

Color Calibration Glossary

Absolute White – In theory, a material that perfectly reflects all light energy at every visible wavelength. In practice, a solid white (with known spectral data) that is used as the "reference white" for all measurements of absolute reflectance.

Accuracy – The degree of closeness between a measured value and the true or nominal value.

Achromatic Color – A neutral color that has no hue, such as white, gray, or black. See also chromatic color.

Additive Color – The additive primary colors are red, green and blue. These additive primaries represent the three main components of white light. Used individually or together, these three colors of light can be mixed to create nearly all colors. Additive color is used in scanners and computer displays.

Ambient Light – The light reflected off a monitor, most likely affected by the lighting of the room's environment.

Black – Ideally, the complete absorption of incident light; the absence of any reflection. In the practical sense, any color which is close to this ideal in a relative viewing situation, i.e., a color of very low saturation and of low luminance.

Brightness – The dimension of color that is referred to an achromatic scale, ranging from black to white, also called lightness or luminous reflectance. Because of confusion with saturation, the use of this term should be discouraged. See also luminance.

Calibration – The process of ensuring that all color production devices (scanners, monitors, printers) conform to an established state, specified by the manufacturer, user, or an industry-wide specification or standard.

Candelas (cd/m²) – An international unit of light intensity. Luminance may be described in units of Candelas per meter squared or sometimes as just Candelas or nits.

Cathode Ray Tube (CRT) – The glass tube that forms the display screen. A beam of electrons excites phosphors coated on the inside of the glass to create an image.

Characterization – The process of determining the output of a system in response to a known input. Characterization provides a way of deriving the color gamut and reproduction characteristics of a device.

Characteristic Curve – The graphical representation of the measured luminance response of a display in terms of digital input (digital driving level).

Chromatic Color – Perceived as having a hue; not white, gray, or black. See also achromatic color.

CIE LAB – A three-dimensional, mathematical color model based on human sensitivity to the visual spectrum of light; L= lightness, a = red-green axis of the space, b = blue-yellow axis of the space.

Closed Loop Calibration – A method of scanner calibration where a factory provided file is printed on the desired printer and then scanned back in. The scanned result is compared with the original file data and a compensation setting is stored. This compensation setting is used as a filter for all future scans to be output on that particular output device.

CMM – Refers to color management module, a color transformation algorithm that accepts color data and translates it to another color space referencing color profiles.

CMYK – The process printing colors. Cyan, Magenta, Yellow, Black.

Colorimeter – A three-color instrument for measuring light reflected from a surface or transmitted by an object, relating reflectance or transmittance to a mathematical model of human vision. A colorimeter is used for calibration/characterization of monitors and characterization of printers.

Color Management System – Abbreviated CMS. A CMS is a set of software designed to increase the accuracy and consistency of color between a scanner, display and printer. A CMS consists of: "Device profiles" which document the performance of the particular scanner, display and printer you may own. A "device transformation engine" that converts data between the scanner, display and printer. A "gamut compensation mechanism" that addresses differences between the capabilities of the scanner, display and printer. And a "device independent color space" through which all color transformations occur.

Color space – The three-dimensional range of color coordinates that mathematically defines the hues and shades a device can print or display.

Contrast Ratio – The ratio of intensity between the brightest white and the darkest black of a particular device or a particular environment.

Contrast Sensitivity – A characterization of the sensitivity of the average human observer to luminance level changes of the standard target. The DICOM Part 14 standard uses the DICOM model for contrast sensitivity. Contrast sensitivity is inversely proportional to threshold modulation.

Conversion – Translating a color image from the color space of one device to that of another. Also known as color transformation.

Custom Aim – The desired curve that specifies the relationship of digital input level to output luminance.

Default – A selection automatically made by a computer for a certain parameter, unless you change it. For example, the default value for Number of Calibration Values on the Calibration tab is 33.

Delta E – Distance in CIE LAB color space between two colors. Delta E is used to indicate total color difference and establish quantitative color tolerances.

Densitometer – A black-and-white or four-color instrument for reading the amount of light reflected by a surface or transmitted by an object. Reflection densitometers are used to read the density of process-color inks on press, as well as to calculate other values such as dot gain, ink trap, and hue error. Transmission densitometers are used to read density of black-and-white film.

Device Dependent Color Space – For example RGB. A device dependent color space is one in which the same color values will give different results on different devices. This is why the same scan file will appear different when viewed on different computer displays.

Device Independent Color Space. For example CIE LAB. A device independent color space is one in which a particular color value is considered absolute and not subject to interpretation.

CIE LAB is the central color space in color management systems and is used to translate between different device dependent color spaces such as scanner RGB and display RGB.

Device Profile. A file used as part of a Color Management System. A device profile contains information documenting the unique characteristics of that brand and model of device. There are device profiles for scanners, computer displays and printers

Display Data Channel/Command Interface (DDC/CI) – An extension to the VESA DDC standard allowing control commands to be sent to the monitor by the system.

Dot gain – Net percent increase in halftone dot size (or tone value) throughout the tone scale or at a specified percentage. A dot gain of 20%, then, signifies that a 50% tint reproduces at 70% apparent dot area.

Foot Lamberts (fL) – A unit of luminance. One foot Lambert is equal to $10.76/\pi$ (approximately 3.426) Candelas per square meter. You can specify luminance in either unit in Calibration TQA.

Gamma – The relationship between the input video signal to a monitor and the screen output luminance. Screen luminance follows a mathematical power function of the input video signal, the exponent of which is called the gamma.

Gamma Adjustment – An adjustment that makes the Tonal Distribution lighter or darker. A Gamma Adjustment may be made to a monitor, a scanner or to an image during the scanning or image editing process.

Gamma Correction Table (GCT) – You can save a GCT as a binary or text file. The GCT corrects the individual monitor's luminance response.

Gamut – A term referring to the range of available color on a display or printer. A particular color is either in or out of the gamut of the device. If outside, it cannot be accurately shown on that display or printed on that output device. (Each device has its own gamut capabilities.)

Gamut Alarm – A software function that tells the user if a color falls outside the Gamut of the currently targeted printer.

Gamut Transformation – A function of Color Management Systems where out of Gamut colors are converted to colors within the Gamut of the targeted printer. For photographs, the gamut transformation progressively transforms all color in the image so the image retains a realistic

appearance. For line-art, only the colors falling out of gamut are changed and the rest of the art is left intact.

Grayscale – An achromatic scale ranging from black through a series of successively lighter grays to white. Such a series may be made up of steps, which appear to be equally distant from one another, or may be arranged according to some other criterion such as geometric progression based on lightness.

GSDF – Grayscale Standard Display Function. A standard defined by the DICOM committee.

Hue – The main attribute of a color that distinguishes it from other colors. For example, a color may have a green, yellow, or purple hue. Colors defined as having hue are known as chromatic colors. White, black, and grays possess no hue are known as achromatic colors.

HLS – A color space with the three variable of Hue. Lightness. Saturation. See HSB.

HSB – A color space with the three variables of Hue. Saturation. Brightness. Hue means color (as in the color wheel.) Saturation is an indication relating to the richness or vibrancy of the color. Brightness is a term best related to the intensity of light illuminating the object.

ICC – International Color Consortium, an internationally accredited committee that sets standards for color profiles. See "Profile."

Illuminance – Light from the environment surrounding the display system, which illuminates the display medium, otherwise known as ambient light. It contributes to the luminance that is received by an observer from the image display, thereby reducing the inherent luminance range of the display system and the contrast in the image.

Inverted Display – Images and/or data displayed on a monitor in the opposite of the usual display mode. Inverted display causes dark areas to appear light and light areas to appear dark. For example, an image displayed with text annotations that are black letters on a white background is the inverted display of the text displayed as white letters on a black background.

JND (Just Noticeable Difference) – The luminance difference of a given target under given viewing conditions that the average human observer can just perceive.

Lightness – Lightness is a term referring to the lightness or brightness of an image. Also, as part of the HSL color space, it refers to the imagined amount of light illuminating a viewed color.

Linearization – A specific type of calibration in which an output device is adjusted to deliver a straight-line relationship between input and output. For example, an image setter is linearized to output halftone dot values within a certain tolerance of those input.

Lookup Table (LUT) – A common tool used to change a digital driving level. This two-dimensional table contains x, y pairs, where input digital driving levels are passed in as x values and the corresponding y value is assigned. DOME boards use lookup tables to modify the native characteristic curve to produce the aim response with respect to digital driving level. Calibration TQA then uses the LUT or GCT to apply gamma corrections to a monitor's luminance.

Luminance – A measure of the brightness or luminous intensity per unit area projected in a given direction. In other words, it is the "light" emitted from a display device or the light from a lightbox after being attenuated or filtered by film. The international system unit is Candela per square meter (cd/m^2), also called a nit. Another unit often used is foot Lambert (fL). $1 \text{ fL} = 3.426 \text{ cd}/\text{m}^2$.

Megapixel – 1024 pixels. A 5-megapixel DOME board, such as the Md5/PCI board, can display at resolutions ranging up to 2048 x 2560 pixels, for example.

Monitor – A video display terminal. Also referred to as screen.

Nanometer (nm) – A unit of length equal to 10^{-9} meter. In light measurement, the wavelength of light is measured in.

Nanometers – The portion of the spectrum that we perceive as visible light includes wavelengths from about 380 nm to 770 nm.

Nit – A unit of luminance equal to Candelas per square meter (cd/m^2).

Output Simulation – A term used in some Color Management Systems to describe the function whereby the computer display is used to predict the results achievable on a particular printer.

Phosphor – Material that emits light when irradiated by photons of certain wavelengths or energetic particles, like electrons in a CRT. Color monitors use phosphors to produce red, green, and blue light to display images on the screen.

PhotoYCC – The CIE based device independent color space used to store images on a Kodak PhotoCD disc.

Photometer – An instrument that measures luminance in Candelas per square meter or in foot Lamberts.

Pixel – Abbreviated term for picture element. A pixel is the smallest unit of a video display.

Precision – The degree of consistency and agreement among independent measurements of a quantity under the same conditions. The coherence or closeness of one result to all the measurement results.

Primary Photometer – The default photometer used to calibrate and perform conformance tests on a monitor. This photometer may be an external photometer with a digital connection to the system, a sensor built into the monitor, or a hand-held photometer with no digital interface. The primary photometer must be available and properly initialized to perform most calibration and conformance testing functions. See also reference photometer.

Profile or ICC Profile – Developed by the ICC and introduced in 1995, a profile is a standard file format that communicates measured color output of a system or device in response to a known input. Its data describes a device as characterization to applications and operating systems that support the format.

Reference Photometer – A secondary photometer used to calibrate the primary photometer to a known standard. This photometer is typically an external photometer with a digital connection

to the system or a hand- held photometer with no digital interface. The reference photometer need not be available to perform routine calibration and conformance testing functions. See also primary photometer.

Reliability – The ability of an instrument to perform as specified without premature failure.

Repeatability – The degree of agreement among independent measurements of a quantity under the same conditions.

Resolution – (of an indicating device) The smallest change in quantity that can be detected or provided by an instrument.

RGB – Red, Green, Blue. These Additive Primary colors are the basic elements of white light. By mixing them in a computer monitor or in a scanned image file, other colors can be made. For instance, Red and Green light make Yellow light. and equal amounts of all three make grey.

Saturation – Saturation is one attribute of color in the color space called HSB. (Hue Saturation, Brightness) Saturation is a characteristic indicating the vibrancy or intensity of a hue. A color with high saturation will appear more intense than the same color with less.

Spectrophotometer – An instrument for reading reflectance or transmittance of light at specified increments throughout the visible spectrum. Spectrophotometric data can be used to calculate densitometric and colorimetric variables.

Subtractive Color – A term used to describe the subtractive primary colors: Cyan, magenta, yellow. As ink applied to a piece of paper by a printing press, these colors absorb light and alter the colors seen by one looking at the press sheet. Cyan ink absorbs the red third of the spectrum, magenta ink absorbs the green third, and yellow ink absorbs the blue third. This should theoretically cause the viewer to see a black color, (with three thirds absorbed, no light is reflected) but due to unavoidable impurities in the inks, there is still light reflected and the viewer sees a muddy brown.

Threshold Modulation – The minimum luminance modulation required by the average human observer to detect the standard target at a given mean luminance level. The threshold modulation corresponds to the Just-Noticeable Difference in luminance of the standard target.

Tonal Distribution – Tonal Distribution describes the distribution of various bright or dark tones within an image. During the scanning or image editing stage, tones can be redistributed lightening a dark image or darkening a light one.

Viewing Conditions – A term used to describe the lighting conditions surrounding a computer display or color proof viewing area. The intensity and type of light have a dramatic impact on the colors perceived by the viewer.

Glossary Resources

http://www.dome.com/support/faq/caltqa/cal_glossary_main.html

www.apple.com/publishing/ama/0102s/glossary.html

www.binarygraphics.com/glossary/color.html