.

### Do not depend on your computer to fix your images

Images taken using a digital camera can be adjusted for sharpness, brightness, contrast, and other factors using a computer. However, avoid becoming over-dependent on your computer to fix the shortcomings of your photography. The reason is that most image processing is accompanied by a drop in the quality of the image. The basics of good photography are the same for digital cameras as they are for film cameras. If your goal is to take a good photograph, it is of vital importance that you check the exposure and focus and prevent the camera from shaking. It will be safest if you only rely on computer touch ups as a final, complementary aspect of your photography, if you wish to get the most out of your EF lens's image performance.

It is often difficult to achieve better results than the actual photograph by touching up the image afterwards on your computer, especially with JPEG format images, since a standardised type of “developing” (actually a type of digital image processing) takes place inside the camera right when the photograph is taken. If you use a RAW format, you have to process the image on your computer using the bundled software (including Digital Photo Professionals). This process allows you to manipulate the image as you like without causing a drop in image quality — even if the same data is treated over and over. But again, no amount of treatment later can fix a picture that was taken at a wrong exposure, out of focus, or if the camera shook when the picture was being taken.

### Preventing dirt and dust from getting in the camera body or onto the lens when changing lenses

Changing lenses in windy places can cause dirt and dust to enter the camera through the lens mount. Any dust that gets on the image sensor may appear as black specks or smudges on the image. To avoid this, we recommend doing the following:

- Change lenses quickly in places where there is no wind
- Always attach the body cap to the camera body when no lens is attached
- Change lenses with the camera mount facing down
- Do not place the camera face down
- Watch out for dust getting inside the body cap on the camera or the lens's dust cap

Image sensors are very delicate. If dirt or dust ever needs to be cleaned off the sensor surface, either do it as described in the camera manual or take the camera to a Canon service center.

# EF LENS WORK III The Eyes of EOS

September 2006, Eighth edition

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**Publisher and Planning** Canon Inc. Lens Products Group

**Production and Editorial** Canon Inc. Lens Products Group

**Printer** Nikko Graphic Arts Co., Ltd.

**Thanks for the Cooperation of :** Brasserie Le Solférino/Restaurant de la Maison Fouraise, Chatou/  
Hippodrome de Marseille Borély/Cyrille Varet Créations, Paris/Jean  
Pavie, artisan luthier, Paris/Participation de la Mairie de Paris/Jean-  
Michel OTHONIEL, sculpteur

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