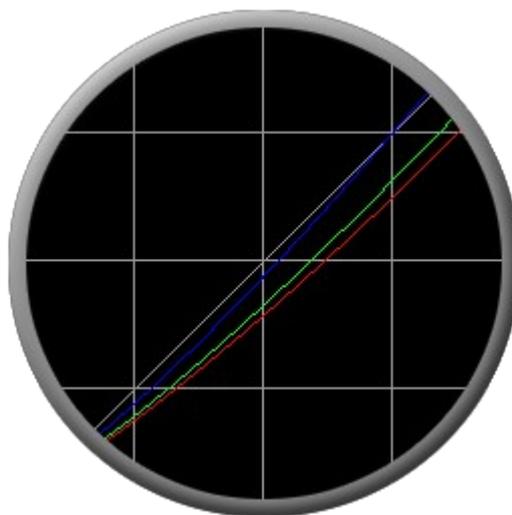


Atrise Lutcurve

Monitor Calibration Software

User Manual

Version 1.4.4



Software, documentation, images © 1999-2009 **Andrew Revvo, Atrise Software**
Documentation, images © 2008 **Martin Stiles**

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Introduction

About Lutcurve

Lutcurve is a program which enables users to calibrate their CRT or LCD monitor display through monitor and software controls without the need for any sensor hardware and may be used on a single or multiple monitor set-up.

Software adjustments are made to the monitor “look up table” (LUT) which is the method used for computers to convey brightness and color information to display devices. The ability for precise adjustments of the red, green and blue values for up to 256 gradations from black to white, enable the generation of a linear gray scale, (brightness curve).

The five step process presents the user with real time display of each adjustment made as well as a unique incremental presentation which offers a view of each progressive setting.

Adjustments are portrayed as numerical values, graphical representations and real time image, giving users practical feedback on each and every setting made or reverted to.

The five steps are:

1. **Black Point**
2. **White Point**
3. **Gamma**
4. **Color Correction**
5. **Curve Adjustment**

Each step is critical to achieving best possible calibration of the monitor. Skipping or not completing any step will defeat the purpose of using this program.

The functions of each step are:

- | | | |
|-------------------------|---|---|
| Black Point | - | adjusts brightness control
(or black level, if used in the advanced monitor menu). |
| White Point | - | adjusts contrast and monitor RGB controls. |
| Gamma | - | adjusts monitor gamma.
(or monitor gamma RGB controls, if available). |
| Color Correction | - | fine adjustment of monitor color temperature setting. |
| Curve Adjustment | - | fine adjustment for the linearity of the brightness curve. |

Lutcurve is designed to provide optimal monitor display for these values:

Gamma: Any value from 0.1 to 5.0, **2.2 as default**,
White Point: **6500K**,
Luminance Level: **80 cd/m²**,
Color Space: **sRGB or native monitor color space**.

The software is based on an article "Measurement of display transfer characteristic (gamma)" by A. Roberts. The calibration method is optimized for physiological sensibility of human eye to gray tones.

System Requirements

Windows 2000, XP, x64, Vista SP1 x86/x64, Windows 7 x86/x64
32-bit color display mode
Video driver from manufacturer
Mouse or another pointing device
PDF Viewer

Known Issues

If your computer returns from a hibernating or a sleep mode, or if some software such as a computer game changes the system LUT curve itself, your monitor may lose calibration.

To correct this, manually execute Lutloader from Start Menu.

Lutcurve is capable of performing calibration on aging monitors, however it does not diagnose or fix; faulty monitors, operating systems or graphics software.

Note for color professionals: The software calibration method cannot give you a color precision, because it does not take into account monitor RGB color coordinates. It is impossible to create correct ICC profiles without a measurement device. **So it is strongly recommended to use Lutcurve with an ICC profile from a monitor manufacturer.**

Getting Started

Conditions

To achieve the utmost benefit from calibrating your monitor display with Lutcurve, users should establish some basic workplace conditions which are readily reproduced and typical of the conditions in which the display will be used, such as image editing.

To obtain absolute best results the directions in this manual should be followed carefully, especially those relating to the work environment and monitor control settings.

For users calibrating LCD displays, it is worthwhile to observe the differences in the screen display when viewing under less than ideal situations and at other than straight on angles.

To assess the impact of these situations a trial viewing of black point and white point displays at other than normal operating viewing positions and with over lit room conditions will demonstrate the need to establish best viewing before calibration.

Lighting

Lighting should be at a level which offers enough illumination to comfortably read text such as printed newspaper and yet not interfere with your screen displays. The actual color of the lighting must be considered also as even though our eye brain system compensates for impure white light our photo system and associated technology does not. As you will be performing evaluation of colors during the calibration process and subsequently, of images on screen and likely as prints, then starting with a known standard of white light is of significant benefit.

Lighting levels and type must also be consistent, which often will mean relying upon artificial light and not daylight or a combination of the two. Therefore with lights on, and curtains closed, you can be assured of having a standard light source reference. The recommended bulbs to use are known as D50 types. This will also provide for optimum conditions for monitor color temperature of 6500K.

Ensure that lighting does not interfere with your screens either by shining directly upon the screen itself or lighting an object in the room which reflects on to the screen, and that will include yourself so take a while to study your room light position and effect on your screen.

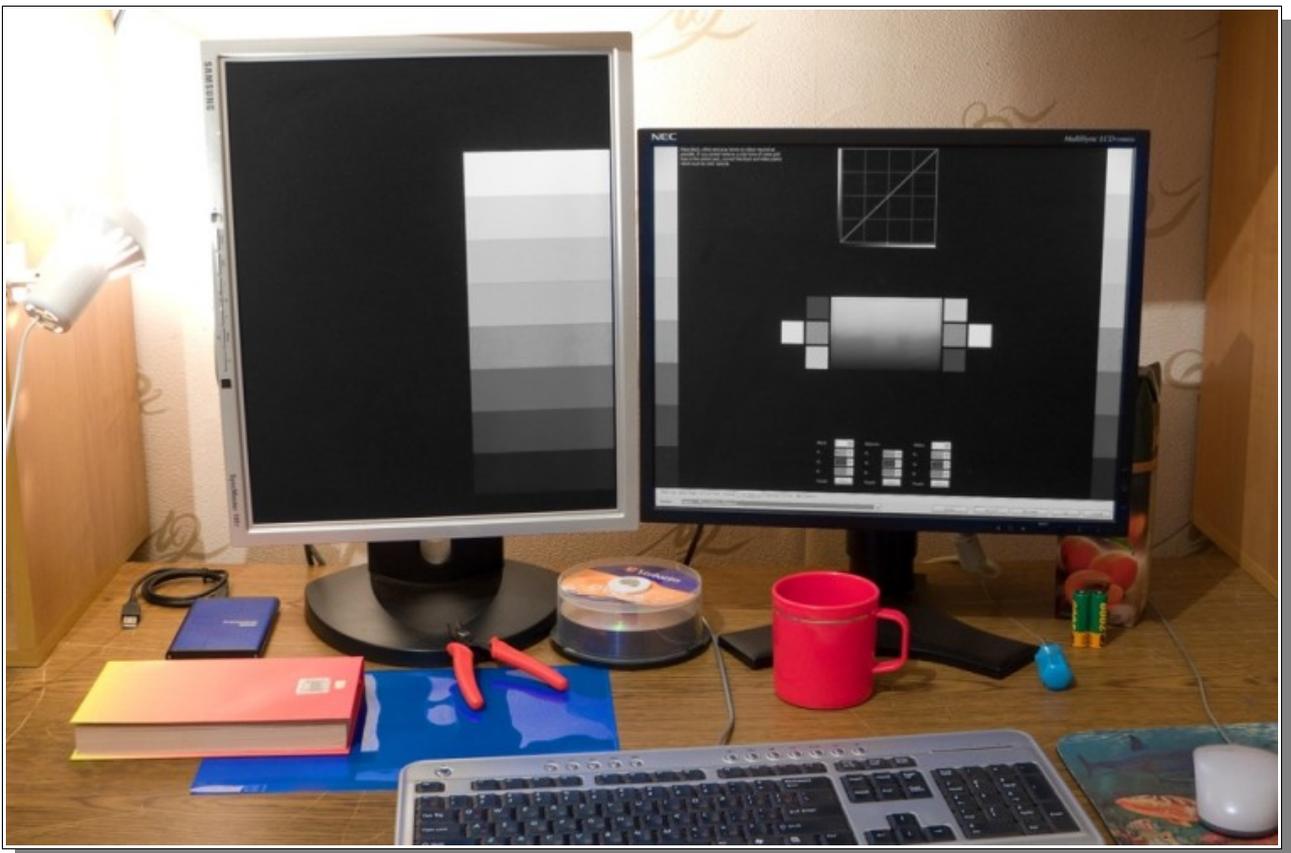
Ideally, the area behind the screens must also be considered as that will be in your field of view when looking at the screen. Best conditions will have a neutral or gray background and lit to the same or a level just below screen brightness.

Ensure that monitor tilt and swivel angles are those that you will use when working with images and that monitor positions are not adjusted during the calibration process, especially important when working with LCD panels.

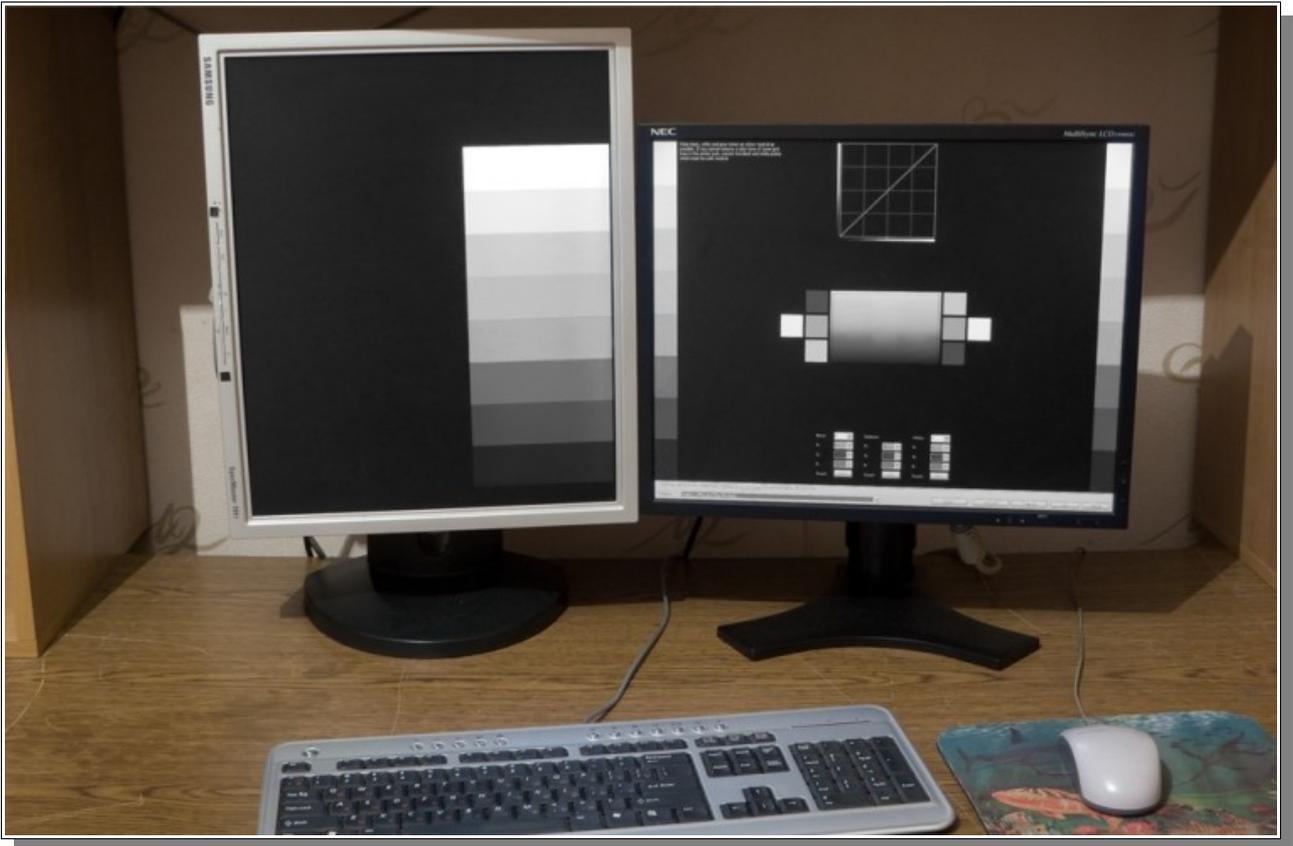
It is worth noting that the work environment conditions for monitor calibrating should be the same as when performing image processing such as editing or print preparation.

Workplace Conditions

In addition to the comfort and health of establishing good workplace conditions, any image evaluation or processing will benefit from a few simple environmental standards.



This illustrates a poor work environment, with overpowering lighting and an unevenly lit background, as well as visual distractions from colored objects.



This illustrates a preferred work environment with subdued lighting giving an evenly lit background, and no visual distractions from colored objects.

Monitor Profiles

As with all computer devices that are designed to reproduce color, monitors have provision for a color profile. Often the monitor manufacturers' profile will be the default setting and may not be readily changed.

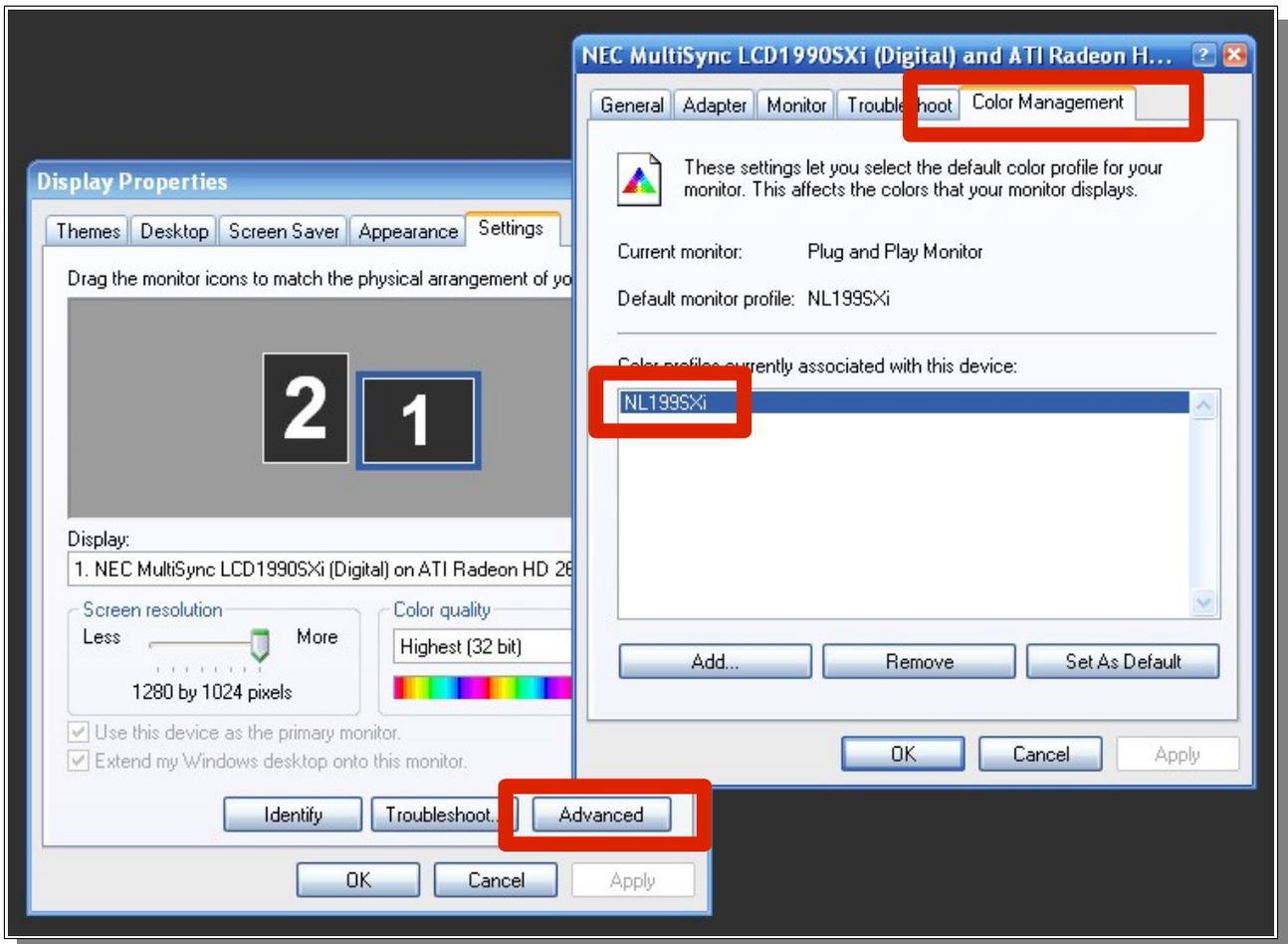
Before using Lutcurve to calibrate your display, be aware of the manufacturers' monitor profile in use. If you have no default monitor profile, use the sRGB profile instead or not use any.

Once calibrated, revert to your preferred monitor profile or create a new profile, using your hardware calibration device.

To set your monitor profile

in Windows XP go to **Control panel / Display / Settings / Advanced / Color Management**.

In Windows Vista go to **Desktop (right-click) / Personalize / Display Properties / Advanced / Color Management**.



Monitor profile on Windows XP

Dual Monitors

Lutcurve automatically detects a multimonitor set-up and allows the user to select the monitor to be calibrated or checked.

In a dual monitor arrangement, Lutcurve display will span across both monitors, the controls and references displaying on the selected monitor and blank over the second

(inactive) monitor. Lutcurve calibration will achieve matching or closest match for multi-monitor setups.

Each monitor requires individual calibration.

Graphics Card

Many graphics or video cards are supplied with software that provides users with monitor settings from a 'master control panel'. Removing this software may limit or disable one or more functions so before calibrating with Lutcurve, it is necessary to set the graphic card controls at either null or a neutral value.

Other Calibration Software

Uninstall any third party "Gamma Loader" software and remove any monitor tweak programs as they may modify LUT settings at the system startup or during the calibration stages.

Initial Monitor Adjustment

In the workplace environment already established, and ensuring that your monitor has been operating for at least 20 minutes, adjust for best viewing using the monitor controls, (contrast and brightness).

The "AUTO" feature may also provide a useful starting point.

Some monitors have advanced setup menu. Please read your monitors' user manual for details. If advanced set-up is available, the critical areas are: Color Temperature (or RGB Level Gains), Gamma, Black Point, Brightness, Contrast, Color Space Mode. Where available, use your monitor advanced setup possibilities.

Set your monitor(s) color temperature at 6500K and Gamma at 2.2. Most current monitors have a luminance level about 200 cd/m², so to get a recommended "dark room" standard value 80 cd/m² you may use the 40% contrast level.

If you do not have a monitor ICC profile, select sRGB color space. Else setup native monitor color space.

This initial monitor adjustment is sufficient to begin the calibration process.

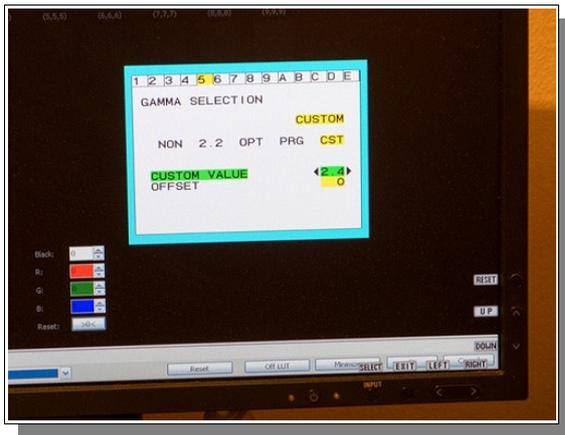


Illustration of an advanced monitor menu for gamma setting

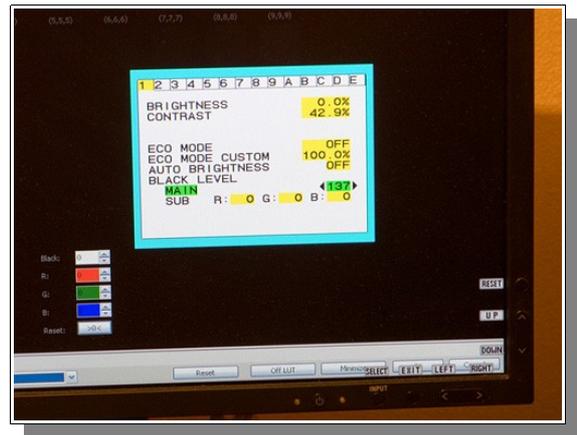


Illustration of an advanced monitor menu for black level setting

Calibration Phases

Displays are calibrated in two phases:

1. **Hardware Controls Phase**
2. **Software Controls Phase**

These phases use the same main steps, but in the first phase only hardware controls are used. In the second phase Lutcurve controls tune your hardware setup for ideal state. Do not use any Lutcurve controls before all steps in the first phase are completed.

Remember, always use hardware controls first and only apply Lutcurve adjustments in the first phase if your monitor controls appear to be inadequate to provide a suitable display.

Monitor control calibration will give you the maximal possible image quality.

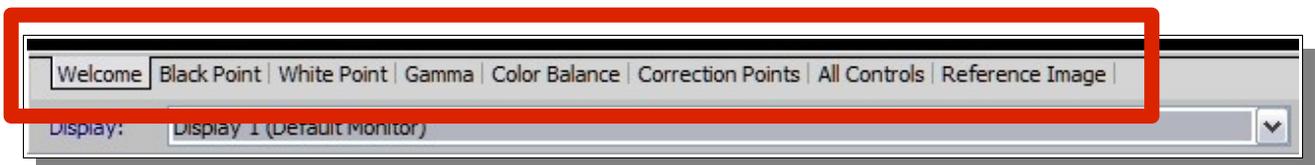
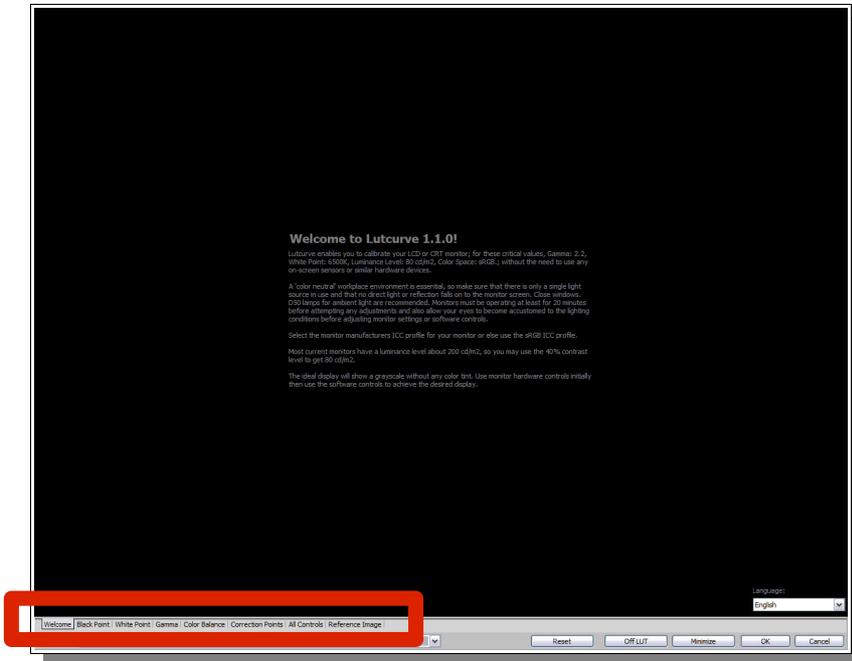
Execute Lutcurve

Launch Lutcurve by clicking on the Lutcurve desktop icon or Windows Start Menu.

The Lutcurve Welcome screen is displayed.

Navigation

Navigation tabs for switching between calibration steps are on the base at the left side of the page. Each page displays concise text instructions as white text over the black background except for the White Point page when black text is used against white.

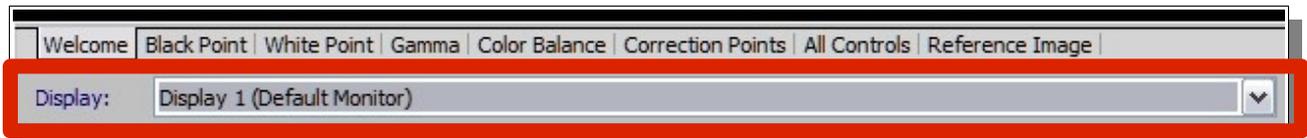


Navigation tabs

Calibration steps are to be made in the tabbed sequence. Users may navigate back and forward using the tabs, any settings made will be preserved.

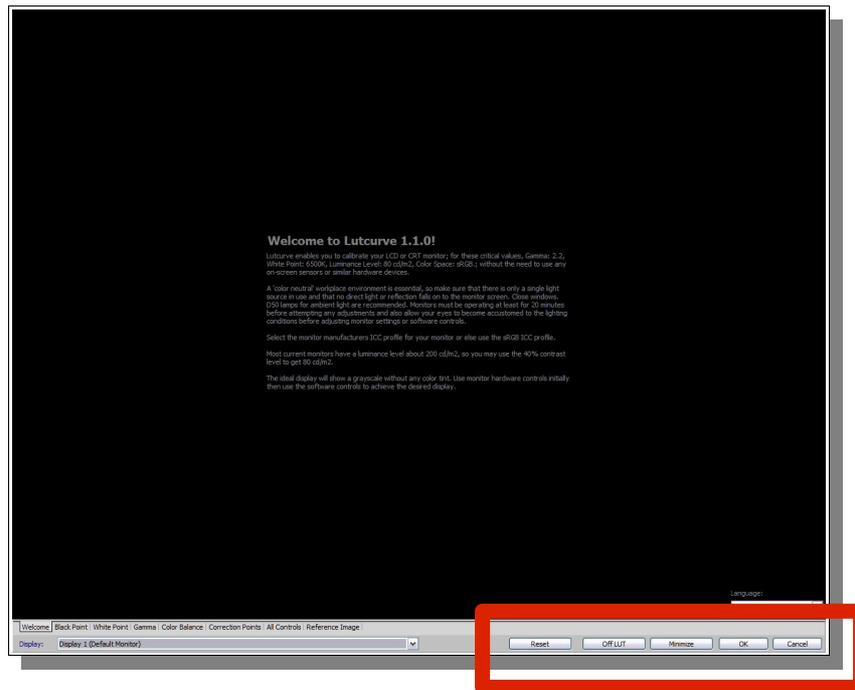
If you are unable to clearly discern the text on the first 3 pages, it means that your monitor is extremely out of calibration and you should therefore adjust the monitor contrast and brightness controls to achieve a clear display. With a properly adjusted monitor and having read the Welcome page text, you are ready to begin monitor calibration.

If using multi-monitor set-up, from the navigation tabs, select the applicable display:



Display selection

Command Button Bar



Command Button Bar

The controls are:

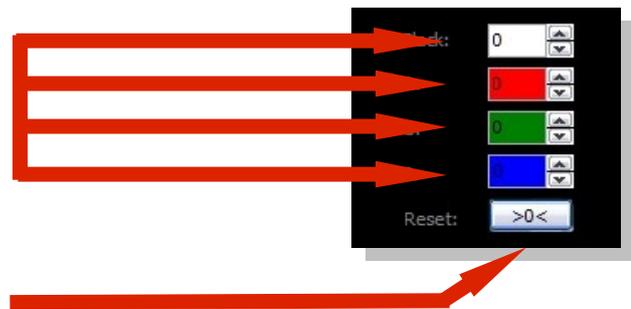
- Reset** Restores settings of Black Point; White Point; Gamma; Color Correction; Curve Adjustment to “ZERO” or null state. Cancel will retrieve recently stored settings.

- Off/On LUT Toggles between display settings applied before adjustment with Lutcurve and current Lutcurve setting.
- Minimize Collapses Lutcurve to Task Bar and displays active desktop. It enables also to show other applications over Lutcurve Window.
Restore Lutcurve to full screen display by clicking on Lutcurve in Task bar.
- OK Applies current Lutcurve settings and closes Lutcurve session.
- Cancel Voids last action made.

Calibration Controls

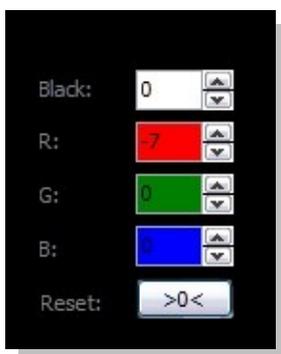
Throughout Lutcurve, controls are provided for users to make adjustments of various calibration settings.

The controls provide for negative and positive adjustment of the selected setting as well as precise adjustment of the RGB component of the selected setting.

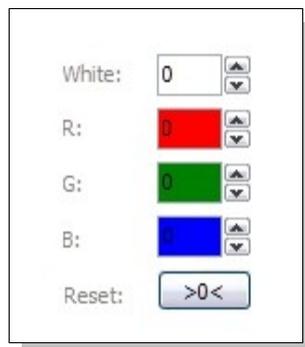


A reset [>0<] button will return all control levels of the selection to null or zero.

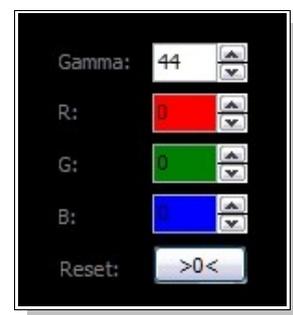
All controls in Lutcurve are specific to each function despite some similarity in appearance.



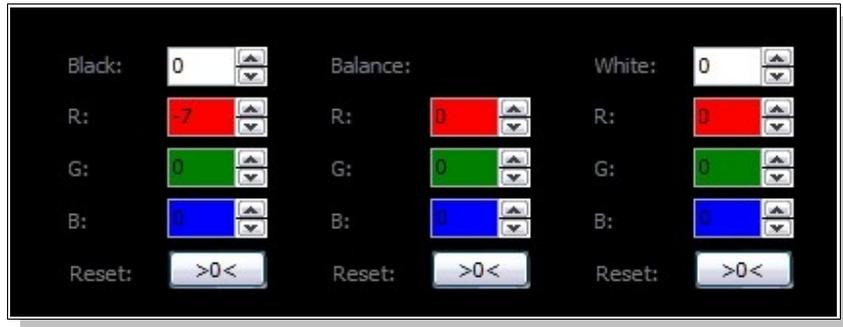
Black Point



White Point

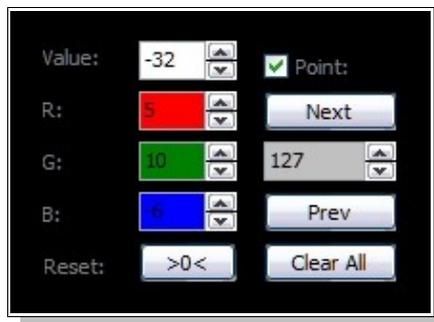


Gamma



Color Balance

(Note: Also offers Black and White point controls for continuous refinement of adjustment.)



Correction Points

You can see all calibration control changes in the program curve viewer:

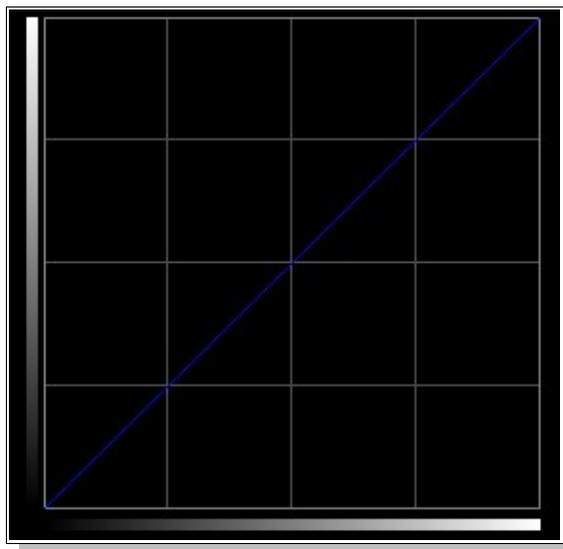
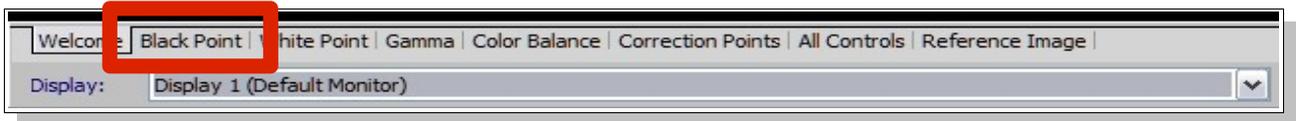


Illustration of unadjusted curve viewed on Black Point page

Hardware Controls Phase

Black Point

Select Black Point:



Use monitor black level controls if present on your monitor, else use the brightness control to show the levels immediately above black.

You must get the screen as black as possible with as many of the 9 (1,1,1 to 9,9,9) black squares visible. These levels of black may not be possible on all monitors.

Increase brightness to distinguish between these values if required. Keep the black background as black as possible. Each level must be color neutral.

On S-IPS TFT monitors and notebook displays a deep black color is not obtainable, adjust for as black as possible for these display types.

White Point

Adjust contrast so that the values (252,252,252), (253,253,253) or (254,254,254) are just visible and color neutral. Decrease the monitor contrast if you cannot see them. Each level must be color neutral. Use monitor R, G and B Gain controls if available to achieve color neutrality.

You should get all white squares visible. Note that many LCD displays and especially aging displays will have a tendency to distort absolute white and upper ranges 235 – 255 and display a yellowed tint.



Illustration of LCD White Point error

Decrease Lutcurve White by -20 to fix it. Note evenly graded squares from left to right at full white and absence of 'blow out' and yellow tint.



Illustration of correctly set White Point

Gamma

Windows and MacOS standard gamma is 2.2. But you can change it on a Welcome page. Any value from 0.1 to 5.0 is supported.

Make vertical columns less visible on the background in the center part using monitor Gamma. On notebook displays and TN monitors view the display from a constant position without changing the viewing angle at all.

It is OK to leave top and bottom parts colored. Only the center part of all columns must be gray and have the same intensity as the background. If your monitor supports Gamma for R, G and B separately, use these controls.

It may not be possible to achieve absolute absence of color(s). If this is the case, adjust so that a center strip of the rectangle is gray, leaving some coloration at the top and bottom of the rectangle.

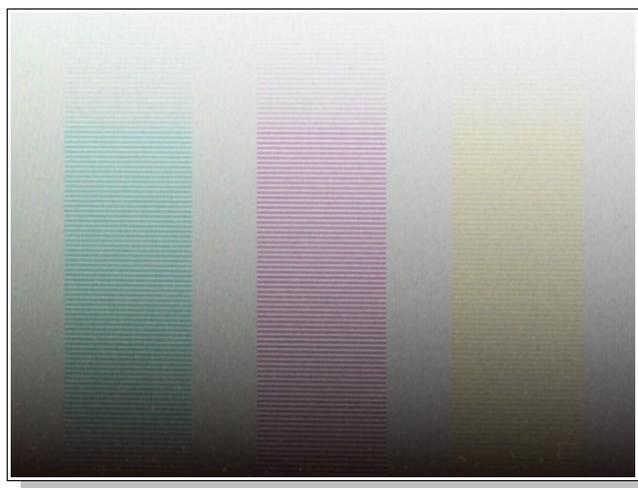


Illustration of incorrect gamma setting

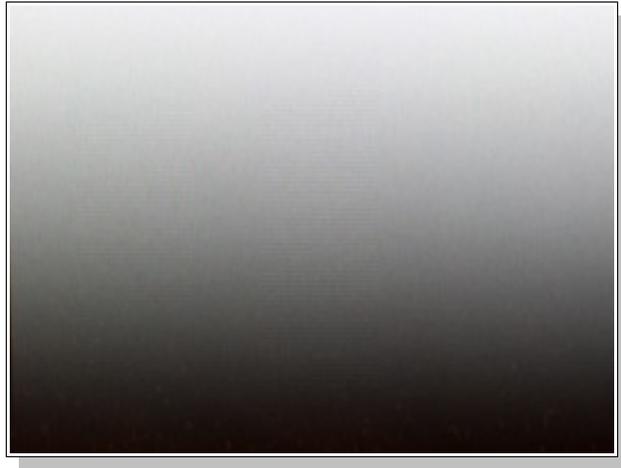


Illustration of correct gamma setting

Color Balance

Make black, white and gray tones as color neutral as possible. If you cannot remove a color tone of some grid lines in the center part, correct the black and white points which must be color neutral.

You may use all previous monitor controls here.

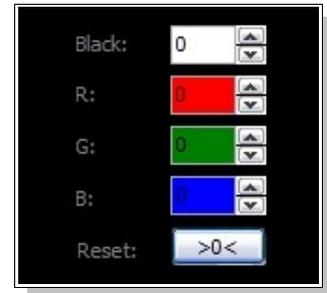
Color Balance adjustments are for 6500 K. Best results will be obtained when using the recommended room lighting conditions with D50 lamps.

Lutcurve Controls Phase

Black Point

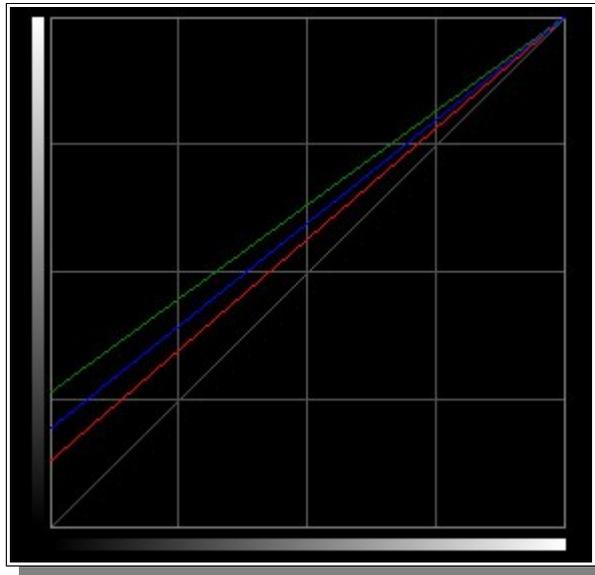
The controls provide for negative and positive adjustment of the selected setting as well as precise adjustment of the RGB component of the selected setting.

A reset [>0<] button will return all control levels of the selection to null or zero.



Users with CRT or notebook displays may need to adjust Lutcurve Black Point controls even though this has been set with monitor control already.

The ideal adjustment is so that you can just see the first black square (1,1,1) against the absolute black background (0,0,0), essentially nil amounts red, green and blue.



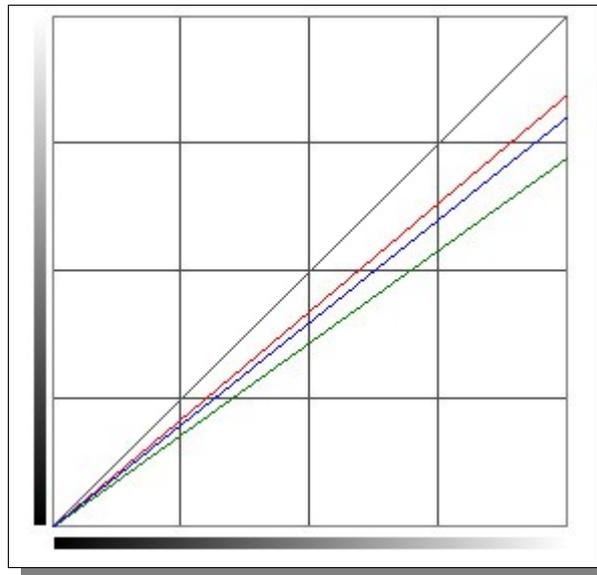
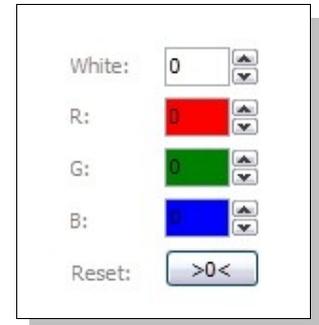
It is acceptable to get the screen as black as possible with as many of the 9 (1,1,1 to 9,9,9) black squares visible. These levels of black may not be possible on all monitors. Do not increase the Black Point if you cannot see (1,1,1) or (2,2,2). Your absolute black level must be as black as possible, even if you cannot see some squares.

Should you notice any coloring of the squares, neutralize the coloring by adjusting the R, G, or B controls, whilst viewing the affected squares.

White Point

The ideal adjustment is so that you can just see the last white square (254,254,254) against the absolute white background (255,255,255) essentially nil amounts red, green and blue.

Should you notice any coloring of the squares, neutralize the coloring by adjusting the R, G, or B controls, whilst viewing the affected squares.



You should get all white squares visible. Note that many LCD displays and especially aging displays will have a tendency to distort absolute white and upper ranges 235 – 255 and display a yellowed tint.



Illustration of LCD White Point error

Decrease Lutcurve White by -20 to correct distorted or yellowed upper ranges 235 - 255.

Note evenly graded squares from left to right at full white and absence of 'blow out' and yellow tint. Without this setting, all subsequent steps will be useless, as gray will not be possible to obtain.

Some colors will always be visible. Contrast loss is not a big problem, but incorrect white settings will adversely impact on subsequent settings, creating a problem when attempting to calibrate.

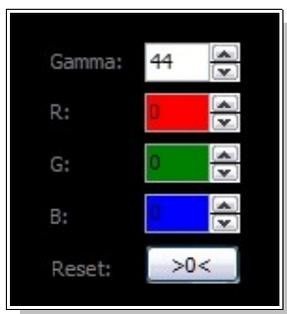


Illustration of correctly set White Point

Gamma

Make adjustments to Gamma and fine tune with RGB until none or very little color is discernible in the center gray rectangle.

On some monitors, it may not be possible to achieve absolute absence of color(s). If this is the case, adjust so that a center strip of the rectangle is gray, leaving some coloration at the top and bottom of the rectangle.



← Start here for a general adjustment.

←
←
←
← Finely adjust R,G,B if required to eliminate any traces of color.

On notebook displays and TN monitors view the display from a constant position without changing the viewing angle at all.

It is OK to leave top and bottom parts colored. Only the center part of all columns must be gray and have the same intensity as the background intensity.



it may not be possible to achieve absolute absence of color(s). If this is the case, adjust so that a center strip of the rectangle is gray, leaving some coloration at the top and bottom of the rectangle.

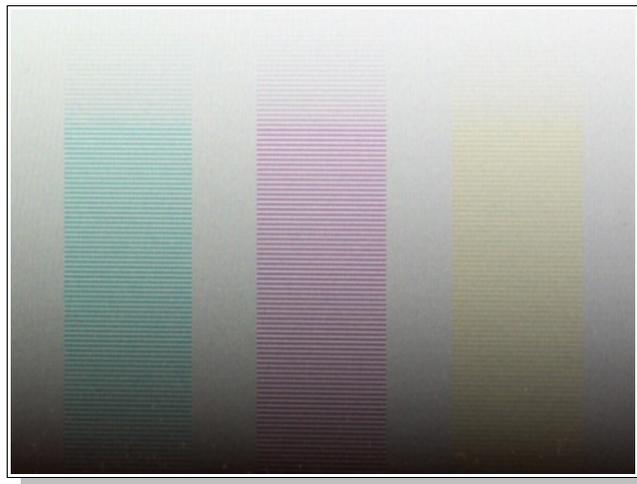


Illustration of incorrect gamma setting

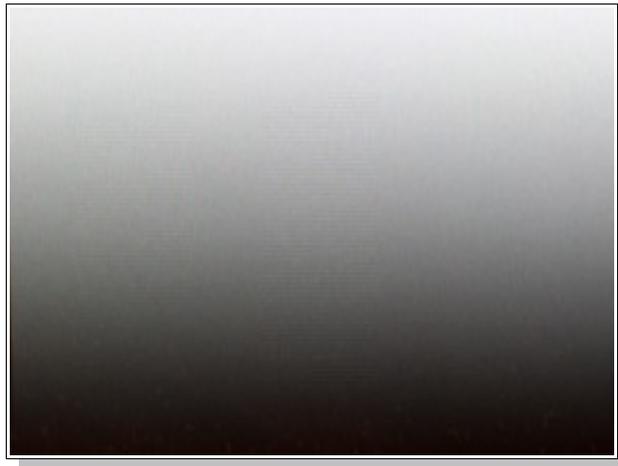
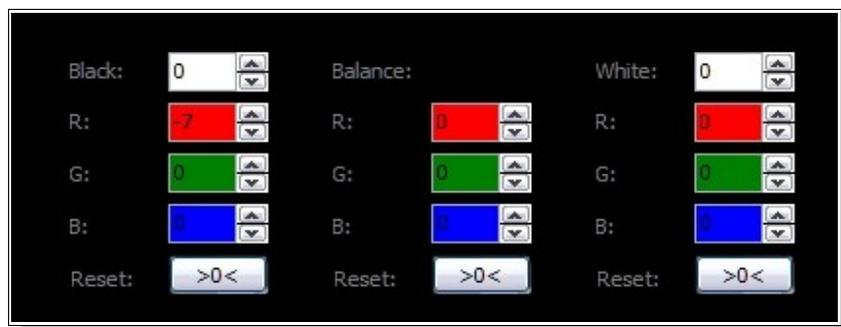


Illustration of correct gamma setting

Color Balance

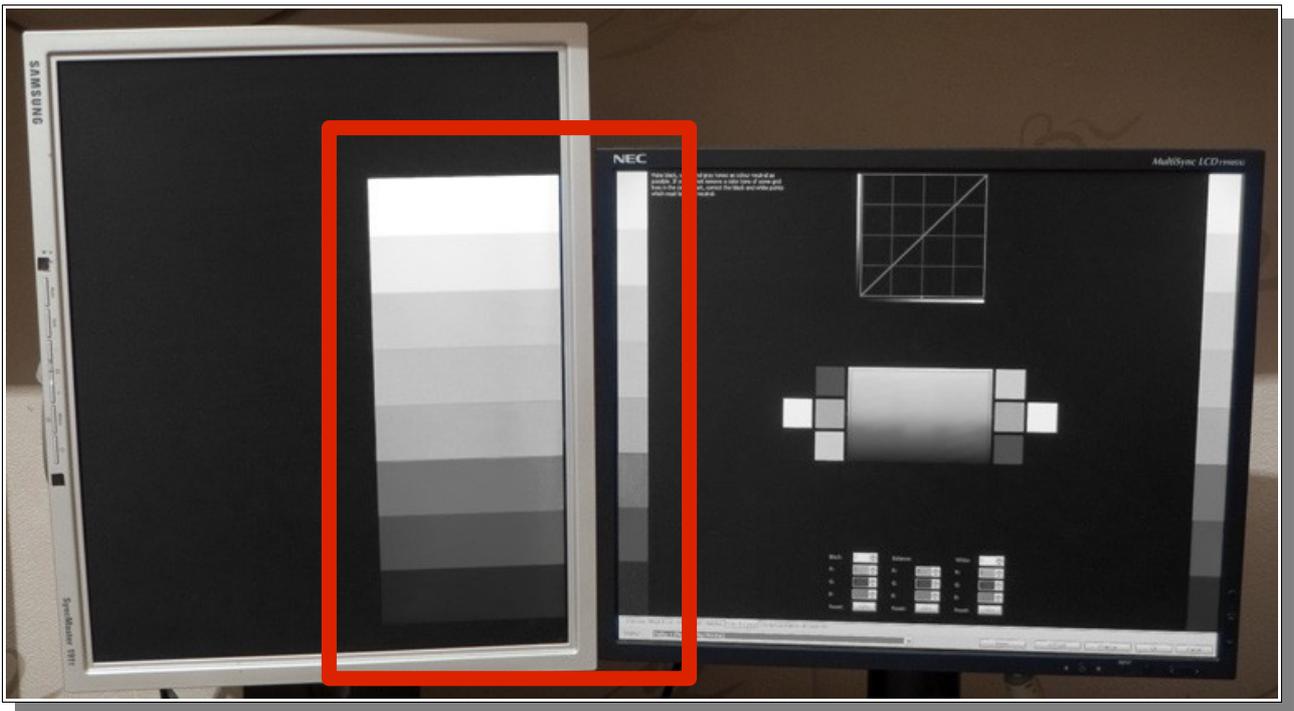
Follow similar procedure as before, only this time you will see a gray scale at either side of the Lutcurve screen display. Use this along with the center gray rectangle to evaluate color purity.



Color balance controls

Cross check with Black Point and White Point settings just to understand what the display range is and the results of other adjustments. Modify if necessary.

This stage also allows users to setup the same brightness, contrast and colors on different displays on multi-monitor configuration. Use gray lines on another display to adjust secondary monitor settings. You can use monitor controls first.



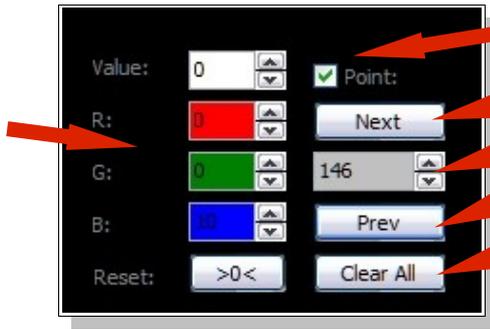
Two-monitor Color Balance areas

Correction Points

It is this stage that the power and ease of Lutcurve is to be observed and will also demonstrate the fine tune capabilities absent in almost all other calibration techniques or systems.

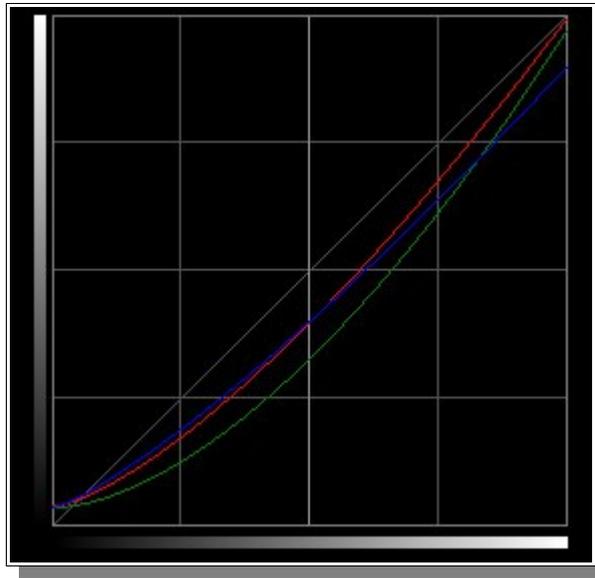
This final stage of the process allows for fine tuning of the RGB values from 0 to 255 at either preset points on the curve, (the vertical lines); or at user selected points, selected by incrementing or decrementing values on the scrolling counter between 'Next' and 'Previous'.

Adjusts R,G,B, by equal increments at selected curve position.



Check this box to remove a 'Point' on the curve.
 Click to select next point on curve.
 Select a value along curve for a point.
 Select a previous point.
 Remove correction settings from curve.

You may find referring to the leftmost portion of the center gray rectangle the easiest method of judging the degree of change occurring.

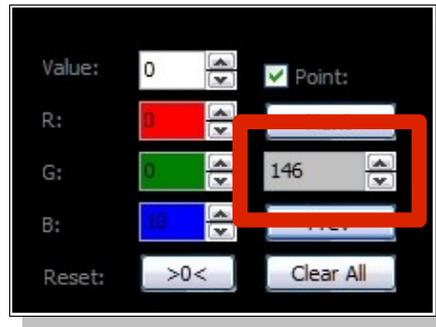


Example of gray scale curve before inserting new points

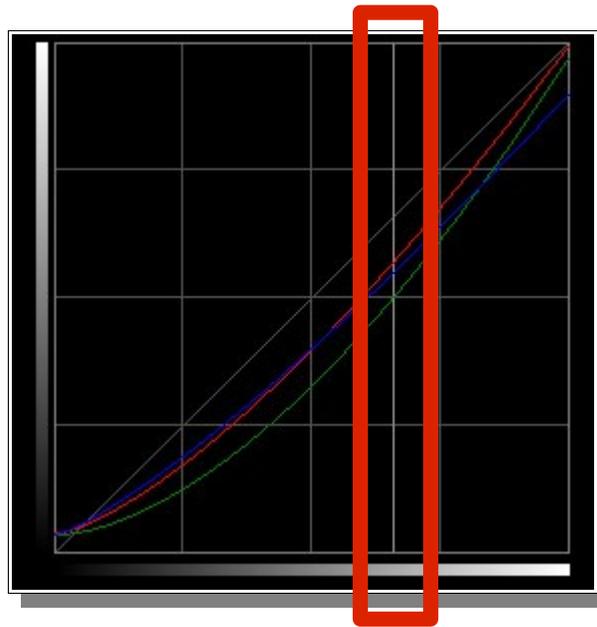
View the curve at top of screen to get an idea of what is happening also.

Occasional reference to the original gray scale will prompt you as to the direction your calibration is taking too.

Having selected a 'point' (refer to point value on control and to the intersection of the vertical line and curve on the display), use the value control to adjust for a neutral (gray) display.



Point value



Example of moving point position (point 168)

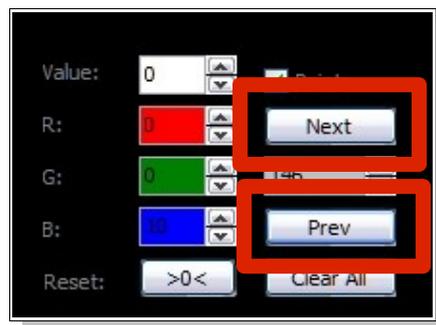
Fine tune this setting if required by setting R, G, B values.

Once satisfied with the setting at this point, select next point by moving point position and adjust as required. Observe that at each point where a setting is made a white 'point' dot is placed at the base of the curve display.



Stored point at point 168. New point position is moved to point 182

Once a point has been selected and adjustment made, the 'previous' and then the 'next' control will enable selection of those points.

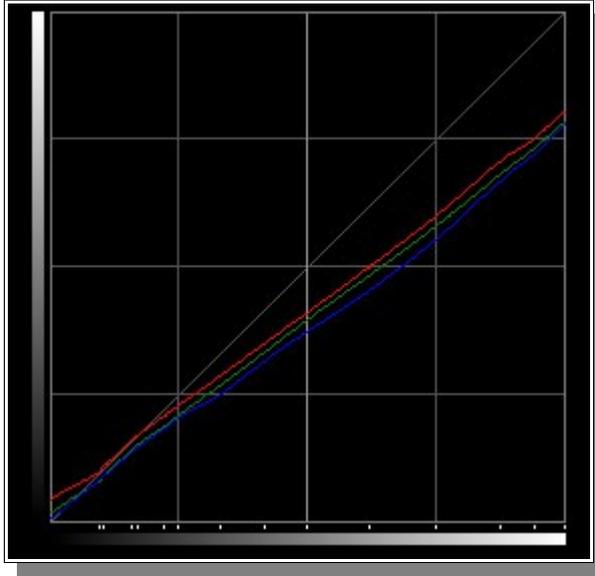


Controls to navigate between stored points

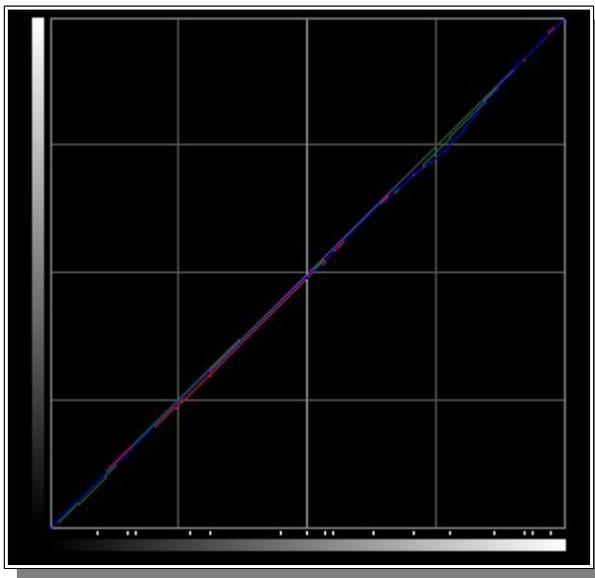
Continue to adjust settings at points further along the curve.

Be sure to only adjust where necessary. Although many points may be selected for adjustment, (up to 255) it should only be necessary to select a few points. If very many are required it suggests that either your work environment is inappropriate or previous settings such as monitor hardware, graphics card, black point, white point, gamma are incorrect and require further adjustment.

Once you have set the Correction Points, your monitor is expected to be calibrated.



Example of a real curve with stored points set on a monitor with yellowed tint



Example a real curve with stored points. Monitor hardware settings are correct.

If not or you are not happy with the results, re-check these

- room lighting;
- monitor hardware controls;
- graphics card controls;
- settings in Lutcurve especially Black and White point.

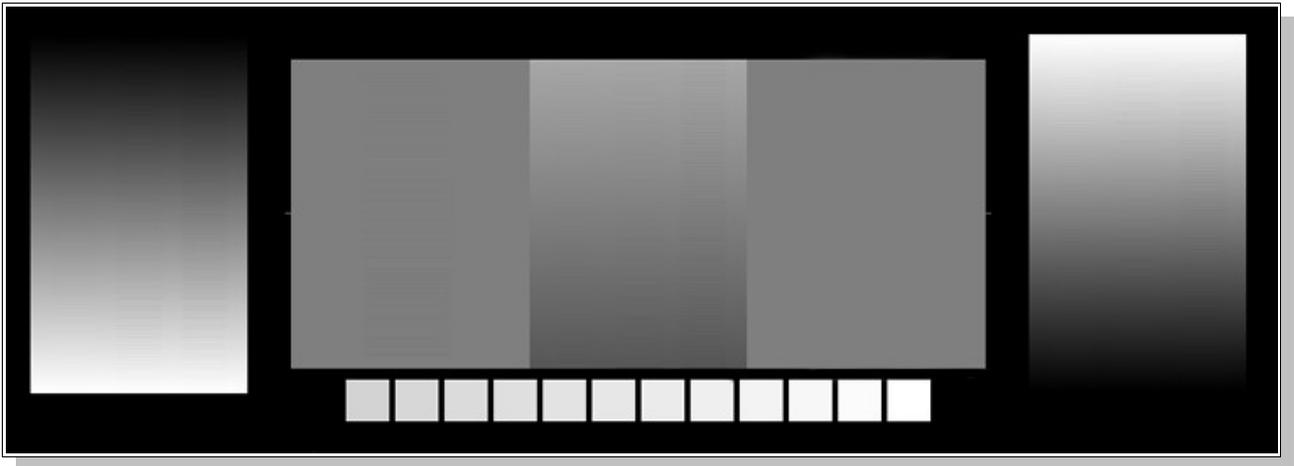


Illustration of properly calibrated monitor

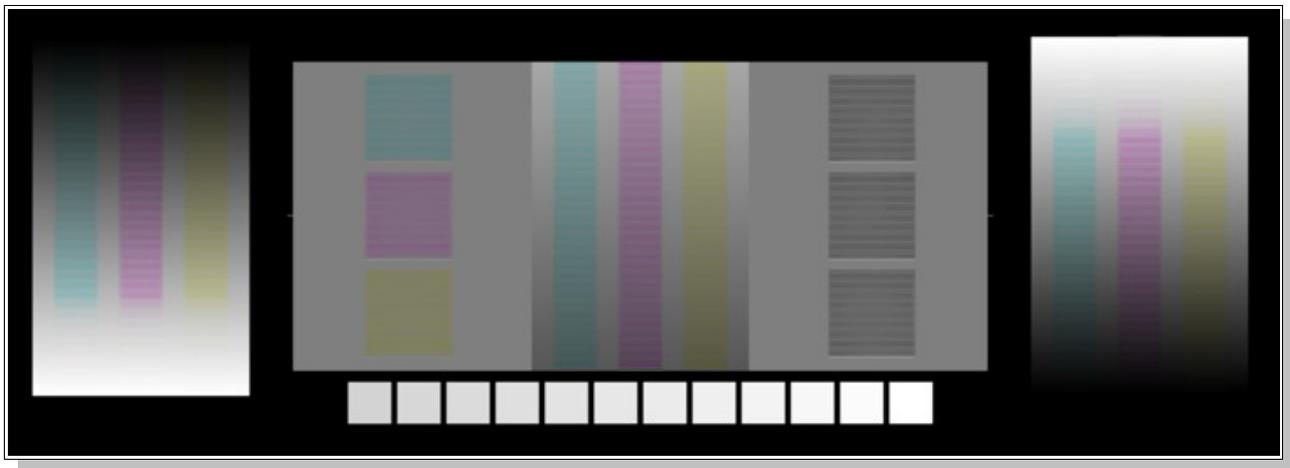


Illustration of incorrectly calibrated monitor

Reference Images

To see the reference images correctly, user should install a correct monitor profile from a manufacturer, or use an icm profile created by a hardware calibration device.

Users may adopt their own image. Making sure that it has sRGB color space. Adobe RGB is not supported.

Click on the link at bottom right corner. Select the desired image from the files in the displayed folder.



Click here to select your own image

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Changelog

Version 1.4.4 – Dec 06, 2009

Dutch translation.

Version 1.4.3 – Oct 02, 2009

Lutloader size optimization;
Internal engine code optimization.

Version 1.4.2 – Sep 20, 2009

Italian translation;
Installer is updated to the latest version.

Version 1.4.1 – Jul 18, 2009

English text corrections;
Finnish translation;
Installer is updated to the latest version.

Version 1.4.0 – Jun 17, 2009

Precise calculation of calibration images on a white area;
Customized gamma values from 0.1 to 5.0.

Version 1.3.2 – May 04, 2009

Polish and French translations;
Documentation is corrected;
Tested on Windows 7 RC.

Version 1.3.1 – Apr 09, 2009

Chinese translation.

Version 1.3.0 – Feb 22, 2009

Portuguese Brazil translation;
A possibility to show other applications over Lutcurve Windows. Use Minimize button;

Windows 7 Beta compatibility tests;
Installer is updated to the latest version.

Version 1.2.1 – Nov 12, 2008

A bug with Vista color correction crash is fixed.

Version 1.2.0 – Oct 01, 2008

Native Vista manifest;
Desktop icon;
Uninstall icon is removed. Please use Control Panel;
License is corrected;
Ready for new Atrise web site structure;
Installer is updated to the latest version.

Version 1.1.0 - Sep 08, 2008

Multilingual mode;
Reference Image is added;
New User Manual;
Trial mode behavior changes;
Installer changes.

Version 1.0.1 - May 29, 2008

A bug of executing HTML help files in Firefox on Vista is fixed;
Minor changes in the user interface;
Bugfix: Incorrect settings files directory name;
Documentation and installer updates.

Version 1.0.0 - Mar 19, 2008

This is the first public release.



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