

MonacoOPTIX **User Guide**

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Congratulations

Congratulations on your purchase of MonacoOPTIX—a monitor calibration system that combines a state-of-the-art colorimeter with powerful and easy-to-use software to provide an outstanding profiling solution for both LCD and CRT displays.

With MonacoOPTIX, you can create a monitor profile that optimizes your display or with MonacoOPTIX Pro, a profile that simulates the output of another monitor. You can also use MonacoOPTIX Pro to evaluate a monitor profile's color accuracy or to fine tune its output.

MonacoOPTIX software is intended for experienced designers, desktop publishers, graphic artists, and digital photographers.

MonacoOPTIX Package Components

Your MonacoOPTIX package includes the following:

- MonacoOPTIX or MonacoOPTIX Pro CD
- MonacoOPTIX User Guide.pdf (*this document*)
- Registration card
- MonacoOPTIX^{XR} colorimeter (*optional in Pro version*)

Product Registration and Support

So that we can provide you with technical support and keep you updated with the latest product information, be sure to complete registration on-line or return the enclosed registration card.

For more information on support options, the latest software updates, and other helpful information, visit Monaco Systems at www.monacosys.com.

Using the Documentation

This guide contains information on the installation and use of MonacoOPTIX and MonacoOPTIX Pro software packages. It provides instructions for creating, evaluating, and fine tuning monitor profiles.

If you purchased MonacoOPTIX software...

<i>Read...</i>	<i>To learn about...</i>
Preface	package components, product registration and support, and using the documentation
Chapter 1	system requirements, supported measurement devices, installation, and registration
Chapter 2	MonacoOPTIX vs. MonacoOPTIX Pro software, getting started, creating a viewing environment, calibration vs. characterization, and when to profile
Chapter 3	creating CRT monitor profiles
Chapter 4	creating LCD profiles
Chapter 9	using monitor profiles
Chapter 10	setting preferences
Glossary	useful terms

If you purchased MonacoOPTIX Pro software...

<i>Read...</i>	<i>To learn about...</i>
Preface	package components, product registration and support, and using the documentation
Chapter 1	system requirements, supported measurement devices, installation, and registration
Chapter 2	MonacoOPTIX vs. MonacoOPTIX Pro software, getting started, creating a viewing environment, calibration vs. characterization, and when to profile
Chapter 3	creating CRT monitor profiles
Chapter 4	creating LCD profiles
Chapter 5	creating profiles in expert mode
Chapter 6	evaluating monitor profiles
Chapter 7	editing monitor curves
Chapter 8	matching monitor profiles
Chapter 9	using monitor profiles
Chapter 10	setting preferences
Glossary	useful terms

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I Installation

This chapter lists minimum system requirements and supported measurement devices, and provides instructions for installing and registering the software.

Minimum System Requirements

CPU	Power Macintosh Pentium PC or better
System	Mac OS X version 10.2 or later Windows 98SE/2000/ME/XP
Display*	Macintosh: 24-bit Windows: any compatible 24-bit video card designed for Windows 98/2000 supporting 800x600 resolution and LUTs
Memory	24 MB RAM 24 MB free disk space

* If calibrating multiple displays attached to a single CPU, a separate video card is required for each display.

Supported Measurement Devices

MonacoOPTIX software supports the following measurement devices:

- MonacoOPTIX^{XR}
- MonacoOPTIX
- MonacoSENSOR

MonacoOPTIX Pro software supports the following measurement devices:

- MonacoOPTIX^{XR}
- MonacoOPTIX
- MonacoSENSOR
- X-RiteColor Monitor Optimizer
- Gretag Macbeth Spectrolino
- Gretag Macbeth Eye-One

Installing MonacoOPTIX Software

Refer to the *Release Notes* on the CD for the most up-to-date installation information.

Colorimeter Installation

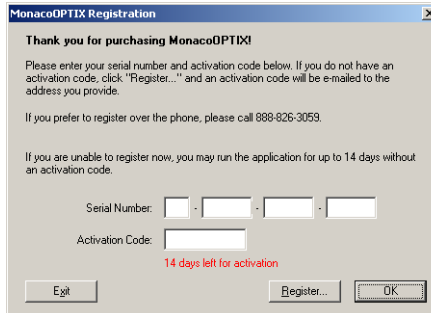
To install the MonacoOPTIX^{XR} colorimeter:

1. Shut down the system.
Connect the colorimeter to any available USB port. If your computer has one USB port, and it is being used, connect the colorimeter using a powered USB hub (not included).
2. Restart the system and launch your Monaco Systems software. The application automatically detects the colorimeter.

NOTE: MonacoOPTIX software will not run without the colorimeter installed.

Registering MonacoOPTIX Software

1. To register your software, launch MonacoOPTIX. The *MonacoOPTIX Registration* window appears.



2. If you've already registered your software, enter your **serial number** and **activation code** in the fields provided and click **OK**.

If you do not have an activation code, enter your **serial number** in the fields provided and click **Register** to register your software online. An activation code will be electronically mailed to you within a few minutes.

If you do not wish to register at this time, enter your **serial number** in the fields provided and click **OK**. You can run the software for 14 days without an activation code.

2 Getting Started

This chapter provides an overview of:

- MonacoOPTIX software vs. MonacoOPTIX Pro software
- getting started with using the software
- creating a proper viewing environment
- calibrating and characterizing a monitor
- determining when to profile a monitor

MonacoOPTIX is software that is used to build ICC-compliant profiles for CRT and LCD displays.

Please note that MonacoOPTIX is not a complete color management system (CMS). It is one component. A profiled monitor will not ensure your monitor matches your output. There are many non-monitor related variables—such as system-level calibration, viewing conditions, paper stock, and operator practices—that need to be controlled to ensure complete workflow predictability. Only a complete color management solution, such as MonacoPROFILER, can help you achieve predictable results.

MonacoOPTIX vs. MonacoOPTIX Pro

MonacoOPTIX software is available in standard and *Pro* versions to meet your profiling needs. Both versions support creating monitor profiles for CRT and LCD displays.

MonacoOPTIX software includes an unlimited site license, allowing you to profile multiple workstation monitors at one site.

MonacoOPTIX Pro software contains a 5 seat license agreement and includes all the features available in the standard version with the following additions:

The **Create Monitor Profile** option supports an *Expert* mode, allowing advanced users to calibrate to target white point, gamma, and luminance values. It also offers control over black bias, and a means to determine the effect of the OSD's (on screen display) visibility during monitor measurements.

The **Evaluate Monitor Profile** option enables you to validate the accuracy of your CRT or LCD monitor profile and to track monitor drift.

The **Edit Calibration Curves** option provides advanced curve editing for fine-tuning the color balance and white point of your display.

The **Match Monitor Profiles** option gives you the ability to calibrate dual monitors or multiple workstation monitors to better match each other.

Quick Start to Using MonacoOPTIX

1. Print this user guide and refer to it as needed.
2. Install the software and measurement device.
3. Power on your display and let it warm up.
4. Using the recommendations in this chapter, configure your viewing environment.
5. Launch the application and follow the displayed prompts. The wizard-like user interface will lead you through the process.

Quick Start to Using MonacoOPTIX Pro

1. Print this user guide and refer to it as needed.
2. Install the software and measurement device.
3. Power on your display and let it warm up.
4. Using the recommendations in this chapter, configure your viewing environment.

5. Launch the application. When the main window appears, select the **Create Monitor Profile** option and follow the displayed prompts to profile your display. The wizard-like user interface will lead you through the process.

Viewing Environment

Consistent lighting is a must when working with ICC profiles. Environmental lighting hitting the monitor from an outside source affects your perception of displayed color. Whether you are creating, editing, or using a monitor profile, your room lighting must be standardized and controlled. Create your profile using the same ambient lighting conditions you will use when viewing images with the profile. When creating CRT profiles, ambient light levels should be kept low. If possible, shield the display and hardcopy viewing area from ambient light.

Other environmental factors affecting color perception should likewise be standardized and controlled. For example, set your desktop to a neutral gray and avoid placing your monitor near windows, bright lights, or intensely colored objects. Your environment—work surfaces, walls, floor, ceiling— should be kept as neutral as possible.

Calibrating and Characterizing a Monitor

Color management systems rely on system-wide calibration as an essential first step in bringing consistency to the color reproduction process. Individual devices cannot be reliably profiled or *characterized* until they are calibrated. With MonacoOPTIX software, calibration and characterization may be combined in the same procedure, however both are separate processes. To ensure the highest quality profile, be sure to perform both procedures under consistent and controlled lighting conditions.

Calibration

MonacoOPTIX is software that is used to *calibrate* and *characterize* a CRT or LCD display. Calibration is the process of opti-

mizing a display to compensate for factors affecting its response to known inputs. This is done by sending color signals to the display, using a colorimeter to measure the display's output, and using the software to modify the response. When a display is properly calibrated, the gamma, white point, black point, and color balance are adjusted and corrected.

A monitor profile is a snapshot of a display's behavior at a single point in time. Because computer monitors fluxuate over time—phosphors age and gamma settings shift—periodic calibration is required to measure and correct these characteristics in preparation for profiling. Only when a display is behaving consistently, will a profile provide an accurate description of its behavior.

Characterization

Characterization is the process of creating a mathematical model—or profile—that *describes* how the CRT or LCD processes color. Characterization is accomplished by sending known RGB values to the display and measuring its output of the same colors in LAB. The results are then compared, correlated, and used to construct the mathematical model which describes the device's use of color.

What is a monitor profile?

A monitor profile is a file that describes the reproducible gamut of the display. It is created for use by an ICC-compliant application or a color management system and is used to specify how colors are converted between the color space of the display (RGB) and the color space of a profile connection space (LAB). Displayed RGB values can appear quite different on another device due to the different gamut or color space associated with the target device. For this reason, a display's RGB values must be converted via a device-independent color space. The LAB values of a color in the profile connection space are device-independent.

How often should I profile my monitor?

Calibrating and profiling is an ongoing process. A profile will be inaccurate if the display is not calibrated prior to profiling. The *Color Trend* option, located in the Evaluate Profile branch of MonacoOPTIX Pro software, provides a means to track your display's drift over time. See page 72 for details.

You should calibrate and profile your display:

- every week for consistently high quality, or every two weeks at a minimum
- when you move the monitor to a different location
- when the brightness or contrast controls have been adjusted
- when the white point of the viewing environment has changed
- when a noticeable amount of drift is apparent

3 Creating CRT Profiles

This chapter provides an overview of using the software along with a supported measurement device to create profiles for CRT (cathode ray tube) displays.

If you are profiling an LCD (flat panel or laptop) device, see *Chapter 4: Creating LCD Monitor Profiles*.

You'll need the following to get started:

- MonacoOPTIX or MonacoOPTIX Pro software
- a supported colorimeter

CRT Profile Basics

CRT monitor profiles are created by using a measurement device to measure a series of color patches that are sent to the display by the software. The collected data is analyzed and used, along with other monitor attributes (gamma and white point), to calibrate and profile your monitor.

With MonacoOPTIX, you can choose to create a profile using a full **Calibrate & Profile** procedure, or if you are confident the current calibration is good, you can choose an abbreviated **Profile Only** workflow.

Once a monitor is profiled, there are a few points to keep in mind.

- Monitor profiles are not interchangeable; they are monitor specific. You cannot use a profile created for one monitor with a different monitor.
- Profiles are based on phosphor measurements and certain information you supply about your monitor—white point, gamma, brightness, and contrast settings. If you adjust a monitor's brightness, contrast, and color controls after it has been profiled, the profile will no longer be accurate.
- Be aware of your environment.

The appearance of a displayed image is strongly influenced by the ambient lighting in the room. Any increase in ambient light decreases the effective monitor gamut. Profiles should be used under the same lighting conditions that were used when the profile was created.

Avoid using bright lights or intensely colored objects near your workstation. These variables can change your perception of color.

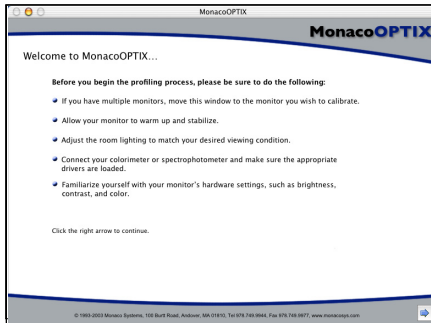
Before you begin

Before you begin profiling your monitor, do the following.

1. Turn your monitor on, and allow it to stabilize by letting it warm up for at least one hour prior to calibrating your display. This will increase the accuracy of color readings.
2. Become familiar with your monitor's brightness, contrast, white point, and RGB color controls. Set the monitor bit depth to maximum resolution.
3. Set your desktop pattern to a light gray or as close to neutral as possible.
4. Connect your colorimeter or spectrophotometer and be sure the proper drivers are installed.
5. Set your room lighting to the level you typically use when evaluating images. Avoid bright lights; they may affect the profiling process. If you are creating a profile to use when evaluating images for press, turn the room lighting off with the exception of your viewing booth. In this manner you replicate the conditions used to evaluate proofs.
6. Clean the surface of your display following the manufacturers recommended procedures. Dust and fingerprints can foul readings. **DO NOT** use household glass cleaners. They can damage the display surface.
7. If applicable, clean the suction cup(s) on the colorimeter using a damp lint-free cloth. Dust on a cup can cause the colorimeter to lose suction during the measurement process.
8. Do not use other calibration or gamma correction software with MonacoOPTIX software, or functionality may be impaired. Remove any other monitor calibration or gamma correction software from your system.
 - Macintosh: If using a version of Adobe Photoshop that includes the Adobe Gamma Control Panel, disable it.
 - Windows: If you are using Adobe Photoshop, uninstall the Adobe Gamma Loader, from your system. **Do not remove the Adobe Gamma Control Panel.**

Step 1: Launch MonacoOPTIX

1. Launch MonacoOPTIX or MonacoOPTIX Pro software.
The *Welcome to MonacoOPTIX* window appears.



▲ **MonacoOPTIX** Welcome window



▲ **MonacoOPTIX Pro** Welcome window

The *Welcome to MonacoOPTIX* window outlines some of the previously discussed prerequisites for creating a valid monitor profile. If you have not already completed these, do so now.

If your workstation has dual monitors, drag the application window onto the monitor to be profiled. The application must remain on this monitor throughout the profiling process.

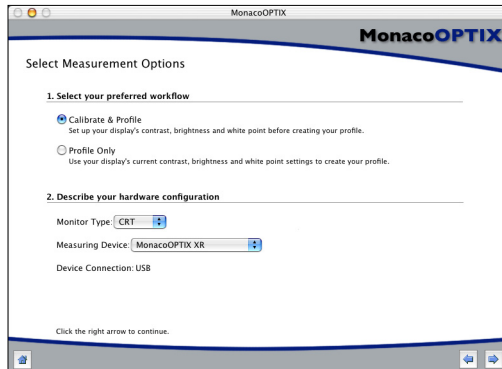


2. If you are using *MonacoOPTIX* software, click the next (>) arrow. If you are using *MonacoOPTIX Pro* software, click **Create Monitor Profile**.

The *Select Measurement Options* window appears.

Step 2: Select Measurement Options

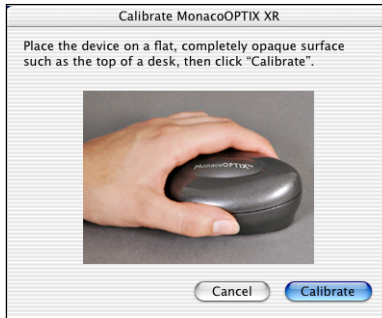
The *Select Measurement Options* window prompts you to define your workflow, monitor type, measurement device, and connection port.



1. Select a workflow:
 - To perform a complete calibration and profiling procedure, select the **Calibrate & Profile** radio button.
 - To create a profile using the current calibration, select the **Profile Only** radio button.
2. Select **CRT** from the **Monitor Type** list.
3. Select your measurement device and connection port:
 - If necessary, choose your measurement device from the **Measuring Device** list.
 - If available, choose the port your measurement device is connected to from the **Device Connection** list.
4. Click the next (>) arrow to continue.

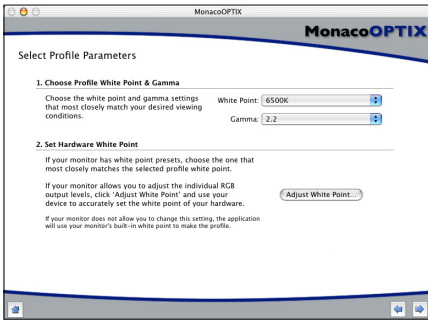
The application verifies the connection with your measurement device. Depending on which device you are using, you may be presented with device configuration or calibration windows. If this occurs follow the screen prompts to calibrate your device.

Sample device
calibration windows ▶

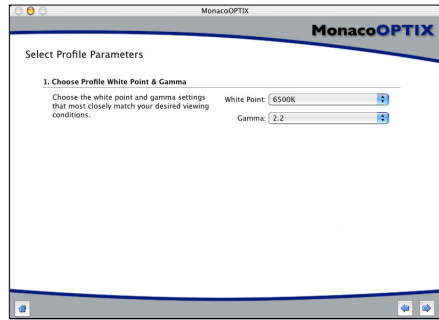


Step 3: Select Profile Parameters

Before you can use MonacoOPTIX software to build your profile, you must input the target white point and gamma settings for the profile. The *Select Profile Parameters* window prompts you for this information. Options available in the



▲ **Calibrate & Profile workflow**



▲ **Profile Only workflow**

Select Profile Parameters window are dependent on the workflow selected in the previous step.

1. Identify a *target* white point for your profile by making a selection from the **White Point** list:

- Select the white point preset with the correlated color temperature that matches or is closest to the temperature of your viewing environment:

5000 K	7500 K	D55*
5500 K	9300 K	D65*
6500 K	D50*	D75*

* D illuminants available in MonacoOPTIX Pro version only

- Select **Monitor Native** to have the software determine the white point during the profiling process. This setting is used for monitors that have factory preset white points or for users who have already set the hardware white point and do not want to change it.
- Select **Custom...** and enter the correlated color temperature (K) or the xy chromaticity coordinates of your target white point.

Ambient light measurements taken with a MonacoOPTIX XR are more accurate when using the optional light diffuser. To purchase a diffuser, call your local sales representative.

- Select **Measure Ambient Light...** and follow the prompts to measure the white point of your viewing conditions. For best results, point the measurement device towards a white sheet of paper which reflects the ambient light, and never directly at a light source or bulb.

2. Choose a gamma setting from the **Gamma** list.

The available settings are 1.8 and 2.2. You can create a custom gamma curve by altering the sample gamma table (Sample Gamma.txt; found on install CD) using your own data. Gamma tables are stored in the following locations:

Mac OS X: Library/Application Support/Monaco/MonacoOPTIX/Gamma Curves

Windows: Program Files\Monaco Systems\MonacoOPTIX\Preferences\Gamma Curves

Follow the formatting instructions in the sample file to change, add or subtract data points, and save the table as a text file. Restart the application to add the curve to the Gamma list. **Once you have named the file, do not rename it.**

```

#
# MonacoOPTIX Custom Gamma Curve sample file
#
# This sample custom gamma curve file consists of a series of
# points along a curve, ranging in scale from 0.0 to 1.0.
#
# Custom curves MUST begin with a point 0,0 and end with a point 1,1.
# Any curve not containing these points will be ignored.
#
# You MUST put a comma and space between each entry as below.
#
# The file must be a text file. Any line beginning with '#' will be
# ignored.
#
0.00, 0.00
0.50, 0.25
1.00, 1.00
    
```

Instructions — (points to the first 10 lines of the code block)

Input and Output curve values — (points to the last three lines of the code block)

▲ *Sample custom gamma curve file*

In the above example, you can change the curve by adding or changing the *Input* and *Output* values as desired.

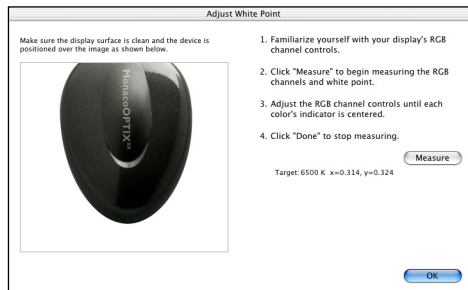
3. Set the hardware white point. (Calibrate & Profile workflow)

If your monitor's white point is not user selectable, skip this prompt and MonacoOPTIX software will use your monitor's built-in white point.

If your monitor's white point is user adjustable, use the controls on the front of your monitor or in the software associated with your monitor to set your monitor's white point to match the target *profile white point* selected above. If the target white point is not an available preset, select the closest match.

Optionally, if your monitor has adjustable RGB controls, you can use the software to maximize the monitor's dynamic range by using measurement results to set the RGB levels. RGB levels set using measured results are more precise than the factory presets and result in more accurate profiles.

To set the monitor white point using measured results, click **Adjust White Point...** and follow the prompts.



4. Click the next (>) arrow to continue.

If you are performing the **Profile Only** procedure, skip steps 4 through 6 in this guide, and continue with step 7. The software will automatically advance to the appropriate screen (*Measure Color Patches*).

About White Point

The white point setting used by your monitor determines the color of your monitor's white. This displayed white can range from warm (yellow-red) to cool (blue) white. A color temperature of 5000 K appears yellowish, and a color temperature of 9300 K appears bluish.

When selecting a white point, your objective is to choose the setting that is closest in color temperature to the white point of the lighting in your room or viewing environment. If you are a designer and view images and proofs using a viewing booth, choose the white point that matches the temperature of the lights used in the viewing booth. Standard viewing booths use 5000 K to 6500 K illuminants.

Once you've determined the white point in your viewing environment, you can set the monitor's white point to match. (Note that not all monitors have a white point adjustment.)

A white point of 5000 K or 6500 K is typically used in most settings. There are varying intensities of simulated daylight.

Source	Degrees K
Artificial Light	
Match Flame	1700
Candle Flame	1850
40-Watt Incandescent Tungsten Lamp	2650
75-Watt Incandescent Tungsten Lamp	2820
100-Watt Incandescent Tungsten Lamp	2865
200-Watt Incandescent Tungsten Lamp	2960
500-Watt Incandescent Tungsten Lamp	2980
1000-Watt Incandescent Tungsten Lamp	2990
3200-Degree Kelvin Tungsten Lamp	3200
"C.P." (Color Photography) Studio Tungsten Lamp	3350
Photo Flood or Reflector Flood Lamp	3400
Daylight Blue Photo Flood Lamp	4800
White Flame Carbon Arc Lamp	5000
Xenon Arc Lamp	6420

Source	Degrees K
Daylight	
Sunlight: Sunrise or Sunset	2000
Sunlight: One Hour After Sunrise	3500
Sunlight: Early Morning	4300
Sunlight: Late Afternoon	4300
Average Summer Sunlight at Noon (Washington DC)	5400
Direct Mid-summer Sunlight	5800
Overcast Sky	6000
Average Summer Sunlight (plus blue skylight)	6500
Light Summer Shade	7100
Average Summer Shade	8000
Summer Skylight (will vary from)	9500 to 30000

Reference: Kodak Motion Picture Imaging, "Approximate Correlated Color Temperature for Various Light Sources" <http://www.kodak.com/country/US/en/motion/support/h2/temp.shtml>

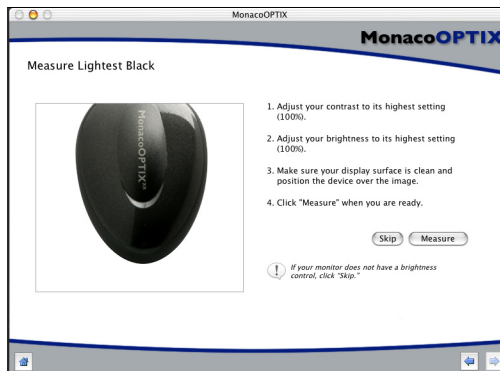
Step 4: Measure Lightest Black

In this step, MonacoOPTIX software uses measurement results to determine the lightest black your monitor can display.

1. Set the contrast control to the maximum (100%) setting.
2. Set the brightness control to the maximum (100%) setting.

Accurately measuring your monitor's lightest black requires adjusting your monitor's brightness. If your monitor does not have a brightness control, click **Skip**, skip steps 5 and 6 in this guide, and continue with *step 7*. The software will automatically advance to the appropriate screen (*Measure Color Patches*).

3. Using the appropriate attachment and method for your measurement device, place the device over the image displayed on the screen.



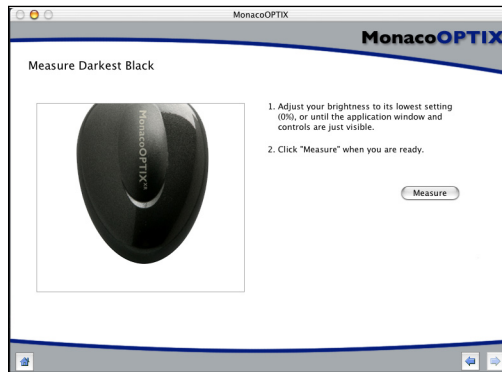
4. Click **Measure** to start the measurement process. When measurements are complete, a check mark appears.
5. Click the next (>) arrow to continue.

Step 5: Measure Darkest Black

In this step, MonacoOPTIX software uses measurement results to determine the darkest black your monitor can display.

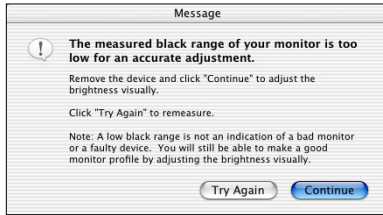
1. Set Brightness.

Using your monitor's brightness control, set the brightness to the minimum (0%) setting. The contrast setting should remain at 100%.



2. With the measurement device still in position, click **Measure**.
3. When measurements are complete, a check mark appears. Click the next (>) arrow to continue.

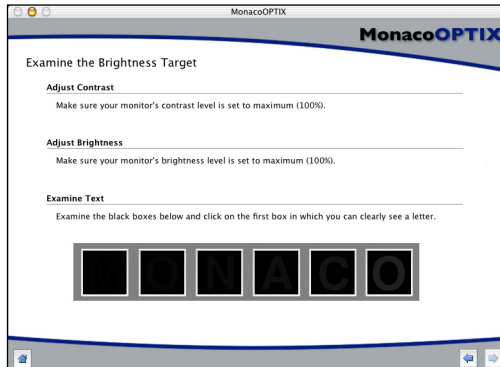
If the software determines that the black range of your monitor is too low for accurate adjustment, the following message appears:



Should this occur, remove the measurement device, click **Continue**, and follow the prompts to create a profile using the alternative visual method.

Examine the Brightness Target

The *Examine the Brightness Target* window begins the process of visually determining the darkest black. This window appears only if the software was unable to determine the darkest black using measured readings. (This is often the case with inexpensive monitors.)



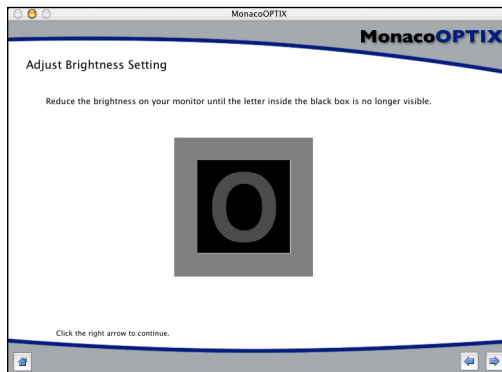
1. Set your monitor's contrast control to its maximum (100%) setting.

2. Set your monitor's brightness control to its maximum (100%) setting.
3. Examine the row of black squares and click on the first box in which you can clearly see a letter.



4. Click the next (>) arrow to continue.

The *Adjust Brightness Setting* window appears, displaying the selected letter.

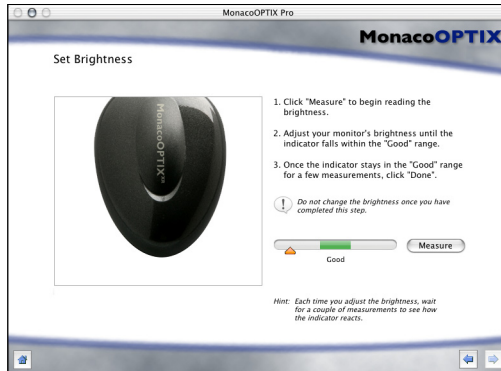


5. Slowly adjust the monitor's brightness control until the letter inside the black box is no longer visible.
6. Click the next (>) arrow to continue.

Skip step 6 in this guide, and continue with step 7. The software will automatically advance to the appropriate screen, (*Measure Color Patches*).

Step 6: Set Brightness

In this step, MonacoOPTIX uses your measurement device to determine the monitor's optimal brightness setting. If the software previously detected that the black range of your monitor is not adjustable, this window will not appear.



1. With the measurement device still in position, click **Measure**.
2. Adjust your display's brightness control until the indicator falls within the **Good** range. Each time you adjust the brightness, wait until the indicator stabilizes before continuing.



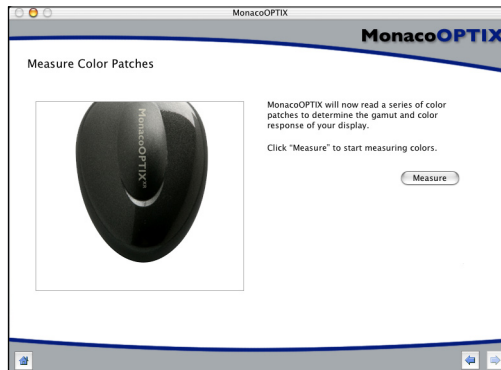
3. When the indicator remains within the *Good* range, click **Done**. A check mark appears.
4. Click the next (>) arrow to continue.

IMPORTANT: *Once you have completed this step, do not change the brightness or contrast controls. If you alter either of these controls, you will inadvertently change the monitor's white point.*

Step 7: Measure Color Patches

In this step, MonacoOPTIX sends a series of color patches to the display and records the measured response. The difference between the detected values and the original values is used to determine the monitor's range of reproducible color.

1. With the measurement device still in position click **Measure**.



The software displays a series of color patches and collects the data measured by your device.

2. When the measurements are completed, carefully remove the colorimeter from the display and click the next (>) arrow to continue.

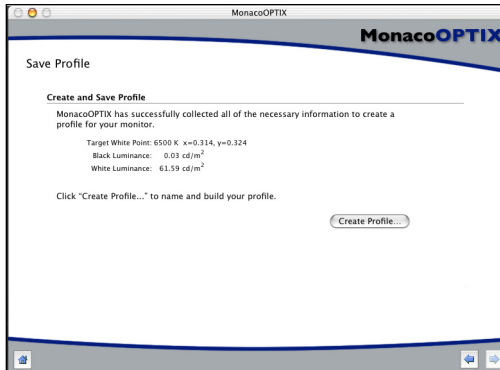
NOTE: *If the device comes loose during the measurement process, click Cancel and try again. If your device uses suction cup(s), you may need to dampen them with a moist, lint-free cloth before pressing the device to the display.*

Step 8: Save Profile

The *Save Profile* window displays the collected settings that will be used to build an ICC profile for your monitor.

From the *Save Profile* window:

1. Click **Create Profile** to name, build, and save the profile.



NOTE: Make a practice of taping the controls/knobs (if applicable) once adjustments are properly made. If the brightness and contrast controls are accidentally changed, you will need to create a new profile for your monitor.

2. Follow the screen prompts. The software defaults to the following locations for storing profiles:

Mac OSX: /Library/ColorSync/Profiles
Win 98SE/ME: Windows\System\Color
Win 2000: WINNT\System32\spool\drivers\color
Win XP: Windows\System32\spool\drivers\color.

WARNING FOR WINDOWS USERS: Do not let the number of profiles stored in the Color directory exceed 30 (approximately), or your O/S may apply the wrong profile.

3. Click the **Home** button or next (>) arrow to return to the main MonacoOPTIX window, or close the application.

4 Creating LCD Profiles

This chapter explains using the software and a supported colorimeter to create a profile for a laptop or flat panel display (LCD). If you are profiling a CRT monitor, see *Chapter 3: Creating CRT Profiles*.

You'll need the following to get started:

- MonacoOPTIX or MonacoOPTIX Pro software
- a supported colorimeter

LCD Profile Basics

LCD profiles are created by sending color data to your display and measuring and evaluating the results. A custom profile is based on the collected data and certain other information you supply about your display—white point, gamma, brightness and contrast settings.

When profiling an LCD device, use a colorimeter that is designed for LCD profiling. The suction cups on devices intended for CRT profiling will damage an LCD display.

MonacoOPTIX supports the following measurement devices for profiling LCDs:

- MonacoOPTIX^{XR}
- MonacoOPTIX

MonacoOPTIX Pro supports the following measurement devices for profiling LCDs:

- MonacoOPTIX^{XR}
- MonacoOPTIX
- GretagMacbeth Spectrolino
- GretagMacbeth Eye-One

Before you begin

Before you begin profiling your display, do the following:

1. Configure the colorimeter for use with an LCD.

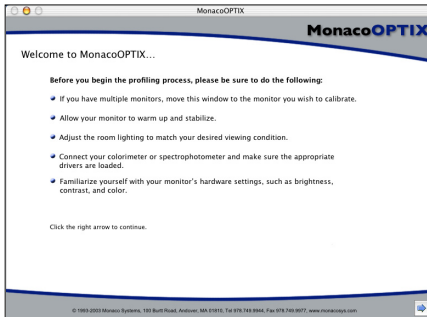
Caution: Suction cup attachments are not designed for use with LCD display surfaces. Using a suction cup device will damage the display. Only use device attachments which are designed for LCDs.

2. Check the current bit depth setting for your display. If necessary, change the display to maximum bit depth.
3. Set your room lighting to the level you typically use when evaluating images. Avoid bright lights; they may affect the profiling process. If you are creating a profile to use when evaluating images for press, turn the room lighting off with the exception of your viewing booth. In this manner you replicate the conditions used to evaluate proofs.
4. Set your desktop pattern to a light gray or as close to neutral as possible.
5. Do not use other calibration or gamma correction software with MonacoOPTIX software, or functionality may be impaired. Remove any other monitor calibration or gamma correction software from your system.
 - Macintosh: If using a version of Adobe Photoshop that includes the Adobe Gamma Control Panel, disable it.
 - Windows: If you are using Adobe Photoshop, uninstall the Adobe Gamma Loader, from you system. **Do not remove the Adobe Gamma Control Panel.**

Step 1: Launch MonacoOPTIX

1. Launch MonacoOPTIX or MonacoOPTIX Pro software.

The *Welcome to MonacoOPTIX* window appears.



▲ **MonacoOPTIX Welcome window**



▲ **MonacoOPTIX Pro Welcome window**

The *Welcome to MonacoOPTIX* window outlines some of the previously discussed prerequisites for creating a valid monitor profile. If you have not already completed these, do so now.

If you are profiling dual monitors, drag the application window onto the monitor to be profiled. The application must remain on this monitor throughout the profiling process.

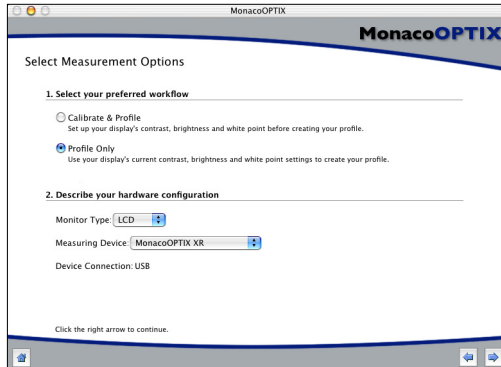


2. If you are using *MonacoOPTIX* software, click the next (>) arrow. If you are using *MonacoOPTIX Pro* software, click **Create Monitor Profile**.

The *Select Measurement Options* window appears.

Step 2: Select Measurement Options

Use the *Select Measurement Options* window to define your workflow, display type, measurement device, and connection port.



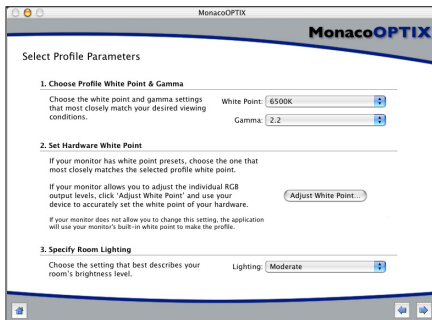
1. Select a workflow:
 - To perform a complete calibration and profiling procedure, select the **Calibrate & Profile** radio button.
 - To create a profile using the current calibration, select the **Profile Only** radio button.
2. Select **LCD** from the **Monitor Type** list.
3. Select your measurement device and connection port:
 - If necessary, choose your measurement device from the **Measuring Device** list.
 - If available, choose the port your measurement device is connected to from the **Device Connection** list.
4. Click the next (>) arrow to continue.

The application verifies the connection with your measurement device. Depending on which device you are using, you may be presented with device configuration or calibration windows. If this occurs, use the calibration plate that came with the device and follow the screen prompts to calibrate your device.

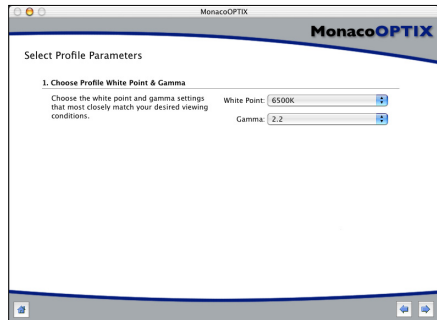
Step 3: Select Profile Parameters

Before MonacoOPTIX software can be used to create a profile, you must input your target gamma and white point, and a description of the lighting conditions used in your work space.

The *Select Profile Parameters* window prompts you for this information. Options available in the *Select Profile Parameters*



▲ **Calibrate & Profile workflow**



▲ **Profile Only workflow**

Parameters in the *Select Profile Parameters* window are dependent on the workflow selected in the previous step.

1. Identify a *target* white point for your profile by making a selection from the **White Point** list:

- Select the white point preset with the correlated color temperature that matches or is closest to the temperature of your viewing environment:

5000 K	7500 K	D55*
5500 K	9300 K	D65*
6500 K	D50*	D75*

* D illuminants in MonacoOPTIX Pro version only

- Select **Monitor Native** to have the software determine the white point during the profiling process. This setting is used for monitors that have factory preset white points or for users who have already set the hardware white point and do not want to change it.

Ambient light measurements taken with a MonacoOPTIX XR are more accurate when using the optional light diffuser. To purchase a diffuser, call your local sales representative.

- Select **Custom...** and enter the correlated color temperature (K) or the xy chromaticity coordinates of your target white point.
 - Select **Measure Ambient Light...** and follow the prompts to measure the white point of your viewing conditions. For best results, point the measurement device towards a white sheet of paper which reflects the ambient light, and never directly at a light source or bulb.
2. Choose a gamma setting from the **Gamma** list.

The available settings are 1.8 and 2.2. You can create a custom gamma curve by altering the sample gamma table (Sample Gamma.txt; found on install CD) using your own data. Gamma tables are stored in the following locations:

Mac OS X: Library/Application Support/Monaco/MonacoOPTIX/Gamma Curves

Windows: Program Files\Monaco Systems\MonacoOPTIX\Preferences\Gamma Curves

Follow the formatting instructions in the sample file to change, add or subtract data points, and save the table as a text file. (See *Step 3: Select Profile Parameters* in Chapter 3 for detailed instructions.) Restart the application to add the curve to the gamma list. **Once you have named the file, do not rename it.**

3. Set the hardware white point. (Calibrate & Profile workflow)

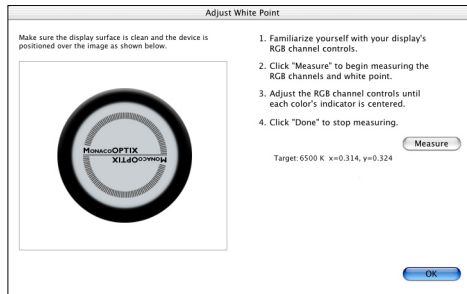
If your monitor's white point is not user selectable, skip this prompt and the software will use your display's built-in white point.

If your display's white point is user adjustable, use the controls on the front of your monitor or in the software associated with your monitor to set your monitor's white point to match the target *profile white point* selected above. If the target white point is not an available preset, select the closest match.

NOTE: Some LCDs offer RGB “white point” controls, but our testing has indicated better results may be achieved by using the native white point

Optionally, if your display has adjustable RGB controls, you can use the software to maximize the monitor’s dynamic range by using measurement results to set the RGB levels. RGB levels set using measured results are more precise than the factory presets and result in more accurate profiles.

To set the display’s white point using measured results, click **Adjust White Point...** and follow the prompts.



4. Specify room lighting. (Calibrate & Profile workflow)

Select a setting from the **Lighting** list that best describes the brightness level of your room lighting.

- Dim - Proofing
- Moderate - Typical office environment
- Bright - Brightly lit environment/outdoors

5. Click the next (>) arrow to continue.

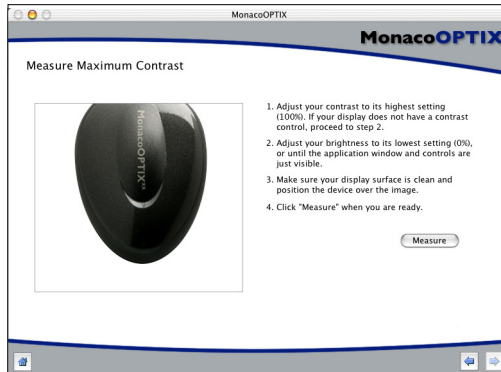
If you are performing the **Profile Only** procedure, skip steps 4 through 8 in this guide, and continue with step 9. The software will automatically advance to the appropriate screen (*Measure Color Patches*).

For more information, see *About White Point*, in *Chapter 3: Creating CRT Monitor Profiles*.

Step 4: Measure Maximum Contrast

Measure Maximum Contrast is the first of several screens that are used to determine the optimal brightness and contrast settings for your display.

TIP: Many LCDs require a “warm-up” and “cool down” period before the display stabilizes. For best results, wait a minute or two between adjusting the brightness and contrast, and clicking the Measure button.



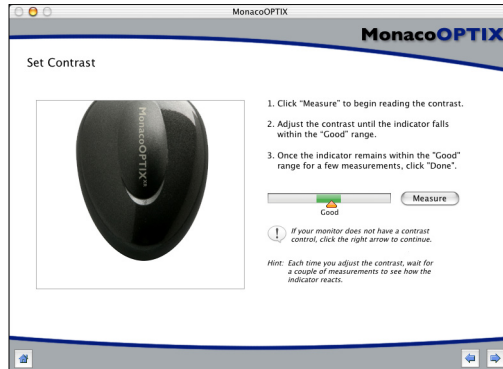
1. If your display has a contrast control, set it to the maximum level (100%), otherwise skip this prompt.
2. Adjust your display's brightness to the lowest level (0%), or until the application window and controls are just visible.
3. Position the colorimeter over the displayed outline.
4. Click **Measure**.

The software displays alternating white and gray patches and takes readings to determine if highlight clipping occurs.

5. When a check mark appears, click the next (>) arrow to continue.

Step 5: Set Contrast

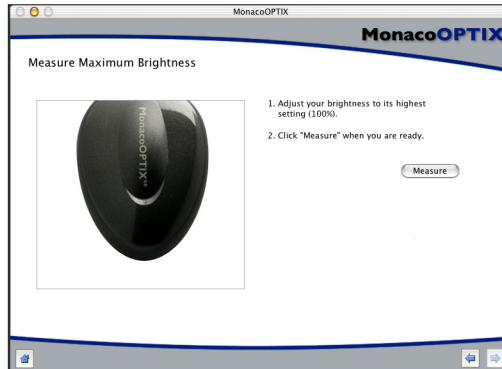
The *Set Contrast* window only appears if the software detected clipping in the previous step. The *Set Contrast* window prompts you to adjust the contrast to eliminate clipping.



1. If your display does not have a contrast control, click the next (>) arrow and proceed to the next step.
2. With the measurement device in position over its displayed outline, click **Measure**.
3. Adjust your display's contrast control until the indicator falls within the **Good** range. Each time you adjust the contrast, wait until the indicator stabilizes before continuing.
4. When the indicator remains within the **Good** range, click **Done**.
5. When a check mark appears, click the next (>) arrow to continue.

Step 6: Measure Maximum Brightness

In this step, the software determines the brightest white your display can reproduce without introducing clipping.



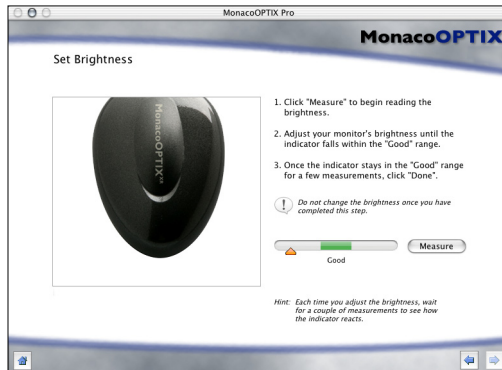
1. With the contrast still set to the previously determined level, set your display's brightness to the maximum level (100%).
2. With the measurement device over its displayed outline, click **Measure**.

The software displays alternating white and gray patches and takes readings to determine if highlight clipping occurs.

3. When a check mark appears, click the next (>) arrow to continue.

Step 7: Set Brightness

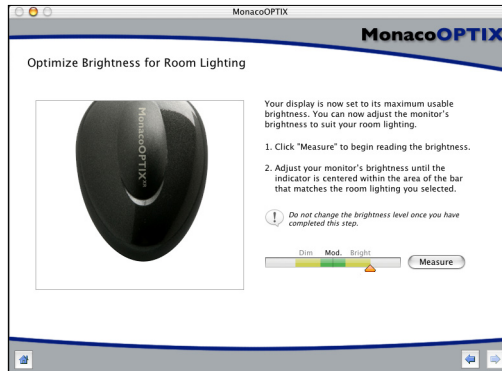
The *Set Brightness* window only appears if the software detected clipping in the previous step. The *Set Brightness* window prompts you to adjust the brightness until clipping is eliminated.



1. With the measurement device in position over its displayed outline, click **Measure**.
2. Adjust your display's brightness control until the indicator falls within the **Good** range. Each time you adjust the brightness, wait until the indicator stabilizes before continuing.
3. When a check mark appears, click the next (>) button to continue.

Step 8: Optimize Brightness for Room Lighting

This step is optional. MonacoOPTIX software has set your display to its maximum usable brightness level. Any brightness setting below this level should produce good results. If this setting is too bright for your particular room lighting, use the *Optimize Brightness for Room Lighting* window to adjust the display's brightness to match your room lighting.



1. With the colorimeter still in position over its outline, click **Measure**.
2. Adjust your display's brightness control until the indicator falls within the range that matches the room lighting setting you chose in *Step 3: Set White Point and Lighting*.
3. When the indicator falls within range, click **Done**.
4. When a check mark appears, click the next (>) arrow to continue.

Step 9: Measure Color Patches

In this step, MonacoOPTIX sends a series of color patches to the display and records its response. The difference between the detected values and the original values is used to determine the monitor's range of reproducible color.

1. With the measurement device still in position, click **Measure**.



The program displays a series of color patches and collects the data measured by your device.

2. When measurements are completed, carefully remove the colorimeter from the display and click the next (>) arrow to continue.

Step 10: Save Profile

The *Save Profile* window displays the collected settings that will be used to build an ICC profile for your monitor.

From the *Save Profile* window:

1. Click **Create Profile** to name, build, and save the profile.
2. Follow the screen prompts. The software defaults to the following locations for storing profiles:

Mac OSX: /Library/ColorSync/Profiles
Win 98SE/ME: Windows\System\Color
Win 2000: WINNT\System32\spool\drivers\color
Win XP: Windows\System32\spool\drivers\color

WARNING FOR WINDOWS USERS: Do not let the number of profiles stored in the Color directory exceed 30 (approximately), or your O/S may apply the wrong profile.

3. Click the **Home** or next (>) arrow to return to the main MonacoOPTIX window, or close the program.

When using your profile, keep in mind that it is only valid when used with the same display settings and lighting conditions that were used to build the profile. If you need to view images using different viewing conditions or settings, create a new profile for each set of conditions. In most cases you will have only one set of conditions and one monitor profile.

5 Using Expert Mode

The Expert calibration mode is an available option in the MonacoOPTIX Pro version of the software. This chapter provides an overview of using the Expert calibration mode to create LCD or CRT profiles. This feature is intended for users with advanced knowledge of color management as well as display and calibration control.

You'll need the following to get started:

- MonacoOPTIX Pro software
- a supported colorimeter

Before you begin

Before you begin profiling your monitor, do the following:

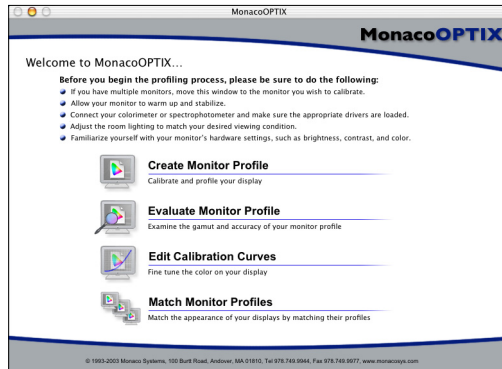
1. Turn your display on. If profiling a CRT display, allow it to stabilize by letting it warm up for at least one hour prior to calibration. This will increase the accuracy of color readings.
2. Become familiar with your display's brightness, contrast, white point, and color controls. Set the bit depth to maximum resolution.
3. Set the desktop pattern to a light gray or as close to neutral as possible.
4. Connect your colorimeter or spectrophotometer and be sure the proper drivers are installed.

5. Set your room lighting to the level you typically use when evaluating images. Avoid bright lights; they may affect the profiling process. If you are creating a profile to use when evaluating images for press, turn the room lighting off with the exception of your viewing booth. In this manner you replicate the conditions used to evaluate proofs.
6. Remove dust and fingerprints by cleaning your display with a soft, lint-free cloth and a cleaner intended for this purpose. DO NOT use household glass cleaners. They can damage the display surface. Use only cleaners manufactured for monitor displays. DO NOT spray cleaner directly onto the monitor screen. Any liquid that seeps into the monitor case could damage the electronics.
7. CRT: If applicable, clean the suction cup(s) on the measurement device using a damp lint-free cloth. Dust on a cup can cause the device to lose suction during the measurement process.
LCD: Configure the colorimeter for use with an LCD.
8. Do not use other calibration or gamma correction software with MonacoOPTIX Pro software, or functionality may be impaired. Remove any other monitor calibration or gamma correction software from your system.
 - Macintosh: If using a version of Adobe Photoshop that includes the Adobe Gamma Control Panel, disable it.
 - Windows: If you are using Adobe Photoshop, uninstall the Adobe Gamma Loader, from your system. **Do not remove the Adobe Gamma Control Panel.**

Step I: Launch MonacoOPTIX Pro

1. Launch MonacoOPTIX Pro software.

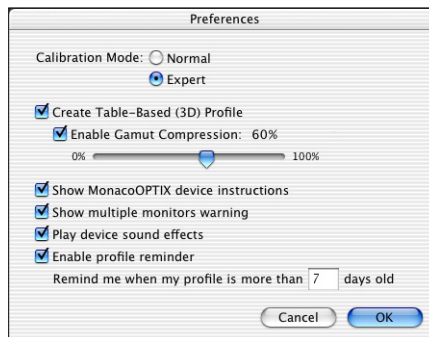
The *Welcome to MonacoOPTIX* window appears.



The *Welcome to MonacoOPTIX* window outlines some of the previously discussed prerequisites for creating a valid monitor profile. If you have not already completed these, do so now.

If your workstation has dual monitors, drag the application window onto the monitor to be profiled. The application must remain on this monitor throughout the profiling process.

2. Select **Preferences** from the **MonacoOPTIX** (Mac) or **File** (Win) menu.



Select the **Expert** radio button and click **OK**. For more information on setting preferences, see *Chapter 10: Preferences*.

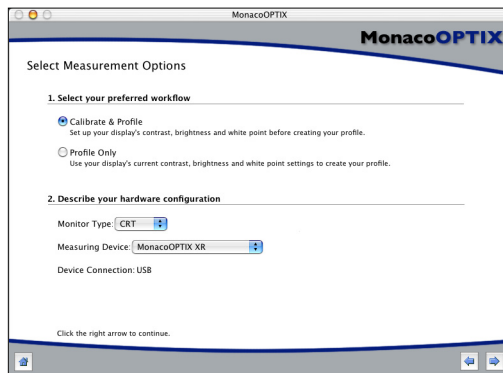


3. Click **Create Monitor Profile**.

The *Select Measurement Options* window appears.

Step 2: Select Measurement Options

The *Select Measurement Options* window prompts you to define your workflow, monitor type, measurement device, and connection port.



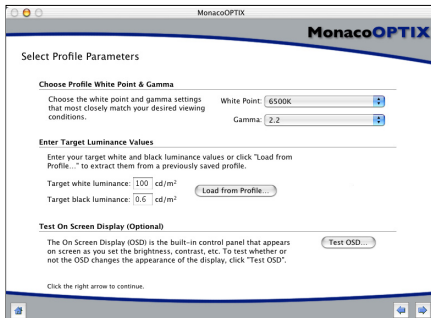
1. Select a workflow.
 - To perform a complete calibration and profiling procedure, select the **Calibrate & Profile** radio button.
 - To create a profile using the current calibration, select the **Profile Only** radio button.
2. Select your display type from the **Monitor Type** list.
3. Select your measurement device and connection port:
 - If necessary, choose your measurement device from the **Measuring Device** list.
 - If available, choose the port your measurement device is connected to from the **Device Connection** list.

4. Click the next (>) arrow to continue.

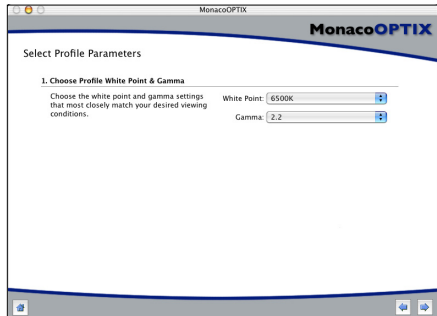
The application verifies the connection with your device. Depending on which measurement device you are using, you may be presented with device configuration or calibration windows. If this occurs, use the calibration plate that came with the device and follow the screen prompts to calibrate your device.

Step 3: Select Profile Parameters

The *Select Profile Parameters* window prompts you to enter your target white point, gamma, white and black luminance values, and to test the effects of taking measurements when the display's internal on-screen display (OSD) is visible.



▲ **Calibrate & Profile** workflow



▲ **Profile Only** workflow

Options available in the *Select Profile Parameters* window are dependent on the workflow selected in the previous step.

1. Identify a *target* white point for your profile by making a selection from the **White Point** list:
 - Select the white point preset with the correlated color temperature that matches or is closest to the temperature of your viewing environment:

5000 K	7500 K	D55
5500 K	9300 K	D65
6500 K	D50	D75
 - Select **Monitor Native** to have the software determine the white point during the profiling process. This setting is used for monitors that have factory preset white points or for users who have already set the hardware white point and do not want to change it.
 - Select **Custom...** and enter the correlated color temperature (K) or the xy chromaticity coordinates of your target white point.

- Select **Measure Ambient Light...** and follow the prompts to measure the white point of your viewing conditions.

For best results, point the measurement device towards a white sheet of paper which reflects the ambient light, and never directly at a light source or bulb.

2. Choose a gamma setting from the **Gamma** list.

The available settings are 1.8 and 2.2. You can create a custom gamma curve by altering the sample gamma table (Sample Gamma.txt; found on install CD) using your own data. Gamma tables are stored in the following locations:

Mac OS X: Library/Application Support/Monaco/MonacoOPTIX/Gamma Curves

Windows: Program Files\Monaco Systems\MonacoOPTIX\Preferences\Gamma Curves

Follow the formatting instructions in the sample file to change, add, or subtract data points, and save the file as a text file. (See *Step 3: Select Profile Parameters* in Chapter 3 for detailed instructions.)

Restart the application to add the curve to the gamma list. **Once you have named the file, do not rename it.**

3. Enter target luminance values. (Calibrate & Profile workflow)
Enter target values for white and black luminance, or click **Load From Profile** to use the values from a previously saved profile. Luminance values define the dynamic range of the display.

White luminance indicates the desired brightness level of the display. With CRTs, the higher the luminance value, the higher the contrast ratio. However, there is a trade-off. A high white luminance setting can shorten the life of the display. Experts in the color management field recommend using a value between 85 and 95 cd/m².

4. Test on-screen display. (Calibrate & Profile workflow)

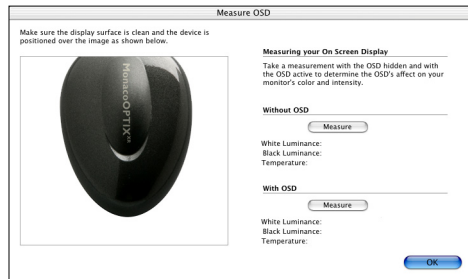
Some monitors change significantly when the internal on-screen display (OSD) is activated. The OSD is the con-

The previously saved profile must have been created using MonacoOPTIX 2.0, MonacoOPTIX Pro 2.0, or MonacoEZcolor 2.6.

trol panel or dialog box that is used to adjust display parameters (brightness, contrast, and white point). The **Test OSD** option allows users to measure the effect of using the OSD when taking measurements, and provides a means of determining the best way to take readings using their particular hardware.

To measure the effect of using your OSD, click **Test OSD**. The *Measure OSD* window appears.

5. With your device in position over its displayed image, click the Without OSD **Measure** button.



The software measures reference data and returns corresponding white luminance, black luminance, and white point values.

6. Launch your OSD (Display Control Panel or hardware controls). Position the OSD window in the area of the screen where you would typically use it to adjust the monitor during calibration. Be sure it does not obstruct device measurements.
7. With your device in position over its displayed image, and the OSD visible, click the With OSD **Measure** button.

The software measures the reference data and returns corresponding luminance and white point values.

8. Compare the values from the two measurements. A large difference means displaying the OSD during measurements affects readings. If this occurs, close the OSD after each

adjustment, allowing the visual indicator to stabilize before continuing.

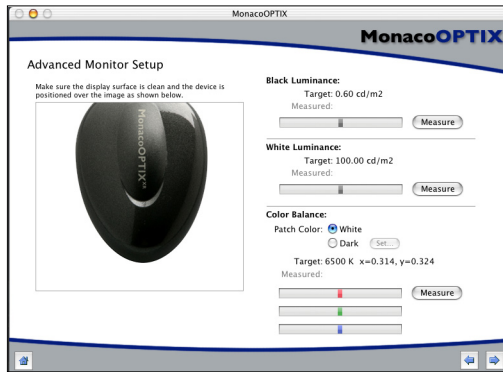
- Click the next (>) arrow to continue.

If you are performing the **Profile Only** procedure, skip step 4 in this guide and continue with step 5. The software will automatically advance to the appropriate screen (*Measure Color Patches*).

Step 4: Set Advance Monitor Settings

Use the *Advance Monitor Setup* window to adjust your monitor to the desired aims.

When setting aim values using the brightness, contrast and RGB gun controls, be aware that changing any one setting will affect the remaining settings. Consequently, some amount of compromise is necessary.



- With your device in position over its displayed image, click the Black Luminance **Measure** button and adjust your monitor's brightness and contrast controls until you achieve the *Black Luminance* aim value.

When the Black Luminance target value is reached, click **Done**.

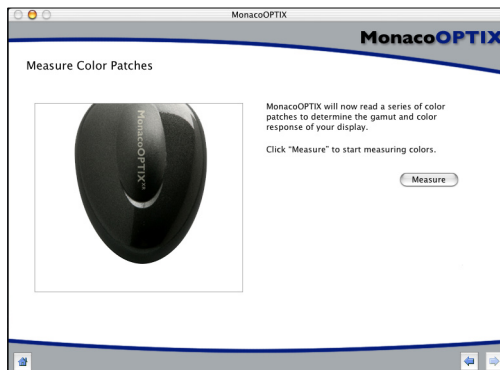
2. Repeat the procedure for the *White Luminance* option.
3. Use the *Color Balance* option to check the color temperature, based on your target white point, across the gray scale.
 - With the **White** radio button enabled, click **Measure**, and adjust your display's RGB controls until the software's RGB indicators align. Click **Stop**.
 - If you are profiling a CRT monitor and your monitor has separate RGB controls for adjusting the black bias, enable the **Dark** radio button, and click **Set**. Otherwise, skip this step and continue with *Step 5: Measure Color Patches*.

Select a gray range to measure. (Readings below the 20% range may be inconsistent and are not recommended for all displays.) Click the **Measure** button and adjust your display's black bias controls until the software's RGB indicators align. Click **Stop**.

Step 5: Measure Color Patches

In this step, MonacoOPTIX Pro uses measurement data to determine your display's output and response relative to the specified aims.

1. With the measurement device still in position, click **Measure**.



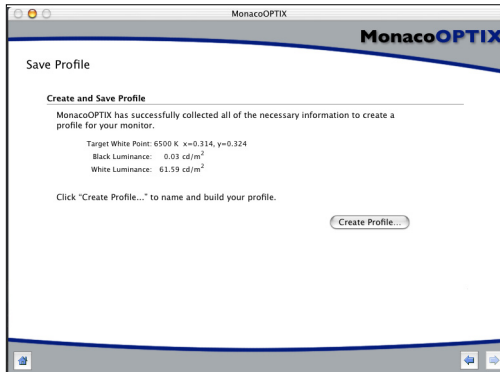
The program displays a series of color patches and collects the data measured by your device.

2. When measurements are completed, carefully remove the colorimeter from the display and click the next (>) arrow to continue.

CRT NOTE: *If the device comes loose during the measurement process, click Cancel and try again. If your device uses suction cups, you may need to dampen them with a moist, lint-free cloth before pressing the device to the display.*

Step 6: Save Profile

The *Save Profile* window displays the collected settings that will be used to build your profile.



The Target White Point setting is the aim value you entered. The Measured White Point setting is the actual color temperature as measured. If desired, you can go back and fine tune your aim value before creating the profile.

1. Click **Create Profile** to name, build, and save your profile.
2. Follow the screen prompts. The software defaults to the following locations for storing profiles:

Mac OSX:	/Library/ColorSync/Profiles
Win 98SE/ME:	Windows\System\Color
Win 2000:	WINNT\System32\spool\drivers\color
Win XP:	Windows\System32\spool\drivers\color

WARNING FOR WINDOWS USERS: Do not let the number of profiles stored in the Color directory exceed 30 (approximately), or your O/S may apply the wrong profile.

3. Click the **Home** button or next (>) arrow to return to the main MonacoOPTIX Pro window, or close the application.

NOTE: Make a practice of taping the controls/knobs (if applicable) once adjustments are properly made. If the brightness and contrast controls are accidentally changed, you will need to create a new profile for your monitor.

6 Evaluating Profiles

This chapter provides an overview of using MonacoOPTIX Pro software along with a supported measurement device to determine the accuracy of your CRT or LCD monitor profile and to track monitor drift. Note that only profiles created with MonacoOPTIX or MonacoOPTIX Pro can be evaluated.

You'll need the following to get started:

- MonacoOPTIX Pro software
- a supported colorimeter
- a monitor profile

Evaluating Basics

MonacoOPTIX Pro gives you the ability to evaluate the general accuracy of your monitor profile and its ability to simulate specific colors.

Evaluating a profile's accuracy is accomplished by using a measurement device to measure a set of color patches (referred to as a chart). The chart is displayed using the active monitor profile. As each patch is measured, the software compares the original data, sent to the display by the software, to the measured data and calculates the difference as a delta E (ΔE) value. Delta E represents how close two colors are to each other. The measured $L^*a^*b^*$ values and delta E value are displayed in fields to the right of the original data. Any measured colors that fall outside the gamut of the active profile are flagged with an asterisk.

Viewing a profiles reported delta E values, gives you an objective way to measure the accuracy of your monitor profile. Delta E is a number representing the color difference between the expected and measured colors. A color's delta E is calculated using the color difference equation and $L^*a^*b^*$ values of both expected and measured colors.

Why should I evaluate my monitor profile?

Evaluating your monitor profile provides a basis for verifying its color accuracy, a means of tracking monitor drift by systematically comparing results that are saved over time, and a way to make sure the monitor is behaving properly.

The evaluation process includes testing the accuracy of any number of colors. Aim color values can be customized, allowing you to test a profile's accuracy with specific colors. This is useful when attempting to reproduce critical colors, for example, the corporate color standard used in a logo.

A monitor's performance fluctuates over time. Observing a monitor's tracking trend can provide information about the state of your monitor and help you gauge when it's time to recalibrate or reprofile.

A trend indicating a sudden shift may be due to someone inadvertently having changed the brightness, contrast, or white point settings, or the monitor may have burned in. A smaller continuous drift could indicate the phosphors are fading, or the monitor is gradually wearing out. Small amounts of shifting are normal and are to be expected.

With the exception of color originating from a display, all color matches are dependent on two or more profiles. Evaluating your monitor profile eliminates it as a possible weak-link when mismatches occur.

Before you begin

Be sure the monitor profile you intend to evaluate is the current default profile for your system. Only profiles created with MonacoOPTIX or MonacoOPTIX Pro may be evaluated. If you change the system profile, you must relaunch MonacoOPTIX Pro to activate the new profile. The software defaults to the profile currently loaded in the following locations:

Macintosh: System Preferences>Displays>Color

Windows: Start\Settings\Control Panel\Display\Settings\Advanced\Color Management

Step 1: Launch MonacoOPTIX Pro

1. Launch MonacoOPTIX Pro.

The *Welcome to MonacoOPTIX* window appears.



If you have more than one monitor connected to your computer, drag the application to the monitor associated with the profile you are evaluating. The application must remain on this monitor throughout the evaluation process.

2. Click **Evaluate Monitor Profile**.

The *Select Device* window appears.

Step 2: Select Device

The *Select Device* window displays the name of the active profile and prompts you to define your monitor type, measurement device, and connection port.

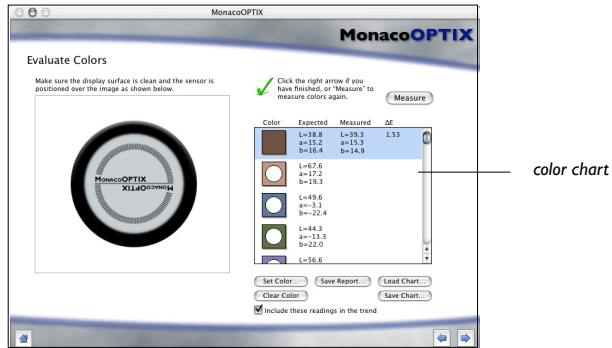


1. The **Current profile** field displays the active profile. If this profile is incorrect, quit the application and using the appropriate control panel, load the profile to be evaluated.
2. Select your monitor type—**CRT** or **LCD**—from the **Monitor Type** list.
3. If necessary, select your measurement device from the **Measuring Device** list.
4. If available, choose the port your measurement device is connected to from the **Device Connection** list.
5. Click the next (>) arrow to continue.

The application verifies the connection with your device. Depending on which measurement device you are using, you may be presented with a device configuration or calibration window. If this occurs, use the calibration plate that came with the device and follow the screen prompts to calibrate your device.

Step 3: Evaluate Colors

A monitor profile is evaluated by testing its ability to accurately render a color chart of up to 24 test patches. MonacoOPTIX Pro can measure any number of color charts, individual colors within a color chart, or subsets of colors. Any color within a chart can be altered to create a specific color for evaluation.



1. Using the appropriate method for your measurement device, attach the device over its displayed image.
2. Select a color chart to measure.

By default, a chart containing 24 patch values corresponding to the GretagMacbeth ColorChecker is displayed in the *Evaluate Colors* window. You can use this chart, load a previously saved chart, measure a subset of colors, or create a new chart.

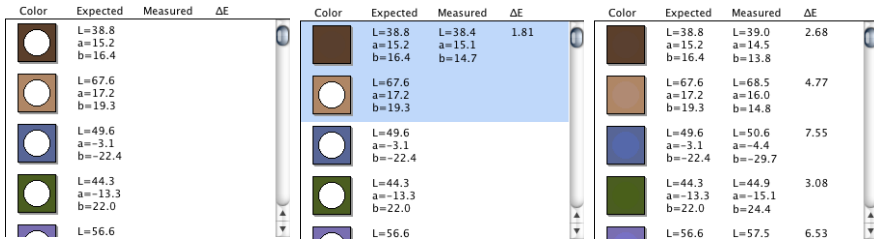
Select a color chart by doing one of the following:

- To use the default chart, no action is required.
- To load a previously saved chart, click **Load Chart**, locate and select the saved chart, and click **Choose** (Mac) or **Open** (Win).
- To create a custom color, highlight an existing color and click **Set Color**, or double-click on the sample

color box. When the **Enter a Color** window appears, enter Lab values for the new color and select **OK**.

- To delete a color from the chart, highlight the color and select **Clear Color**.
- To measure a single color, highlight the color.
- To measure a subset of colors, press command+ shift (Mac) or control + shift (Win) and click on the desired colors.

3. When you have configured your patch set as desired, click **Measure**.

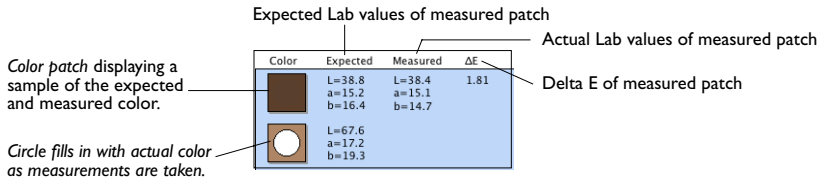


Default chart displaying 24 Gretag Macbeth ColorChecker color patches and **Expected** Lab values.

First patch has been read and the resulting **Measured** and **ΔE** values displayed.

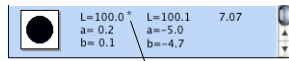
All patches has been read and the resulting **Measured** and **ΔE** values displayed.

As each color patch is read, the circle within the patch is filled in with a simulated sample of the measured color and the corresponding Lab and ΔE values are displayed.



When measurements are complete, an asterisk (*) appears beside any color that falls outside the gamut of

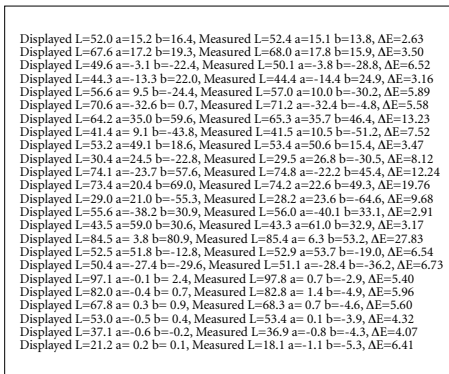
the active profile. This indicates that the monitor profile will not accurately display this color.



asterisk (*) indicating out-of-gamut color

4. Click **Save Report** if you desire to save a written account of your evaluation results as a **.txt** file.

The saved report documents the original Lab values, the measured Lab values, and the resultant delta E for each color in the chart.



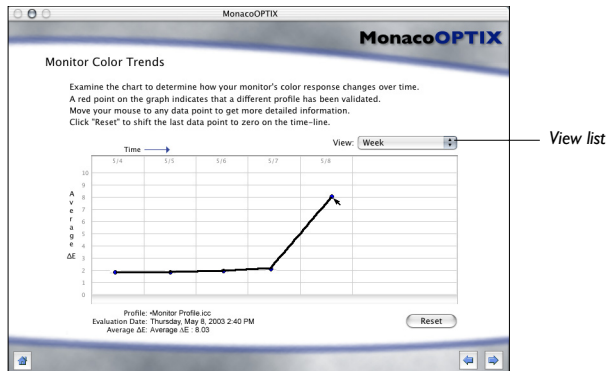
Saved Report

5. If you created a custom chart and want to save it for future use, click **Save Chart**. The chart will be saved as a **.txt** file.
6. If you desire to save the measurement results to use in plotting a monitor trend, enable the **Include these readings in the trend** check box.
7. Click the next (>) arrow to continue.

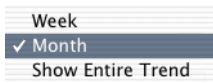
Step 4: Monitor Color Trends

MonacoOPTIX Pro calculates an average delta E for all patches in the last measured chart and displays the result as an individual point in the *Monitor Color Trends* window. By plotting averaged delta E results over time, you can track your monitor's performance.

For a monitor trend to be valid, the same chart must be used each time a profile is evaluated. The averaged delta E of each evaluation session is represented as a single point on the graph. When the mouse is positioned over a point, the profile name, creation date, and averaged delta E (ΔE) value are displayed in fields below the graph. If you plot a trend using more than one profile, the new profile is represented as a red point.



In the example above, five daily evaluation sessions are plotted. On the fifth day, the average delta E jumps six points. This indicates the monitor settings may have inadvertently been changed and the monitor should be reprofiled.



You can view a trend for the last week, month, or the entire trend by making a selection from the **View** list. Clicking **Reset** resets the trend to begin with the most current evaluation.

7 Editing Monitor Profiles

This chapter provides an overview of using MonacoOPTIX Pro software to fine-tune the output of a monitor profile. Only monitor profiles created with MonacoOPTIX or MonacoOPTIX Pro using the 35 patch set can be edited.

You'll need the following to get started:

- MonacoOPTIX Pro program
- a monitor profile

Editing Gamma Curves

The *Edit Monitor Profile* option allows you to fine-tune a monitor profile by adjusting its LUT (look-up table) using standard curve adjustments. The results of edits can be previewed in real time by viewing an image loaded into Photoshop or another imaging application.

During the profiling process MonacoOPTIX Pro uses the white point, gamma, and phosphor chromaticities of your monitor, and the target white point and gamma to calculate a LUT for your monitor. The LUT is a table of values that returns a specific output for any given input, while maintaining the desired white point and gamma. On a color monitor, there is a LUT for each of the three colors—red, green, and blue.

Once a LUT is created for your desired white point and gamma, the software loads it into your video card where it is accessed to look up values in transit to your monitor. The monitor LUT is stored in your profile and loaded each time your computer is started. This is characterized by a sudden shift in brightness.

If you are dissatisfied with the matching ability of your monitor profile, use the *Edit Calibration Curves* option to adjust the gamma curves until the results are acceptable.

Before you begin

Be sure the monitor profile you intend to edit is loaded. MonacoOPTIX Pro defaults to the profile currently loaded in the following locations:

Macintosh: System Preferences>Displays>Color

Windows: Start\Settings\Control Panel\Display\Settings\Advanced\Color Management

Step 1: Launch MonacoOPTIX Pro

1. Launch MonacoOPTIX Pro.

The *Welcome to MonacoOPTIX* windows appears.



If you have more than one monitor connected to your computer, drag the application to the monitor associated with the profile you are editing. The application must remain on this monitor throughout the editing process.

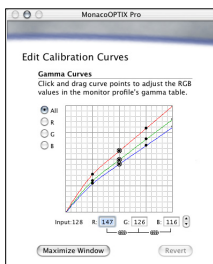
2. Click **Edit Calibration Curves**.

The *Edit Calibration Curves* window appears.

Step 2: Edit Calibration Curves

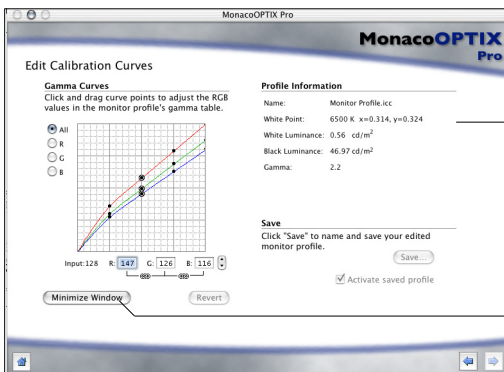
The *Edit Calibration Curves* window, displays a response curve representing the values in the profile's gamma table. A linear device would be represented by a response curve in the form of a straight line. The corrected curve of a monitor indicates it is a non-linear device with deviation most pronounced in the midtone areas (middle) of the curve.

When the *Edit Calibration Curves* window appears, it displays the gamma curves and profile information associated with the active monitor profile. The curves can be *locked* to move together, or adjusted as individual R, G, B channels by selecting the appropriate radio button. The horizontal axis of the



Minimized window

Maximized window



Profile Information

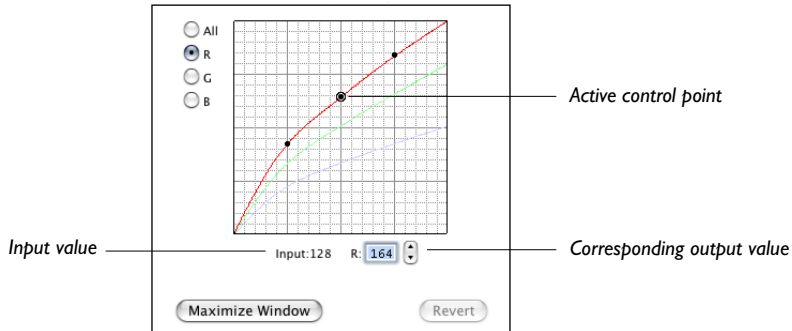
Minimize Window

curve indicates the input values. Modified output values are read from the vertical axis.

To preview edits to the profile, open an image into Photoshop (or another imaging application) and place the window along side the *Edit Calibration Curves* window as you make edits. To free up space on your desktop, you can minimize the *Edit Calibration Curves* window by clicking the **Minimize Window** button.

To select a curve to edit: select **All** to lock all curves for simultaneous editing, or select the appropriate **R**, **G**, or **B** radio button to edit curves individually.

To edit a curve: change the output values manually by selecting and dragging a control point, or adjust the output values numerically by selecting a control point and clicking on the arrows to the right of the output field.



You can have any number of control points on a curve. **To add a control point**, position the cursor over the desired area of the curve and click the mouse button. The active point on the curve is enclosed by a circle.

To remove a control point from the curve, select the point and drag it off the curve. **To reset the curve** to its original state, click **Revert**.

To view the input/output values for any point on the curve, click the mouse button on the desired location.

To save your edited profile, click **Save**.

To use the new profile, check the **Activate Saved Profile** checkbox before clicking **Save**. The saved profile becomes the active profile, and the LUT is downloaded.

8 Matching Monitor Profiles

Use the *Match Monitor Profiles* option to calibrate multiple monitors to better match each other. Profiles that were created using a custom gamma table or the large patch set cannot be matched.

You'll need the following to get started:

- MonacoOPTIX Pro program
- a supported colorimeter

Matching Workflow

Use this workflow to match the output of any number of monitors in a workgroup.

1. Create a monitor profile for each display in your workgroup.
2. Transfer the profiles to a single location.
3. Load the profile into MonacoOPTIX Pro using the *Match Monitor Profiles* option.
4. Use the software to identify the profile with white and black luminance values that can be matched by all other profiles in the group.
5. Use the software to modify the luminance values of the remaining profiles to match the profile identified in the previous step.
6. Save the edited profiles, transfer them to the original profile locations, and load them.

Step I: Launch MonacoOPTIX Pro

1. Launch MonacoOPTIX Pro.

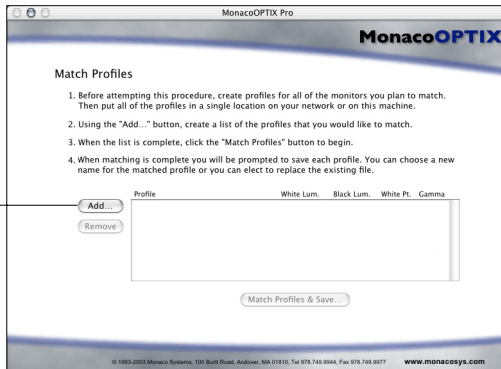
The *Welcome to MonacoOPTIX* window appears.



2. Click **Match Monitor Profiles**.

The *Match Profiles* window appears.

Add profiles to list
for matching

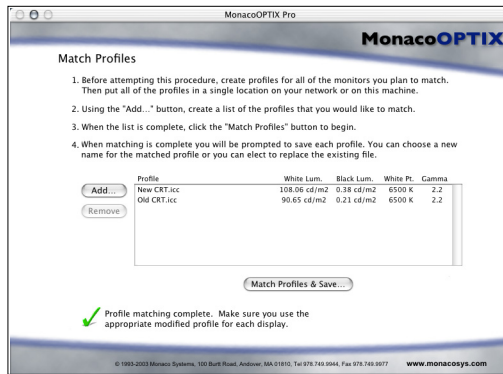


Use the *Match Profiles* window to create a list of the profiles you desire to match.

Step 2: Load Profiles

Click **Add** to load the profiles you desire to match.

- Select a single profile by clicking it.
- Select a contiguous range of profiles by highlighting the first profile, hold down the **Shift** key, and then select the additional profiles.
- Select a non contiguous group of profiles by holding down the **Ctrl** key and then click the profiles you want to load.



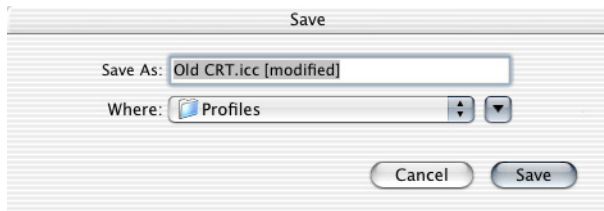
Profile parameters are listed to the right of each profile's name. Only profiles with the same white point can be matched. If you inadvertently load a profile using a different white point, the software will notify you of the inconsistent white point during the matching process.

Step 3: Match Profiles

1. Click **Match Profiles & Save...**

The software identifies the profile with white and black luminance values that can be matched by all other profiles in the group, and modifies the luminance values of the remaining profiles to match.

2. When the *Save* dialog box appears, rename the profile and click **Save**.



3. Repeat this procedure for each *Save* dialog box that appears.
4. When you are returned to the *Match Profiles* window, select the next (>) or **Home** button to return to the main application window.
5. Return the new profiles to the original profile locations, and load them.

9 Using Monitor Profiles

This chapter provides information on:

- storing and managing profiles
- configuring your O/S to use your monitor profile
- where to get more information

Storing and Managing Profiles

Profile storage locations are O/S specific. Most color-managed applications will default to these locations when using profiles. Although you can choose another location for saving profiles, MonacoOPTIX will always default to the correct location.

<i>Platform</i>	<i>Profile Location</i>
Macintosh OSX	User:Current User:Library:ColorSync Profiles
Windows 98/ME	Windows\System\Color
Windows 2000	WINNT\System32\spool\drivers\color
Windows XP	Windows\System32\spool\drivers\color

When you create profiles, give them meaningful names that include the device type, settings used, and date created.

WARNING FOR WINDOWS USERS: Do not let the number of profiles stored in the Color directory exceed 30 (approximately), or your operating system may apply improper profiles.

Configuring your O/S to use your Monitor Profile

When you create a monitor profile using MonacoOPTIX, the program automatically loads the profile into the *ColorSync* (Macintosh) or *Display* (Windows) control panel. If you experience problems or need to change the default profile, follow the directions below.

Configuring the ColorSync Control Panel (Mac)

Use the following workflow to load a monitor profile using the *ColorSync* control panel.

1. Select **Apple Menu >System Preferences>ColorSync**.
2. If not already active, select the **Profiles** tab and **Profiles for Standard Devices** from the uppermost pop-up list.
3. Select **your monitor profile** from the **Display:** pop-up list.
4. Close the control panel.

Configuring the Display Control Panel (Win)

Use the following workflow to associate a profile with a monitor on Windows operating systems:

1. Select **Start\Settings\Control Panel** (98/2000/ME) or **Start\Control Panel** (XP).
2. Double-click the **Display** control panel.
3. Click the **Settings** tab, then click **Advanced**.
4. Click the **Color Management** tab.
5. Select **your monitor profile** and click **Set as Default**.

If your profile is not in the list, click **Add** and select your profile from:

- Windows\System\Color folder (98,ME)
- WINNT\System32\spool drivers\COLOR folder (Win 2000)
- Windows\System32\spool drivers\color folder (Win XP)

Then, click **Add** in the *Add Profile Association* dialog box, then click **Set as Default**.

6. If you are using a Windows 98 operating system, select all other profiles in the list and click **Remove**.
7. Click **Apply**, then **OK** in the *Advanced Display Properties* dialog box.
8. Click **OK** in the *Display Properties* dialog box.

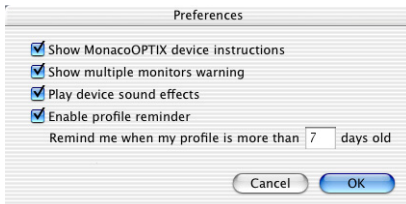
Using Monaco Gamma (Win)

Due to limitations in the Windows operating system, the gamma table contained in a monitor profile is not loaded. MonacoOPTIX includes Monaco Gamma, a startup utility that automatically loads monitor gamma tables. After creating a monitor profile and restarting your computer, Monaco Gamma automatically accesses the monitor profile from the *Display* control panel and loads its gamma table.

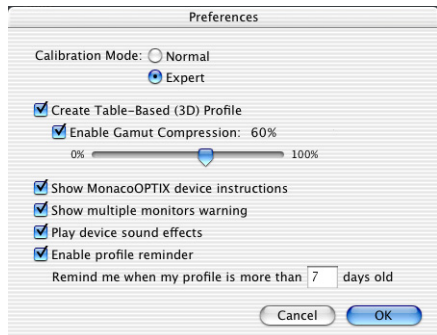
If you're using another monitor profiling package, the Monaco Gamma startup utility may interfere with its operation. To disable the utility, remove the short cut to the Monaco Gamma file from the C:\Windows\Start Menu\Programs\Startup folder and restart your computer.

10 Preferences

This chapter provides information on setting preferences. You probably have preferences for the way you use the software. The *Preferences* dialog box displays settings that you can customize to best suit your needs. Changes you make to the *Preferences* dialog box are saved in a MonacoOPTIX Preferences file and stored in the appropriate location for your platform. The *Preferences* dialog box is accessed from the MonacoOPTIX menu.



▲ MonacoOPTIX



▲ MonacoOPTIX Pro

Calibration Mode (Pro version)

You can use MonacoOPTIX Pro in **Normal** or **Expert** mode by checking the appropriate radio button in the *Preferences* dialog box. Expert mode is intended for users with advanced knowledge of color management as well as display and calibration control.

Create Table-Based (3D) Profile (Pro version)

Use the **Create Table-Based (3D) Profile** option to specify the size patch set you will be using. MonacoOPTIX Pro can be configured to use patch sets of 99 or 35 patches. The 99 patch set uses a compression-based 3D LUT (lookup table) instead of the matrix-based mathematical model that is used by the smaller patch set. The larger patch set provides a more complete picture of the monitor's gamut and phosphors and can, in some instances, provide a better soft-proof of out-of-gamut and highly saturated colors.

Use the gamut compression slider to adjust the amount of gamut compression built into the profile. Less gamut compression will result in more saturated images on screen and the best colorimetric match for all colors. More gamut compression will result in less saturated images on screen, but may provide more pleasing color on screen. Use the default setting to start with and adjust the slider to get the profile you like best.

Profiles created using the larger patch set take longer to build, consume more disk space, cannot be edited, and cannot be matched for use in a workgroup setting. Most users will probably find it unnecessary to use the larger patch set.

Show MonacoOPTIX Device Instructions

When **Show MonacoOPTIX device instructions** is on, prompts are displayed for using the MonacoOPTIX colorimeter with the software.

Check the **Show MonacoOPTIX device instructions** checkbox to enable colorimeter instructions. Once you are familiar with using the device, you may want to disable this option by checking the **Don't show again** checkbox in the *Device Prep-*

aration window, or by unchecking the option in the *Preferences* window.



Show Multiple Monitors Warning

MonacoOPTIX can prompt you to drag the application window to the appropriate monitor when using multiple monitors. Select the appropriate checkbox to enable this option.

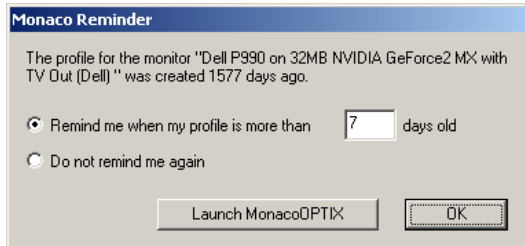


Play Device Sound Effects

Check the **Play device sound effects** checkbox to enable colorimeter sound effects. This option lets you know when measurements have paused or are completed.

Enable Profile Reminder

MonacoOPTIX can remind you to create a new profile after any number of days. To use this option, check the appropriate checkbox and enter the duration in the **...days old** field. To



disable the reminder, uncheck the **Enable profile reminder** option in *Preferences* or enable the **Do not remind me again** radio button in the *MonacoOPTIX Reminder* window.

Glossary

brightness

The lightness of a color or tone, regardless of hue or saturation.

calibration

The process of adjusting the performance of input, display, and output devices to a known state.

characterization

The process of creating a custom profile for an input, display, or output device by describing the unique gamut of each device.

CIE

The Commission Internationale d'Eclairage (International Commission on Illumination), an organization which has determined many of the standards used in color measurement.

color cast

An overall color imbalance in an image.

color gamut

The limited range of colors that can be reproduced by a device or set of colorants. Color gamuts are device-specific.

colorimeter

An instrument used to read or specify color by measuring the amount of light transmitted or reflected in tristimulus values.

Color Management System (CMS)

A software system that ensures color consistency and repeatability across all devices in a production workflow.

ColorSync

The Macintosh Operating System's color management resource for passing device-specific color profiles.

color space

A mathematical model that is used to describe color in which each color is represented by a point in space. Each color is defined in terms of three numbers and plotted as a point in space relative to three axes. RGB and CMYK are examples of color spaces.

color temperature

A measurement of the color of light in degrees Kelvin. The lower the temperature the yellower the light appears. The high temperatures appear bluer. 6500K represents a neutral gray.

contrast

The variation between the lightest and darkest areas in an image.

CRT (cathode-ray tube)

The vacuum tube that is used as a display screen in computer monitors and television sets.

drift

Small changes to a device that occur over time.

gamma

A number representing the gamma curve of a device. A gamma of 1.0 represents a linear device. Gamma is associated with contrast because increasing the gamma increases the contrast in shadows and midtones which decreasing the contrast in highlights.

gamut

The limited range of colors reproducible by a given device.

gray balance

The balance between colorants required to produce neutral grays with no color bias.

highlight

The lightest or brightest points in an image.

ICC (International Color Consortium)

A committee formed in 1993 to establish standards for electronic color publishing.

ICC profile

Profile conforming to International Color Consortium profile format standards.

Kelvin

A system of absolute temperature. For our purposes, the scale is used for the expressing color temperature of the white point of the light source in a computer monitor, and the color temperature of the light source used to view images.

LCD (liquid-crystal display)

The display screen used in laptop computers.

lightness

The variation of a hue along a range from white to black.

midtone

The middle range of tones in an image.

neutral

An area of color containing no bias; white, gray, or black.

phosphor

A substance which coats the inside of computer monitors which glows when struck by certain wavelengths of radiation.

profile

A file containing data which describes how a device handles or distorts colors. Profiles are used by a color-managed application to correct the passage of color through the device.

RGB

A color model based on the three additive primary colors of light used in color reproduction — red (R), green (G), and blue (B). Monitors, scanners, and film recorders are generally RGB devices. RGB is a relative color space.

shadow

The darkest areas in an image.

spectrophotometer

An instrument used to describe or specify color by measuring spectral data.

tonal range

The maximum range of visible tones in an image.

USB (Universal Serial Bus)

USB is a multi-platform industry standard for connecting computers and peripherals.

white balance

The balance between colorants required to produce neutral gray with no color bias.

white point

The chromaticity of a light source, often described by referring to its chromaticity coordinates or the color temperature of the light source.