Flanders
Scientific
Inc.

Reference Viewing Environment

20210827

Flanders Scientific, Inc.
6215 Shiloh Crossing
Suite G
Alpharetta, GA 30005
Phone: +1.678.835.4934
Fax: +1.678.804.1882
E-Mail: Support@FlandersScientific.com
www.FlandersScientific.com

This document provides recommendations on setting up a reference viewing environment for editing and color grading. It combines information gathered from various industry standards as well as practical experience gained from helping our clients setup reference viewing environments over the years. Because some of what is suggested below is based on our specific experiences and opinions we encourage you to also review the relevant industry standards directly including, but not necessarily limited to, SMPTE ST2080-3 and ITU BT2100.

A controlled viewing environment is essential for proper reference display monitoring because the viewing environment impacts our perception of what is being displayed. Establishing agreed-upon viewing environment benchmarks helps us recreate the same general viewing environment anywhere, which when combined with agreed-upon reference monitor standards enables a repeatable viewing experience across the industry.

Monitor Positioning

For HD resolution displays the primary reference display should be positioned at a distance of approximately 3 to 3.2 (ST2080-3) times the picture height of the monitor from the viewer. Make sure you are using picture height, not display diagonal, when calculating the appropriate viewing distance.

Examples:
For a 17” HD display ~26” viewing distance
For a 24” HD display ~36” viewing distance

For UHD resolution displays the standards guidance suggests that the reference display should be positioned at a distance of 1.6 to 3.2 times (BT2100) the picture height. For pixel-peeping applications like rotoscope work a user may want to sit near the closer end of this range whereas for general editorial and color correction work a distance more in the middle of this range is usually preferred. We find that a value of 2.5 times picture height works very well for most users.

Examples:
For a 22” UHD display ~27” viewing distance
For a 31” UHD display ~38” viewing distance
For a 55” UHD display ~67” viewing distance

The reference monitor should be placed no more than 30° off center from the operator horizontally and 15° vertically (ST2080-3). Placing the reference monitor centered to the operator is a popular configuration that we recommend, especially for color grading.

A minimum monitor to wall distance of approximately 3” is suggested (ST2080-3), but the monitor may be placed much further from the wall as well. If the wall behind the monitor is further than 2.5 times the picture height of the display we would suggest placing a separate visual surround within this distance.

Monitor Surround Size, Color, and Illumination

Monitor surround is the area the observer can see behind the reference display. We are typically most concerned with the surround area occupying 90° of the horizontal field of view and 60° of the vertical field of view for the primary operator, though extending the surround area configuration well beyond these minimum thresholds (ST2080-3) is both common and good practice.

The surround area should be a neutral (achromatic) gray to avoid the impact of simultaneous color contrast, a phenomenon that can change the perception of colors on your reference display when viewed against chromatic backgrounds.

The surround area should also be illuminated, typically by using a bias light, to produce approximately a 5cd/m^2 reference surround luminance (ST2080-3, BT2100). Proper surround luminance helps to alleviate eye strain, ensures proper eye adaptation state for color critical decision making, and improves perceived display contrast.

The combined quality of the surround area and bias light are critically important for best results. The nature of the reflected light should match the white point chromaticity standard in use. This is typically assumed to be D65. A high CRI bias light that mimics daylight / D65 response is ideal. Poor quality bias lights can introduce a color cast that can engender simultaneous color contrast problems that change the appearance of colors on the reference monitor. FSI recommends and sells MediaLight bias lights, which can be adhered directly to the back of the reference monitor and have been designed specifically with the professional user in mind: https://www.shopfsi.com/category-s/113.htm

When possible, a painted surround area using spectrally flat Munsell N5 matched matte paint is ideal. We suggest N5 as it is approximately equivalent to mid gray (18% reflectance). Using lighter shades of gray is permissible if necessary, but it is important to ensure your paint is spectrally flat, which means that it reflects the light shined on it without inducing any color cast. Many off-the-shelf gray paints are not neutral and will induce an unwanted color shift. Some formulas for affordable neutral gray paints can be found online, but for professional installs we do recommend something like GTI’s Neutral Gray N5 Paint for the best possible results: https://www.shopfsi.com/GTI-N5-Paint-Gallon-p/gti.n5.g.htm

Other Room Considerations

Information displays, like GUI or scope monitors, should be properly calibrated if possible with a peak luminance capped at no more than 100cd/m^2 (ST2080-3). It is common for computer displays to be set much brighter than 100cd/m^2 by default and this can have the unintended consequence of making “white” look “gray” on the reference monitor so regulating this peak luminance through calibration or even the application of an external ND filter is strongly encouraged.

It is a best practice to ensure that all other room lighting, especially those lights that might be on during color critical evaluation, match the surround bias lighting closely. Though not as critical as the monitor surround area, using console, accent, and desk lights that match your bias lights will help avoid potential negative perceptual influence of these light sources. Appropriate reading, capped at 100lx (SMPTE 2080-3), and console, capped at 40lx (SMPTE 2080-3), lights are suggested. FSI recommends and sells MediaLight desk lamps, console lights, and bulbs for best results: https://www.shopfsi.com/category-s/113.htm

All other surfaces in the room should be matte when possible to minimize reflection. Highly chromatic surfaces (e.g. red walls) are discouraged and if present one should ensure that these surfaces are not in the primary field of view and are not reflected on the reference display.

Note: The reference viewing environment is currently defined the same way for both SDR and HDR use cases so no modifications to surround luminance are required. However, users should keep in mind that the higher luminance output capabilities of HDR monitors can contribute to higher ambient light levels in the reference viewing environment so extra care should be taken to manage potential surface reflections.

Note: Some monitors may employ a modified color matching function or perceptual match white point that is not standard 0.3127, 0.3290 chromaticity. SMPTE 2080-3 recommends matching the chromaticity of the bias light to the white point chromaticity of the reference display. In our recommendations we specifically modify this advice to state: “the reflected light should match the white point chromaticity standard in use.” Alternate CMFs / perceptual white point adjustments on displays are typically employed to alleviate metamerism concerns resulting from the specific spectral power distribution (SPD) of the reference display to make it look more like the intended reference standard (e.g. D65).The bias light is unlikely to have the same SPD as the reference monitor so it would be inappropriate for the bias light to try and match the display’s modified chromaticity setting. The bias light should therefore target the standard chromaticity target instead.