

Normal lens

In photography and cinematography, a normal lens is a lens that reproduces a field of view that generally looks "natural" to a human observer under normal viewing conditions, as compared with lenses with longer or shorter focal lengths which produce an expanded or contracted field of view that distorts the perspective when viewed from a normal viewing distance. Lenses of shorter focal length are called wide-angle lenses, while longer-focal-length lenses are referred to as long-focus lens (with the most common of that type being the telephoto lenses).

For still photography, a lens with a focal length about equal to the diagonal size of the film or sensor format is considered to be a normal lens; its angle of view is similar to the angle subtended by a large-enough print viewed at a typical viewing distance equal to the print diagonal; this angle of view is about 53° diagonally. For cinematography, where the image is normally viewed at a greater distance, a lens with a focal length of roughly double the film or sensor diagonal is considered 'normal'.

The term normal lens can also be used as a synonym for rectilinear lens.

Typical normal focal lengths for different formats

Film still

Four "normal" lenses for the 35mm format.



Typical normal lenses for various film formats for photography are:

Film format	Image dimensions	Image diagonal	Normal lens focal length
9.5 mm Minox	8 × 11 mm	13.6 mm	15 mm
Half-frame	24 × 18 mm	30 mm	30 mm
APS C	16.7 × 25.1 mm	30.1 mm	28 mm, 30 mm
135, 35mm	24 × 36 mm	43.3 mm	40 mm, 50 mm, 55 mm
120/220, 6 × 4.5 (645)	56 × 42 mm	71.8 mm	75 mm
120/220, 6 × 6	56 × 56 mm	79.2 mm	80 mm
120/220, 6 × 7	56 × 68 mm	88.1 mm	90 mm
120/220, 6 × 9	56 × 84 mm	101.0 mm	105 mm
120/220, 6 × 12	56 × 112 mm	125.0 mm	120 mm
large format 4 × 5 sheet film	93 × 118 mm (image area)	150.2 mm	150 mm
large format 5 × 7 sheet film	120 × 170 mm (image area)	208.0 mm	210 mm
large format 8 × 10 sheet film	194 × 245 mm (image area)	312.5 mm	300 mm

Wide-angle lens

In photography and cinematography, a wide-angle lens refers to a lens whose focal length is substantially smaller than the focal length of a normal lens for a given film plane. This type of lens allows more of the scene to be included in the photograph, which is useful in architectural, interior and landscape photography where the photographer may not be able to move farther from the scene to photograph it.

Another use is where the photographer wishes to emphasise the difference in size or distance between objects in the foreground and the background; nearby objects appear very large and objects at a moderate distance appear small and far away.

This exaggeration of relative size can be used to make foreground objects more prominent and striking, while capturing expansive backgrounds.

A wide angle lens is also one that projects a substantially larger image circle than would be typical for a standard design lens of the same focal length. This large image circle enables either large tilt & shift movements with a view camera, or a wide field of view. By convention, in still photography, the normal lens for a particular format has a focal length approximately equal to the length of the diagonal of the image frame or digital photo sensor. In cinematography, a lens of roughly twice the diagonal is considered "normal".

Wide-angle lenses for 35 mm format

For a full-frame 35 mm camera with a 36 mm by 24 mm format, the diagonal measures 43.3 mm and by custom, the normal lens adopted by most manufacturers is 50 mm. Also by custom, a lens of focal length 35 mm or less is considered wide-angle.

Ultra wide angle lenses have a focal length shorter than the short side of the film or sensor. In 35 mm, an ultra-wide-angle lens has a focal length shorter than 24 mm. Common wide-angle for a full-frame 35 mm camera are 35, 28, 24, 21, 20, 18 and 14 mm, the latter four being ultra-wide. Many of the lenses in this range will produce a more or less rectilinear image at the film plane, though some degree of barrel distortion is not uncommon here.

Ultra wide-angle lenses that do not produce a rectilinear image (i.e., exhibit barrel distortion) are called fisheye lenses. Common focal lengths for these in a 35 mm camera are 6 to 8 mm (which produce a circular image). Lenses with focal lengths of 8 to 16 mm may be either rectilinear or fisheye designs. Wide-angle lenses come in both fixed-focal-length and zoom varieties. For 35 mm cameras, lenses producing rectilinear images can be found at focal lengths as short as 8 mm, including zoom lenses with ranges of 2:1 that begin at 12 mm.

Macro Lens

The official definition of a macro lens is that it should be able to reproduce a life-sized image of an object on the recording medium – in this case the image sensor. True macro lenses offer a magnification factor of 1.0x or 1:1 at its closest focus setting. Fit one of these lenses to a DSLR like the Canon EOS 60D, and a standard UK postage stamp will fill the whole frame.

That might not sound particularly impressive, but when you consider that the 18Mp sensor in cameras like enable very large format prints, the potential for creating massive enlargements from shots of tiny objects is really quite astonishing.

Micro Lens

A microlens is a small lens, generally with a diameter less than a millimetre (mm) and often as small as 10 micrometres (μm). The small sizes of the lenses means that a simple design can give good optical quality but sometimes unwanted effects arise due to optical diffraction at the small features.

Tilt shift lenses: perspective control

Tilt shift lenses enable photographers to transcend the normal restrictions of depth of field and perspective. Many of the optical tricks these lenses permit could not otherwise be reproduced digitally—making them a must for certain landscape, architectural and product photography. The first part of this tutorial addresses the shift feature, and focuses on its use for in digital SLR

cameras for perspective control and panoramas. The second part focuses on using tilt shift lenses to control depth of field.

Tilt shift movements

Shift movements enable the photographer to shift the location of the lens's imaging circle relative to the digital camera sensor. This means that the lens's center of perspective no longer corresponds the image's center of perspective, and produces an effect similar to only using a crop from the side of a correspondingly wider angle lens.

Tilt movements enable the photographer to tilt the plane of sharpest focus so that it no longer lies perpendicular to the lens axis. This produces a wedge-shaped depth of field whose width increases further from the camera. The tilt effect therefore does not necessarily increase depth of field—it just allows the photographer to customize its location to better suit their subject matter.