



4 Fine-Tuning Monitors

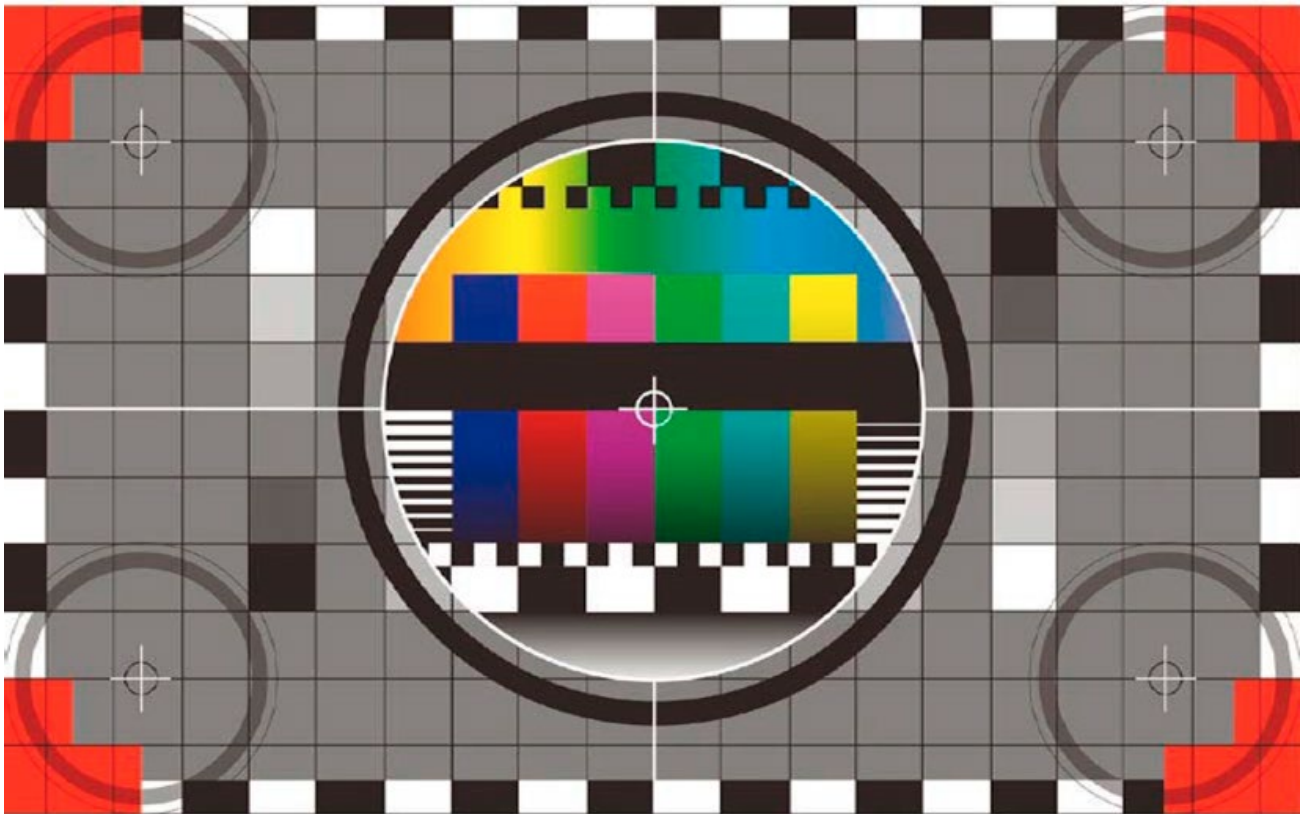
Display calibration for experts

- ✓ Developing expert calibration settings
- ✓ What advanced analysis involves
- ✓ How to calibrate two monitors
- ✓ Techniques for calibrating a complete studio and projector

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Calibration Specs



Things to consider

Simply stated: A monitor is not calibrated in isolation, instead, the calibration is always aimed at a target. This calibration target depends on the workflow and needs of the image processor. It is defined in the calibration specs.

It is relatively easy for people who use their monitor exclusively as a photographer to correct images, which are then printed directly to an ink jet printer or a photo lab. The color space of the workflow defines the calibration target. The default settings are for the standard photographic workflow. It targets a gamma (gray density) of 2.2 and a white point (color tint) of 6,500 Kelvin. The same standards work for those who publish their images on the Internet.

When multiple monitor profiles are required

It is more complex if one prepares photos for self-printing or lab-printing as well as offset printing such as magazines, books or newspapers. In this case, you should work with two monitor profiles, which target different white points. This allows you to integrate applications that lack color management. A photo-oriented monitor profile is then used for the photographic workflow and a press-emulation profile is used to evaluate the images for offset printing.

These two monitor profiles are necessary due to the differing industry standards. It is not enough that the colors are displayed correctly just for your system. They must also be displayed for the service providers who come later in the process. These workflows use differing color spaces with different gamma and whitepoint values.

Anyone who wants to prepare their images for video may need a further monitor profile. This will be oriented toward a video color standard, such as Rec 709 or Rec 2020. There are also special applications in other fields, which in turn require calibration to other industry standards.

The following example shows how you can define calibration requirements.

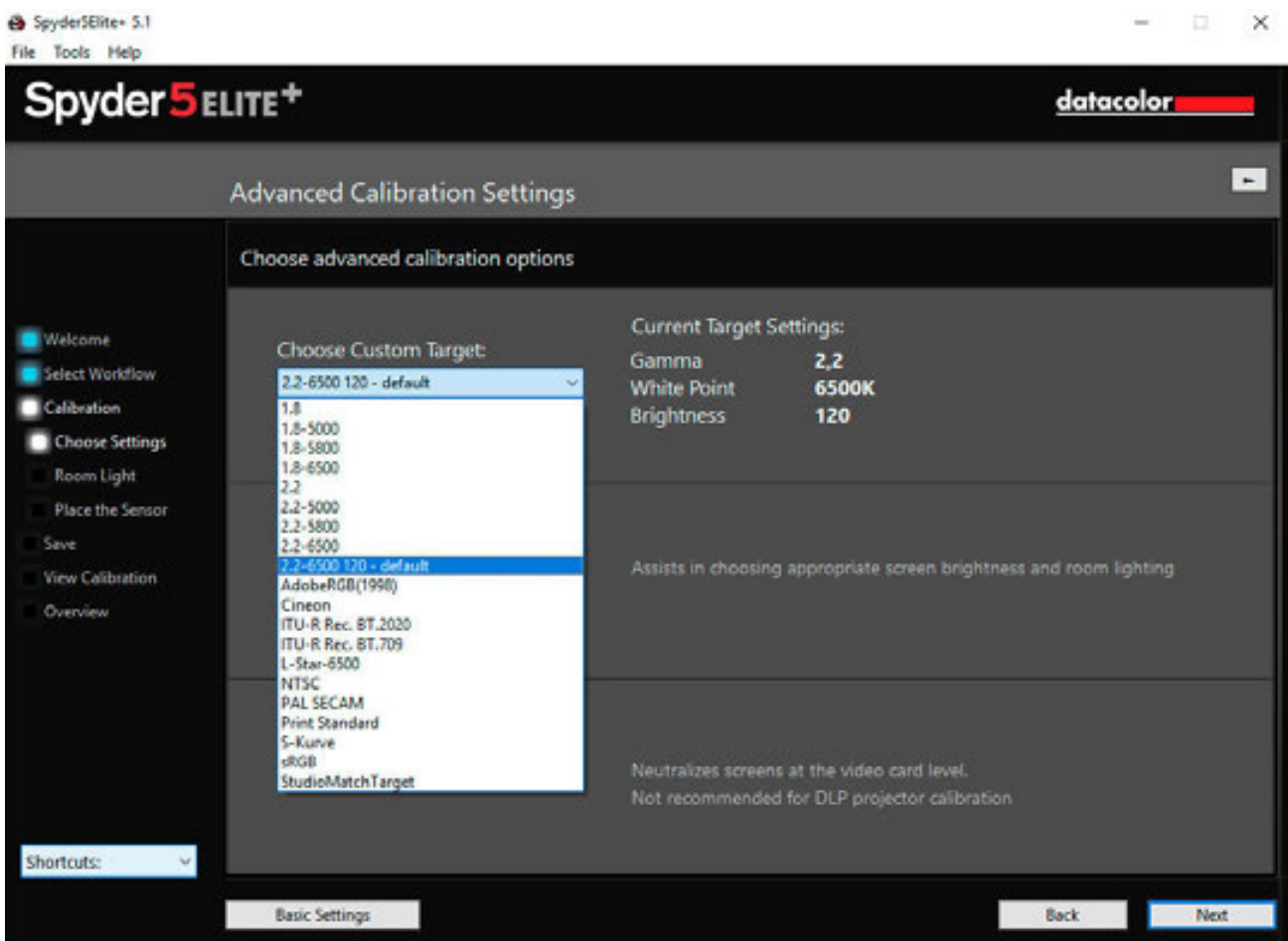
TIP

For more information on “Advanced Settings” with Spyder5, read the previous article “Calibrating Monitors”, which explains the basic handling of the software.



Target Values Specs

What you can set here



In this dialog you see the list of available standards. You can use this to define the combination of the color temperature - the setting of how warm or how cool colors display - and the gamma - the density of colors. Photographers use a combination of 6,500 Kelvin (K) color temperature for sRGB and Adobe RGB - roughly equivalent to daylight at noon - and a gamma of 2.2. Those who work in the prepress process use the D50 standard and select a slightly yellowish 5,000 K temperature, and a gamma of 1.8. Clicking on "Advanced" allows for further adjustments.

Pro Specs: Gamma

What you should know about gamma



INFO

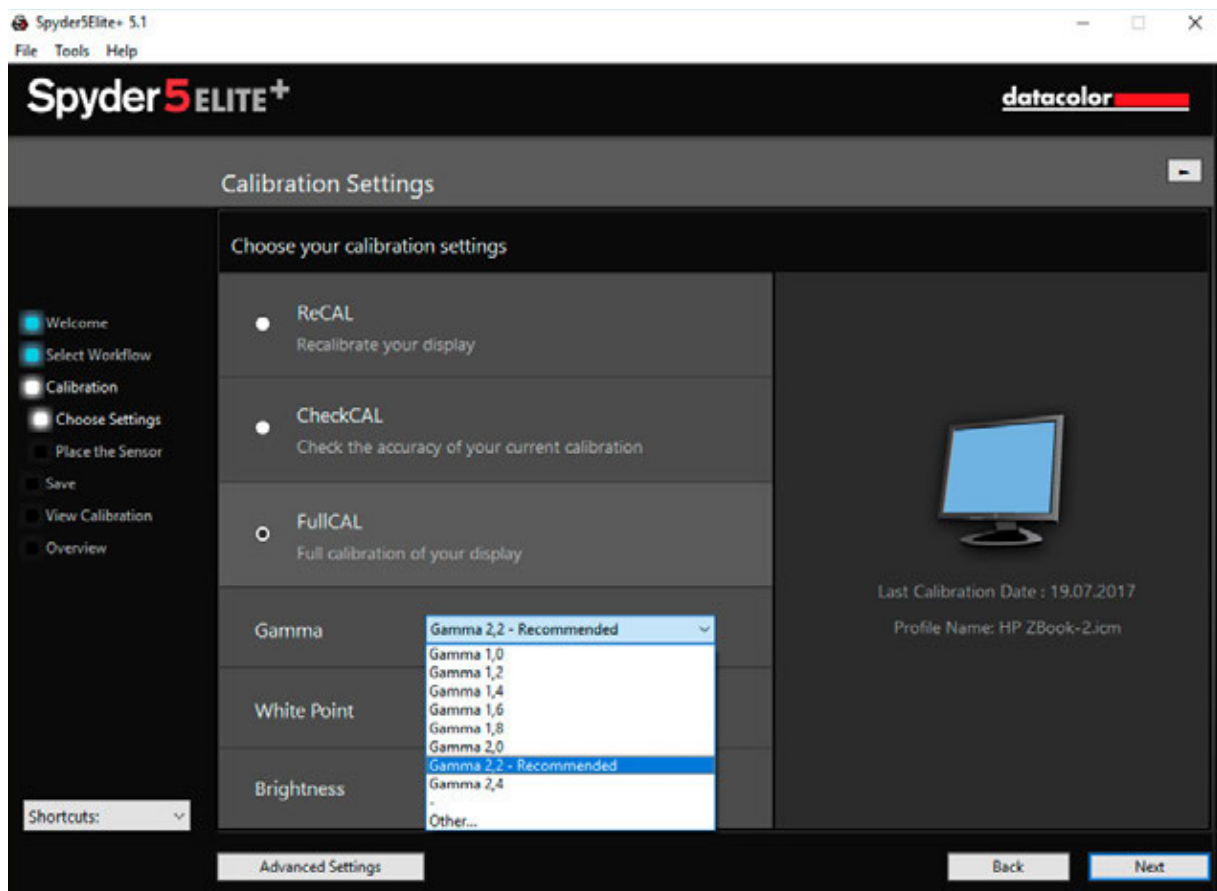
The gamma curve describes the density of the mid tones in the image. Black remains black, white remains white, and the range in between runs either linearly with Gamma 1.0, which is the very low contrast, linear, density ramp that measurement devices create or in a curve. The deeper the curve, the higher the gamma value and the higher the contrast.





For illustration, we have set three different gamma values using the monitor's OSD controls. The contrast increase is clearly seen with the higher gamma values.

In most cases, the gamma is set to 2.2. This is also the default value of Windows and macOS, and a fairly good representation of the response of the human eye. In the pre-press process, however, to get more details into the shadows, one returns to a gamma of 1.8, which allows for more “dot gain” or ink spread on press. Higher gamma values primarily result in more saturated colors. This is more difficult to implement with four colors in offset printing than with the high saturation colors of an ink jet printer or photo lab.

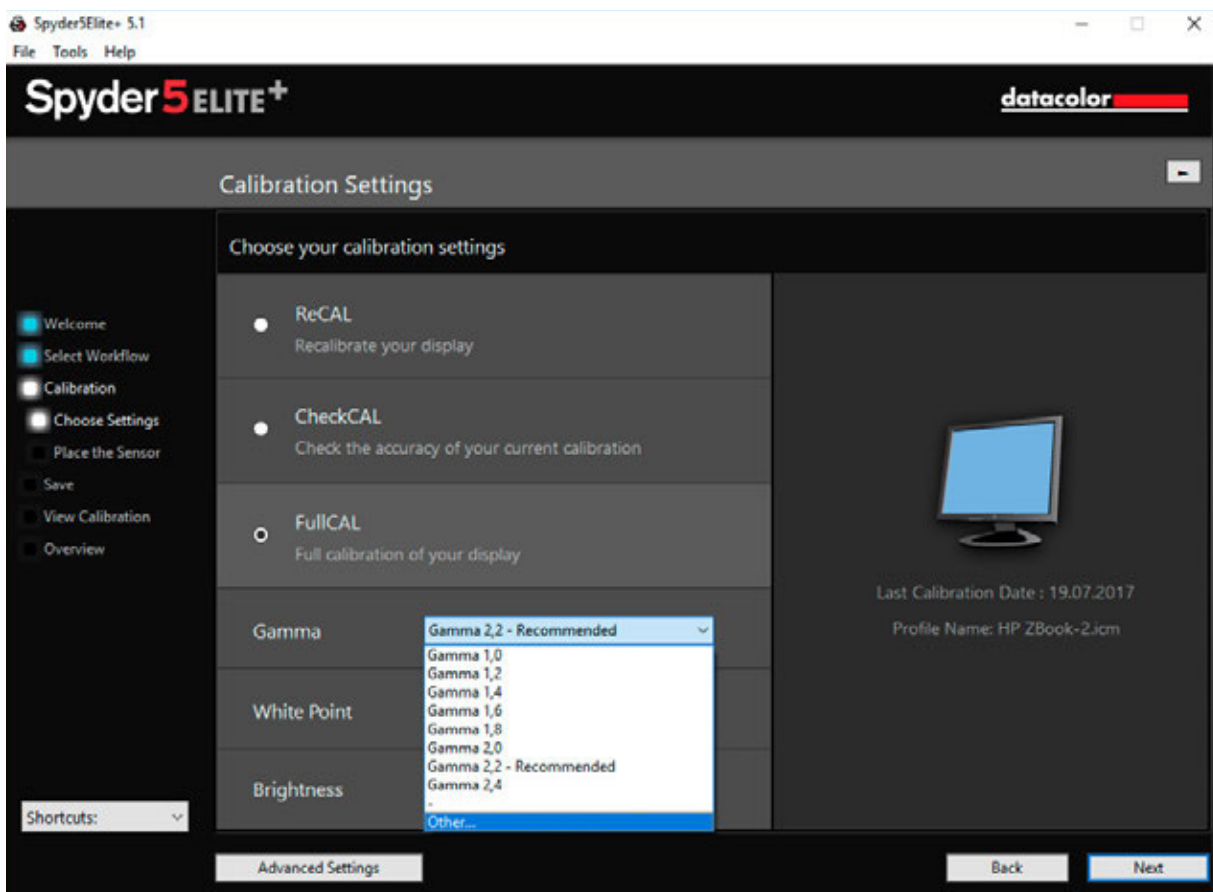


Different gamma values can be selected via the pull-down menu.

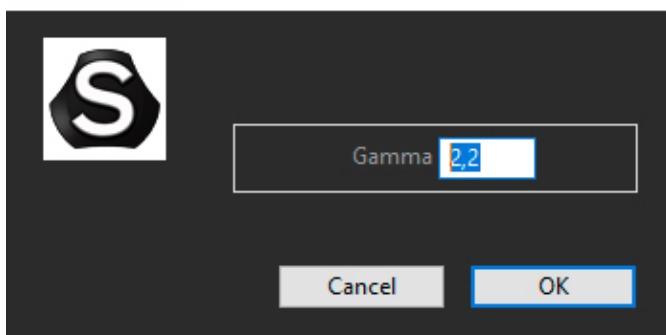
Pro Specs: User Gamma Values

How to enter your own gamma values

In addition, it is possible to specify a gamma beyond the range 1.0 to 2.4 or with higher precision. To do this, click on the “Advanced” button on the Spyder5ELITE and define the gamma value by means of a keyboard input. The value range for the selection ranges between 0.5 and 3.0. In addition, the inputs can be specified with up to two digits behind the decimal point, for example “2.65” .



Custom Gamma

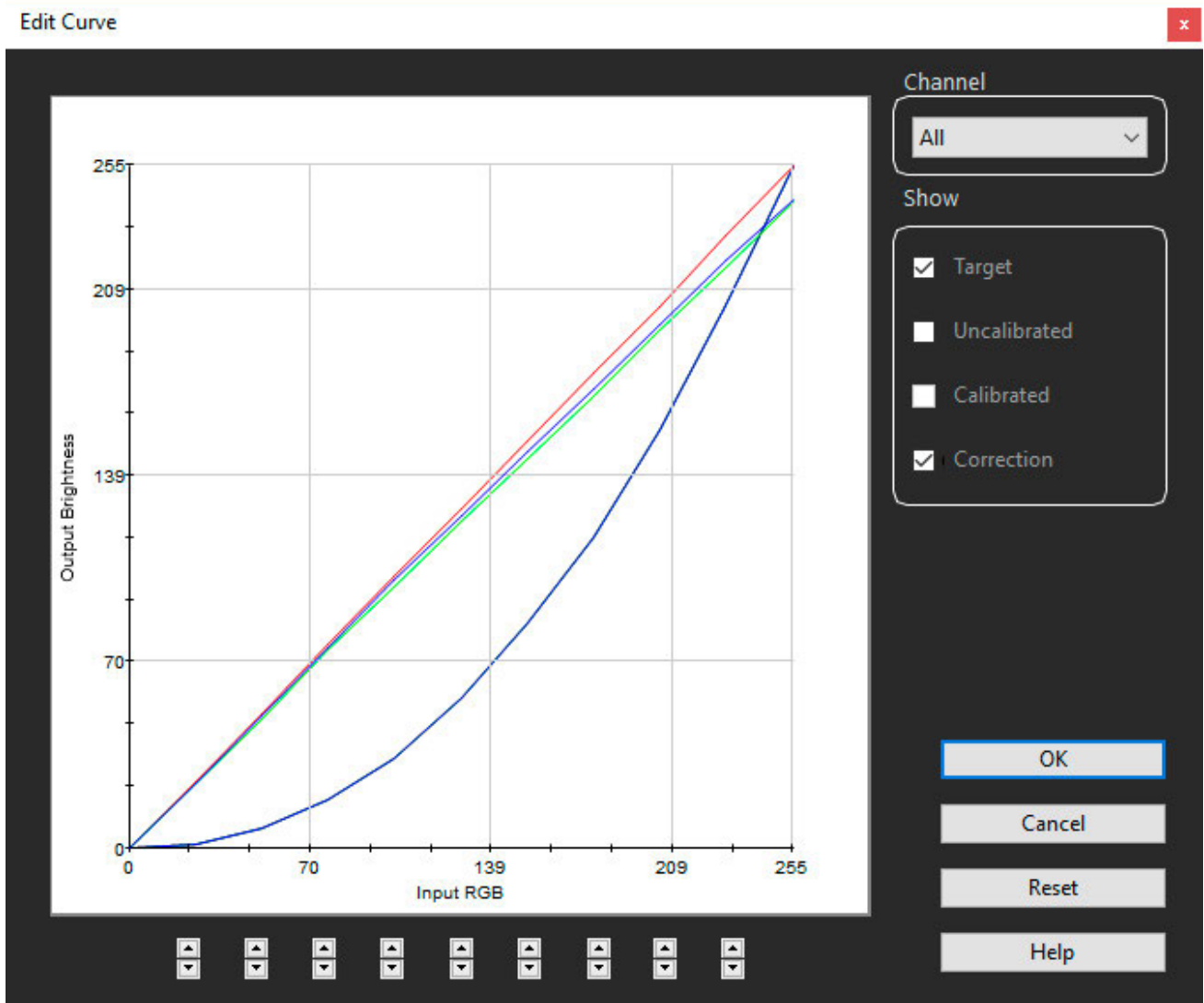


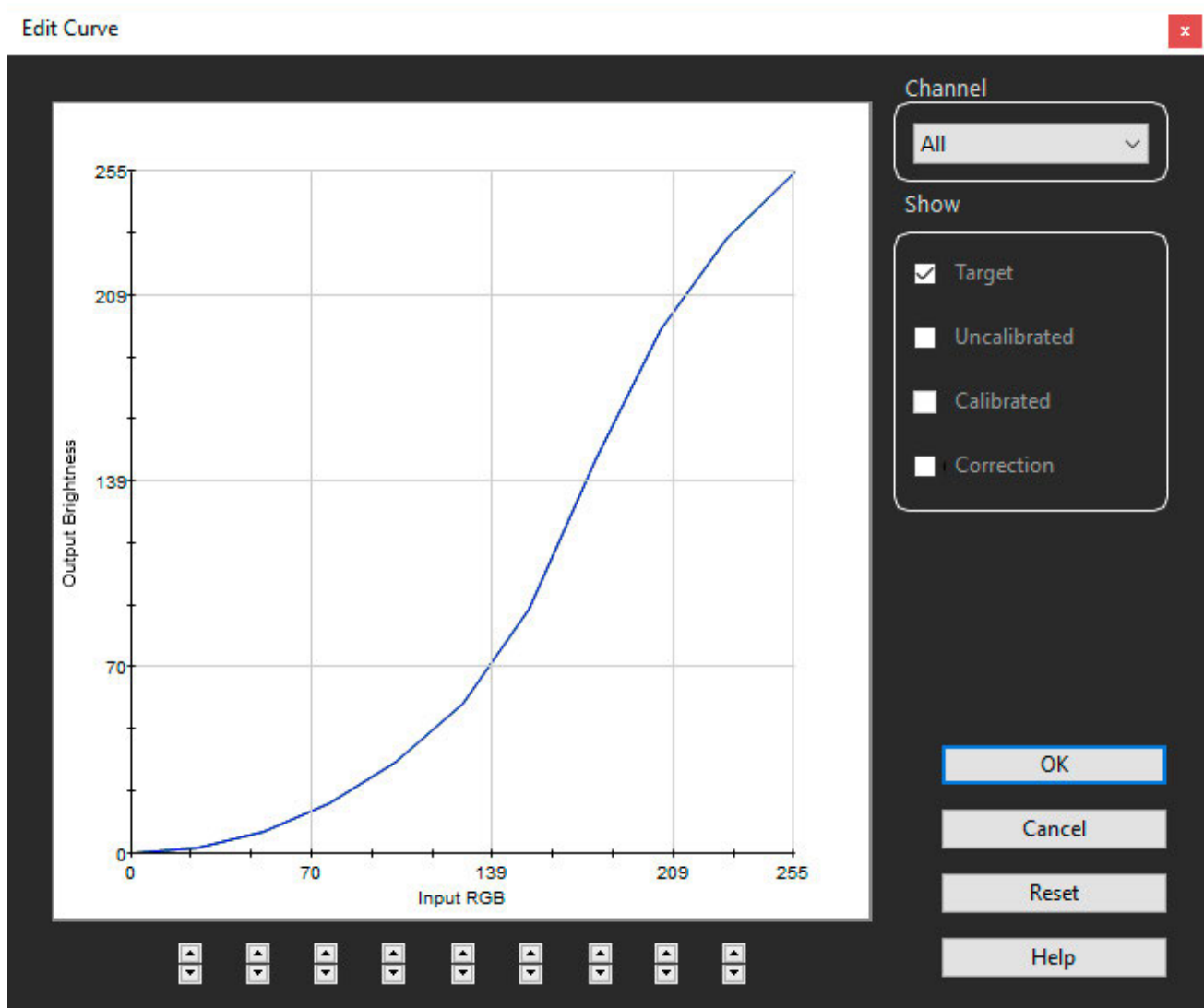


EXPERT INSIGHT

Create a non-gamma curve

The Spyder5ELITE software also allows you to create your own non-gamma curves. This is a special feature and is of interest to experts. To generate your own non-gamma curve go to the application menu bar and select Tools/Edit Curves. Here you can create custom curves for the individual color channels. These can be saved and selected using the gamma drop-down menu.



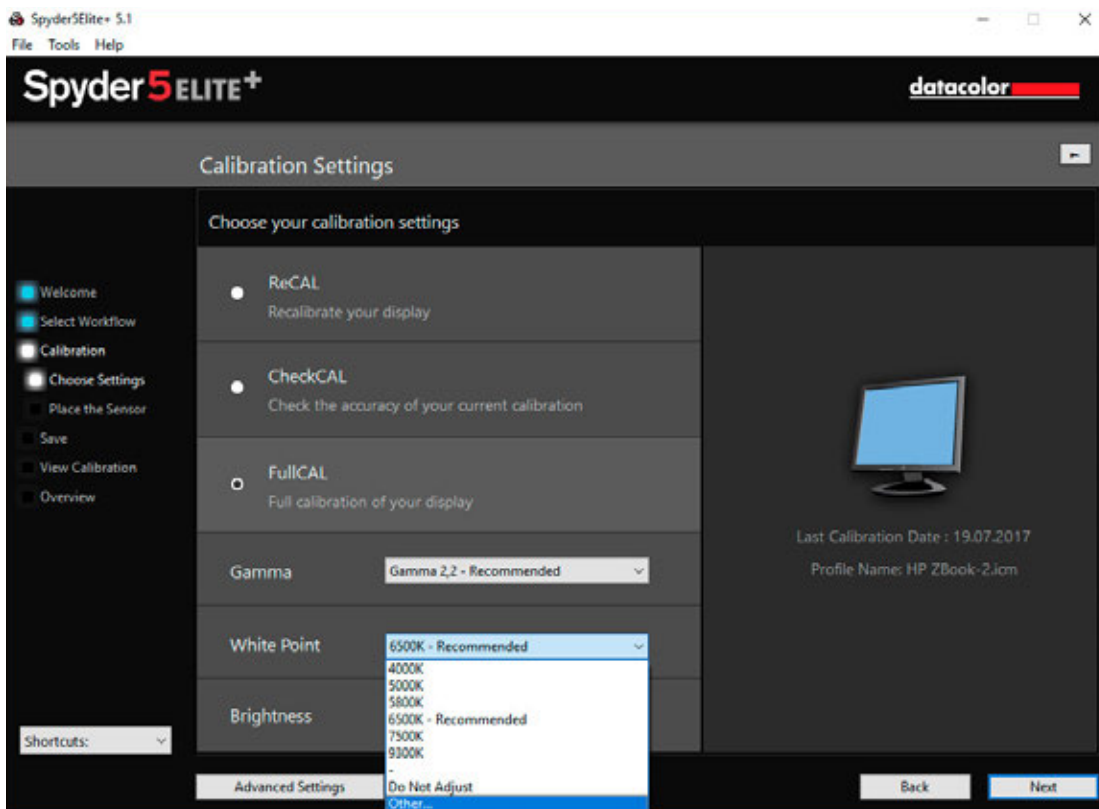


When you use this function, the gamma curve currently selected in the calibration settings will be displayed for you, as a starting point, to create your own non-gamma curve. The non-gamma L-Star curve can be loaded by selecting the L-Star-6500 target from the Expert Console.

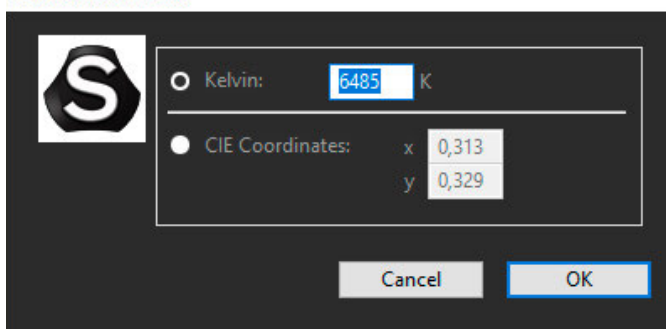
Pro Specs: White Point

What should be considered when making a WP selection

For setting the display white point, Spyder5ELITE contains a list with the most common values between 4,000 and 9,300 K. In addition, you can access the white point presets of your monitor manufacturer via "Do not adjust", and then setting in the OSD before the calibration process. If you select "Other", a dialog will appear in which you enter either a numerical Kelvin value or a CIE-xy value via the keyboard. The option is usually 6,500 K for a photographic workflow or 5,000 K for a prepress workflow.



Custom White Point



The white point setting simply defines the desired color tint of the monitor.

Table of calibration values (example table Oli)

	Gamma	White Point
AdobeRGB(1998)	2.2	6500K
sRGB	Non-gamma (approx 2.2)	6500K
ECI RGB	1.8	5000K
Apple RGB	1.8	6500K
Wide Gamut RGB	2.2	5000K
eciRGBv2	Non-gamma (L-Star)	5000K

As an example, here are the gammas and white points for the most common color spaces.



INTERESTING ONLINE FINDS

If you want to learn more about individual color spaces, you should take a look at SLR Lounge. All of the color schemes and their uses are described there.

[Read Article >](#)

Pro Specs: Luminance

What options you have here



INFO

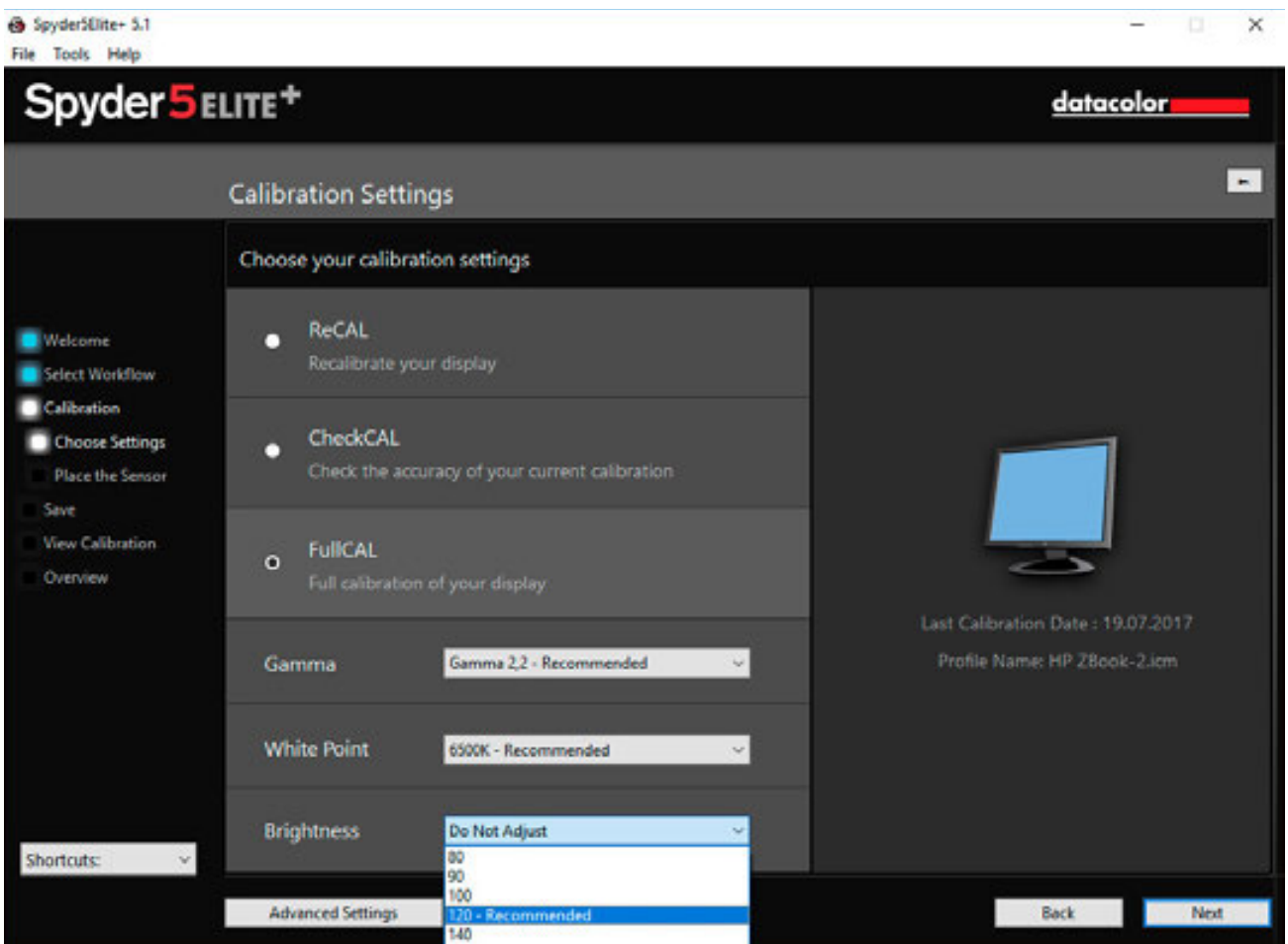
Luminance is the brightness of the light source behind the panel. To visualize this, please refer to the diagram of a structure of an LED display in Chapter 3.

For best results use LCD monitors in dim and rooms with stable lighting. This is how you create optimal conditions for reduced glare, improved contrast and correct color perception. As a rule, LCD monitors should be calibrated to a luminance of 120 cd/m². For setting the desired brightness, Spyder5ELITE provides commonly used values between 80 and 180 cd/m². Use the “Do not adjust” option to keep the luminance provided by the selected target and not change it to reflect current room lighting.

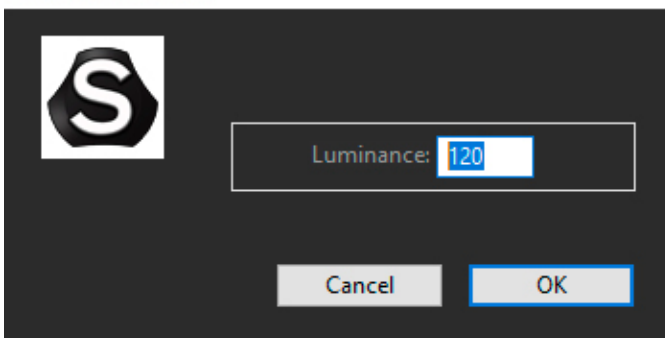


TIP

To ensure reliable color perception avoid having colored surfaces around the monitor. The desk surface, the wall behind the monitor, and the objects in the immediate vicinity of the screen should ideally be neutral; white, gray or black. This also applies to clothes. A brightly colored shirt in front of the screen effects color perception, by reflecting color on the surfaces around the display.



Custom Luminance

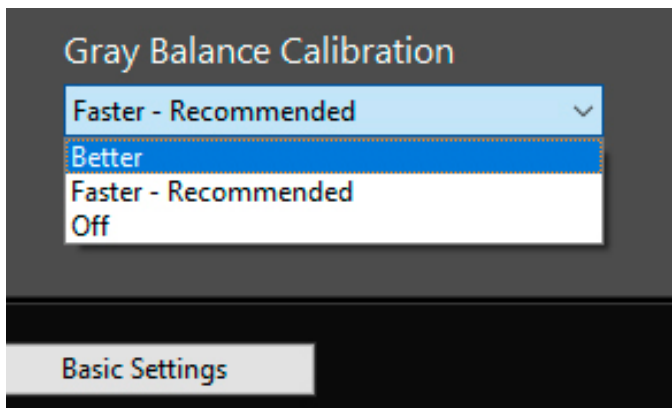


Brightness adjustment plays a key role outside of display color calibration. It's most important value is in avoiding unintentionally dark prints.

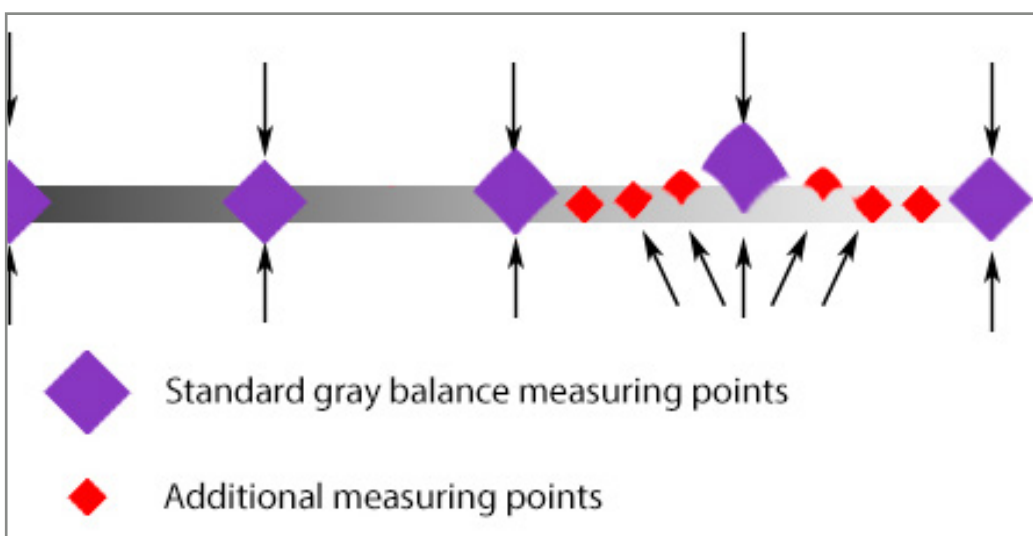
Pro Specs: Gray Balance Calibration

What should be taken into account

With Spyder5ELITE's "Gray Balance Calibration", LCD displays can produce especially neutral grays. The setting is enabled by default for all devices. Shutting it off should only occur in special cases. Take a look at the "Better" option: This optimized measurement can lead to measurements lasting several minutes, particularly for low-quality monitors. As a result, however, very accurate profiles are produced. LCD Projectors function best with the gray balance function switched on; but DLP projectors require turning this feature off.



Iterative Gray Balance is accessed in the Gray Balance Calibration Menu, via the "Better" option.



Additional measuring points due to Iterative Gray Balance to adjust standard measuring point.



EXPERT INSIGHT

Iterative Gray Balance – A facelift for older and cheaper monitors

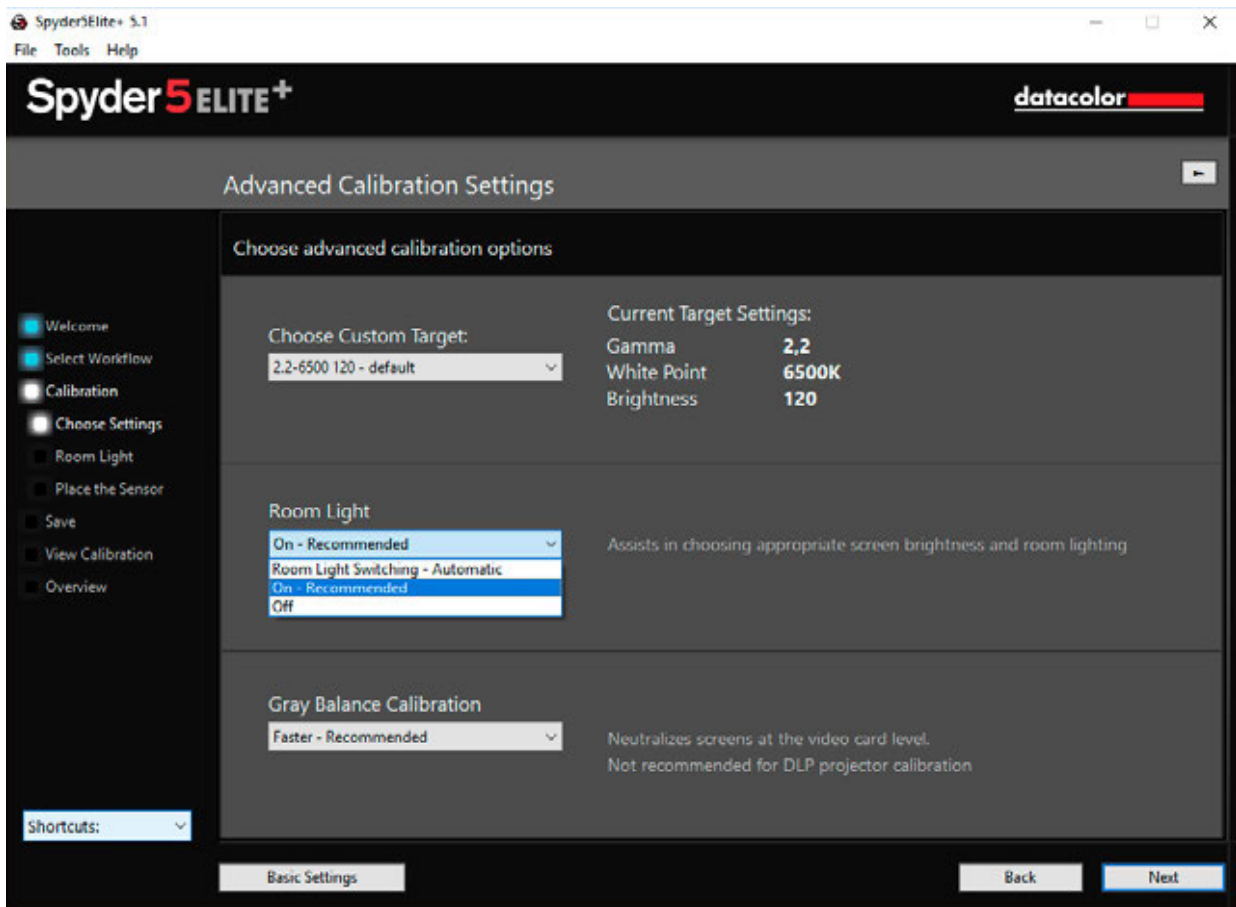
“Iterative Gray Balance” is very inconspicuous in the Spyder5ELITE software, hidden in the pull down menu for gray balance calibration under the term “Better”. This is a very powerful and innovative technology from which older monitors or lower-priced monitors especially can benefit. The idea behind it is to make iterative corrections per color channel at points where the color reproduction of the monitor deviates more strongly from the ideal curve. This gives a higher degree of precision in the three color channels. This results in more accurate correction curves and more neutral grays.

Pro Specs: Room Light Compensation

When this option is relevant

Room light compensation balances the brightness of the monitor and the room. Time of day, weather conditions, and room lights all influence the ambient light. Such fluctuations have an effect on the sensitivity of the eye to color and brightness. As a result, the colors, and above all the brightness, of the same image are perceived differently. The room light sensor measures the brightness of the light in order to set the optimum brightness of the monitor in a given room. The Spyder5 provides this option in the PRO and ELITE versions.

What happens when you enable this feature? The program measures the light that is present in the room and suggests corrections of the target values for the calibration. You should therefore create profiles for multiple light situations at daylight workstations, where the brightness set for the monitor must be adjusted manually.

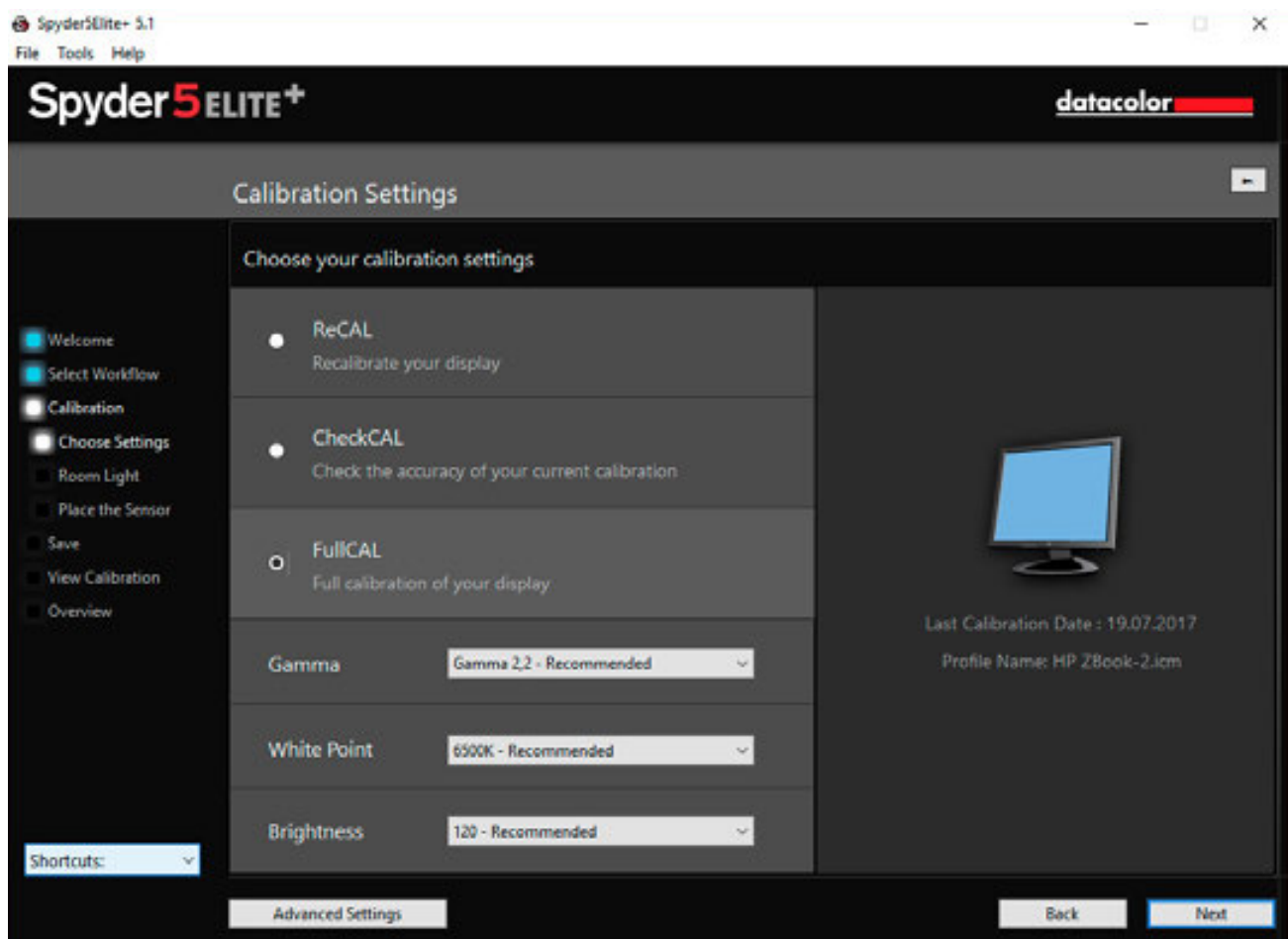


When selecting Desktop Display mode, the ambient light option is recommended.

New Calibration Functions

How quickly recalibration occurs

Once the monitor has been calibrated, the Spyder5PRO and ELITE actions can be reduced to a minimum with functions such as ReCAL and CheckCAL. You can check your display calibration in about one minute, remeasuring gamma, white point, black value and white value. These measurements are compared to the previous values. This determines if a full recalibration is required.

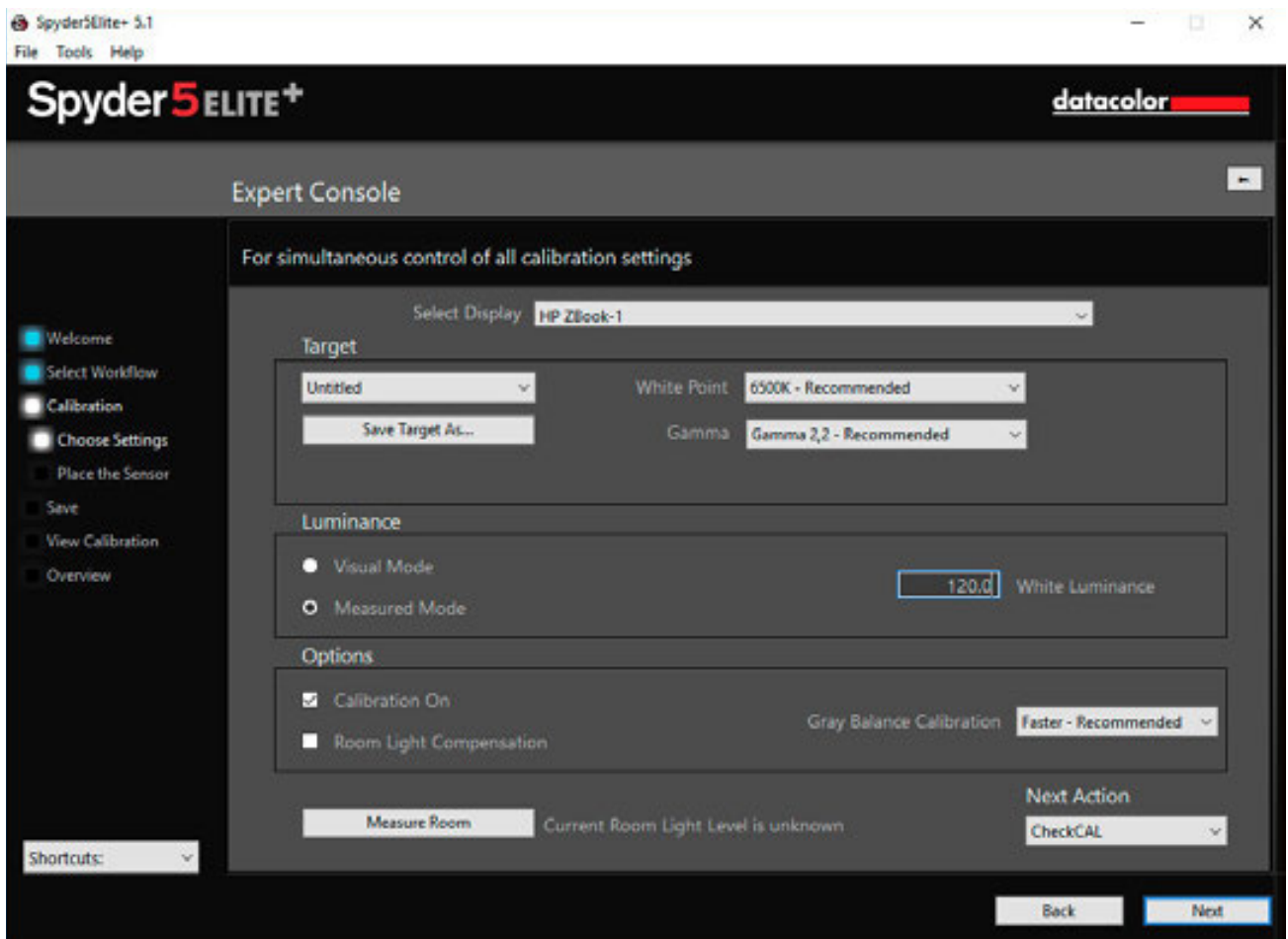


The choice of calibration function is simple and clear

Expert Console

For when you don't want a wizard

If you know exactly what you want and do not need a wizard workflow, the “Expert Console” is your home screen for Spyder5ELITE. It controls many different settings from a single window. The console reflects earlier software design, when calibration was performed only by technicians, for advanced users.

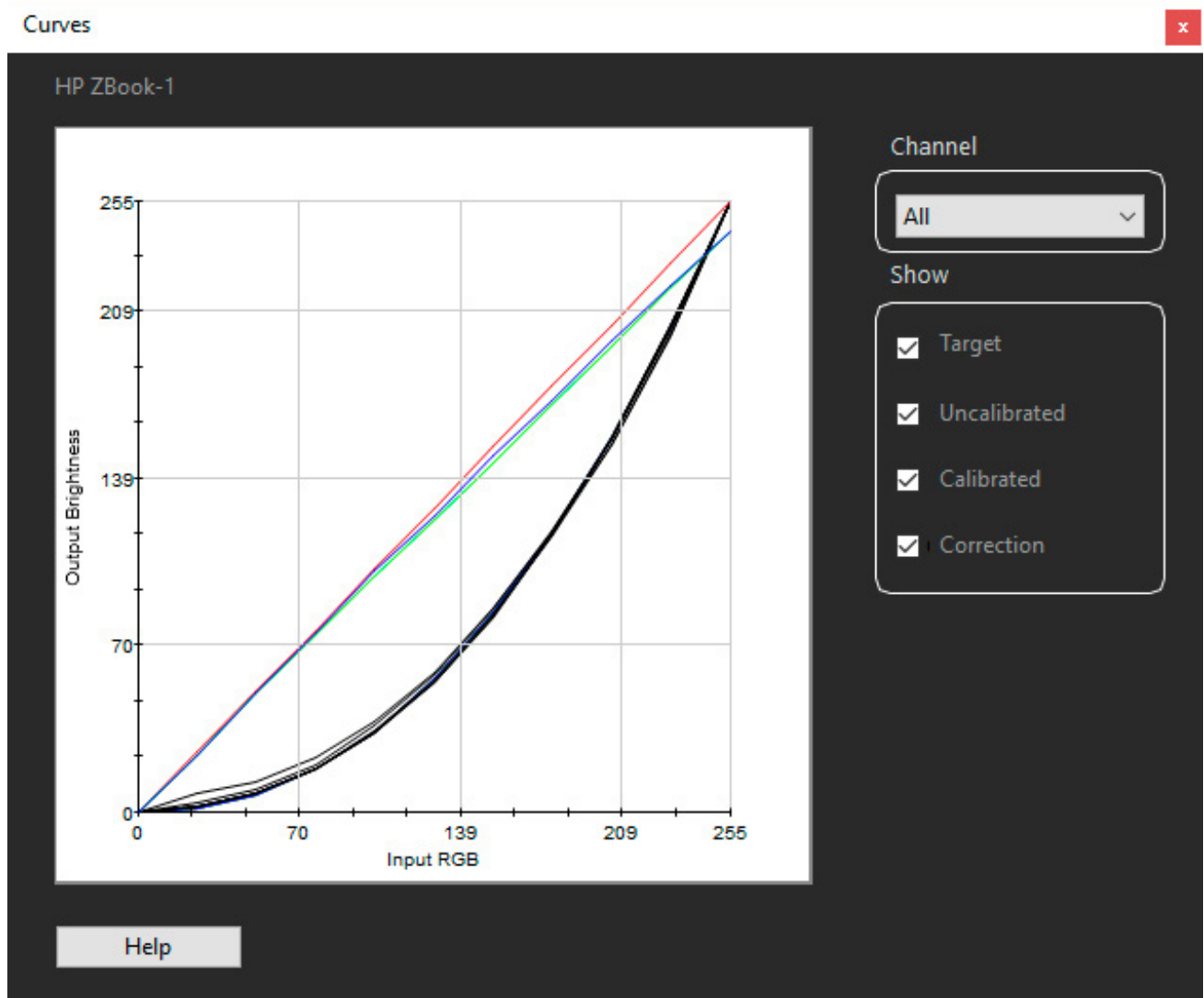


All possible settings at a glance

Curves

What you can see here

The curve dialog allows you to compare output, ideal, and target curve representations of all or individual channels. This provides a technical view of the adjustments made during calibration and profile creation. It is possible to see how far the output curves deviate from the ideal gamma spec, and to what extent the calibration corrects them.



Clicking on "Correction" shows which channels had to be trimmed to reach the target white point.

Information

What useful info you can find in this window

In the “Information” floating window you will find measurements and computations from your display . This includes data about black and the white point – before and after calibration, plus the targeted values. This provides key information about the aging of a display. If the candela value of an LCD used for color-critical work drops much below 100c/m², start planning to replace it soon.

Information x

EIZO CS2420 v

Brightness (Candelas):		
	Black	White
Uncalibrated	0,20	122,7
Target	0,26	119,0
Calibrated	0,20	120,4

White Point (CIE xy):		
	x	y
Uncalibrated	0,313	0,329
Target	0,313	0,329
Calibrated	0,313	0,329

Primaries (CIE xy):		
	x	y
Red	0,682	0,307
Green	0,182	0,732
Blue	0,147	0,046

DeltaE (Lab):	
White Point	0,5
50% Gray	0,1


Gamma:	
Uncalibrated	2,19 (0,00)
Target	2,20 (0,00)
Calibrated	2,18 (0,00)

[Help](#)

It also displays the Delta E deviation for white and 50% gray. With a good calibration this deviation should not be higher than 3.0.

TIP

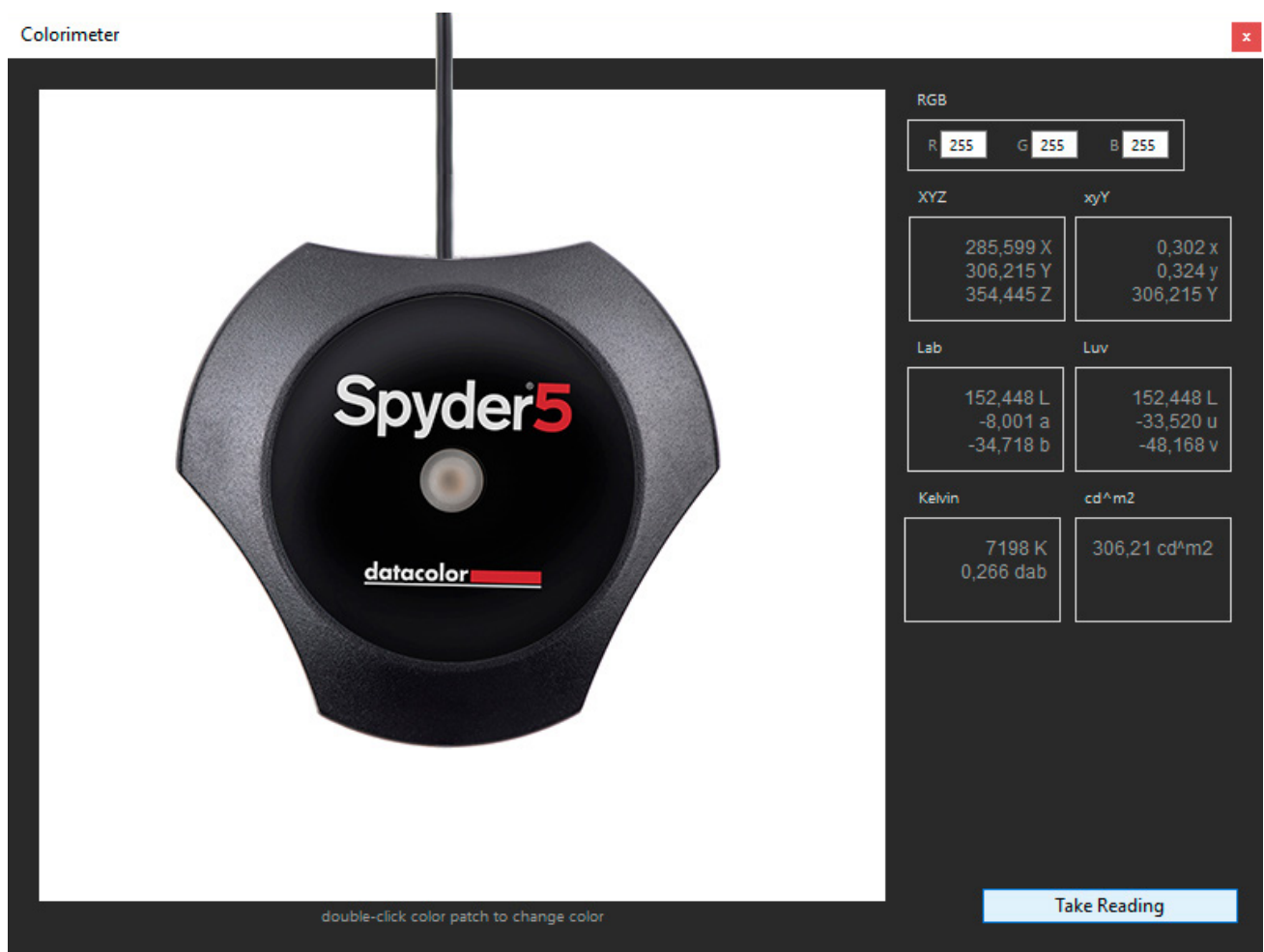
This info can be printed using the “Print information” command in the “File” menu.



Colorimeter

What this meter can measure

The colorimeter measures any color that has been entered as an RGB value or, after clicking on the measurement field, by color selector as shown on the monitor. This can, for example, be used to check the brightness drop of the monitor toward the edges or corners. Choose pure white as the color (RGB 255/255/255). Then measure the field, not only in the center of the screen, but also moved to the edges or corners. Any drop indicates non-uniformity in the screen. Low-quality monitors show more variation than more expensive displays. Such variations cannot be corrected with color profiles, as profiles deal with the screen as a whole, not local variations.



The colorimeter window can be moved around on screen

History

What can be read from this diagram

The “History” graph illustrates the gradual changes in the display device. This means the history visualizes the gradual loss of quality through use. Correspondingly, the graph drops down and to the right over time. But what do up and down fluctuations in the diagram show? These are probably signs that the measurement was not made on a “warm” monitor, which ran for at least an hour, but was measured immediately on start-up. For users who prefer to keep the pure numbers, there is an additional “Detailed Data” window, which shows the values as a table.



Example of several measurements. The decrease in luminance over time is clearly visible here.

Advanced Analysis

What your monitor shows after calibration

Monitor calibration is based on the ICC standard. The goal is to relate the colors of the individual devices involved in the color workflow to one another. As a rule, the output target is a printed medium, and after calibration the colors and brightness values on the display should be shown as they are look in the print. However, there are also other applications such as video, offset printing or medical analysis using the display. A display needs be adapted to the appropriate use; but what if it cannot?

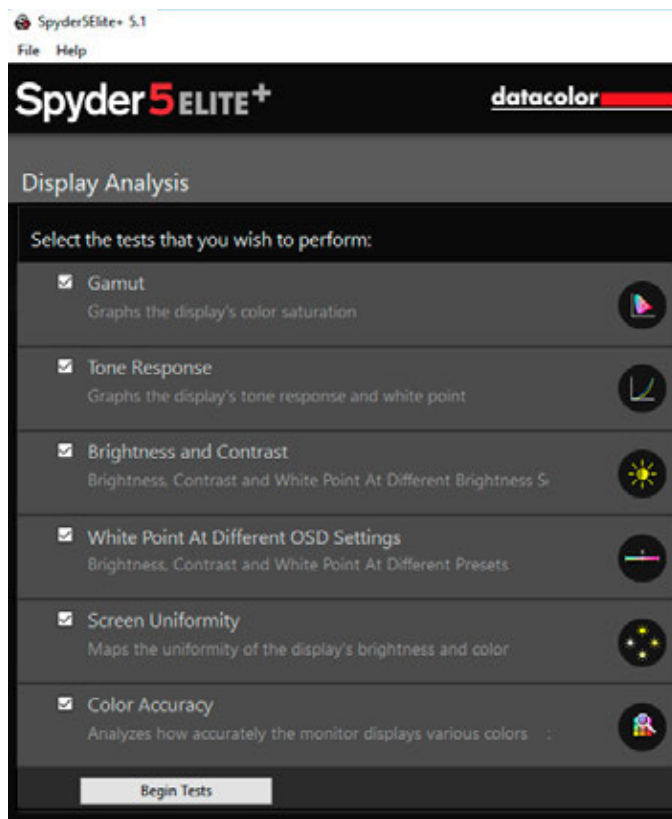
Professionals usually knows what to expect from a monitor of a certain quality. Beyond that, they know that a monitor is rarely uniform across the entire screen. Most displays darken at the edges and do not show exactly the same brightness and color everywhere. Over time, screens show reduced luminance, color uniformity, and contrast. While this is not as rapid in LCD screens as with old-style CRT displays, where deterioration was easily seen month to month, elements of modern LCD screens still age.

In short: If you want color accuracy, you need to track your monitor's characteristics. In the next sections you will learn about the capabilities for this offered by Spyder5ELITE+.



Display Analysis

What your monitor can do



The Display Analysis screen

On the “Display Analysis” screen, there are six different test options. With these you can use your monitor to analyze:

- Gamut
- Tone Response
- Brightness and Contrast
- White point at Different OSD Settings
- Screen Uniformity
- Color Accuracy

The tests can be carried out individually or as a series. Important: Performing all the tests takes at least 15 minutes. But in return, you get a very detailed analysis of your monitor’s capabilities.

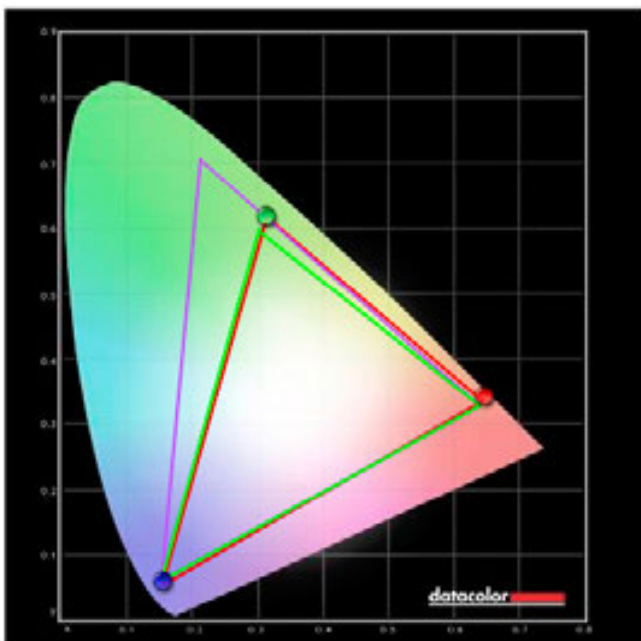
Gamut

How this changes over time



For all monitors, the color capabilities decrease with time. This development is primarily due to backlight aging. As a result, we no longer see colors as intensely as when new. The luminance and contrast are also reduced by the decreasing brightness. Test results are expressed as a percentage of the target gamut.

Color Gamut of display



The green triangle shows the sRGB color space, the purple triangle shows the AdobeRGB color space. The measured display can represent 97% of the sRGB and 75% of the AdobeRGB color space, and would be considered an "sRGB Display".

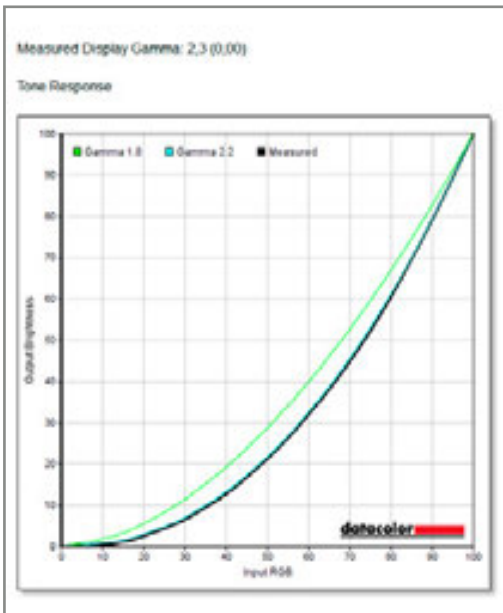
97% of sRGB 75% of AdobeRGB

Tone Response, Brightness, Contrast, and OSD settings

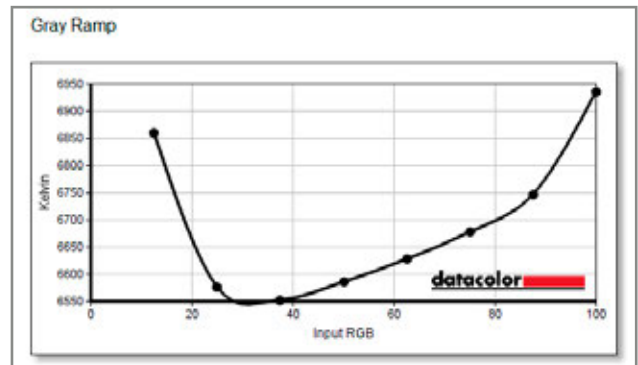


What can be determined with these tests

There are three tests of tone response, brightness, contrast, and on screen display (OSD) settings. Their results illustrate the aging process, as well as optimal settings. The measurement of the white point at different OSD settings is particularly important. OSDs allow the adjustment of the monitor firmware. For many models, you can set presets for videos, games, office, photos, or other uses. These presets are primarily aimed at the typical consumer who does not calibrate displays. But they also offer an important aid to color professionals: the analysis function. This function can determine which OSD setting is closest to the calibration target. What happens when you select this preset? The calibration must then compensate for the smallest differences and can obtain the maximum tonal gradations from the monitor hardware. The result is less extreme profile corrections leaving more levels for on-screen display.



This diagram shows the gamma curve of your display compared to gamma curves of 1.8 and 2.2.



This diagram shows the color temperature in Kelvin on the Y axis and the gradually rising level control of the RGB channels of the display on the X axis.

Brightness, Contrast and White Point At Different Brightness Settings

Setting	Brightness	Black	Contrast	White Point
0 %	132,3	0,20	€50 : 1	€900 (0,305,0,329)
25 %	132,3	0,20	€50 : 1	€900 (0,305,0,329)
50 %	132,3	0,20	€50 : 1	€900 (0,305,0,329)
75 %	132,3	0,20	€50 : 1	€900 (0,305,0,329)
100 %	132,3	0,20	€50 : 1	€900 (0,305,0,329)

Brightness, Contrast and White Point At Different Presets

Setting	Brightness	Black	Contrast	White Point
OSD Preset1	131,3	0,20	€50 : 1	7000 (0,305,0,329)

Data shown as tables



TIP

If you know the uniformity of a monitor, you can better judge the brightness of an image at the corners. In order to be able to evaluate important video footage, transfer it to the center of the screen.

Screen Uniformity

Why you should know your screen's evenness

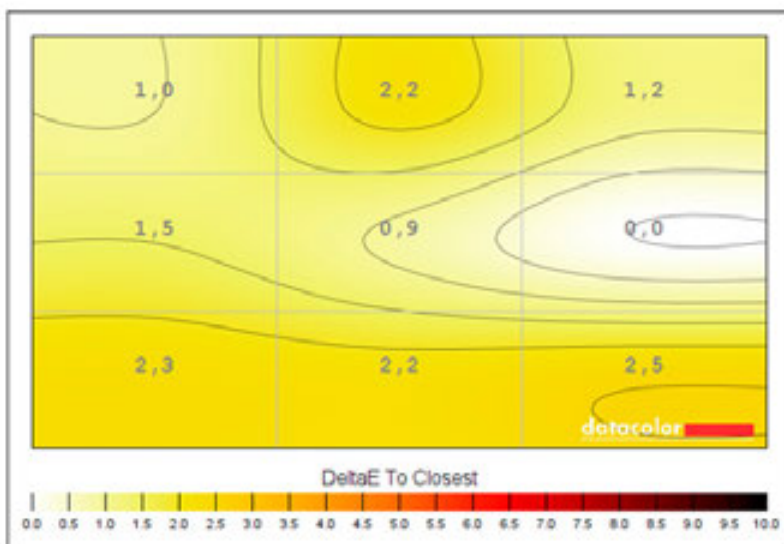


In a monitor, uniformity refers to the brightness variation from the center to its edges and corners. This depends on the quality and uniformity of the backlight. It is important to know your monitor's degree of variation, in order to be able to assess the color and luminance of an image.

Color homogeneity for brightness 100%

Quadrant	Color (Lab)			DeltaE To Closest
1	08,95,	4,79,	,70	1,0
2	0,09,	4,11,	,00	2,2
3	09,44,	4,18,	2,12	1,2
4	9,40,	4,47,	2,39	1,5
5	10,24,	4,21,	1,81	0,9
6 (Closest To D65)	00,09,	4,19,	,91	0,0
7	10,54,	4,19,	3,23	2,3
8	09,48,	,08,	3,14	2,2
9	10,17,	3,97,	3,37	2,5

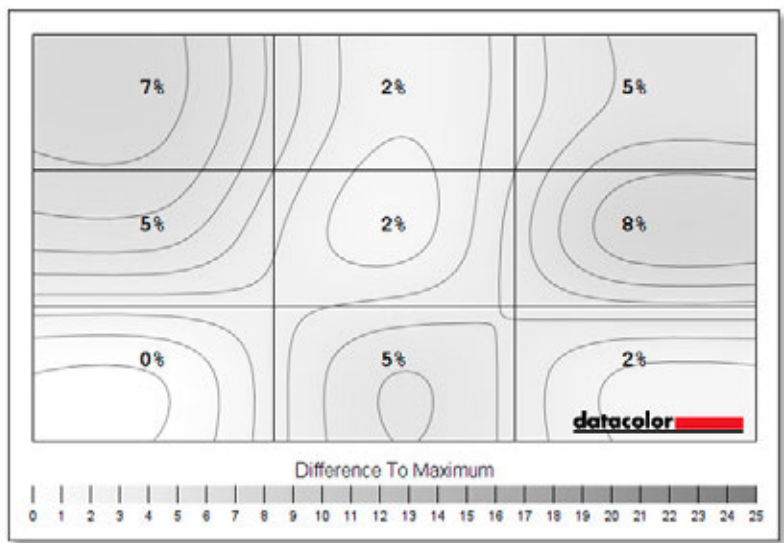
Color Uniformity at 100% brightness. This test is performed at four different brightness levels



Luminance homogeneity for brightness 100%

Quadrant	Luminance (cd/m2)	Difference To Maximum
1	125,2	7%
2	132,2	0%
3	129,1	5%
4	127,9	5%
5	133,1	0%
6	124,9	8%
7 (maximum)	135,2	0%
8	126,4	5%
9	132,7	2%

Luminance Uniformity at 100% brightness. This test is performed at four different brightness levels.



TIP

Color fidelity and uniformity are monitor-specific properties which you must adapt to. They cannot be “calibrated”, since no calibration system can adjust different zones or individual pixels, only the entire display. By being aware of the limitations of the screen, you can adapt, avoiding the cost of a more uniform display.

Color Accuracy




Determine which colors you can trust on-screen



When speaking about the color accuracy, there are problems similar to those with luminance. In particular, very cost-effective monitors often have color errors with certain shades due to physical limitations. In this test, 12, 24 or 48 color fields are measured as requested by the user.









































This produces an evaluation that shows the deviation for each color. The longer the bar, the greater the error. Following all tests, there is a monitor quality evaluation.

Color Accuracy

ID	Patch Lab	Result Lab	Delta-E	1	2	3	4	5	6	7
1E	96,04 2,16 2,60	96,25 1,95 1,79	00,00							
2E	80,44 1,17 2,05	80,44 1,40 2,31	00,00							
3E	65,52 0,69 1,86	65,35 0,92 1,14	00,00							
4E	49,62 0,58 1,56	49,90 0,98 1,19	00,00							
5E	33,55 0,35 1,40	34,50 0,00 1,20	00,00							
6E	16,91 1,41 -0,81	18,01 1,13 -0,72	00,00							
1F	47,12 -32,52 -28,75	49,10 -19,60 -25,23	6,00							
2F	50,49 53,45 -13,55	50,87 52,21 -13,11	00,00							
3F	83,61 3,36 87,02	83,51 3,65 87,38	00,00							
4F	41,05 60,75 31,17	41,11 60,59 29,84	00,00							
5F	54,14 -40,76 34,75	54,19 -40,05 33,76	00,00							
6F	24,75 13,78 -49,48	25,93 11,55 -47,77	1,00							
1G	60,94 38,21 61,31	61,36 38,30 61,60	00,00							
2G	37,80 7,30 -43,04	38,44 6,47 -42,06	00,00							
3G	49,81 48,50 15,76	50,19 47,29 15,56	00,00							
4G	28,88 18,36 -24,48	30,00 18,03 -24,09	1,00							
5G	72,45 -23,57 60,47	72,28 -23,50 59,30	00,00							
6G	71,65 23,74 72,28	71,40 24,82 71,87	00,00							
1H	70,19 -31,85 1,98	70,05 -31,35 1,84	00,00							
2H	54,38 8,84 -25,71	54,34 9,32 -25,71	00,00							
3H	42,03 -15,78 22,93	42,51 -15,74 22,23	00,00							
4H	48,82 -5,11 -23,08	49,07 -4,98 -22,91	00,00							
5H	65,10 18,14 18,68	65,18 18,39 18,08	00,00							
6H	36,13 14,15 15,78	36,75 13,37 14,51	00,00							
		Min:	00,00							
		Max:	6,00							
		Average:	00,00							

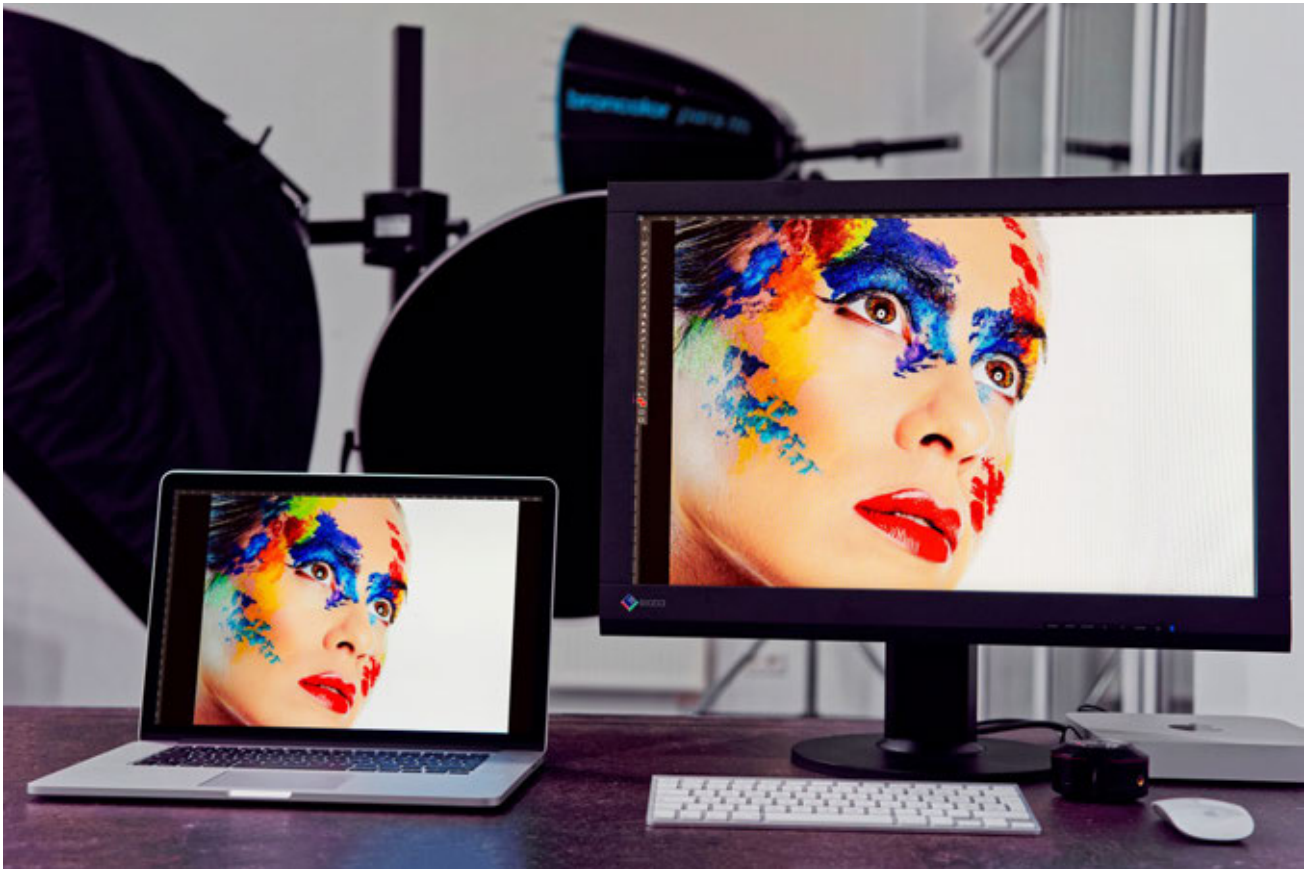
It can be clearly seen that the measured display has a delta E = 6 when displaying cyan. Cyan is a color that many LED displays have difficulty displaying correctly.

Monitor evaluation

Category	Rating	1	2	3	4	5
Gamut	5,0					
Tone Response	4,5					
White Point	4,0					
Contrast	5,0					
Luminance Uniformity	4,0					
Color Uniformity	4,5					
Color Accuracy	5,0					
Overall Rating	4,5					

Monitor evaluation – On completion of the tests a report is produced, with a simple graphic depiction on the display's quality in each category.

Side Note: Calibrating Multiple Displays



Special considerations

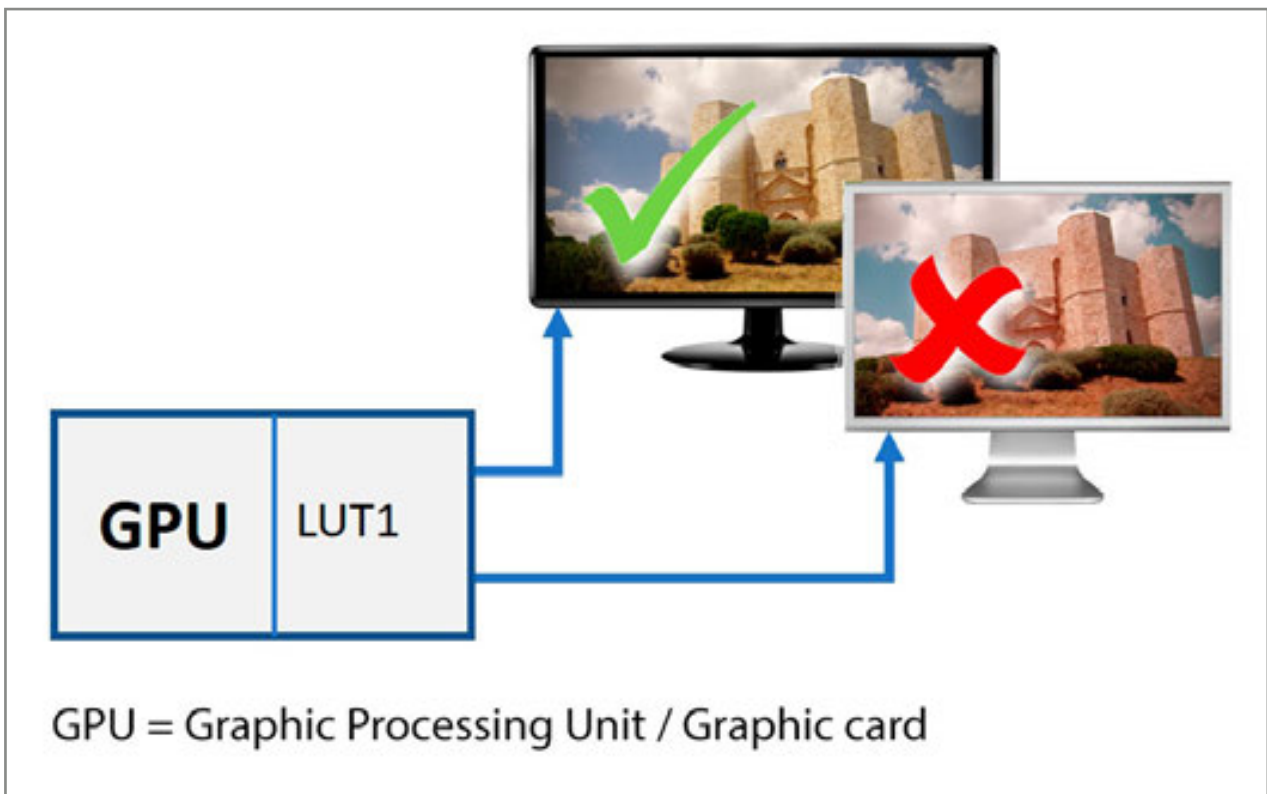
Many photo editors and graphic designers work with multiple monitors: one monitor shows the photo or the layout, the second monitor offers direct access to image processing and graphics tools.

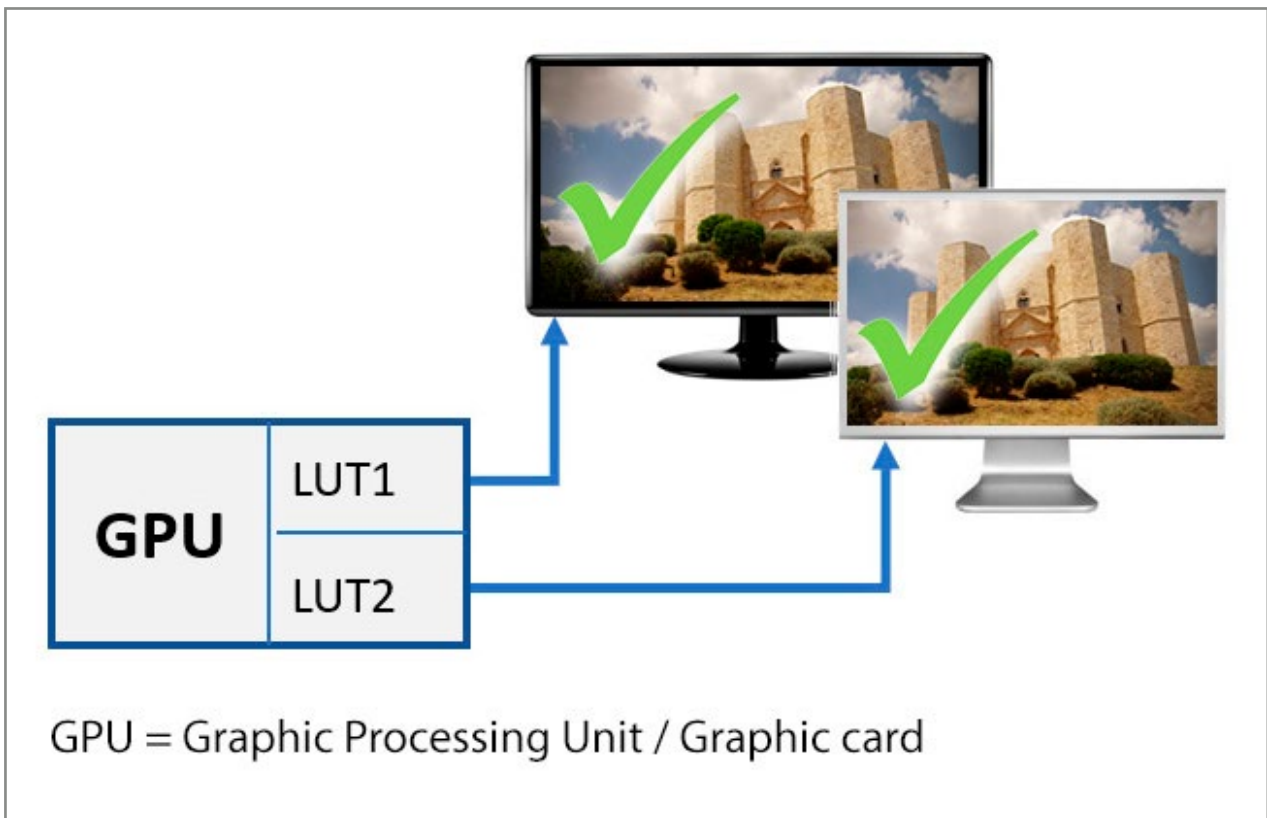
Even two identical screens do not match visually without being calibrated and profiled. But what is needed for the color correction of two monitors with two different characteristics? This requires a graphics card that is designed for operation with two monitors and which can manage two different Color Look-Up Tables. Alternatively, one can also work with two graphics cards, which should, at least for use with older Windows systems, be identical. Unfortunately, some low cost so-called dual-head cards support only one color profile, even though they output to two displays.



EXPERT INSIGHT

Some Dual-head cards have only one memory slot for a Color Look-Up Table (CLUT), which is overwritten when the second monitor is calibrated, so it only displays correct color on one display. More modern cards work with two or more CLUTs.





Schematic diagram of a graphics card with one or two CLUTs

If there are any problems, first check whether you are working with the latest version of the graphics card driver.



INFO

The operation of several color managed monitors – apart from the noted hardware issues – has been provided for since Windows XP. For Apple computers there were never problems, except for Snow Leopard (10.6) where OS color control can cause issues. More recent macOS versions work reliably.

Important: For both monitors, the same target values (i.e. the same color temperature and the same gamma value) must be set.

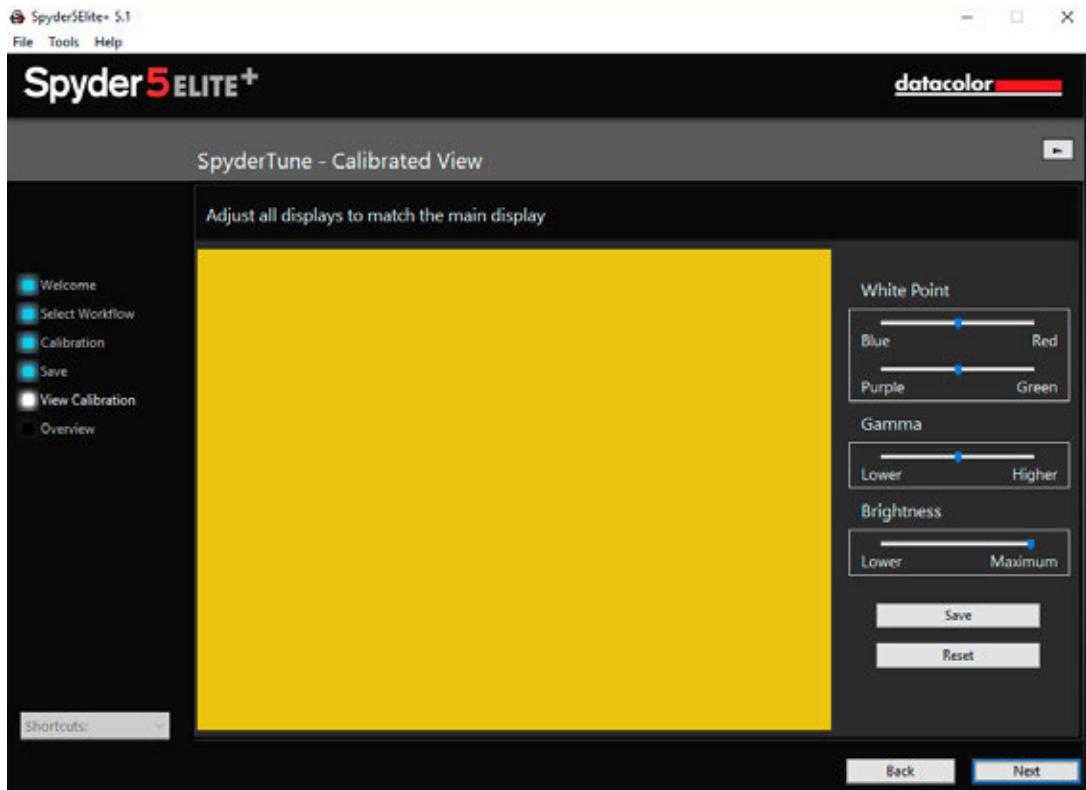


TIP

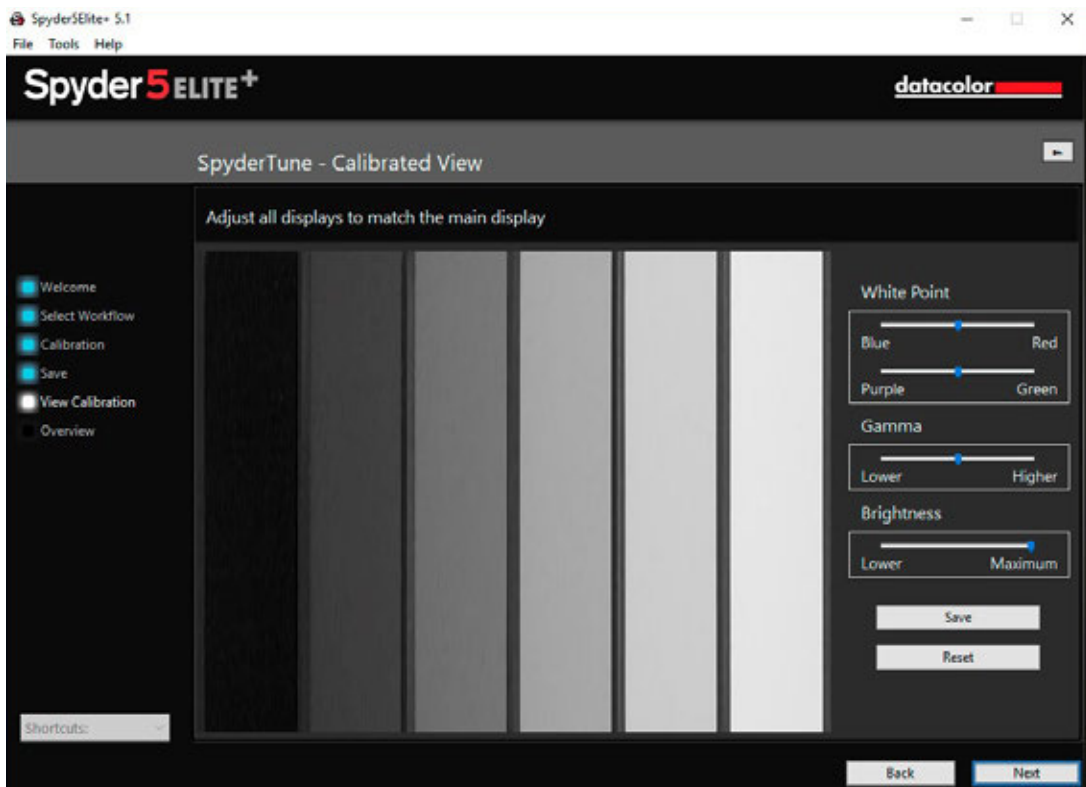
If the system or the hardware cannot manage two different profiles, here's a workaround: simply calibrate the image editing screen. The tool palettes are then displayed on the unmanaged screen. Be sure the palettes display is dimmer than the main display, so its unmanaged whitepoint does not influence your eye.

SpyderTune / StudioMatch

The "SpyderTune" function allows you to manually adjust two monitors that are already calibrated, but which differ slightly to the eye because of the different types of light source (white LED, RGB LED or CCFL background display). With the Spyder5+ upgrade the SpyderTune function has been expanded once again. With it, two displays can be even more precisely matched. After both monitors have completed the calibration process, final corrections can be made manually. You should ensure that the second monitor is matched to the main monitor and not the other way around. SpyderTune guides you through the yellow, magenta and cyan color fields, which you adjust accordingly. Afterwards, you can fine-tune the white point, the gamma and the brightness using a gray ramp.



The software screen with yellow, magenta and cyan is displayed on both displays for fine tuning.



The screen for white point, gamma and brightness tweaking follows.

Side Note: Calibrating a Studio



Spyder[®]5 ELITE⁺

Things to keep in mind

A studio usually has several computers and monitors. In a typical situation, there are three basic groups: one or multiple relatively new, high-speed workstations with high-quality monitors; one or more out-of-the-box computers with older displays that mainly handle batch processing and printing jobs; and one or more laptops for image review and remote presentations. These devices will display the photos quite differently – even if they have been calibrated. There are technical reasons for this. High-quality and newer monitors often have a larger color gamut and softer color transitions. The calibration does not improve the hardware, but neutralizes the display and assures colors are not too saturated on the high saturation screens. A low quality calibrated display will be neutral, but may not be as smooth and will not offer highly saturated colors. This means that variations are to be expected, based on display quality.

It is possible to force nearly identical display of images on all these monitors. But to achieve this goal, one has to reduce the gamut and dynamic range to that of the weakest display. In order for all monitors to display the same color, the brightness of the better monitors are limited by adjusting their black and white values to make them match the weakest.

How to proceed

A sample Studio Match calibration works as follows:

- Start the “StudioMatch” module of the software
- This automatically measures the brightness of the monitors to be adjusted, in order to bring them to a level all can reach
- Subsequently, all monitors display the same contrast range based on the weakest monitor

TIP

Carefully consider which monitors you include in the group. Older laptops and office grade monitors are best calibrated separately.





Side Note: Calibrating a Projector

That's how easy it is

Calibrating a projector is similar to LCD screen calibration. However, calibration of projectors requires a totally dark room. If a calibrated projector is moved to another computer, it should ideally be recalibrated and profiled. It is possible to copy the projector profile from one computer to another – especially with Macs, in which the video standards are very consistent.

Spyder5ELITE is the most flexible Spyder for projector calibration:

- First, the Spyder is fixed with its tripod thread on a tripod and placed about 35 cm (one foot) in front of the screen. The main sensors of the Spyder5ELITE, and the honeycomb filter, point toward the screen, not the projector.
- In this orientation Spyder5ELITE measures not only the color from the projector, but also the color characteristics of the screen.
- When a projector is calibrated, the software projects a crosshair on the screen. This allows the sensor to be easily aligned. The fact that the Spyder5ELITE throws a shadow on the screen is not a problem, since a much larger area of the screen is being measured.

TIP

Different profiles can be created for different lighting levels. However, the best results are achieved by calibrating in a completely darkened room.



Glossary

AdobeRGB (1998):

The AdobeRGB color space was specified by Adobe in 1998. The objective was to create a color space from which the CMYK color space of a color printer could be adapted to the RGB color space of a monitor. It is larger than the sRGB color space.

Bayer filter:

Photo sensor named after its inventor Bryce E. Bayer. The sensor is overlaid with green, blue and red filters, which are in a ratio of 50 % green, 25 % blue and 25 % red. In this way, it approximates the sensitivity of the human eye, in which green accounts for the greatest share of the perception of brightness.

Border shadowing:

See objective vignetting.

CCFL display:

This is a first generation flat screen. CCFL stands for Cold Cathode Fluorescent Lamp. In contrast to today's monitors, which are illuminated with LEDs, the CCFL displays produce light using neon tubes.

Cd/Candela:

Candela is the SI unit of the SI basic variable of luminosity.

CEPS tools:

CEPS stands for Color Electronic Page Setting. In photography, this involves photo retouching or photo editing with the aid of image editing programs such as Adobe Photoshop or Adobe Lightroom.

CIE-xy color space:

The CIE standard valence system has been defined by the International Commission on Illumination (Commission internationale de l'éclairage). It is the link between human perception and physical causes.

CMOS technology:

CMOS stands for Complementary Metal Oxide Semiconductor. This involves semi-conductor technology, which has become widespread in photo sensors, etc. CMOS sensors are primarily characterized by low power consumption and short switching times.

Color balance:

The color balance determines the ratio of the colors to each other. For example, if the colors in a recorded image are not reproduced as they are in the original, the colors are not in balance.

Color fidelity:

Color fidelity is the measure of the deviation or the similarity of colors during recording and output. Color management systems are normally used to achieve maximum color fidelity.

Color fringes:

Color fringes, also called chromatic aberrations, occur in images because of deviations of optical lenses. Because the individual wavelengths of the visible spectrum in a lens are refracted differently, each wavelength range has its own focal point. In practice, this leads to color fringes, which are particularly visible on the contours and edges of an image. This error can be corrected using additional lenses, which are attuned to the respective wavelengths.

Color homogeneity:

The color homogeneity describes the color consistency or the color deviations from a set point over an area, e.g. the surface of a display. In the case of poor color homogeneity, the same color value is reproduced differently on the surface of the display. For example, this could cause a green tint on the upper right and a red tint on the bottom left corner.

Color noise:

Color noise, or image noise, describes the deterioration of image quality due to structures, which themselves do not carry any image information. The impacted image sections deviate from the actual image information in terms of color and brightness, and are especially visible in dark areas of the image in which the signal-to-noise ratio is very low.

Color separation:

In the prepress stage, this means the conversion of the colors of a wide variety of image datasets, mostly to the CMYK color model. The colors are separated into the print colors cyan, magenta, yellow and black.

Color space:

A color space is a defined range of colors. The best-known color spaces from the RGB color model are sRGB and AdobeRGB (1998), as well as the CMYK color model, Euroscale Coated v2, Fogra39 and ISO Coated v2.

Color temperature:

The color temperature describes the light mood and is specified in Kelvin. A cooler light mood (bluish) prevails, for example, in a cloudy sky, than in sunshine (yellowish).

Contrast:

Contrast is the ratio of the brightest to the darkest area of an image.

Contrast balance:

Is the ratio of the brightest and darkest areas and defines from where the light is being drawn.

Cross-effect:

The cross-effect originally came from analogue photography, in which a slide film was combined with a negative development process or a negative film with a reverse development. The colors are artificial and the contrasts are higher. This effect is often used for artistic styling and is imitated today by digital techniques.

Contrast ratio:

See contrast.

DLP projector:

DLP stands for Digital Light Processing and it is a technology developed by Texas Instruments where the image is created by an array of micro mirrors within the optical path. A special feature is that the red, green and blue pixels are not generated simultaneously (as in LCD projectors), but quick alternate flashing through a rotating color filter wheel.

Glossary

ECI RGB:

The ECI (European Color Initiative) RGB is a standardized RGB color space, which covers a large part of the printing processes, as well as all currently known display technologies. Thus, it is a color space that is designed especially for the needs of the graphic arts and prepress.

eciRGBv2:

Further development of ECI RGB. It has been optimized in terms of the visual equidistance, as is known from the CIE-L a*b* color space. This results in a minimization of banding and clipping errors, as with the L-Star color space. The ECI recommends using the color space as early as data creation, for example when converting RAW data or 16-bit material to 8-bit color depth.

EXIF information:

The Exchangeable Image File Format (EXIF) is a standard format for saving metadata in digital images. EXIF information can be, among other things, a camera model, shutter speed, ISO value, aperture or date and is written to the header of the image file.

Fine Art Printer:

There is no uniform definition for the term Fine Art Printing. All Fine Art printers attempt to create an image which most closely resembles a one-of-a-kind or work of art, in terms of its properties, selected motif, and post-editing, and in the use of the best photographic materials.

Gamma:

In relation to a monitor, gamma refers to the modulation of an input signal to a desired output signal. In practice, this means that a low-contrast image is obtained by correction of the output signal to contrast.

Gamut:

Is the description of the color range which can be reproduced by a technology or a technical device.

Gray balance:

"Achromatic" colors are the gray shades that lie between white and black. These are produced by equal proportions of the respective primary colors such as cyan, magenta and yellow (CMY) in the print or red, green, blue (RGB) in self-luminaires. If the primary colors change to equal proportions, a gray may become brighter or darker, but remains neutral gray. If the color components are no longer in the same proportion, one can immediately perceive a gray tint and gray balance is no longer maintained.

High-Key Image:

In high-key photography bright tones, few contrasts and soft light lend style to an image.

ICC profile:

An ICC profile describes the color space of input and output devices such as printers, scanners, digital cameras or monitors and refers to the reference values.

IPTC conventions:

IPTC is the acronym for International Press Telecommunications Council. As per the IPTC convention, metadata is saved to the header of an image file for improved classification. The metadata contains such things as parameters such as file format, file size, filename, height and width in pixels of a file, date recorded and the description of the contents.

Kelvin:

Kelvin is an SI unit of temperature measurement. It is also used for measuring the color temperature.

L*a*b* color space:

Is a device-independent color space and describes all perceivable colors equally, so that color deviations can be described by a Delta E.

LCD:

This refers to Liquid Crystal Display. The liquid crystals regulate the light impermeability per color channel. LED monitors are also LC displays, but irradiate the color filters from the rear with LEDs instead of fluorescent tubes.

LCD projectors:

The white light of the projector lamp is split into 3 basic colors by a prism and then sent through 3 LC displays, which control the image information per color channel. Subsequently, the image is put together by another prism. LCD projectors are characterized by a smaller contrast range, but can reproduce the colors very differently.

Low-pass filter:

With image files, so-called Moiré effects may occur instead of very fine recurring structures, which are at the limit of the sensor's resolution. These small, colored structures have a specific pattern, but are not part of the image information. Low-pass filters are used to prevent these phenomena.

L-Star RGB:

A modern color space, which combines the advantages of a higher color resolving power of the human visual sense of the CIE-LAB color space with the usual RGB color spaces like AdobeRGB and ECI-RGB. Banding and color tipper errors are reduced to a minimum when viewed on a display and in printing.

Luminance:

The luminance describes the brightness of image points
Luminance homogeneity:
Describes uniformity of brightness for a defined area. A poor luminance homogeneity of a monitor can be seen as vignetting, although all image areas must be equally bright.

LookUp table:

IT term. LookUp table (also called LUT) are tables in which application-specific values are stored which are used in a program routine.

Glossary

LUT:

See LookUp table.

Luv color space:

A color space that is calculated from the CIE-XY system, similar to the L*a*b* color space. This system is mainly used for the evaluation of light sources or monitors.

LED backlight:

This refers to a flat radiator that consists of many light emitting diodes and is used for the background lighting of an LED display.

Low-Key image:

In contrast to high-key photography, low-key photography uses little light as a stylistic device. Light is used consciously to accentuate highlight contours and the few details that are important for the image. Many sections of the image often remain in the dark. This lends a certain amount of drama to this type of image, a familiar sight in theatrical or stage photography.

Objective vignetting:

Vignetting refers to the shadowing of the image to its borders, which can be highlighted by components of the objective, such as lens mounts, and by filters or lens hoods. The effect itself is originally unwanted, but it is also used as a stylistic device.

Offset printing:

A printing method, in which the pressure roller does not directly contact the printed product, but the printing is transferred indirectly by a rubber roll. This is the most common method for printing books, newspapers, and packaging.

OSD:

Stands for On Screen Display and describes an input menu window of a monitor, which is shown on the display.

Primary colors:

Primary colors are the basic colors that compose secondary colors. Thus, the colors that a monitor can display are composed of the colors red, green and blue. The same applies to cyan/magenta/yellow, by means of which all colors which can be displayed by the process are mixed in printing.

Polarization layer:

A polarization layer, as used in LE and LC displays, ensures that light is polarized, which means only the fractions that oscillate in a plane are transmitted. This is the prerequisite for the option of regulating the light quantity per pixel with LCs.

Reflection idiosyncrasies:

Printing paper and photo paper have a large number of surface properties. The bandwidth ranges from matte and glossy to a wide variety of textures and materials. Every surface and material has very specific characteristics, with regard to how they absorb and reflect light. These must be taken into consideration when setting up a color workflow.

Rendering Intent:

The way in which the colors must be converted from one color model into another.

Softproof:

In a softproof, the colors on a monitor are simulated as they will appear on the selected output material. Also known as ink color simulation.

sRGB:

Standard RGB is also a color space developed by Hewlett-Packard and Microsoft. It is widespread, but smaller than the AdobeRGB (1998) color space.

THM file:

THM files are miniature view video files, which are used to create a thumbnail image (miniature image) of the video file for improved orientation.

Tonal value:

The tonal value describes the measure of tone scales. For example, a digital camera with 8 bits per color channel has a tonal value reduction of $2^8 = 256$ steps per color channel.

White balance:

In the case of a white balance, a camera should be set to the color temperature of the recorded scene to keep the color balance neutral. This is also done by the human eye, which evaluates colors in a largely neutral manner.

White luminance:

White luminance is the maximum brightness of a white point that can be displayed by a monitor.

White point:

The white point defines the white of a monitor with full control.

Wide gamut:

Gamut is the displayable color space of a monitor. Wide gamut features a device class that is characterized by a very large color space that is close to AdobeRGB (1998) or even slightly more. Monitors with wide gamut are typically used in image editing.

Workflow:

A workflow in photography includes all devices and technologies, which are used in the processing of the final image. A typical workflow includes a digital camera, image editing software, display units/monitors, and printers.

Spyder5 eBook

Color management can be easy

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