DreamColor and HP DreamColor LP2480zx Professional Display Frequently Asked Questions

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DreamColor

Q .   What is the DreamColor initiative?

A .   The initiative is a two-year technology collaboration between HP and DreamWorks Animation that aims to deliver standout color that remains consistent from application to application, device to device, and medium to medium. HP introduced the first printers built on the HP DreamColor Engine in March of 2007.

Q .   In addition to printers, are there any other HP DreamColor products?

A .   The HP DreamColor LP2480zx Display is the first non-printer product to be introduced under the HP DreamColor technology initiative.

Q .   What will be the hallmarks of a DreamColor display?

A .   In general, all HP DreamColor displays introduced over the coming year will have one thing in common—the ability to provide very accurate color performance as defined by at least one standard output device or color space definition, with the target standard selected per the needs of the market in question. In some cases, such as with the HP DreamColor LP2480zx monitor, multiple user-selectable color spaces will be supported.

Q .   What is a "standard output device" or "standard color space?"

A .   In order to ensure consistent and accurate color rendering, numerous specifications have been developed which define the expected color performance of an "ideal" output device for a given market or application. These include such standards as the "sRGB" specification (widely used in computer graphics and consumer digital photography) and "Adobe® RGB" (common in professional document creation and editing). Images will be rendered properly only on devices which accurately conform to the appropriate specifications.

Q .   How does DreamColor relate to the HP "BrightView" and "VividColor" logos?

A .   "BrightView" is HP's name for what are commonly referred to as "glare" panels by the LCD industry—LCDs which have a polished, glossy surface (although they also often provide anti-reflective treatments which still maintain the "polished" appearance) instead of the traditional "matte finish" anti-glare surface of other displays. "VividColor" is a name used in connection with HP consumer display products which provide a wider color gamut than standard displays, and therefore more "vivid" or "vibrant" colors. Neither of these is specifically concerned with color accuracy, which is the key focus of the DreamColor initiative.

HP DreamColor LP2480zx Professional Display

Q .   What is the HP DreamColor LP2480zx Professional Display?

A .   The HP DreamColor LP2480zx Professional Display is the world's first affordable color-critical display. It is a 24-inch diagonal widescreen true 30-bit, LED backlit LCD display that provides a range of over 1 billion colors at a breakthrough price compared to other displays with 30-bit panels.

Q. I want to convince my manager that I need an HP DreamColor LP2840zx monitor. In a nutshell, what's so special about this product?

A. This professional LCD monitor is the only product in its class which provides accurate color and tone response out of the box. Almost all of the industry's commonly-used standard color spaces are supported by the HP DreamColor LP2480zx monitor. Its sophisticated feature set makes it a clear choice for demanding professionals. It is ideal for use in any color- and tone-critical workflow, including photography, video, film, industrial design, and graphic arts.

Q. What is meant by "% of NTSC" when describing the color gamut?

A. The HP DreamColor LP2840zx monitor's range of colors (the color gamut) can be compared to a pervasive (but rarely used) standard, the NTSC color space, as defined in 1953. According to one way of representing color gamuts (using the CIE 1931 xy Chromaticity Diagram), the area of the HP DreamColor LP2480zx monitor's color gamut is 1.1 times the area of the NTSC gamut, hence the "110%." In practical terms, this measure is not very useful, since it tells you nothing about the exact characteristics of the monitor's gamut.

Q. And what is "color gamut" anyway?

A. The HP DreamColor LP2480zx monitor incorporates advanced technology which gives exceptionally saturated primary colors and a very broad color gamut (compared to other LCD displays). In the context of the HP DreamColor LP2480zx display, its wide physical (or "native") color gamut is a good thing, because almost all of the standard color spaces (see below) are completely enclosed. This makes it possible to set the monitor to accurately reproduce a chosen standard color space (such as sRGB). The monitor's internal electronics (known as the HP DreamColor Engine) make the transformation for you. If the native color gamut were not large enough to enclose a desired color space, it would not be possible to accurately represent that color space. The HP DreamColor LP2480zx monitor's very broad native color gamut is a key enabler for its applicability in many color-critical workflows.

Q. What can I do when all my pictures look unrealistically bright or vivid?

A. The HP DreamColor LP2480zx display's very wide "native" color gamut doesn't match the color spaces with which most pictures and videos are encoded. The result is that when displayed on the monitor, images can look very saturated, especially the reds, which can look unnatural. The solution is very easy—simply use the monitor's on-screen display (OSD) to select the color space that's appropriate for your content. The monitor will adjust itself—in essence, it changes its red, green, and blue primaries—and the image will look accurate and natural.

Q. Can professionals use the display to design to industry-standard specifications?

A. Yes. Designed for professional use, the HP DreamColor LP2480zx includes easy factory presets that allow the user to "snap" to the color ranges specified by the Rec. 601, Rec. 709, sRGB, Adobe RGB, and DCI-P3 standards.

Q. What are the standard color spaces, and who uses them?

A. There are many standard color space or output device definitions. Some are no longer in widespread use and some are very new and have yet to be used to any great extent. Currently, some of the most popular standards are:

- sRGB. Originally promoted by HP and Microsoft, sRGB was intended to provide a standard description of the typical output device (display) used in personal computer systems. Developed in the 1990s, the sRGB standard approximates the characteristics of an ideal CRT monitor (the most widely used PC display at the time). Today, sRGB is very widely used as the standard for which most computer graphics, web-based images, and digital photographs are encoded.

- SMPTE-C/Rec. 601. The original 1953 definition of a standard set of color TV primaries, created by the National Television Systems Committee (NTSC), it was never widely adopted in practice and was not practical even for use in television receivers of the day. In 1974, the Society of Motion Picture and Television Engineers (SMPTE) formally adopted a standard (SMPTE RP-145) which defined the primaries actually being used by North American television broadcasters. These became known as the "SMPTE-C" primaries. Most TV content produced for the standard-definition analog TV system used in the U. S., Canada, and elsewhere conforms to the SMPTE-C specifications. A very similar primary set used in most European analog television standards is known as the European Broadcast Union, or "EBU," standard. Later, the "SMPTE-C" set of primaries was incorporated into a more complete standard-definition digital video specification, ITU-R Recommendation BT.601, commonly known simply as "Rec. 601."

- Adobe RGB. Similar in intent to the sRGB specification, but intended for the needs of professional document editing, the Adobe RGB standard was introduced in 1998 by Adobe Systems, Inc. The gamut of this standard is identical to that of sRGB, with the exception that it uses a much more saturated green primary. Adobe RGB encoding is found primarily in connection with professional document tools, high-end digital photography, and similar applications.

- ITU Recommendation BT. 709. This standard from the International Telecommunications Union, often referred to simply as "Rec. 709," is used for essentially all digital and high-definition TV systems worldwide. The Rec. 709 gamut is identical to that of the sRGB standard, but the two specifications differ in other details (notably the standard tone response curve assumed by each).

- Digital Cinema Initiatives. This group, formed in 2002 as a joint venture of six movie studios, was created to develop a common standard for the digital production, distribution, and exhibition of what have traditionally been "films." While the DCI standard does not establish a specific color space, it does specify the minimum requirements for a reference projection system for use under this standard. These requirements are now commonly referred to as the "DCI-P3" color space, and have also been documented in the SMPTE-431-2 standard.

Q. Does the HP DreamColor LP2480zx monitor support all these standard color spaces?

A. Yes, the HP DreamColor LP2480zx monitor provides presets for all of the spaces mentioned above, with the exception of the "EBU" space. In the case of the "DCI" preset, the native gamut of the panel does not fully cover the "DCI-P3" gamut, and so this preset is referred to as an "emulation" of this space. (The HP DreamColor LP2480zx monitor does provide ~97% coverage of the DCI-P3 gamut; the excluded portions are primarily in the extreme red and green areas of the DCI gamut). The HP DreamColor LP2480zx display also provides a "User" color space preset. This may be programmed by the user (via the optional HP DreamColor Advanced Profiling Solution calibration package) to any desired color space within monitor's range.

Q. How does the HP DreamColor LP2480zx monitor achieve accurate compliance with these standard color spaces?

A. Each monitor is factory-calibrated with values used to apply corrections to the red, green, and blue input values, within the "front-end" electronics of the monitor. The result is that the effective color gamut of the display (the triangular space bounded by the three primaries) is shifted and sized into accurate alignment with the standard definition for your selected color space. Tone response and white point are similarly corrected to match that of the standard.

Q. What is a "10-bit panel?" Why is it important for image quality?

A. The HP DreamColor LP2480zx display's internal electronics can adjust the brightness of red, green or blue to any of 1024 levels (2^{10} hence, "10 bits/color" or "30 bits/pixel). This allows the internal calibration tables (for color space and tone response) to work their magic without introducing banding artifacts or loss of detail. Furthermore, with the use of the DisplayPort 1.1 or HDMI 1.3 inputs provided on the HP DreamColor LP2480zx display, the computer is able to send 10-bit/color images to the monitor without losing detail.

Q. Do I need a 30-bit graphics card (also called 10-bit) to use the HP DreamColor LP2480zx display?

A. No. The HP DreamColor LP2480zx display has 36-bit precision in the HP DreamColor Engine. A full 30-bit pixel is sent from the DreamColor Engine to be displayed on the HP 30-bit LCD panel with no dithering or frame rate control. However, even with an 8-bit per color channel, 24-bits per pixel graphics card, the user benefits from the HP 30-bit LCD panel because the HP DreamColor Engine still selects colors from the full 1.07 billion color palette. The benefit is more accurate gamut control and tone response and the virtual elimination of visual artifacts such as banding or contouring.

Q. What is the benefit of using a 30-bit graphics card with the HP DreamColor LP2480zx display?

A. With a 30-bit/pixel-aware OS, graphics card, and application, the user is able to display images that choose from the full palette of 1.07 billion colors. This is primarily important when the source data is inherently greater than 8 bits per color. Examples include medical imaging or satellite imaging where the source data can be from 10 to 16-bits per color.

Q. The HP DreamColor LP2480zx display offers "low black level." Why is this important?

A. A very dark black is a key contributor to the "contrast ratio" of the display. A good contrast ratio gives a pleasing, engaging image. The LCD panel used in the HP DreamColor LP2480zx monitor provides a typical contrast ratio of 1000:1[1].

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[1] All specifications represent the typical specifications provided by HP's component manufacturers; actual performance may vary either higher or lower.

Q . The HP DreamColor LP2480zx display can be dimmed to very low levels—as low as 40 cd/m2 for the peak white luminance. Why is this important?

A . Some of the expected users of the HP DreamColor LP2480zx monitor typically work in dark rooms, with the brightness of the display turned down unusually low by normal office-use standards. This emulates, for example, a movie theater, allowing a graphics artist to see the image or video content just like his or her audience will experience it. Another reason for working in low-ambient environments is the phenomenon of adaptation, whereby a viewer's color perception may be biased by the presence of additional light sources within the field of view. The HP DreamColor LP2480zx display with reduced ambient lighting helps ensure that the perceived colors are those intended by the image creator, and provides the reduced brightness levels needed for comfortable viewing.

Q . What is "tone response"? Does the HP DreamColor LP2480zx monitor have good tone response?

A . Tone response (sometimes referred to as "gamma") refers to how the monitor translates changes in the input signal level to variations in brightness within the image. For various reasons, the target tone response or "gamma curve" of most standards is a non-linear function. Poorly-adjusted tone response can result in "blown-out" whites or loss of detail in dark regions. An uneven tone-response curve can also result in visible banding artifacts in gently shaded areas of the image. The HP DreamColor LP2480zx display is factory-calibrated to provide highly accurate tone response for each of the supported standard color spaces. Its 10-bit panel allows tone response curves to be applied without compromising image quality.

Q . The HP DreamColor LP2480zx display can synchronize to all the standard video frame rates. What does that mean, and why is it important?

A . By ensuring that the image on the screen is updated exactly in synchronization with the video source, the "tearing" effect, which would be distracting when reviewing video or film content, is eliminated.

Q . How does the HP DreamColor LP2480zx monitor's backlight provide the ability to adjust the white point, and what does this do for me?

A . The backlight is composed of an array of red, green, and blue light-emitting diodes, or LEDs. By adjusting the relative brightness of the three colors—something which cannot be done in a conventional CCFL fluorescent backlight—the monitor's firmware can adjust the white point anywhere in the useful range of the industry-standard "color temperatures" for white. By doing this completely within the backlight, the HP DreamColor LP2480zx display avoids the need to artificially limit the range of input values to the LCD panel (commonly used in other monitors in order to adjust the white point), and so more accurately preserves the image content.

Q . Why is it a good thing that the buttons go dark after a few seconds?

A . Illuminated buttons can be visually distracting, especially in low-light work environments. And, as noted above, light sources other than the onscreen image can throw off a viewer's perception of color. By presenting only the onscreen image to the viewer, and no other interfering lights, the ability of the viewer to accurately see the colors of the image is preserved.

Q . What is the size of the display and maximum available resolution?

A . It is a widescreen 24-inch diagonal display with a resolution of 1920x1200.

Q. What is the color range of this display?

A. Users will have access to a range of more than 1.07 billion colors—64 times the colors available on mainstream LCD displays with 16.7 million colors.

Q. What is the real benefit of one billion colors?

A. The real benefit of the 30-bit panel, which is able to display over 1 billion colors, is that it virtually eliminates banding or contouring artifacts. A mainstream LCD display typically only has 8 bits (or less) per color for 24 bits total. With 8 bits of resolution per color, you only get 256 shades to choose from. The human eye can perceive these jumps in adjacent shades. The HP DreamColor LP2480zx display has a 30-bit panel with 10 bits per color channel. This provides 1,024 shades per color channel. The steps between adjacent shades are 4 times smaller than for the mainstream display and smaller than the human eye can detect. This provides the smoother color transitions and the virtual elimination of contouring artifacts.

Q. How did you get to 1.07 billion colors?

A. The 30-bit LCD panel is able to produce 1,024 shades of each of red, green, and blue. When you permute these shades you get 1.07 billion different colors. This is calculated as 1024 x 1024 x 1024 = 1.07 billion. Another way to calculate this is 2^{30} = 1.07 billion.

Q. How did you accomplish this?

A. By identifying a collection of advanced technologies that previously have been out of reach due to cost or availability, and adding HP engineering to put them all together into one powerful and affordable display package.

Q. Why do you call it breakthrough technology?

A. This is the first display in this price range with 30-bit color accuracy in the LCD panel. The leadership features include an RGB LED backlight with a broad color gamut and programmable white point. Equally important is the HP DreamColor Engine that is able to harness the full potential of the 30-bit panel and the RGB LED backlight to deliver highly accurate color performance in any of five factory calibrated color space presets. This display exceeds the performance of CRTs in many areas including wider gamut and programmable white point.

Q. Why is the monitor's bezel black?

A. The black bezel is not visually distracting for the viewer; lighter colors in the area surrounding the screen will present unwanted additional light to the viewer (in this case, through reflected ambient light sources) and degrade the viewer's ability to correctly see the intended colors of the image.

HP and DreamWorks

Q. What's so special about how this display was developed?

A. The HP DreamColor display is the result of an unprecedented technology collaboration with DreamWorks Animation and was designed to solve an increasingly critical need for color accuracy in the animation, game development, film/video post-production, broadcast, product design, and graphic arts categories.

Q. Why did DreamWorks Animation come to HP to develop this new technology?

A. The HP DreamColor LP2480zx display is the result of an unprecedented technology collaboration with DreamWorks Animation SKG Inc. (NYSE: DWA)

Ed Leonard, chief technology officer, DreamWorks Animation summarized the results of this HP/DreamWorks collaboration: "With the new DreamColor display, HP has broken through barriers that have existed in display technology for the past decade. The new DreamColor display packs a list of significant advances into one amazingly powerful display, enabling an unprecedented level of color management and fidelity in our production process. It's a digital filmmaker's dream."

Target customers

Q. Who is the display designed for?

A. The display was designed for professionals in the animation, game development, film/video post-production, broadcast, product design, and graphic arts categories, and consumers and hobbyists for whom only the newest technology developments will do.

Q. Has color accuracy been a challenge for these industries?

A. Yes, lack of affordable color accuracy results in many extra steps, causing expensive—and now unnecessary—time and money cycles.

Q. I'm a digital photographer. How does the HP DreamColor LP2480zx display benefit me?

A. Photography is often an important part of creative design. With 30-bit (billion-color) capabilities, the HP DreamColor LP2480zx display reduces contouring artifacts seen with other displays. It's like having a box of 1024 crayons instead of 16—with many more shades of individual colors. With CRT-class blacks, 30-bit color resolution to eliminate banding, the HP DreamColor Engine to lock in the color space you want to standardize on, and an RGB LED backlight with wide gamut and programmable white point, you finally have an affordable LCD color-critical display to replace your aging CRTs and exceed their performance in many respects.

Q. I'm a professional video editor. How does the HP DreamColor LP2480zx display benefit me?

A. A post-production colorist has a wide range of responsibilities that (attempt to) keep the director happy—from making sure film gets properly transferred to video, to achieving a "look" that was intended but perhaps not quite caught during shooting. A key component of successfully achieving these tasks is the accurate and consistent representation of the production's color at your desktop. You need a display that can consistently and accurately represent the range of colors that will appear on the final video or film.

With the HP DreamColor LP2480zx Professional Display, you get a billion-color display that puts unprecedented color accuracy and control on your desk. This display can faithfully recreate the colors that will ultimately end up in the theatre or shown elsewhere—allowing color accuracy and consistency from concept through production.

For video and film professionals specifically, the HP DreamColor LP2480zx display offers an additional advantage—the ability to sync up to sources at standard film and video frame rates (48 Hz, 50 Hz, 59.94 Hz, and 60 Hz) without frame-rate conversion and the possibility of artifacts resulting from that process.

Q. I'm an industrial designer. How does the HP DreamColor LP2480zx display benefit me?

A. There are times in the design process where color selection is important, and it is important to match the color image created on the screen to the real product. It is also important that others see the exact color combinations that have been selected for the product to represent the true look and feel of the product. DreamColor can provide calibrated color from monitor to monitor and can provide the exact product colors that will be produced later in the production cycle. This takes the guesswork out of color selection and color matching and simplifies the design process

Q. I'm an automotive styling designer. How does the HP DreamColor LP2480zx display benefit me?

A. In the design of an automobile, color selection is a key customer preference item, and often dictates consumer choice. It is important to get it right and match the color image created on the screen to the real product. It is also important that others see the exact color combinations that have been selected for the product to represent the true look and feel of the style. DreamColor can provide calibrated color from monitor to monitor and can provide the exact product colors that will be produced later in the production cycle. Others can now share in your exact color concepts and creations.

Q. What if I am not one of the specific target markets? Will the HP DreamColor LP2480zx monitor benefit me in anyway?

A. Absolutely. By accurately providing the display performance required for any particular application or standard color space, the HP DreamColor LP2480zx display provides an industry-leading combination of low price, color accuracy, and consistency.

HP also offers the HP DreamColor Advanced Profiling Solution, a complete set of optional calibration tools that includes the hardware and software needed to the easily maintain the precision of the HP DreamColor LP2480zx monitor. HP reliability and product support complete the package, making this monitor a great choice for color-critical professionals in a wide range of fields.