Basic Digital Photography

Glossary of Terms

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Digital Photography Glossary

A

ACCESSORY SHOE (See HOT SHOE)

ADAPTALL SYSTEM
In 1976, Tamron's mildly successful **Adaptamatic Sys tem** is dramatically improved and re-named the **Adaptall System.** The Adaptall System is a series of lenses with a proprietary mount that accepts the Adaptall adapter, which adapts the lens to fit a specific camera manufacturer's lens mount. Unlike the old T-Mount System, the Adaptall lenses had auto-aperture control and metering linkage to work with the camera to which the lens was mounted. These were available in Canon, Leica R, Minolta, Nikon, Olympus, and Pentax mounts as well as the highly popular S-Mount used by so many different camera makers of the time. This system did not survive Tamron's conversion to primarily auto focus lenses and by the time digital cameras were prevalent it was a thing of the past, except for a few manual focus cameras and some current Nikon and Pentax cameras.

ADDITIVE COLOR
An additive color model involves light emitted directly from a source or illuminant of some sort. The additive reproduction process usually uses red, green and blue light to produce the other colors. Combining one of these additive primary colors with another in equal amounts produces the additive secondary colors cyan, magenta, and yellow. Combining all three primary lights (colors) in equal intensities produces white. Varying the luminosity of each light (color) eventually reveals the full gamut of those three lights (colors). The most common use of additive light is the projected light used in theatrical lighting (plays, concerts, circus shows, night clubs, etc.). Computer monitors and televisions use a system called optical mixing and cannot be considered additive light because the colors do not overlap. The red green and blue pixels are side-by-side. When a green color appears, only the green pixels light up. When a cyan color appears, both green and blue pixels light up. When white appears all the pixels light up. Because the pixels are so small and close together our eyes blend them together, having a similar effect as additive light.

Results obtained when mixing additive colors are often counterintuitive for people accustomed to the more everyday subtractive color system of pigments, dyes, inks and other substances which present color to the eye by reflection rather than emission. For example, in subtractive color systems green is a combination of yellow and blue, in additive color, red + green = yellow and no simple combination will yield green. It should be noted that additive color is a result of the way the eye detects color, and is not a property of light. There is a vast difference between yellow light, with a wavelength of approximately 580 nm, and a mixture of red and green light. However, both stimulate our eyes in a similar manner, so we do not detect that difference.

James Clerk Maxwell is credited as being the father of additive color. Shortly before the American Civil War, he had the photographer Thomas Sutton photograph a tartan ribbon three times, first with a red, then green, then blue color filter over the lens. The three images were developed and then projected onto a screen with three different projectors, each equipped with the corresponding red, green, or blue color filter used to take its image. When brought into register, the three images formed a full color image, thus demonstrating the principles of additive color.

AMBIENT LIGHT (often called "Existing Light")
The light surrounding the subject or subject area. Light that is not by any illumination supplied by the photographer.

ANGLE OF VIEW
The area of a scene that a lens covers or sees. Angle of view is determined by the focal length of the lens. A wide-angle lens (Short focal length) includes more of the scene-a wider angle of view-than a telephoto lens (long focal length). A normal lens should have an angle of view of about 53°.

APERTURE
Lens opening. The opening in a camera lens through which light passes to expose the medium. The size of an aperture can be fixed or adjustable, depending on the type of lens. The size of the aperture is expressed in "f/numbers" representing the ratio of the lens focal length to the size of the opening. This is why the higher the f/number, the smaller the lens opening. For example f/2 means that the opening is half the length of the lens, a 50mm f/2 lens would have a maximum lens opening of 25mm. A 50mm f/4 lens would have a maximum lens opening of 12.5mm. This is represented as a ratio for two reasons, brevity, and the ratio is what is used to calculate exposure. Comparing two correctly designed lenses side by side, a 200mm lens should give you the same shutter speed as a 28mm lens, at the same aperture, if used in exactly the same lighting situation.

APERTURE PRIORITY (Aperture Value)
An automatic exposure mode that lets the photographer select the aperture (lens opening) while the camera's meter sets the shutter speed for the proper exposure. This is useful in situations in which the photographer wishes to control depth of field in a changing lighting situation. The Aperture Priority Mode is generally represented on the camera with the letter "A" and is often mistaken to mean simply "Automatic." In an effort to avoid this confusion, Canon and Pentax refer to the Aperture Priority Mode as "Aperture Value" and represent it with the initials "Av."

APS (Advanced Photo System)
In 1996, the major film and camera manufacturers introduced a new format in the hopes of getting more people interested in photography. The APS format involved small, rather expensive cameras that shot a smaller format than 35mm, which was then considered the smallest useful format available. APS involved three different formats:

H: Designed to match the aspect ratio of the then fledgling Hi-Definition format of 16:9, this format utilized the entire frame of film at 30.2 × 16.7 mm and presented the photographer with a 4"x7" print.

C: Designed to match the aspect ratio of 35mm film, the "Classic" format measured in at 25.1 × 16.7 mm cropped the left and right sides of the frame and presented the photographer with a 4"x6" print. This format dimension lives on in many digital cameras. Having the roughly same aspect ratio as 35mm film, this was adopted for many digital cameras and is roughly the size of most digital sensors, give or take a fraction of a millimeter. See **CROP FACTOR**

P: The Panoramic format cropped the top and bottom of the frame to render a 30.2 × 9.5 mm negative. The intention was for the photographer to get a 4"x12" print; but the introduction of APS to photo-labs was so profoundly badly orchestrated that one could never be sure what size print would come from this format. It all depended on the capabilities of the lab making the print.

ASA (Now ANSI)
The American National Standards Institute or ANSI is a private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States. The organization also coordinates U.S. standards with international standards so that American products can be used worldwide. For example, standards make sure that people who own cameras can find the film they need for that camera anywhere around the globe.

ANSI accredits standards that are developed by representatives of standards developing organizations, government agencies, consumer groups, companies, and others. These standards ensure that the characteristics and performance of products are consistent, that people use the same definitions and terms, and that products are tested the same way. ANSI also accredits organizations that carry out product or personnel certification in accordance with requirements defined in international standards.

ANSI was originally formed in 1916, when five engineering societies and three government agencies founded the American Engineering Standards Committee (AESC). In 1928, the AESC became the American Standards Association (ASA). In 1966, the ASA was reorganized and became the United States of America Standards Institute (USASI). The present name was adopted in 1969.

Prior to 1916, these five engineering societies, the American Institute of Electrical Engineers (AIEE, now IEEE), American Society of Mechanical Engineers (ASME), American Society of Civil Engineers (ASCE), the American Institute of Mining and Metallurgical Engineers (now AIME), and the American Society for Testing Materials (now ASTM International), had been members of the United Engineering Society (UES). At the behest of the AIEE, they invited the U.S. government Departments of War, Navy and Commerce to join in founding a national standards organization.

According to Paul G. Agnew, the first permanent secretary and head of staff in 1919, AESC started as an ambitious program and little else. Staff for the first year consisted of one executive, Clifford B. LePage, who was on loan from a founding member, ASME. An annual budget of $7,500 was provided by the founding bodies.

In 1931, the organization (renamed ASA in 1928) became affiliated with the U.S. National Committee of the International Electrotechnical Commission (IEC), which had been formed in 1904 to develop electrical and electronics standards. http://www.iec.ch/ **SEE "ISO"**

ASPECT RATIO
The aspect ratio of a shape is the ratio of its longer dimension to its shorter dimension. The aspect ratio of older digital cameras was usually 4:3 which matched the aspect ratio of the standard computer monitor of the time. It also matched that of a standard television set. As digital cameras became more popular and customers became more distraught by having their images cropped to get the 4x6's they came to expect from their labs, many camera manufacturers changed over to the 3:2 aspect ratio of a 35mm camera. Now that Hi-Definition television is here to stay, the 16:9 aspect ratio has increased in popularity. Many computer monitors and televisions are built in that aspect ratio now. Many video cameras are available in the 16:9, or HD, aspect ratio. Several still camera manufacturers have begun offering HD as an alternative setting in the camera; especially in those still cameras that also shoot video. Some camera manufacturers are sticking with the old 4:3 aspect ratio because it requires the least cropping from standard sized enlargements like 8x10 which are at an aspect ratio of 5:4.

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BACKDROP
Artificial backgrounds are used to concentrate attention on the subject. They can be anything from a blank sheet of paper or muslin, to plastic or vinyl sheets, to scenes painted on wood, canvas, muslin, or just about any flat medium.

BACKGROUND
In a photograph, anything behind the subject. It's always a good idea to look the background over before taking the picture to make sure there is nothing there that will detract from the picture.

BACKGROUND LIGHT
In studio lighting, the light used to illuminate the background or backdrop. Can be used to light the entire backdrop or just part of it
Also see **FILL LIGHT, HAIR LIGHT,** and **MAIN LIGHT**

BACKLIGHTING
Light coming from behind the subject toward the camera; tends to produce a silhouette. See **FILL FLASH**.

BELLOWS
In older cameras, the folding, accordion-like portion of the camera on the end of which the lens is mounted. Used to allow the lens to travel on rails for the purpose of focusing. Though rarely used today, two modern cameras that use bellows focusing are the Mamiya RB and RZ 67 Medium Format cameras.

A bellows attachment is a very useful tool for macro photography. A bellows attachment allows the lens to be extended far from the camera allowing for very close focusing and high magnification. A bellows attachment tends to be rather heavy and depth of field is so minute that it must be mounted on a tripod or other fixed support device.

BIT
Short for BInary digiT, this is the smallest unit of data that a computer can handle and that can be represented in digits (0 and 1) of the binary number system. Bit depth is a measure of the accuracy of the color that can be represented in a digital image.

BOUNCE FLASH
A lighting technique that involves "bouncing" a flash's light off of a reflective surface to create directional and/or diffuse, more natural looking light. Bounce flash is a very useful technique for minimizing background shadows when there is a reasonably low ceiling available.

BROAD LIGHTING
The positioning of the main light or primary light source on the side of the subject's face that is closest to the camera. In portraiture, this is generally considered unflattering to the face and tends to evoke a negative mood.

BULB (B)
A shutter speed setting that allows for long or "timed" exposures. When a shutter speed dial is set to "B" or "BULB" the shutter remains open for as long as the shutter button is depressed. With older analog (film) cameras, this was generally facilitated by a cable release; which is a cable that screws into the center of the shutter button with a lockable remote button on the other end. On most digital cameras this is done with a remote control. Most modern cameras use wireless controllers, but many still have an electric release that plugs directly into the camera. The name "Bulb" is derived not from "Flash Bulbs" as is often assumed, but from the triggering device used on the old box cameras of the nineteenth and early twentieth centuries. The photographer held a bulb that when squeezed, would trigger the shutter mechanism. There were generally two shutter speeds with this completely manual system, 1/15 of a second (squeeze for a quick count of "two") and 1/8 of a second (squeeze for a quick count of "one").

BYTE
Eight adjacent bit units used to encode a letter, number, or other computer character and operated as a single unit.

C

CABLE RELEASE
A flexible wire covered with metal, plastic, or cloth with a tip fitted to a standardized thread to fit a socket on a camera (usually the center of the shutter button) with a plunger or button on the opposite end used to actuate the shutter remotely. Most modern cameras require an electronic release rather than the old-fashioned mechanical cable release.

CANDID
Un-posed pictures of a subject. Usually taken without the subject's direct knowledge. These pictures tend to look more relaxed than posed pictures.

CCD
A charge-coupled device (CCD) is an analog shift register that enables the transportation of analog signals (electric charges) through successive stages (capacitors), controlled by a clock signal. Charge-coupled devices can be used as a form of memory or for delaying samples of analog signals. Today, they are most widely used in arrays of photoelectric light sensors to serialize parallel analog signals. Not all image sensors use CCD technology; for example, CMOS chips are also commercially available.

"CCD" refers to the way that the image signal is read out from the chip. Under the control of an external circuit, each capacitor can transfer its electric charge to one or another of its neighbors. CCDs are used in digital photography, digital photogrammetry, astronomy (particularly in photometry), sensors, electron microscopy, medical fluoroscopy, optical and UV spectroscopy, and high speed techniques such as lucky imaging.

Eugene F. Lally of the Jet Propulsion Laboratory wrote a paper published in 1961, "Mosaic Guidance for Interplanetary Travel", illustrating a mosaic array of optical detectors that formed a photographic image using digital processing. Digital photography was conceived by this paper. Lally noted such an optical array required development so digital cameras could be produced. The required array consisting of CCD technology was invented in 1969 by Willard Boyle and George E. Smith at AT&T Bell Labs. The lab was working on the picture phone and on the development of semiconductor bubble memory. Merging these two initiatives, Boyle and Smith conceived of the design of what they termed 'Charge "Bubble" Devices'. The essence of the design

was the ability to transfer charge along the surface of a semiconductor. As the CCD started its life as a memory device, one could only "inject" charge into the device at an input register. However, it was immediately clear that the CCD could receive charge via the photoelectric effect and electronic images could be created. By 1969, Bell researchers were able to capture images with simple linear devices; thus the CCD was born. Several companies, including Fairchild Semiconductor, RCA and Texas Instruments, picked up on the invention and began development programs. Fairchild was the first with commercial devices and by 1974 had a linear 500 element device and a 2-D 100 x 100 pixel device. Under the leadership of Kazuo Iwama, Sony also started a big development effort on CCDs involving a significant investment. Eventually, Sony managed to mass produce CCDs for their camcorders. Before this happened, Iwama died in August 1982. Subsequently, a CCD chip was placed on his tombstone to acknowledge his contribution. In October 2009, Willard Boyle and George Smith were awarded the Nobel Prize in Physics for inventing the CCD.

CLOSE-UP LENS

Often called a close-up filter, a close-up lens screws or otherwise attaches to the end of a lens and adapts the optics of that lens to allow you to get closer to the subject. They are generally measured in diopters, and are sometimes sold in kits containing a +1, +2, and +4 diopter which can be stacked to form a +3, +5, +6, or +7. A +1 diopter cuts the focusing distance of a lens in half, a +2 cuts it to a quarter and so on. It's like reading glasses for your camera. It is a very inexpensive way to get close to your subject.

CMOS

Complementary metal–oxide–semiconductor, is a major class of integrated circuits. CMOS technology is used in microprocessors, microcontrollers, static RAM, and other digital logic circuits. CMOS technology is also used for a wide variety of analog circuits such as image sensors, data converters, and highly integrated transceivers for many types of communication. Frank Wanlass successfully patented CMOS in 1967 (US Patent 3,356,858).

CMOS was also sometimes referred to as complementary-symmetry metal–oxide–semiconductor (or COS-MOS). The words "complementary-symmetry" refer to the fact that the typical digital design style with CMOS uses complementary and symmetrical pairs of p-type and n-type metal oxide semiconductor field effect transistors (MOSFETs) for logic functions.

Two important characteristics of CMOS devices are high noise immunity and low static power consumption. Significant power is only drawn when the transistors in the CMOS device are switching between on and off states. Consequently, CMOS devices do not produce as much waste heat as other forms of logic, for example transistor-transistor logic (TTL) or NMOS logic, which uses all n-channel devices without p-channel devices. CMOS also allows a high density of logic functions on a chip.

The phrase "metal–oxide–semiconductor" is a reference to the physical structure of certain field-effect transistors, having a metal gate electrode placed on top of an oxide insulator, which in turn is on top of a semiconductor material. Aluminum was once used but now the material is polysilicon. Other metal gates have made a comeback with the advent of high-k dielectric materials in the CMOS process, as announced by IBM and Intel for the 45 nanometer node and beyond.

COLOR GEL
A color gel or color filter, or a lighting gel or simply gel, is a transparent colored material that is used in theatre, event production, photography, videography and cinematography to color light and for color correction and special effects. Modern gels are thin sheets of polycarbonate or polyester, placed in front of a lighting fixture in the path of the beam.

Gels have a limited life, especially in saturated colors. The color will fade or even melt, depending upon the energy absorption of the color, and the sheet will have to be replaced. In permanent installations and some theatrical uses, colored glass filters or dichroic filters are being used. The main drawbacks are additional expense and a more limited selection.

Gels are useful in studio photography because they enable the photographer to create a variety of colors on a limited number of backdrop media. A black or white paper background can be made nearly any color desired using gel filters. Gel filters can also be used on the subject for special effects or enhancement.

COLOR SPACE(See RGB COLOR)

COLOR TEMPERATURE (Kelvin Temperature)
Most often measured on the "Kelvin Scale" developed by British Physicist William Thompson, the First Baron Kelvin. The Kelvin Scale refers to the color of a bar of platinum heated to different temperatures on the Celsius Scale. Contrary to instinct, the higher the Kelvin Temperature, the cooler the color. A typical household light bulb glows at about 2600° Kelvin, which tends to be rather warm; while average outdoor daylight is usually around 5600° Kelvin. Most electronic flash has a color temperature of 5300°.

CONTRAST
The range of difference between the lightest areas (highlights) and the darkest areas (shadows) of an image.

CROP FACTOR
A crop factor (sometimes referred to as a "focal length multiplier", even though the actual focal length is the same) can be used to calculate the 35mm equivalent focal length from the actual focal length of a lens. The most common multiplier ratios (in order of announcements):

2×— All Olympus DSLR cameras
1.7× — Sigma SD14, Sigma SD10, Sigma SD9, Kodak/Canon EOS DCS 3
1.6× — Canon EOS 50D, 40D, 30D, 20Da, 20D, 10D, D60, D30, 7D, and the Digital Rebel Series
1.5× — all Nikon DSLR cameras except the D3, D3x, D3s, and D700; all Fuji, all Sony (except for the α 900 and α 800), and Konica Minolta DSLR cameras.
1.53× — All current Pentax DSLR's
1.3×↑ — Canon EOS-1D Mark IV, EOS-1D Mark III, 1D Mark II (and Mark II N), EOS-1D, Kodak DCS 460

The Sony Alpha 800 and 900; Nikon D3, D3x, D3s, and D700; and Canon 1Ds Series (MK I, II, III) and Canon 5D and 5D Mk II have no multiplier because the sensors are roughly the same size as 35mm film at 24x36mm.

Many more cameras are sure to follow in many or all of these categories after this is printed.

Also see **FORMAT,** and **APS**

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DEPTH OF FIELD
The distance between the nearest and farthest objects that appear acceptably sharp in a photograph. Depth of field is affected by the lens opening (aperture), focal length of the lens, and the distance focused.

-The longer the lens, the smaller the depth of field
-The larger the aperture, the smaller the depth of field
-The closer the lens is focused, the smaller the depth of field

DIAPHRAGM
The mechanism in a lens that controls the aperture. Sometimes referred to as the Iris.

DICHRIOC FILTER
A dichroic filter or thin-film filter is a very accurate color filter used to selectively pass light of a small range of colors while reflecting other colors. By comparison, dichroic mirrors and dichroic reflectors tend to be characterized by the color(s) of light that they reflect, rather than the color(s) they pass. Used in color printers (enlargers) to balance the color of prints and often in B&W enlargers to control contrast. Currently used in multi-sensor digital cameras (usually video cameras) for more accurate control of the color captured.

DIN
Deutsches Institut für Normung e.V. (DIN; in English, the German Institute for Standardization) is the German national organization for standardization and is that country's ISO member body.

DIN and mini-DIN connectors, as well as DIN rails are several examples of older DIN standards that are today used around the world. However, there are currently around thirty thousand DIN Standards, covering almost all fields of technology. One of the earliest, and surely the most well-known, is DIN 476, the standard that introduced the A-series paper sizes in 1922. This was later adopted as international standard ISO 216 in 1975.

DIN is a registered association (e.V.), founded in 1917, originally as Normenausschuss der deutschen Industrie (NADI, Standardisation Committee of German Industry). In 1926 the NADI was renamed Deutscher Normenausschuss (DNA, German Standardisation Committee) in order to indicate that standardization now covered many fields, not just industrial products. In 1975 the DNA was finally renamed DIN. Its headquarters is in Berlin. Since 1975 it has been recognized by the German government as the national standards body and represents German interests at international and European level.

The acronym DIN is often wrongly expanded as Deutsche Industrienorm (German industry standard). This is largely due to the historic origin of the DIN as NADI. The NADI indeed published their standards as DI-Norm (Deutsche Industrienorm, German industry standard). E.g. the first published standard in 1918 was 'DI-Norm 1' (about taper pins). Many people still wrongly associate DIN as an abbreviation for the old DI-Norm naming of standards.

DNG
The Digital Negative (DNG) file format is a royalty free RAW image format designed by Adobe Systems. Its specification was announced on September 27, 2004. The same day, Adobe introduced Digital Negative to the market with its free of charge Adobe DNG Converter program. According to Adobe, Digital Negative was a response to demand for a unifying camera raw file format. Digital Negative is based on the TIFF/EP format, and mandates use of metadata. All Adobe photo manipulation software (such as Adobe Photoshop and Adobe Lightroom) released since the announcement support DNG.

Adobe is submitting DNG to ISO for standardization.

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EXISTING LIGHT (See "Ambient Light")

EXPOSURE
The quantity of light allowed to act on a photographic medium.
Also used to describe frame or photograph "*I can only get two more exposures on this card.*"

EXPOSURE LATITUDE
The range of light a medium can expose without being over or under exposed.

EXPOSURE METER (See LIGHT METER)

EXTENSION TUBE
An extension tube is an accessory for cameras with interchangeable lenses, used primarily for macro photography. The tube contains no optical elements; its sole purpose is to move the lens farther from the film or digital sensor. The farther away the lens is, the closer the focus, the greater the magnification, and also the greater the loss of light (requiring a longer exposure time). Lenses classically focus closer than infinity by moving all optical elements farther from the film or sensor; an extension tube simply extends this movement. When a lens is focused at infinity, its maximum magnification is the length of the extension divided by the focal length of the lens.

Extension tubes without electrical contacts will not allow an electronic automatic camera to control the lens, thus disabling autofocus and in some cases forcing a user to shoot wide open unless the lens offers manual aperture control. More expensive extension tubes contain electrical contacts allowing the user to use autofocus and electronically control the aperture of the attached lens.

F

f/NUMBER
Not related to the F-word, despite having spawned a good many of them. See **"APERTURE."**

FILL FLASH
Additional light from an electronic flash used to soften or eliminate foreground shadows. Usually used to compensate for backlighting. In the studio, a fill flash is used to soften shadows created by the main light.

FILL LIGHT
In studio lighting, serves the same function as Fill Flash. More than one fill light may be in use, depending on the complexity of the lighting effect sought.
Also see **BACKGROUND LIGHT, HAIR LIGHT,** and **MAIN LIGHT**

FILM SPEED (See ISO, ASA, DIN)
Film speed is the measure of a photographic film's sensitivity to light. Film with lower sensitivity (lower ISO/ASA speed) requires a longer exposure and is thus called a slow film, while stock with higher sensitivity (higher ISO/ASA speed) can shoot the same scene with a shorter exposure and is called a fast film.

FISH-EYE
A fish-eye lens is a special type of wide angle lens often used for artistic purposes or for special effects. A true fish-eye lens will offer a 180° (or more) angle of view (As compared to the roughly 53° angle of view of a normal lens) which is usually rendered on the film or medium as a circle. Fish-eye lenses tend to be rather expensive; so most folks who are interested in that particular angle of view often seek out "fish-eye adapters" which attach to the end of a short lens and render very wide, circular view.

FISH-EYE ADAPTER
A lens adapter that usually attaches to the end of a lens (via filter threads) that creates a fish-eye view for that lens. Generally used in video cameras. Most video adapters can be attached to the end of still camera lenses with the use of stepping rings. Not a very efficient way to get a fish-eye lens, but usually somewhat less expensive than an actual fish-eye lens.

FLASH METER
A special type of light meter designed to measure the output of an electronic flash. Many flash meters are intended for studio lights and do not work accurately on camera-mounted flashes. This is because most studio lights adjust their output by changing the intensity, or brightness, of the light they produce. Camera-mounted flash units usually control their output by changing the duration of the flash.

FLASH SYNCHRONIZATION
On cameras with focal plane shutters, there is a maximum speed at which the shutter can travel and still allow flash to expose the entire frame. This varies from one camera to the next, but on most modern cameras, the flash synch speed is either 1/200 second or 1/250 second. If the shutter is traveling at a speed above the flash synch, only part of the medium will be exposed to the flash and part of the image will be dark.

FLUORESCENT LIGHT
As the name suggests, light derived from a fluorescent light source rather than incandescent or daylight. Tends to create a sickly green hue if shot on daylight balanced film or if your color temperature is balanced for daylight.

See **COLOR TEMPERATURE** for more information.

FOCAL LENGTH
The distance between the film (or image sensor) and the optical center of the lens when the lens is focused on infinity.

FOCAL PLANE SHUTTER
An opaque curtain containing a slit that moves directly across in front of the film or light sensor (CCD or CMOS) in a camera allowing image-forming light to strike the medium. Most modern cameras use a "vertical-travel" focal plane shutter with metal or allow leaves in place of the cloth curtains used in the older "horizontal-travel" focal plane shutters. They are more reliable and last longer. A focal plane shutter is two curtains, a first or front curtain and a second or rear curtain. The two curtains work together to create a "slit" that moves rapidly across the film or sensor to expose it to light. Due to the "slitted" nature of the shutter function, flash is restricted to certain speeds (varying from one camera to the next) in order to be "synchronized" with the shutter.
See **Flash Synchronization**

FOCUSING SCREEN
The plate of ground plastic inside the camera just below the prism onto which the mirror projects images from the lens. If you remove the lens of your single lens reflex camera and look into the body, the first thing you should see is the mirror. Reflected in the mirror is the focusing screen. If you look up, above the mirror, you will see the focusing screen directly. Focusing screens are delicate and easy to damage. Do not touch the focusing screen unless you absolutely have to. Specks of dust on the focusing screen will not affect the image when you take a picture because they are not in the image path. When the picture is taken, the mirror flips up to cover the focusing screen so that the image projected by the lens can pass through to the film or sensor.

Some cameras have interchangeable focusing screens. Different types of screens are used for different purposes. There are grid screens to aid in composition, there are extra bright screens to aid in manually focusing, there are screens with geometric marks to aid in composition based on aspect ratios other than that native to your camera.

FORMAT
The size and aspect ratio of a medium.

APS-C format is 25.1 × 16.7, has an aspect ration of 2:3 and typically renders 4x6 prints. Some digital cameras are designed with the sensors in the APS-C format. A normal lens for this format is 30mm. (See **CROP FACTOR,** and **APS)**

35mm format is 24x36mm, has an aspect ratio of 2:3 and typically renders 4x6 prints. Some digital cameras are designed with the sensors in the 35mm format. A normal lens for this format is 50mm. (See **CROP FACTOR)**

Medium format cameras shoot a variety of formats, depending on the camera and the type of film back used. The most popular medium format sizes are:

6x4.5 or 645 which measures 60x45 mm or 2¼”x1-7/8”, has an aspect ratio of 4:3 and renders a 4x5 print. A normal lens for this format is 75mm.
6x6 or 2¼ which measures 60x60mm or 2¼”x2¼”, has an aspect ratio of 1:1 and renders a 5x5 print. A normal lens for this format is 80mm.
6x7 or “Ideal” which measures 60x70mm or 2¼”x2-7/8 ”, has an aspect ratio of 3:3.5 and renders a 4x5 print. A normal lens for this format is 100mm.
6x9 which measures 60x90mm or 2¼”x3-5/8”, has an aspect ratio of 2:3 and renders a 4x6 print. A normal lens for this format is 110mm.

A medium format digital camera is commonly accepted to be any camera that has a sensor larger than 35mm format. There are a number of medium format digital cameras with sensors of varying formats manufactured by Hasselblad, Mamiya, Leica, Phase One, Calumet, and several others.

Format is also a term used to describe digital file types. JPEG, TIFF, and RAW are file "formats."

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GAMUT
In color reproduction, including computer graphics and photography, the gamut, or color gamut, is a certain complete subset of colors. The most common usage refers to the subset of colors which can be accurately represented in a given circumstance, such as within a given color space or by a certain output device. Another sense, less frequently used but not less correct, refers to the complete set of colors found within an image at a given time. In this context, digitizing a photograph, converting a digitized image to a different color space, or outputting it to a given medium using a certain output device generally alters its gamut, in the sense that some of the colors in the original are lost in the process.

GUIDE NUMBER-GN
The guide number for an electronic flash measures its ability to illuminate the subject to be photographed at a specific ISO and angle of view. A higher guide number indicates a more powerful flash.

The guide number represents an exposure constant for a flash unit. For example, a guide number of 80 at ISO 100 means that a target 20 feet (6 m) away can be fully illuminated with an aperture of f/4 (80 = 20 × 4) and a film speed of ISO 100. For the same guide number and an aperture of f/8, the light source should be 10 feet (3 m) from the subject (80 = 10 × 8).

Guide numbers can be given in feet or meters, and are usually (but not always) given for ISO 100 sensitivity.

Guide numbers do not depend on the focal length of the lens, but if the flash unit can be adjusted to match the focal length, this adjustment will influence the guide number: the wider the angle of the flash, the lower the guide number.

When comparing flash units, make sure to compare the guide numbers for the same ISO rating and the same focal length.

H

HAIR LIGHT
A light placed behind or above a subject's head to highlight the hair and to provide separation between the subject and background.
Also see **BACKGROUND LIGHT, FILL LIGHT, MAIN LIGHT**

HI-DEF
High Definition video. A video format introduced in the mid-1990's. It was first used as a standard in photography with the Advanced Photo System in 1996. (See **APS**) In still photography, HD has come to refer to the 16:9 aspect ratio rendered by hi-definition television. Now that Hi-Definition television is here to stay, the 16:9 aspect ratio has increased in popularity. Many computer monitors are built in that aspect ratio now. Many video cameras are available in the 16:9 aspect ratio. Several still camera manufacturers have begun offering HD as an alternative setting in the camera; especially in those still cameras that also shoot video.

HIGHLIGHTS
The brightest areas in an image.

HOT SHOE
The fitting on a camera (usually atop the finder) that holds a flash unit. A hot shoe has the necessary contacts to establish communication between the camera and the flash. Older cameras had “accessory shoes” which lacked contacts and were intended to allow the attachment of external meters, special view finders or levels.

HYPERFOCAL DISTANCE
In optics and photography, hyperfocal distance is a distance beyond which all objects can be brought into an "acceptable" focus. There are two commonly used definitions of hyperfocal distance, leading to values that differ only slightly:

The first definition: the hyperfocal distance is the closest distance at which a lens can be focused while keeping objects at infinity acceptably sharp; that is, the focus distance with the maximum depth of field. When the lens is focused at this distance, all objects at distances from half of the hyperfocal distance out to infinity will be acceptably sharp. This distance changes depending on the choice of lens opening because the larger the aperture, the smaller the depth of field.

The second definition: the hyperfocal distance is the distance beyond which all objects are acceptably sharp, for a lens focused at infinity. This, too, is affected by choice of lens opening.

The distinction between the two meanings is rarely made, since they are interchangeable and have almost identical values. The value computed according to the first definition exceeds that from the second by just one focal length.

I

ISO-International Organization for Standardization
The International Organization for Standardization widely known as ISO, is an international-standard-setting body composed of representatives from various national standards organizations. Founded on 23 February 1947, the organization promulgates worldwide proprietary industrial and commercial standards. It is headquartered in Geneva, Switzerland.

While ISO defines itself as a non-governmental organization, its ability to set standards that often become law, either through treaties or national standards, makes it more powerful than most non-governmental organizations. In practice, ISO acts as a consortium with strong links to governments.

The organization's logos in its two official languages, English and French, include the word ISO (eye-so), and it is usually referred to by this short-form name. ISO is not an acronym or initialism for the organization's full name in either official language. Rather, the organization adopted ISO based on the Greek word “**isos**“, meaning equal. Recognizing that the organization’s initials would be different in different languages, the organization's founders chose ISO as the universal short form of its name. This, in itself, reflects the aim of the organization: to equalize and standardize across cultures.

In digital camera systems, an arbitrary relationship between exposure and sensor data values can be achieved by setting the signal gain of the sensor. The relationship between the sensor data values and the lightness of the finished image is also arbitrary, depending on the parameters chosen for the interpretation of the sensor data into an image color space such as sRGB.

For digital photo cameras ("digital still cameras"), an exposure index (EI) rating—commonly called ISO setting—is specified by the manufacturer such that the sRGB image files produced by the camera will have a lightness similar to what would be obtained with film of the same EI rating at the same exposure. The usual design is that the camera's parameters for interpreting the sensor data values into sRGB values are fixed, and a number of different EI choices are accommodated by varying the sensor's signal gain in the analog realm, prior to conversion to digital. Some camera designs provide at least some EI choices by adjusting the sensor's signal gain in the digital realm. A few camera designs also provide EI adjustment through a choice of lightness parameters for the interpretation of sensor data values into sRGB; this variation allows different tradeoffs between the range of highlights that can be captured and the amount of noise introduced into the shadow areas of the photo.

The ISO standard 12232:2006 gives digital still camera manufacturers a choice of five different techniques for determining the exposure index rating at each sensitivity setting provided by a particular camera model. Three of the techniques in ISO 12232:2006 are carried over from the 1998 version of the standard, while two new techniques allowing for measurement of JPEG output files are introduced from CIPA DC-004. Depending on the technique selected, the exposure index rating can depend on the sensor sensitivity, the sensor noise, and the appearance of the resulting image. The standard specifies the measurement of light sensitivity of the entire digital camera system and not of individual components such as digital sensors, although Kodak has reported using a variation to characterize the sensitivity of two of their sensors in 2001.

The Recommended Exposure Index (REI) technique, new in the 2006 version of the standard, allows the manufacturer to specify a camera model’s EI choices arbitrarily. The choices are based solely on the manufacturer’s opinion of what EI values produce well-exposed sRGB images at the various sensor sensitivity settings. This is the only technique available under the standard for output formats that are not in the sRGB color space. This is also the only technique available under the standard when multi-zone metering (also called pattern metering) is used.

The Standard Output Specification (SOS) technique, also new in the 2006 version of the standard, effectively specifies that the average level in the sRGB image must be 18% gray plus or minus 1/3 stop when exposed per the EI with no exposure compensation. Because the output level is measured in the sRGB output from the camera, it is only applicable to sRGB images—typically JPEG—and not to output files in raw image format. It is not applicable when multi-zone metering is used.

The CIPA DC-004 standard requires that Japanese manufacturers of digital still cameras use either the REI or SOS techniques. Consequently, the three EI techniques carried over from ISO 12232:1998 are not widely used in recent camera models (approximately 2007 and later). As those earlier techniques did not allow for measurement from images produced with lossy compression, they cannot be used at all on cameras that produce images only in JPEG format.

The saturation-based technique is closely related to the SOS technique, with the sRGB output level being measured at 100% white rather than 18% gray. The saturation-based value is effectively 0.704 times the SOS value. Because the output level is measured in the sRGB output from the camera, it is only applicable to sRGB images—typically TIFF—and not to output files in raw image format. It is not applicable when multi-zone metering is used.

J (Page 17)

JPEG
In computing, JPEG is a commonly used method of compression for photographic images. The degree of compression can be adjusted, allowing a selectable tradeoff between storage size and image quality. JPEG typically achieves 10:1 compression with little perceptible loss in image quality.

JPEG compression is used in a number of image file formats. JPEG/Exif is the most common image format used by digital cameras and other photographic image capture devices; along with JPEG/JFIF, it is the most common format for storing and transmitting photographic images on the World Wide Web. These format variations are often not distinguished, and are simply called JPEG.

K

KELVIN TEMPERATURE (See COLOR TEMPERATURE)

KEPPLER'S CONSTANT(Not to be confused with "Kepler's Constant")
Herbert (Bert) Keppler, the recently deceased editor of Popular Photography Magazine (Not Johannes Kepler, the Seventeenth Century Astronomer) is credited with this measurement technique, but Pop Photo claims no knowledge of ever publishing anything like this under his name. Keppler's Constant is a formula used to determine the optimal size print that can be made from a given digital image. You simply take the pixel count and divide by the optical output resolution you want, and you have the image size. Modern printing and image processing techniques have rather outmoded this technique, but it is a pretty good guideline if you're scanning an image with the intent of printing it. For example, a Canon Digital Rebel XTi produces a ten mega pixel file at 2592x3888 pixels. If you want to know what size print you can get at 200 dpi, which is about the lowest resolution you would want to print with, you would divide 2592 by 200 to get 12.96 and then divide 3888 by 200 to get 19.44. That is a print size of 12.96'x19.44'. You know now that you can make a 200dpi 13x19 from a ten megapixel file. A 4x6 from these pixel measurements comes to exactly 648dpi.

KEY LIGHT (See MAIN LIGHT)

KILOBYTE
Kilobyte (derived from the SI prefix "kilo-", meaning 1,000) is a unit of digital information storage equal to either 1,024 bytes or 1,000 bytes, depending on context.

The exact number of bytes in a kilobyte has traditionally been ambiguous. Locations in electronic memory circuits are identified by binary numbers, which means that the number of addressable locations naturally becomes a power of 2, and memory sizes are therefore not integer multiples (or fractions) of 1000. However, as $2^{10} = 1024 \approx 1000$, the established "k" (for "kilo") was early on employed as a convenient "approximate" prefix for memory capacities in multiples of 1024. On the other hand, for products where (some) capacity factors were not equally bound to powers of two, such as magnetic disks (sector and track numbers) and networking equipment (bit rates), strict decimal-based units were used.

In summation, nobody really knows.

L (Page 18)

LARGE FORMAT
A camera that uses film of 4x5 inches or larger. Some large format cameras are adaptable to digital by attaching a back. Most regular digital backs are more suitable for medium format cameras, but scanning backs, which are basically small scanner heads that attach to a camera, are able to reproduce formidable files from which billboards can be printed.

LEAF SHUTTER (See LENS SHUTTER)

LENS DOUBLER (See TELECONVERTER)

LENS FACE COUPLER (See MACRO RING)

LENS OPENING (See APERTURE)

LENS SHUTTER (Also called "Leaf Shutter")
A lens shutter is an iris type shutter built into the lens of a camera. A lens shutter tends to last longer than a focal plane shutter, but it is limited to slower shutter speeds and the shutter speed and lens opening can create limits for each other. A lens shutter may not be able to achieve its maximum shutter speed at a wide lens opening. The biggest advantage a lens shutter has is that it has no maximum flash synchronization speed; so the flash can be synchronized with any speed the shutter can achieve. The biggest disadvantage of a lens shutter is that having the shutter in the lens makes it difficult to design a camera that permits viewing using the lens. A separate viewfinder lens is usually required.

LENS SPEED
The largest lens opening at which a lens can be set. An f/1.8 lens is faster than an f/4 lens. Faster lenses are more effective in low light because they allow the use of faster shutter speeds and make focusing easier. Faster lenses also tend to be somewhat more expensive than moderate or slow lenses. This is less of a problem with digital cameras because you can just increase the ISO to get a faster shutter speed in low light; and several camera manufacturers are offering image stabilization and anti-vibration features in many lenses and cameras.

LIGHT METER
An instrument with a light sensitive cell that measures light reflected from or falling on a subject. Used as an aid in selecting exposure settings. Most cameras have built-in meters, but hand-held meters often allow for more accurate readings.

M (Page 19)

MACRO BELLOWS (See BELLOWS)

MACRO LENS
This term grows more ambiguous with each advance in photographic technology. Traditionally, a macro lens was any lens that projected a life-sized image (1:1) onto the film. With the advent of digital technology, and the many different sizes and formats of image sensors, macro lenses have come to be any lens that allows you to focus very close to the subject. Lens manufacturers love to put "Macro" on the end of a lens designation. It raises the price and entails no effort at all on their parts.

This term is often used to describe a "Close-up" lens or "Close-up filter" and tends to lead to surprise and disappointment when an unsuspecting individual orders a 62mm close-up lens and ends up with a filter.
See **CLOSE-UP LENS**

MACRO RING
A device that screws onto the filter threads of a lens and converts the female threads to male thus allowing you to mount a short lens backwards on the end of a longer lens creating a dramatic increase in magnification and requiring you to get very close to the subject in order to focus.

MAIN LIGHT
In studio lighting, the primary light against which all other lights in a set are balanced. Often referred to as the Key Light. This is generally the light used to illuminate the front of the subject.
Also See **BACKGROUND LIGHT, FILL LIGHT,** and **HAIR LIGHT**

MEDIUM FORMAT
With film cameras, medium format refers to cameras using 120, 220, or 70mm film. Often referred to by old photographers as 2-¼. With digital, it generally refers to a camera using an image sensor measuring more than 24x36mm, which is also the size of one frame of 35mm film. Many medium format film cameras are adaptable to digital by attaching a digital back. While these cameras can produce superb hi resolution images, the prices can be far out of budget for all but the largest of studios. An inexpensive digital back for a medium format film camera is rarely less than $10,000.00.
Also see **FORMAT**

MEGABYTE
The megabyte is a unit of information or computer storage equal to either 10^6 (1,000,000) bytes or 220 (1,048,576) bytes, depending on context. In rare cases, it is used to mean 1000×1024 (1,024,000) bytes.

The term "megabyte" is ambiguous because it is commonly used to mean either 10,002 bytes or 10,242 bytes. The confusion originated as compromised technical jargon for the byte multiples that needed to be expressed by the powers of 2 but lacked a convenient name.

If you think this is a confused mess, read about kilobytes.

METADATA
Metadata, means, specifically: data about data. In a digital image file, it is the information about the image that is either encoded by the camera that took the picture (camera type, serial number, exposure settings, time and date, sometimes even GPS info) or information added by the photographer or whoever processes the file. This is generally done with a special program like Adobe Bridge or Photoshop or any program that gives access to internal file info. This information can include copyright data, the author's name, address, telephone number, web site, a title for the image, keywords to make it more searchable and a host of other bits of information.

MICRO LENS (See MACRO LENS)

MICROSCOPE ADAPTER
An attachment that allows a camera to be attached to a microscope to take photos using the microscope as the lens. Most microscope adapters require another adapter to attach the microscope adapter to the camera.
See T-MOUNT

MULTIPLE EXPOSURE
More than one exposure taken on the same frame of film. Some digital cameras have a "Multiple Exposure Mode" that mimics the effect of a multiple exposure on film.

N

NORMAL LENS
Any lens that renders the subject with no magnification, a "One Power" lens. This type of lens should have a roughly 53° angle of view). A lens with a focal length about equal to the diagonal size of the film or sensor format is known as a normal lens. Because of the precise nature of the science of photography, sloppy approximations are generally used to determine the proper normal lens focal length for a given format. See **FORMAT.** To determine the exact focal length to get a precisely "One Power" lens, we must consult Pythagoras. The Pythagorean Theorem states that the square root of the sum of the squares of the two shorter sides of a right triangle will give you the hypotenuse. This is also handy for finding the diagonal of a rectangle. You want the square root of a^2+b^2. So for 35mm film at 24x36mm you end up with this formula: $24^2+36^2=576+1296=1872$. The square root of 1872 is 43.2666….. So you can conclude that a normal lens for a 35mm formatted medium is 43.27mm. That's why we just say 50mm. Back in the 1960's and 1970's, before we all got so lazy, a few camera manufacturers actually built 45mm lenses.

Anything longer than a normal lens is considered "telephoto", and anything shorter than a normal lens is considered "wide angle."

See **APS,** and **FORMAT**

P

PANNING
Moving the camera with a moving subject so that it remains in the same relative position in the viewfinder while you take a picture. This, if done correctly, will result in a blurred background and a sharp subject.

PARALLAX
Parallax occurs in cameras that have a separate viewfinder from the actual picture-taking lens. Most commonly today, in auto focus compact cameras. Parallax is the difference between what the viewfinder sees and what the film or image sensor records. Most cameras have faint, off-center lines in the viewfinder. These are for parallax compensation. Composing the picture based on these lines helps minimize the effects of parallax. More sophisticated cameras have devices or functions built in to correct for this. Parallax becomes more evident the closer you get to the subject. Parallax does not occur with a single lens reflex camera because the image in the viewfinder is projected onto the focusing screen by the picture-taking lens.

PC CORD
This has nothing to do with a computer. The initials mean "Prontor-Compur." Prontor is one of many (but the most popular) designator of shutter types made by A. Gauthier of Calmbach (AGC). They also made the Vario, Vero and Pronto shutters and many variations of the Prontor design, including shutters suitable for automatic exposure control. Compur was the trademark of F. Deckel of Munich for their shutters.

F. Deckel is otherwise well known (and still existing) as a manufacturer of precision milling machines - they started this business after they found that available milling machines were not accurate enough for their shutter manufacturing, so they started designing their own and are still very successful. In Germany you will find hardly any metal workshop without F. Deckel machines.

Both companies - AGC and the shutter division of F. Deckel - were owned for decades by Zeiss-Ikon. For some time, some of the shutters of both companies were even assembled in the same plant.

The only left-overs of the Prontor shutters are the Pronto-Press shutters for large format cameras. The shutter division of F. Deckel today belongs to Copal. Some Hasselblad lenses are the only places where you will find new Compur shutters.

Due to the tendency of PC cords to fall off of the camera at inconvenient times, many photographers say that PC stands for "Poor Connection."

That said… A PC Cord is a small electrical cord with a special fitting known as a PC contact and is used for coupling a flash with a camera. Years ago, a PC cord was used to couple a flash to a camera that had no hot shoe. These days it is used to connect a flash to a camera without mounting the flash on the hot shoe of the camera. Manufacturers have begun calling them "remote flash cords."

PIXEL
In science fiction literature, Pixel was Robert Heinlein's cat, and was featured in a good many of his books. In digital imaging, a pixel is a "picture element." Originally, pixels were square. These days, pixels can be square, rectangular, and, thanks to Fujifilm, hexagonal. Whereas with film, the image was composed of a mosaic of silver halide grains; with digital photography, images are composed of a mosaic of pixels. The more pixels you have, the sharper and clearer your image will be.

POINT-AND-SHOOT
Slang term used to refer to auto-focus compact cameras. It is meant to signify that the camera is very simple, but modern point-and-shoot cameras are heavily feature laden and anything but "simple."

R (Page 22)

RAW

A raw image file contains minimally processed data from the image sensor of a digital camera or image scanner. Raw files are so named because they are not yet processed and therefore are not ready to be used with a bitmap graphics editor or printed. Normally, the image is processed by a raw converter in a wide-gamut internal colorspace where precise adjustments can be made before conversion to an RGB file format such as TIFF or JPEG for storage, printing, or further manipulation. These images are often described as "RAW image files" (note capitalization) based on the erroneous belief that they represent a single file format, and thus deserve a common filename extension, .RAW. In fact there are dozens if not hundreds of raw image formats in use by different models of digital cameras.

Raw image files are sometimes called digital negatives, as they fulfill the same role as negatives in film photography: that is, the negative is not directly usable as an image, but has all of the information needed to create an image. Likewise, the process of converting a raw image file into a viewable format is sometimes called developing a raw image, by analogy with the film development process used to convert photographic film into viewable prints. See **DNG**

Like a photographic negative, a raw digital image may have a wider dynamic range or color gamut than the eventual final image format. The selection of the final choice of image rendering is part of the process of white balancing and color grading.

Raw formats' purpose is to faithfully record both 100% of exactly what the sensor "saw" (the data), and the conditions surrounding the recording of the image (the metadata).

RECIPROCAL EXPOSURES

Exposure is built on a combination of lens opening and shutter speed, but, when setting exposures, there are different combinations that can get similar *exposure* results; but the effect on depth of field and motion blur can change. With digital photography, you also have the added variable available to you of ISO. If you took a meter reading in very bright daylight, with your ISO at 400, you might get a reading of 1/500sec at f/16. This exposure setting is great for stopping motion or eliminating blur, and is also good to get plenty of depth of field. If you stop your aperture down to f/22, changing your shutter speed to 1/250 second gets you the same exposure results, while increasing your depth of field and diminishing your motion-stopping ability. You could also go the other way and stop up to f/11 and increase your shutter speed to 1/1000 to slightly reduce the depth of field and increase your motion-stopping potential. Working with 1/1000 at f/11; if you needed to reduce your depth of field without affecting your shutter speed, you could reduce your ISO to 200 and open your lens to f/8 while keeping the same shutter speed. Here are some examples of how reciprocal exposures fit together:

ISO/ Aperture	f/22	f/16	f/11	f/8	f/5.6	f/4
100	1/30	1/60	1/125	1/250	1/500	1/1000
200	1/60	1/125	1/250	1/500	1/1000	1/2000
400	1/125	1/250	1/500	1/1000	1/2000	1/4000
800	1/250	1/500	1/1000	1/2000	1/4000	1/8000

RESOLUTION

CAMERA RESOLUTION: The number of pixels a camera uses to build an image. Generally represented as a two-dimensional measurement and a rough pixel count: 960x1280 or 1.3 mega pixels.

IMAGE RESOLUTION: The number of pixels resident within an image. Generally represented in the same fashion as camera resolution.

LENS RESOLUTION: The sharpness and clarity with which a lens reproduces an image. Usually represented in "lines per inch." A good lens will reproduce about 1800 lines, a great lens, 3000.

NEW YEAR'S RESOLUTION: A promise made to be broken.

OPTICAL RESOLUTION: Refers to lenses, whether on a camera, scanner, or other optical device. With scanners, optical resolution is similar to camera resolution, and refers to the number of pixels the scanner can use to build an image as it scans.

OUTPUT RESOLUTION: Sometimes referred to as "PRINT RESOLUTION." It is the number of "dots" an ink-jet printer can squeeze into a given measurement (an inch in the US, centimeter in the rest of the world) when making a print. The same principal applies to laser and thermal printers as comparable to an ink-jet printer, even though they use neither dots nor pixels.

SCREEN RESOLUTION: The number of pixels available on a monitor screen. The greater the number of pixels, the greater the detail will be in the image on the screen. Generally represented as a two-dimensional measurement: 640x480, 800x600, 1280x768. The range of numbers varies depending on the aspect ratio of the screen. For years the standard aspect ratio of a monitor was 4:3 (The same as most television sets. Interestingly enough, it took the better part of ¾ century for television manufacturers to decide to build televisions with the same aspect ratio as a movie theatre screen.), as is reflected in the aspect ratio of early digital cameras. (Though most new digital cameras have adopted the 2:3 aspect ratio of 35mm film cameras, while no monitor has been designed to reflect that aspect ratio.) The new Hi-Definition screens have an aspect ratio of 16:9, which has become a popular aspect ratio in video cameras, and an option in many new digital still cameras.

REFLECTED LIGHT

Light bounced off of some surface used to illuminate part of an image. Usually used for fill light but can be applied to just about any studio lighting use. Tends to be softer and more diffuse.

Also see **FILL LIGHT**

REFLECTOR

Any surface used to reflect light. Usually a flat white surface. Can be colored for lighting effects. Many photographers carry portable collapsible reflectors. In studio photography, umbrellas are often used as reflectors as well.

RETOUCHING

Any altering of an image from its original form. This applies to the use of dyes or pencils on prints and negatives as well as digital alteration of image files. Most retouching, these days, is done digitally.

REVERSING RING

A lens mount that screws onto the filter threads of a lens thus allowing you to mount the lens on the camera backwards. This affect is similar to looking backwards through binoculars… only backwards. By reversing a wide-angle lens, you get a high magnification macro lens. If your camera will not fire the shutter without the lens attached, this will probably not work for you. Many digital cameras require that the electronic communication between the lens and the camera be maintained before the camera will fire the shutter, so try it before you buy it. It is a very inexpensive way to get very close to a subject.

RGB COLOR

Much of the digital imaging done in color employs the RGB system, in which Red, Green, and Blue make up the primary colors instead of the Red, Yellow, and Blue colors of light found in nature. There are various approaches to RGB color called "Color Space." With most lab printers, sRGB is the preferred color space. This is also the color space for the images you see on the Internet. Most ink-jet printers use the same system. Some newer printers use Adobe RGB1998 or, as it is generally called, Adobe RGB. This has a broader color gamut than sRGB; but most commercial printers can't reproduce it accurately and the Internet definitely can't. ProPhoto RGB has a somewhat broader color gamut, but there are not any printers currently available commercially that can print that range; and the Internet, since it can't reproduce it, tends to render ProPhoto RGB images quite poorly.

RING FLASH

A ring flash, invented by Lester A. Dine, in 1952 originally for use in dental photography, is a circular photographic flash that fits around the lens, especially for use in macro (or close-up) photography. Its most important characteristic is providing even illumination with few shadows visible in the photograph, as the origin of the light is very close to (and surrounds) the optical axis of the lens. When the subject is very close to the camera, as is the case in macro photography, the distance of the flash from the optical axis becomes significant. For objects close to the camera, the size of the ring flash is significant and so the light encounters the subject from many angles in the same way that it does with a conventional flash with soft box. This has the effect of further softening any shadows.

Large, diffused, ring flashes are also very popular in portrait and fashion photography. In addition to softening shadows, which can be unflattering to models, and bringing out unsightly wrinkles, the unique way that a ring flash renders light gives the model a shadowy halo which is a common feature of fashion photography.

Macro ring flash usually consists of two parts: a shoe-mount unit mounted on a hot shoe, and a circular flash unit mounted on the front of a lens. Power is supplied by batteries in the shoe-mount unit, and a cord relays the power and control signals to the circular flash unit. For larger ring flash units like those used for fashion photography, power is usually delivered by a power pack which can be battery or AC powered. Some ring flashes however, like ones made by *Alien Bees*, are constructed like mono lights where the light and power are contained in one unit. Within the circular flash unit, there can be one or more flash tubes, each of which can be turned on or off individually. Some ring flashes have focusing lamps for helping low-light focusing. Ring flash diffusers are also available, which have no light source of their own, but instead mount in front of a conventional flash unit and transmit the light to a ring-shaped diffuser at the front of the lens.

RULE OF THIRDS

I prefer to think of it at the "guideline of thirds." A compositional tool or technique that suggests that you divide your scene into nine equal fields vertically and horizontally, like a tic-tac-toe board and use the intersections of those lines as your composition points. This helps avoid centering disease and static composition.

S (Page 25)

SATURATION
The richness, fullness or intensity of color. Neon colors are strongly saturated while pastels are not.

SHORT LIGHTING
The positioning of the main light or primary light source to the side of the subject's face which is furthest from the camera. In portraiture, this is generally considered the most flattering way to light a face.

SHUTTER (See FOCAL PLANE SHUTTER or LENS SHUTTER)

SHUTTER PRIORITY (Time Value)
An automatic exposure mode that lets the photographer select the shutter speed while the camera's meter sets the aperture for the proper exposure. This is useful in situations in which the photographer wishes to control motion blur in a changing lighting situation. The Shutter Priority Mode is generally represented on the camera with the letter "S." For reasons few understand, Canon and Pentax refer to the Shutter Priority Mode as "Time Value" and represent it with the initials "Tv."

SLAVE
A device used to wirelessly trigger a remote flash. This is usually a light sensor that attaches to the foot or synch outlet on a flash or studio light that fires the flash when it sees another flash go off. Some newer systems use infra-red or radio signals to trigger the slave. This type of system is highly efficient in that it eliminates the need for cords running back and forth across the floor to be tripped over. The down side is that light-triggered and infra-red slaves required careful positioning of lights and slaves in order to assure firing of the flash. Radio slaves allow more freedom in positioning of lights. Light-triggered slaves tend to be less expensive, and radio slaves tend to be the most expensive. A typical studio arrangement would have the main light tethered to the camera with all other lights triggered by slaves. The firing delays entailed with light-triggered slaves are insignificant. The signal travels a very short distance at the speed of light. A thousandth of a second can make a big difference in photography, but a billionth of a second does not.

SLIDE DUPLICATOR
A camera attachment, usually adapted to a camera with a T-Mount. It generally has fixed optics which focus on a slide carrier attached to the end of the duplicator. Types of light sources vary, but most Slide Duplicators have a thin white diffuser at the end which require that the camera be pointed at a bright light source or flash in order to provide illumination for photographing the slide. This was originally used to create either duplicate slides or negatives, from which it would be easier to obtain prints of the slide. On a digital camera it is a very good alternative to an expensive film scanner for getting your old slides digitized.

SOFT BOX
A type of photographic lighting device, one of a number of photographic soft light devices. (All the various soft light types create soft diffused light by directing light through some diffusing material, or by "bouncing" light off a second surface to diffuse the light. The best known form of bouncing source is the umbrella light where the light from the bulb is bounced off the inside of a metalized umbrella to create a soft indirect light.)

A "soft box" is an enclosure around a bulb comprising reflective side and back walls and a diffusing material at the front of the light.

The sides and back of the box are lined with a bright surface - an aluminized fabric surface or an aluminum foil, to act as an efficient reflector. In some commercially available models the diffuser is removable to allow the light to be used alone as a floodlight or with an umbrella reflector.

Soft boxes range in size from less than a foot square (30cm x 30cm)to huge soft boxes called lightbanks. One major manufacturer offers units where the illuminated diffusing surface is 15 x 40 feet (4.6m x 12.3m). These very large units are typically hung over large studio sets to provide broad, even, well controlled light. These lightbanks are best known as light sources for studio photography for the automotive industry.

Photographers choose soft box light sources for the soft even light they throw and for the even highlights they create. The quality of light closely resembles that of the light transmitted through a Shoji screen; the illumination comes from a (usually) evenly illuminated surface. Soft box lighting de-emphasizes lines and blemishes on the face of a human subject. Soft box lighting provides bright, even lighting, smooth broad highlight reflections in product photography, and gentle transitions from the illuminated areas to the areas of shadow. Reflections are of great importance when photographing shiny polished surfaces, reflective metal surfaces, and transparent materials like glass. The image of the highlight on such subjects is really a reflected image of the lightsource.

Soft boxes are often easier to manage than umbrellas when it comes to controlling the amount of light that falls on the backdrop or background of an image. A softbox can be 'feathered', or aimed to direct stray light away from the background. "Barn doors" and "honeycomb grids" can also be used to restrict the area illuminated by soft boxes.

A soft box can be used with either flash or continuous light sources such as fluorescent lamps or "hot lights" such as quartz halogen bulbs or tungsten bulbs. If soft box lights are used with 'hot' light sources, the user must be sure the softbox is heat rated for the wattage of the light it is attached to in order to avoid fire hazard.

STOP
A measurement of light for exposure purposes. One stop up doubles the amount of light, one stop down halves the amount of light.

STOP DOWN/UP
Changing the lens aperture to a smaller opening. Changing your setting from f/8 to f/11 is stopping down. Changing your setting from f/16 to f/11 is stopping up.

SUBTRACTIVE COLOR
A subtractive color model explains the mixing of paints, dyes, inks, and natural colorants to create a range of colors, where each such color is caused by the mixture absorbing some wavelengths of light and reflecting others. The color that an opaque object appears to have is based on what parts of the electromagnetic spectrum are reflected by it, or by what parts of the spectrum are not absorbed.

Subtractive color systems start with white light. Colored inks, paints or films placed between the viewer and the light source or reflective surface (such as white paper) subtract wavelengths from this white, and make a color.

Conversely, additive color systems start with no light (black). Light sources add wavelengths to make a color. In either an additive or a subtractive system, three primary colors are needed to match humans' trichromatic color vision (caused by the three types of cone cells in the eye). See **Additive Color**

SUNNY 16 RULE (Sunny Day Rule)
An exposure guide for shooting without a meter or if you don't trust the meter. "On a bright sunny day, at f/16, the shutter speed should be equal to the film speed (ISO)"

SYNCH CORD (See PC CORD)

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TELECONVERTER
A type of lens that mounts directly onto the camera body and allows you to mount a lens to the teleconverter and magnifies the focal length of the lens by whatever factor is designed into the teleconverter. A 2x teleconverter will double the focal length of the lens without affecting its focusing ability. You do lose one stop of light for each multiplication of focal length. For instance, a 50mm f'1.8 lens on a 2x will become a 100mm f 3.6 lens. Use of a teleconverter can also reduce the sharpness of your image because it puts a lot more glass between you and your subject. It will not only magnify the focal length of the lens, it will also magnify any weaknesses or shortcomings of the lens. Some compact cameras have Teleconverters that attach to the end of the lens.

TELEPHOTO LENS
A lens that makes objects viewed through it appear closer than they really are. With 35mm cameras, and digital cameras with 24x36mm image sensors, anything longer than about 50mm is considered telephoto. With most digital SLR cameras, which use a sensor in the APS-C format (See **APS** and **Format**) anything longer than about 30mm is considered telephoto. This tends to vary a little from one manufacturer to the next, and can vary from one camera to the next. With auto focus compact cameras, there is no firm standard for sensor size, so this can vary radically from one camera to the next.

TIFF
Tagged Image File Format (abbreviated TIFF) is a file format for storing images, including photographs and line art. It is now under the control of Adobe Systems. Originally created by the company Aldus for use with what was then called "desktop publishing", the TIFF format is widely supported by image-manipulation applications, by publishing and page layout applications, by scanning, faxing, word processing, optical character recognition and other applications. Adobe Systems, which acquired Aldus, now holds the copyright to the TIFF specification. TIFF has not had a major update since 1992, though several Aldus/Adobe technical notes have been published with minor extensions to the format, and several specifications, including TIFF/EP, have been based on the TIFF 6.0 specification.

The phrases "Tagged Image File Format" and "Tag Image File Format" were used as the subtitle to some early versions of the TIFF specification; the current specification, TIFF 6.0, does not use either subtitle phrase; the name is now, simply, "TIFF".

TIFF was originally created as an attempt to get desktop scanner vendors of the mid-1980s to agree on a common scanned image file format, rather than have each company promote its own proprietary format. In the beginning, TIFF was only a binary image format (only two possible values for each pixel), since that was all that desktop scanners could handle. As scanners became more powerful, and as desktop computer disk space became more plentiful, TIFF grew to accommodate grayscale images, then color images. Today, TIFF is a popular format for high-color-depth images, along with JPEG and PNG. Adobe Systems, which acquired the PageMaker publishing program from Aldus, now controls the TIFF specification. The most recent upgrade to the TIFF format is its new ability to support multiple layers.

TIMED EXPOSURE
A comparatively long exposure, generally made in seconds or minutes, or even hours, rather than fractions of a second. Typically used in astral-photography or still life shooting in very low light.

TIME VALUE (See SHUTTER PRIORITY)

T-MOUNT or T-MOUNT ADAPTER
Some lenses are sold with a universal threaded mount (Not to be confused with **Screw Mount** lenses) intended to accommodate a T-Mount adapter which will adapt the threaded mount to the proprietary mount of the camera in use. T-Mount lenses tend to be rather inexpensive, and of somewhat lower optical quality.

The T-mount system is less a convenience to the photographer than to the camera dealer. The "T" is reputed to stand for Tamron, a Japanese lens manufacturer, who in 1957 made a line of aftermarket camera lenses all using their T2 T-mount as a universal fit to 35mm SLR cameras of various manufacturers. The proprietary lens mount of each competitive manufacturer was adapted to the T-mount thread with a simple adapter. Thus a retailer could stock a small number of expensive lenses that would fit a large number of camera brands using a selection of inexpensive adapters. In 1966, the T-Mount system was improved and called the Adaptamatic System, but was rather short-lived. Tamron later modified this to include more intricate mechanical lens-to-camera linkage and called it the Adaptall System. **See ADAPTALL SYSTEM**

TRANSMITTED LIGHT
In studio photography, light that has been passed through a translucent medium. Color gel filters are examples of the media. A transparent backdrop is another example.

TTL (Through-the-Lens)
The term TTL was first coined in the early 1960's when cameras first began to appear with built-in light meters that read the light that passed through the lens. Before this, the options were to use a hand-held meter, a meter mounted on the accessory shoe of the camera, or an external sensor built into the front of the camera body. TTL metering was touted as being more accurate because it read exactly what the camera saw. The term, as it applies to an in-camera metering system is now considered archaic because it is now generally assumed that all cameras meter through the lens; even though many do not.

TTL FLASH METERING
The term TTL was brought once more to the fore in the 1980's when auto flash exposure moved into the camera. Previously, "Auto Flash" meant that there was a sensor on the front of the flash that controlled the flash exposure based on light reflected off the subject and back to the flash sensor. With the flash meter mounted inside the camera and controlled by a micro-processor the first steps toward fully automated, and correct, flash exposure were taken. In the early versions of TTL flash metering, the exposure was based on a reading taken off of the light reflected off the film. In fact, Minolta initially referred to it as OTF (Off the Film) flash metering.

With digital cameras, there was no film from which to reflect the light, so, since photographers fully expected TTL flash metering to be available in the technological wonders they shot with, the camera manufacturers had to completely rethink TTL flash metering. So a real flash meter had to be installed into the prism of the camera and the flash had to send a more powerful pre-flash than with film, and the old TTL flash systems became completely incompatible with the new digital cameras.

An interesting throw-back has occurred in the design of modern digital flash units. Most of the better flashes still have the old external-sensor auto-flash as well as TTL which makes them useable on film cameras, and the external sensor is just as useful on digital cameras as well.

TUNGSTEN LIGHT
Light from a regular incandescent lamp rather than daylight or fluorescent. Generally renders with a yellow or amber cast if you use daylight balanced film or if your color temperature is balanced for daylight.

See **COLOR TEMPERATURE** for more information.

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VARI-FOCAL LENS
A lens with variable focal lengths, but as the focal length changes, so does the focus point so that changes in magnification make it necessary to refocus. Many photographers are led to believe that this is just a characteristic of a cheap zoom lens, but it is actually a different type of lens. Many vari-focal lenses are sold today under the title "zoom lens." A true "Zoom" lens maintains the same focus throughout its entire zoom range. Also see **ZOOM LENS**

VIGNETTING
A fall-off in brightness at the edges of an image. Can be caused by poor lens design, use of a lens hood that does not match the lens, or by attaching too many filters to the front of the lens. Once the bane of budget photographers and medium and large format photographers, it is now often used as an artistic tool or special effect and can be digitally created to "enhance" an image.

W

WIDE ANGLE CONVERTER or ADAPTER
A lens adapter that usually attaches to the end of a lens (via filter threads) that creates a wider angle of view for that lens. Generally used in video and on auto focus compact cameras. Most video adapters can be attached to the end of still camera lenses with the use of stepping rings. Not a very efficient way to get a wide angle lens, but usually somewhat less expensive than an actual wide angle lens.

WIDE ANGLE LENS
Any lens that makes the subject look further away than it really is; or is shorter in focal length than a normal lens is considered a wide angle lens. A special type of wide angle lens, called a "Fish-Eye" lens is used for special effect, architectural, commercial, and artistic photography.

See **FISH-EYE, APS,** and **FORMAT**

Z

ZOOM LENS
A lens with variable focal lengths through which the photographer can proceed ("zoom") without having to change focus.

Also see **VARI-FOCAL LENS**

Bibliography-ish

Special thanks must go to Jim Lee who started this glossary in the 1990's.

Much of the information comes from Kodak's *Customer Service Pamphlet AA-9* , as well as the *Life Library of Photography,* published by Time/Life Books; *The Kodak Encyclopedia of Photography,* the revered periodical; *Popular Photography; Camerapedia.org* and of course, *Wikipedia.org.*

Typographical errors and mistakes are the province of the compiler and researcher o f this document, Thomas Gartman, and have been retained to provide flavor and character.