

Kaleidescape PictureCheck: Improve Your Video

Today's Ultra HD televisions and projectors can deliver razor sharp, vivid imagery the likes of which have never been possible in the home before. For the first time, it's possible to experience your favorite movies exactly as the filmmakers intended, with the same vibrancy, richness of color, depth of shadows, and level of detail you'd see on the best commercial cinema screens.

But simply purchasing the best UHD display doesn't guarantee such levels of cinematic performance. Out of the box, most TVs and projectors are calibrated to stand out in brightly lit retail showrooms. They're far too bright, far too blue, and often employ complex processing technologies to mask deficiencies in the display or compensate for poor source material.

Ensuring that your new display looks its best involves precise adjustment of perhaps dozens of different settings, some of which you're likely familiar with—Brightness, Contrast, Color, Tint, Sharpness—but others of which go by often arcane names that vary from manufacturer to manufacturer. What one manufacturer refers to as "Dynamic Contrast" might be known as "Adaptive Luma" on another brand's displays. And the wrong setting on your TV will likely result in a less-than-optimal cinematic viewing experience. To adjust all settings correctly, a professional calibrator must take thousands of measurements of your display using a colorimeter and specialized software.

In the absence of a professional calibration, however, there are simple display adjustments you can make that provide significant improvements in the cinematic experience compared to the out-of-the-box configuration. Your Kaleidescape Strato player now comes with a collection of simple test patterns, dubbed Kaleidescape PictureCheck, designed to help you optimize these display settings without the time or equipment required for a professional calibration.

Downloading Kaleidescape PictureCheck

Navigate to the System Settings menu of the Strato player, scroll down to Setup Videos, and you'll find a link to a special area of the Kaleidescape Store reserved for video setup and calibration tools. From there, you can download Kaleidescape PictureCheck, which will become available as an entry in your movie library after a few minutes. Select PictureCheck from your library once it has downloaded, and the Details page will provide a choice of different videos, organized by video format (HD, UHD, and 4K/HDR, with your choice of 16:9 and CinemaScope aspect ratios to suit the shape of your screen). Before you launch PictureCheck, though, make sure that your viewing environment is appropriately dimmed, and that you're sitting in the proper spot.

Viewing Environment

Just as a quiet room allows you to hear nuances in your music that may be drowned out by noisy fans, HVAC systems, or other environmental noises, a dim room is necessary if you want to see the subtle gradations of contrast in your favorite films.

To find the right light level, you'll want to sit a proper distance from the screen. For a 4K/UHD display, the optimal viewing distance depends on many factors but is often considered to be 1.5 to 3.0 times the height of the screen. More than this distance, and you won't be able to appreciate the enhanced resolution.

Once you're in your seating position—directly in front of the screen, as to avoid any viewing angle distortions—adjust your lights to a level that makes details in the shadows visible, but not so dim that brighter scenes cause eye strain. Once your lights are set to a proper movie-watching level, you're ready to begin your picture adjustments.

Basic Adjustments

Before you begin making detailed changes to your display's settings, there are a few global adjustments you can make to disable any egregious picture or color processing and ensure that your source material is displayed as originally encoded. The first thing you'll want to do is change your Picture Mode to "Cinema," "Movie," "Custom," or perhaps "Calibrated," depending on the make of your display.

Below are some rough guidelines for other settings you'll likely want to adjust before you begin making tweaks based on the screens found in PictureCheck.

General Settings

- Eco Solution, Auto Dimming:
 - o **Off**, to avoid variability.
- HDMI UHD Color or UltraHD Deep Color or HDMI Mode 2 (Panasonic):
 - o **On**, to allow 18 Gbps 4K video signals.

Picture Settings

- Picture Mode:
 - o Consider **Cinema**, **Home Theater**, **ISF Expert**, **Technicolor Expert**, or **Movie**. Avoid Vivid, Dynamic, Sports or Game modes.
 - o Many displays store settings independently for each Picture Mode and each HDMI input. Adjustments may need to be repeated several times (e.g. for SDR and HDR modes) or explicitly saved to all inputs.
- Color Temperature:
 - o **Warm2** or **Expert1**, **Expert2** (Sony). Warmer settings give the white balance typically used when calibrating for digital cinema.
- Backlight, OLED light:
 - o Consider **High** values.
- Contrast (white level):
 - o Consider **High** values. See the white-level tests, below.
- Brightness (black level):
 - o Consider **Low** to **Mid** values. See the black-level tests, below.
- Gamma (mid-tone levels):
 - o For SDR, values in the range **2.2** to **2.4** are typical, perhaps higher numbers for a darker environment. For HDR, you will find that the equivalent of gamma, known as the standard EOTF (“Electro-Optical Transfer Function”) is rarely adjustable. See the gray-level tests, below.

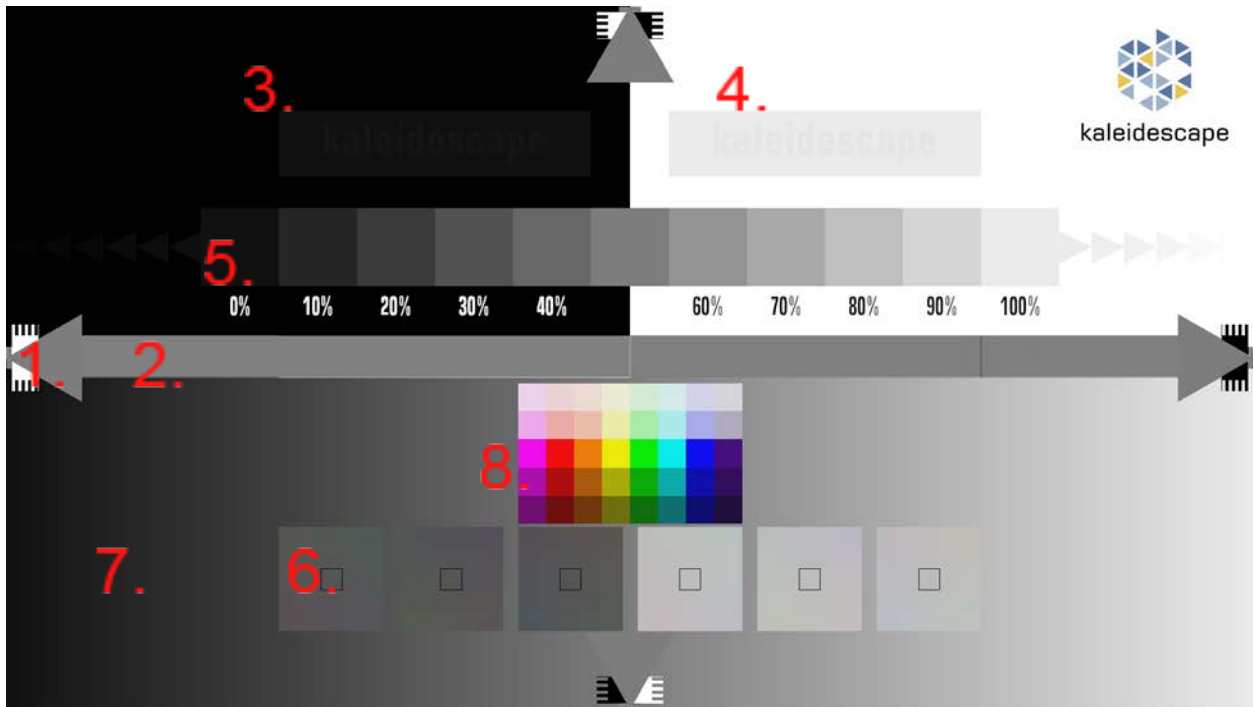


Figure 1. Kaleidescape PictureCheck (UHD). Colors may not appear exactly as shown.

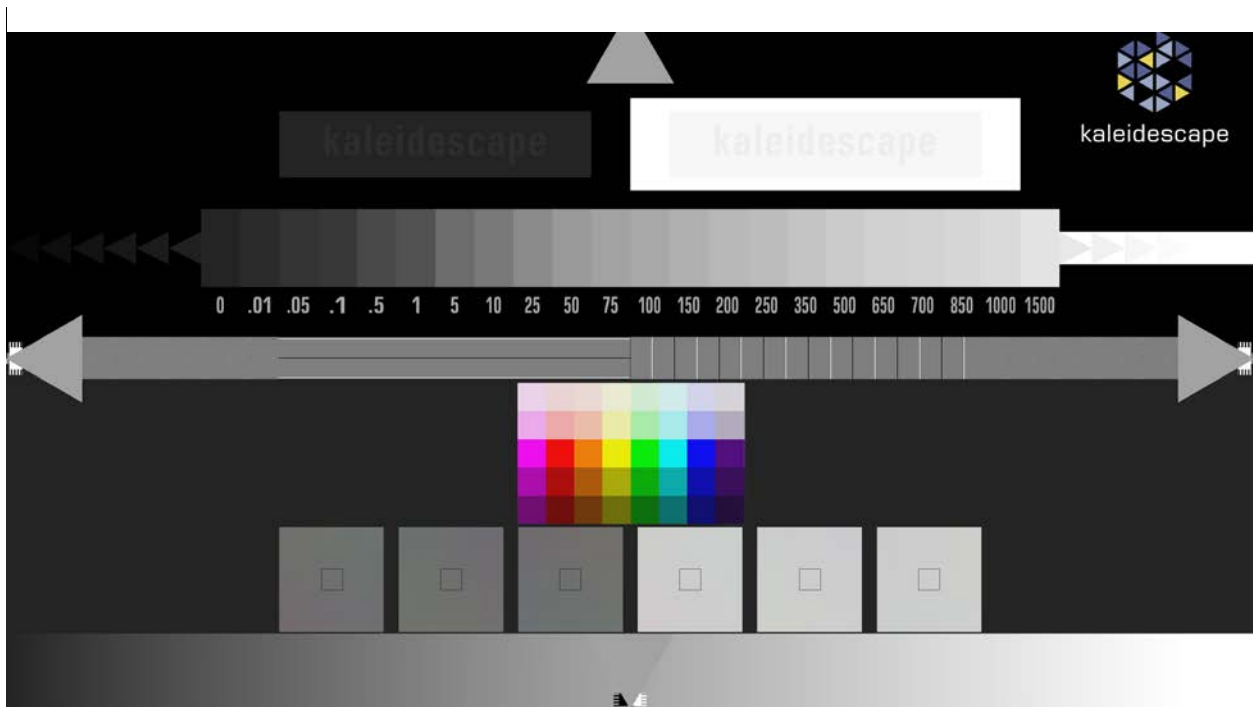


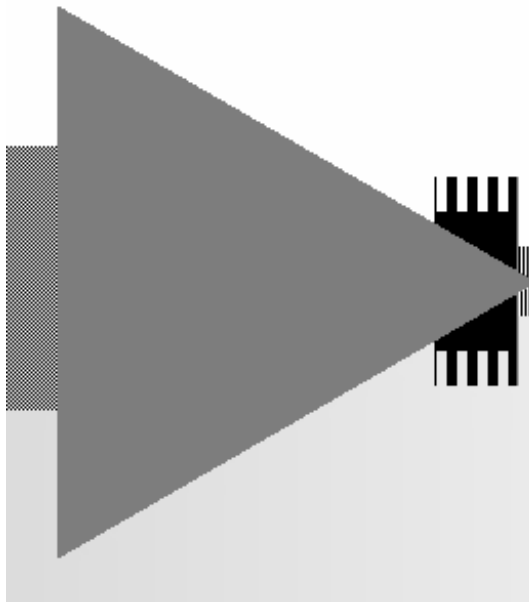
Figure 2. Kaleidescape PictureCheck (HDR). Colors may not appear exactly as shown.

Kaleidescape PictureCheck Tests

Select the Details page of the PictureCheck video and play the version that matches the native resolution and aspect ratio of your display or projector. Press pause on the first chapter of the video to keep the main test pattern displayed while following steps 1 to 8. While viewing the test pattern, adjust your display or projector's settings for the following:

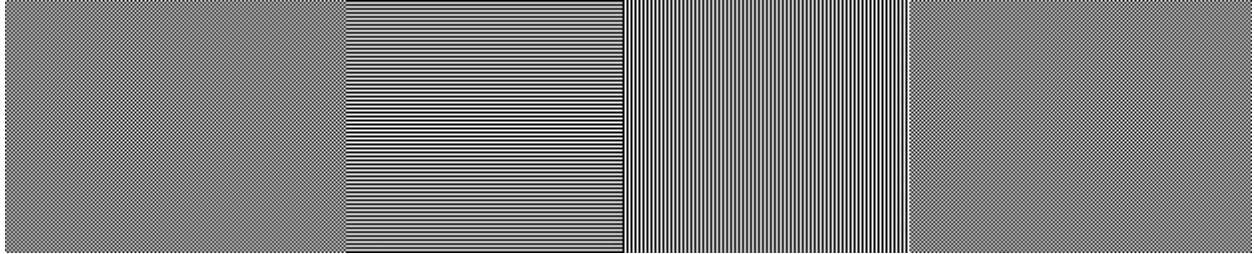
1. Overscan

- A. To avoid overscan—the display or projector zooming the image beyond the confines of the screen—check that the outer tips of the four large gray triangles are all visible. If not, look for Zoom or Overscan settings to adjust—see One-to-One Pixel Mapping, below.
- B. The comb-like patterns count pixels from the edge of the screen. Pixels 1-9 alternate black and white, and the remaining comb teeth are in groups of 5, with the innermost thin line at pixel 50. Ideally, there will be no cropping, and pixels will be visible on each side, including all 9 stripes in the alternating pattern.



2. One-to-One Pixel Mapping

- With one-to-one or dot-for-dot pixel mapping (sometimes also called “Just Scan” in a display’s aspect ratio settings), each pixel in the video corresponds to one pixel on the screen. In this mode there should be no scaling or blurring of the image. Confirm that the central horizontal band of the pattern contains fine checkerboard patterns at the ends near the triangles, and horizontal and vertical stripes in the middle.



3. BlackPoint

- At the top left of the screen, the word “Kaleidescape” is surrounded by a black rectangle (it may be invisible until display Brightness is increased). Adjust the Brightness until the rectangle disappears into the background, leaving the text just barely visible from a normal viewing distance. For some displays, particularly OLEDs, it may be preferable to crush the black levels slightly (making the text very hard to see, or invisible) to maintain high contrast. See Gray Levels below, as the triangle pattern may help with subtle adjustments.



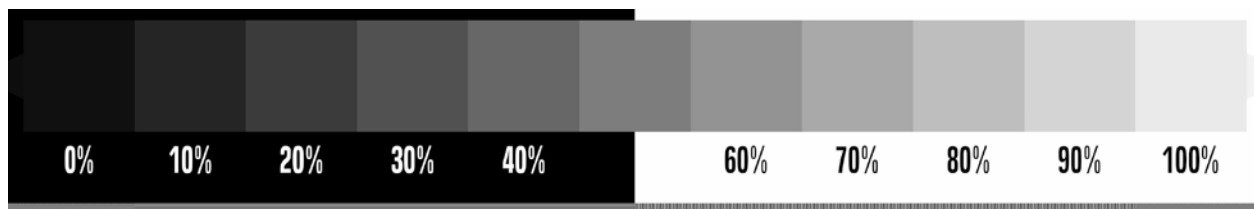
4. White Point

- At the top right of the screen, the word “Kaleidescape” is surrounded by a white rectangle, colored “video white” (it may be invisible until display Contrast is decreased). You have two choices:
 1. If calibrating to video white, common for SDR movies, adjust display Contrast until the rectangle disappears into the peak white background, leaving the “Kaleidescape” text just barely visible.
 2. If calibrating to peak white, common for HDR movies, reduce Contrast slightly from the setting above, so the “Kaleidescape” text and the rectangle surrounding it are very white, but distinguishable from the background. See Gray Levels, below.

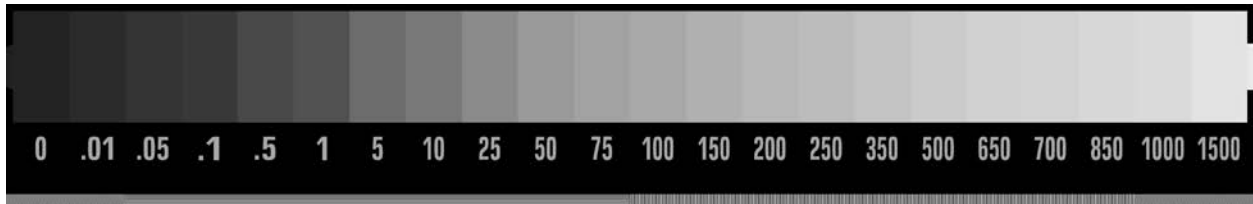


5. Gray Levels

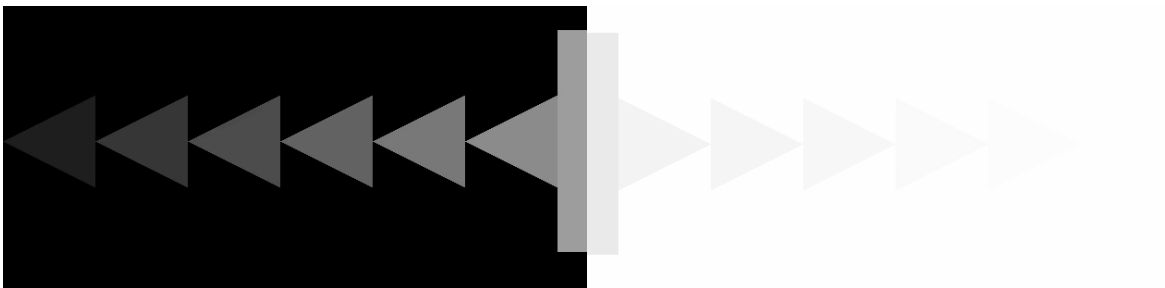
- The sequence of labeled gray squares show dark gray to light gray values. The “Gamma” setting of your display controls the contrast of these mid-tones. For SDR displays, adjust the gamma setting (often shown in the range 2.0 to 2.6, or as a BT.1886 slider) until the middle gray is a satisfactory intermediate value between black and white (similar to the central horizontal band). Darker environments may benefit from higher gamma.



- HDR displays use a different electro-optical transfer function (EOTF) known as PQ or ST 2084; percentage values are replaced by nit codes from 0 to 1500 that approximate brightness. If necessary, look for additional display adjustments, like a slider, related to the EOTF function. The gray squares should all be distinguishable, and gradually lighten to white.

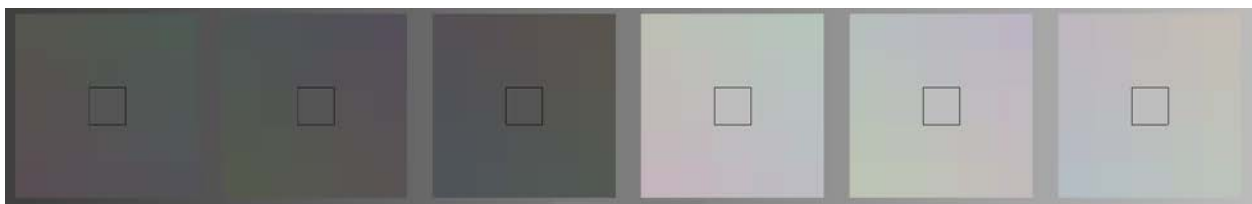


- Triangles to the left of the darkest square and to the right of the lightest square show values below video black and above video white. If you have set the Black Point correctly above, the black triangles will not be visible. If you are calibrating to video white, the white triangles will not be visible. If you are calibrating to peak white, the white triangles will be distinguishable from each other and the background.



6. White Balance

- There are three dark and three light checkerboard patterns near the bottom of the image. Each pattern is tinted toward the corners. If the center tile of each pattern does not appear neutral gray, you may need to adjust the display's color settings (Color, Tint, Color Temperature, or White Balance).



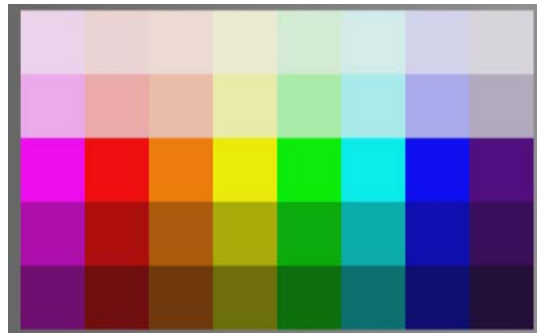
7. Bit Depth

- The background gradient in the lower half of the pattern should smoothly transition from black to white. If there is “banding” (obvious vertical stripes of uniform gray), it may indicate that the display or projector’s video mode does not support 10-bit depth for each RGB channel. Check HDMI Capabilities and Status in Strato’s Browser Interface video configuration to ensure that 30-bit color is supported.



8. Color Saturation

- For SDR, just below the horizontal band of the test pattern there is a grid of colors with a center row (Magenta, Red, Orange, Yellow, Green, Cyan, Blue, Purple) and two rows above and below it with darker and lighter variants. Ensure the display’s Color Space setting (BT.709, Auto, or Native) and Color and Tint settings (often sliders) are adjusted to make these colors match their names and appear colorful, without being overly vivid. For example, Blue and Purple should have similar brightness, and their lighter variants should still be blue and purple hues.



- For HDR, the grid contains three middle rows of primary and secondary colors from the BT.709 color space (row #2), the BT.2020 space using P3 primaries (row #3, a popular color space for Hollywood movies), and the BT.2020 space using BT.2020 primaries (row #4). Top and bottom rows #1 and #5 are lighter and darker variants of the neighboring colors. The display will likely not render the BT.2020 colors (row #4) accurately, making it look similar to the P3 row in the middle. As above, adjust the Color Space settings to make these colors match their names and appear colorful without being excessively vivid (although row #4 should be the most saturated). The middle row of P3 primaries is most representative of movie colors, so make sure it’s appropriately colorful. Some OLED displays may benefit from a slight Tint adjustment to keep HDR reds consistent.

9. Color Measurement

- The main test pattern is followed by a series of color “windows” for those users who have the means and expertise to measure with a colorimeter. Chapter-skip forward to view these color windows. For the calibrator, the usual workflow is to measure tristimulus values (CIE XYZ or xyY) for each window, and plot the results on a CIE chromaticity diagram. The luminance values (Y) of gray windows can be plotted to estimate gamma, while their chrominance values (xy) should lie near the center of the diagram (D65 white point). For an SDR display, primary color (RGB) chrominance values should lie near the vertices of the BT.709 triangle. For an HDR display, the BT.2020 primary chromaticities are extremely saturated colors that are difficult to reproduce exactly -- it is more common to use the P3 primaries (P3 is a standard color space for Hollywood digital cinema).

Each window pattern is a new chapter, and the video can be paused if more time is needed to set up the measurement equipment:

HD/UHD

- The Kaleidescape PictureCheck test pattern.
- BT.709 Red
- BT.709 Green
- BT.709 Blue
- BT.709 Cyan
- BT.709 Magenta
- BT.709 Yellow
- Gray steps (min, 0% through 100%, max)

HDR

- The Kaleidescape PictureCheck test pattern.
- BT.2020 P3 Red, 500 nt
- BT.2020 P3 Green, 500 nt
- BT.2020 P3 Blue, 500 nt
- BT.2020 P3 Cyan, 500 nt
- BT.2020 P3 Magenta, 500 nt
- BT.2020 P3 Yellow, 500 nt
- Gray steps (min, 0 nt through 10000 nt, max)

Movie Scenes

The goal of calibration is a high-quality cinematic experience, and so the final step is to verify that movie scenes look their best. Fortunately, this is very convenient on a Kaleidescape system.

HDR Movie	Scene	What to look for
Rocky Mountain Express	<i>Night Maintenance</i>	Black levels, contrast
Hotel Transylvania 2	<i>Hotel Improvements</i>	Wide range of colors
Black Panther	<i>The Ancestral Plain</i>	Distinct dark grays, blues, and purples
Blade Runner 2049	<i>The Memory Maker</i>	Black and white levels, gradients, skin tones
The Shallows (HDR)	<i>Swimming Through a Smack of Jellyfish</i>	Contrast, black and white levels, vibrant blues

SDR Movie	Scene	What to look for
Guardians of the Galaxy Vol. 2 (UHD)	<i>Escaping the Sovereign Fleet</i>	Wide range of colors and contrast
Moana	<i>Know Who You Are</i>	Wide range of colors
unReal	<i>Someday Believers</i>	Black and white levels (snow), vibrant colors, good shadow detail in night scenes
The Shallows (UHD)	<i>Swimming Through a Smack of Jellyfish</i>	Contrast, black and white levels, vibrant blues