



## TECHNICAL WHITE PAPER

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# THE BENEFITS OF HP DREAMCOLOR TECHNOLOGY IN HP ZBOOKS

Greg Staten, Color Scientist and Architect

## Start of HP DreamColor Era

HP introduced DreamColor color calibration for mobile workstations ten years ago with the 8570w and 8740w mobile workstations. These first models utilized a “scaler” chipset commonly found in desktop displays to provide the same level of color calibration accuracy they used in the first award-winning HP DreamColor display, the LP 2480zx. HP continued to use this technology through 2015, the last models being the HP ZBook 15 G3 and HP ZBook 17 G2. While these displays were renowned for their color accuracy, the challenge with using a scaler for the color engine was that these chipsets were designed for use in displays and did not have the thermal profiles that supported the customer demand for thinner and lighter mobile workstations.

HP engineers found a replacement in the growing sophistication of the discrete GPUs (DGPU) from NVIDIA® and AMD®. HP worked closely with both GPU manufacturers to implement the HP DreamColor engine in their DGPU’s pipeline, ensuring that it would not collide with any third party graphics applications and deliver the color accuracy that customers had come to expect from HP DreamColor technology. In late 2015, the HP ZBook 15 G4 and HP ZBook 17 G3 were released, bringing this new color technology to the marketplace.

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While the DGPU-based solution provided an excellent color pipeline, it required the DGPU to run continuously, which had a negative impact on battery life, effectively halving it. Unfortunately, the Intel® CPU’s graphics pipelines did not have the protected post-processing pipeline required to do color management while allowing all traditional graphics applications to function normally. While halving battery life wasn’t significant to those who used their HP ZBooks as a “transportable” workstation, primarily using it at a desk connected to power, it made it difficult to use the HP ZBook as a true portable device.

## NO COMPROMISE WITH HP DREAMCOLOR – INCLUDING BATTERY LIFE

In 2019 HP filed several patents on a new approach, reprogramming a section of the TCON (timing controller), the chip used to draw pixels on the notebook panel, to provide a high-quality color pipeline. No longer do HP ZBook users have to stay in discrete mode in order to maintain color accuracy. Now the notebook can be set to “hybrid” mode, so that the discrete NVIDIA GPU is only enabled when needed by the host application, resulting in a significant improvement battery life.

Plus, the factory color calibration is stored on the notebook hardware, which means that the color calibration data is not lost when the hard drive is replaced or the notebook is reimaged. Nor is a software application required to activate calibration, ensuring that IT managers can deploy their own custom Windows image without impacting color performance.

The solution implements the standard 1D LUT > 3x3 matrix > 1D LUT pipeline found in HP DreamColor display color pipelines, at the same 12-bits of precision used in the previous DGPU approach. We further decided to increase color accuracy by using a spectrophotometer on the factory line to measure and calibrate the display instead of the colorimeters used previously and still used by most manufacturers. A spectrophotometer is a much-more accurate device than a colorimeter and does not require the maintenance of instrument-level color matrices to ensure accuracy.

This increased accuracy has allowed us to claim a color calibration with an error of less than 2.0 Delta E 2000, the tightest spec ever applied to a notebook. (Delta E is a calculation of the difference between a color onscreen and an industry color specification. A value of 2.3 Delta E is considered to be the “just noticeable difference,” meaning the point that the human eye can detect differences between two nearly identical colors.) By calibrating in the factory so that no color exceeds 2.0 Delta E 2000, HP delivers industry-leading color accuracy.

### New Color Management

While implementing the HP DreamColor color pipeline on the TCON allows us to provide high color accuracy without impacting battery life, it did require us to make a few changes to the available functionality. As compared to previous HP DreamColor products, the HP ZBook Gen 7 cannot be user recalibrated. While we hope to return this capability in a future generation, HP considered that the benefits of improved battery life and color accuracy were important enough to our customers that we decided to ship with this limitation.

We also upgraded the panel for this generation, providing 100% of the P3 gamut. Gamut limiting, though, is not provided in this generation. Therefore your display is always outputting 100% P3 gamut. This may cause some colors to be oversaturated in standard office application but provides for an even better experience in Creative applications such as Adobe® Photoshop® and Adobe® Illustrator®.

### Pantone Validated

All HP ZBook Gen 7 DreamColor displays are validated by Pantone to ensure that the color accuracy provided results in accurate representation of Pantone library colors. This ensures that you can trust that the colors you see while designing onscreen will match those in the final printed piece. It also means that designers working collaboratively at a distance will all see the same colors on their HP ZBook G7 mobile workstations.

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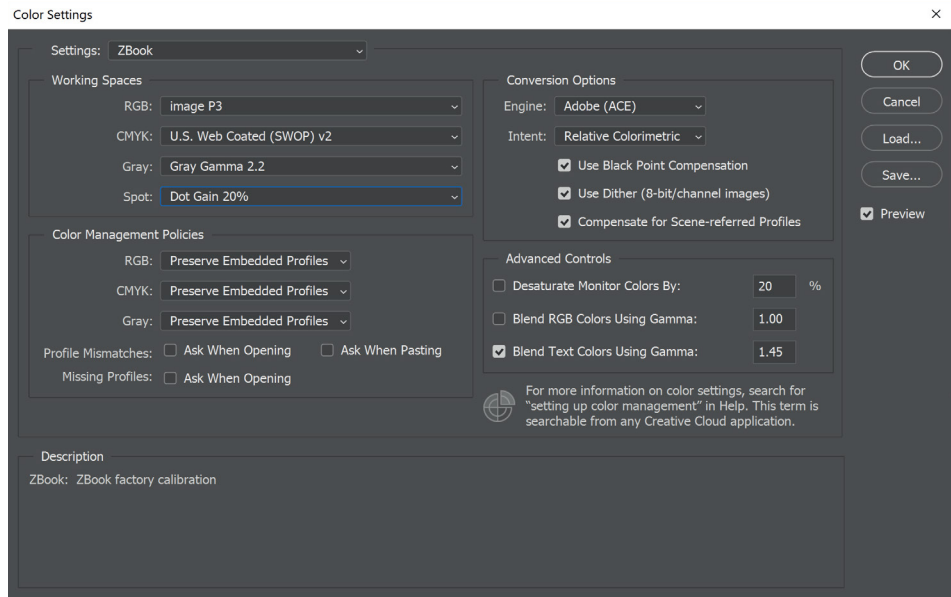
## HP DreamColor with Adobe® Creative Cloud®

In order to see accurate color in applications such as Adobe Photoshop and Adobe Illustrator, you must configure the application's Color Settings.

To configure Adobe Creative Cloud color settings:

1. Launch Adobe Photoshop (or Adobe Illustrator).
2. Choose *Color Settings...* from the Edit menu.
3. Choose *image P3* from the Working Spaces RGB pop-up menu.
4. Choose *Gray Gamma 2.2* from the Working Spaces Gray pop-up menu.
5. Press the Save... button to save your color configuration so you can apply it to other Adobe Creative Cloud applications.  
Name it something easy to remember, such as "ZBook."

The Photoshop color settings should now look like the following:



6. Click OK.

*Tip: If you have Adobe® Bridge installed, the Color Settings you applied in Photoshop will automatically be synchronized across all Adobe Creative Cloud applications.*

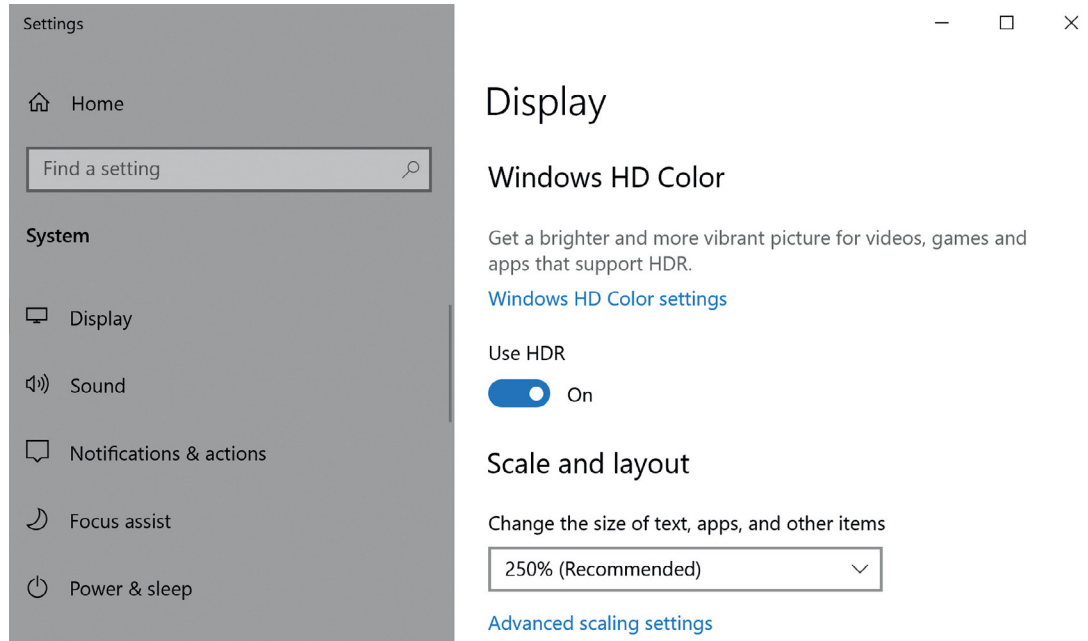
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## Working in High Dynamic Range

In addition to a factory calibrated standard dynamic range configuration, the HP ZBook Gen 7 DreamColor also includes a factory calibrated HDR configuration. This configuration is automatically enabled when you turn HDR in the Windows Display settings.

This allows you to have accurate color when working with HDR-compatible applications such as Affinity Photo. Note, however, that as of the publication of this white paper, Adobe Creative Cloud applications such as Photoshop and Illustrator are not compatible with Windows HDR and colors will not display accurately if HDR is turned on. Make sure HDR is disabled when using Adobe Creative Cloud applications.

HP ZBook G7 displays are certified as VESA DisplayHDR™ 400 and will display HDR images accurately up to a brightness of 400 cd/m². As the display uses global dimming, we recommend that HDR should be used for content consumption only, such as watching HDR content from Netflix, Disney+, or other over the top (OTT) content provider.





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