Avid® Color Correction

User's Guide

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Avid®

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Using This Guide

This guide provides information on the color correction features of your Avid® system. Using these features, you can easily make adjustments to color that will improve the appearance of the video material in your projects.

If your project workflow normally includes traditional color correction, your system's color correction tools can reduce or even eliminate the need for such procedures. If your workflow has not allowed for extensive color correction in the past, your system's color correction tools can make possible a new level of color-finishing quality.

The documentation describes the features and hardware of all models. Therefore, your system might not contain certain features and hardware that are covered in the documentation.

Who Should Use This Guide

This guide is intended for all Avid Color Correction users, from beginning to advanced.

About This Guide

This guide is designed to provide you with all the information you need to make precise color adjustments using your Avid system, including complete explanations of all the color correction tools. The guide leads you through all color correction procedures with task-oriented instructions. Many examples of color correction techniques and typical color correction problems help you understand what to look for when you are correcting color in a sequence. Thorough cross-references to other parts of your Avid documentation make it easy for you to find additional information.

This guide is also available as part of your Avid system's online publications CD-ROM. The online version of the guide displays on your computer screen and offers advanced navigation and search features. It includes the full-color versions of the black-and-white illustrations that appear in the printed version.

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The Contents lists all topics included in the book. They are presented with the following overall structure:

- Chapter 1 provides a general introduction to the organization of the Color Correction tool and summarizes all the other color adjustment tools.
- Chapter 2 describes the Color Correction tool display in detail and explains how to control, customize, and move around in the Color Correction tool.
- Chapter 3 provides step-by-step instructions for all the color adjustment operations you can perform by using the Color Correction tool, together with conceptual information and examples to help you understand the differences between the various color correction controls.

- Chapter 4 provides guidelines for approaching the task of color correction, examples of typical color correction problems, and discussions of how to solve those problems using your system's color correction tools. This chapter is especially useful as an introduction to color correction for Avid users who have little prior experience making color adjustments.
- Chapter 5 explains the Safe Color warning function of your Avid system.
- The Index helps you quickly locate specific topics.

Symbols and Conventions

Unless noted otherwise, the material in this document applies to the Windows® XP and Mac® OS X operating systems. When the text applies to a specific operating system, it is marked as follows:

- (Windows) or (Windows only) means the information applies to the Windows XP operating system.
- (Macintosh) or (Macintosh only) means the information applies to the Mac OS X operating system.

The majority of screen shots in this document were captured on a Windows XP system, but the information applies to both Windows XP and Mac OS X systems. Where differences exist, both Windows XP and Mac OS X screen shots are shown.

Avid documentation uses the following special symbols and conventions:

1. Numbered lists, when the order of the items is important.
    a. Alphabetical lists, when the order of secondary items is important.
- Bulleted lists, when the order of the items is unimportant.
    - Indented dashed lists, when the order of secondary items is unimportant.

▶ One arrow indicates a single-step procedure. Multiple arrows in a list indicate that you perform one of the actions listed.

The ⌘ symbol refers to the Apple or Command key. Press and hold the Command key and another key to perform a keyboard shortcut.

Look here in the margin for tips.

In the margin, you will find tips that help you perform tasks more easily and efficiently.

A note provides important related information, reminders, recommendations, and strong suggestions.

A caution means that a specific action you take could cause harm to your computer or cause you to lose data.

If You Need Help

If you are having trouble using Avid Color Correction:

1. Retry the action, carefully following the instructions given for that task in this guide. It is especially important to check each step of your workflow.
2. Check the release notes supplied with your Avid application for the latest information that might have become available *after* the hardcopy documentation was printed.
3. Check the documentation that came with your Avid application or your hardware for maintenance or hardware-related issues.
4. Visit the online Knowledge Center at www.avid.com/support. Online services are available 24 hours per day, 7 days per week. Search this online Knowledge Center to find answers, to view error messages, to access troubleshooting tips, to download updates, and to read/join online message-board discussions.
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Chapter 1

Introducing Avid Color Correction

Your Avid system includes a comprehensive set of tools for correcting and adjusting colors. These tools have easy-to-use controls that can be mastered quickly by film and video editors.

This chapter provides a conceptual introduction to Color Correction mode, the portion of your system that allows you to correct color across entire sequences. This chapter also summarizes the other color adjustment features available for your Avid system and tells you where to find more information about them.

Introduction to Color Correction Mode

You can perform color correction for your whole project using Color Correction mode. You can correct individual segments in a sequence or correct multiple segments at the same time by linking them in a variety of ways. You can choose from several types of color correction controls, selecting the ones that work best for your project or that are most suitable for your working methods.

When you use Color Correction mode, having a basic understanding of how the color correction toolset is organized and how your system applies color corrections is helpful. The following sections explain these basic concepts.

For an introduction to color correction techniques and illustrated examples of typical color corrections, see Chapter 4.

Making Color Corrections with Color Correction Mode

Avid Color Correction works with video material once it has been edited into a sequence. You make color adjustments in Color Correction mode by selecting segments within a sequence and then altering their color values. The system applies a Color Correction effect to the segment or sequence, associates the adjustments with the sequence on which they are made, and applies them when the sequence is processed for playback. If you disable real-time effects, you can see a real-time preview of a color-corrected sequence, but you must render the Color Correction effect for real-time playback.

For information about disabling and enabling real-time effects, see the section on rendering in the effects guide for your system.

The color corrections that you make with Avid Color Correction do not cause any permanent change to clips in bins or to their associated media files. If you make a color adjustment to a clip in one sequence, that adjustment does not apply to the same clip in a different sequence.

The Color Correction Effect

The Color Correction effect appears in the Image category of the Effect Palette. Because your system automatically applies a Color Correction effect in the Timeline when you make a correction, ordinarily you will not apply the Color Correction effect from the Effect Palette.

One exception occurs if you want to apply a single color correction to multiple segments in a sequence. For more information, see "Applying a Color Correction Effect from the Effect Palette" on page 96.

Once you render the Color Correction effect, you can move the sequence to a system without color correction and the rendered correction will play successfully. In a system without color correction capability, a Color Correction effect is an unknown effect. The effect icon appears blank in the Timeline, and you cannot make any adjustments to it.

Understanding Color Correction Groups

Avid Color Correction provides two groups of color correction controls, the HSL (Hue, Saturation, Luminance) group and the Curves group.

You can make adjustments by using one or both groups of controls. If you make adjustments in both groups, you can turn either group on or off independently to control which adjustments are active. When the system processes the sequence for playback, it applies the adjustments from the active groups to create the final appearance of the sequence. For more information on the interaction between the two groups, see "Understanding Interaction Between Color Correction Groups" on page 37.

Each group uses a different kind of control for making adjustments. The HSL group provides controls for adjusting attributes such as hue, saturation, gain, and gamma; and the Curves group allows you to manipulate points on a graph that control the relationship between input and output color.

For more information on the color correction groups, see "Working with the Group and Subdividing Tabs" on page 35.

Other Color Adjustment Tools

In addition to the work you can do with Avid Color Correction, you can correct and adjust colors at various stages of your project by using several other tools. Some of these tools are described in this guide; others are described in other parts of the documentation for your system. The following is a summary of these tools with the locations of detailed information about them.

- You can create keyframeable color effects on individual segments in a sequence by using the Color Effect. For more information, see the chapter “2D Reference” in the effects guide for your system.
- You can make many adjustments to color within other 2D effects, including color control for keys and border colors. For more information, see the effects guide for your system.
- You can set safe limits for the colors that appear in your project and ask the system to warn you when those limits are exceeded. For more information, see Chapter 5.

Chapter 2

Understanding Color Correction Mode

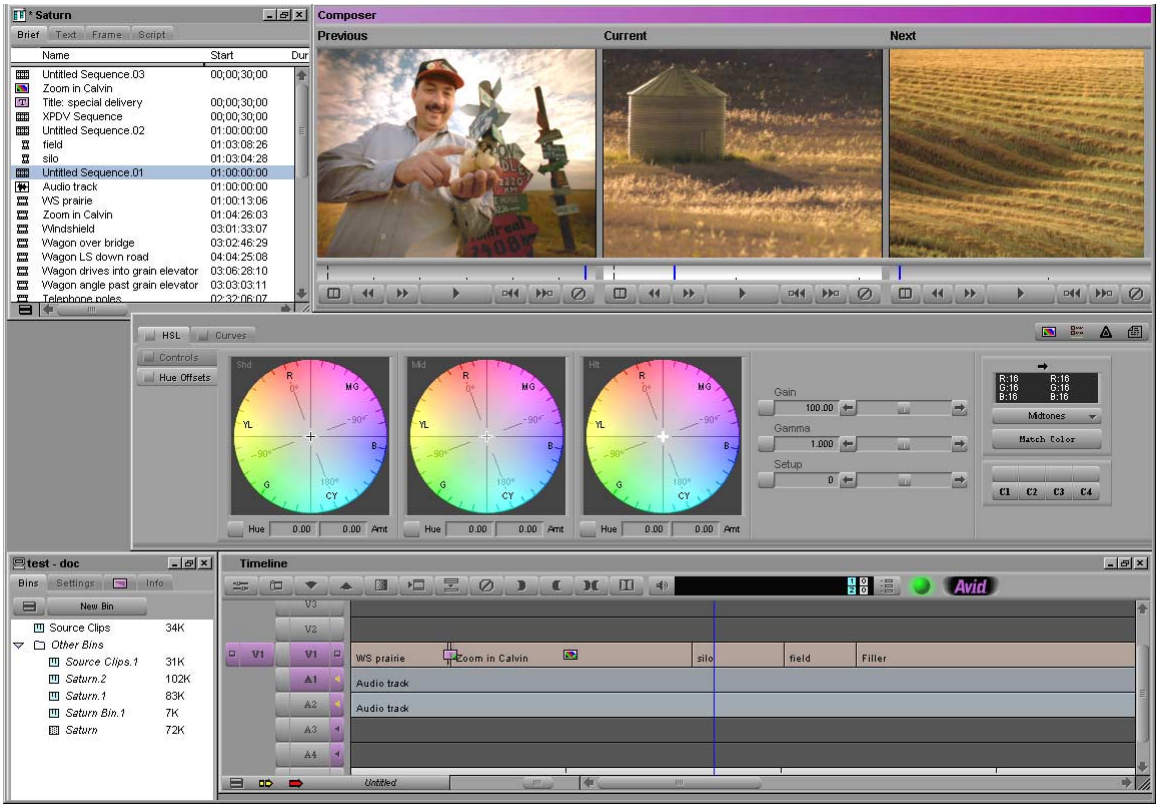
As it does with other modes (such as Trim mode and Effect mode), your Avid system reconfigures the Edit monitor display to provide a specialized interface for Color Correction mode. This chapter describes the monitor display for Avid Color Correction and explains how to control and customize it.

Entering and Leaving Color Correction Mode

To enter Color Correction mode, do one of the following:

- Choose Color Correction from the Toolset menu.
- Press Shift+F8.

  The Color Correction toolset appears.



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You can map the Color Correction Mode button from the CC tab of the Command palette to the keyboard or to another button that can be remapped. For more information, see "Using the Command Palette" in the chapter "Using Basic Tools" in the user's guide or the editing guide for your system.

To leave Color Correction mode and return to another mode:

- Make a selection from the Toolset menu.

  The system replaces the Color Correction toolset with the toolset for the mode you selected.

Overview of the Color Correction Mode Toolset

The toolset for Color Correction mode includes three windows:

- The Composer window, a three-monitor view

  For more information, see "The Composer Window in Color Correction Mode" on page 24.

- The Color Correction tool

  For more information, see "The Color Correction Tool" on page 35.

- The Timeline, resized to accommodate the other elements of the color correction toolset

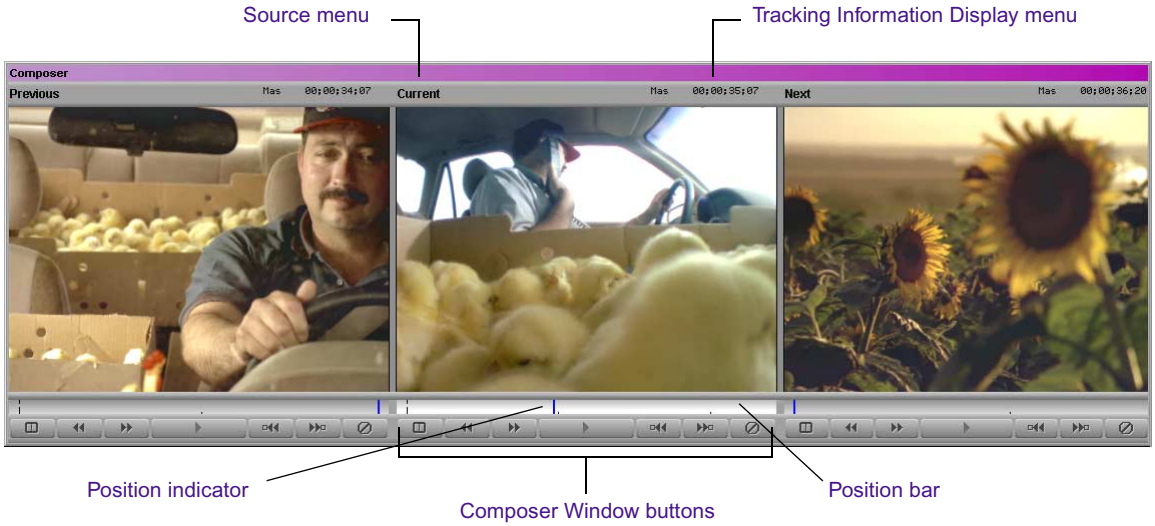
Avid Color Correction also allows you to display several kinds of image information in the Client monitor. For more information, see "The Client Monitor in Color Correction Mode" on page 34.

The following sections describe the organization of these elements and explain how to navigate in them and how to customize them for your project needs.

The Composer Window in Color Correction Mode

The Composer window in Color Correction mode is a three-monitor view. This allows you to view material from three segments at once, making it easy to compare material on a shot-by-shot basis. This three-monitor view shares many of the features of the monitors in other modes but also includes several features specific to Color Correction mode.

The following illustration shows the features of the Composer window in Color Correction mode.



By default, the monitors show (from left to right) the first frame of the previous segment, the first frame of the current segment, and the first frame of the next segment.

Activating Monitors

Only one of the monitors is active at any one time. The position bar is highlighted in the active monitor, and the image from the active monitor is displayed in the Client monitor.

To activate a monitor:

- Click anywhere in the monitor's image area, in the position bar, or on the Tracking Information Display menu.

When you click one of the Composer Window buttons below a monitor, the system activates that monitor and performs the action associated with the button.

Displaying Tracking Information

The Composer Window monitors in Color Correction mode have the same options for displaying tracking information that are available in other modes.

To display tracking information:

- Click the monitor's Tracking Information Display menu, and then choose the format you want from the menu.

By default, the Tracking Information Display menu shows no information until you select a tracking format.

For more information on tracking information display, see the chapter "Viewing and Marking Footage" in the user's guide or the editing guide for your system.

Displaying Images in Monitors

The default Composer window for Color Correction mode is a three-monitor view that shows images from three adjacent segments in the Timeline. You can customize the monitor view to show images from other parts of the sequence, to show specific images in a split-screen display, to hide the video, or to display wide-screen (16:9) video.

Understanding Default Monitor Display

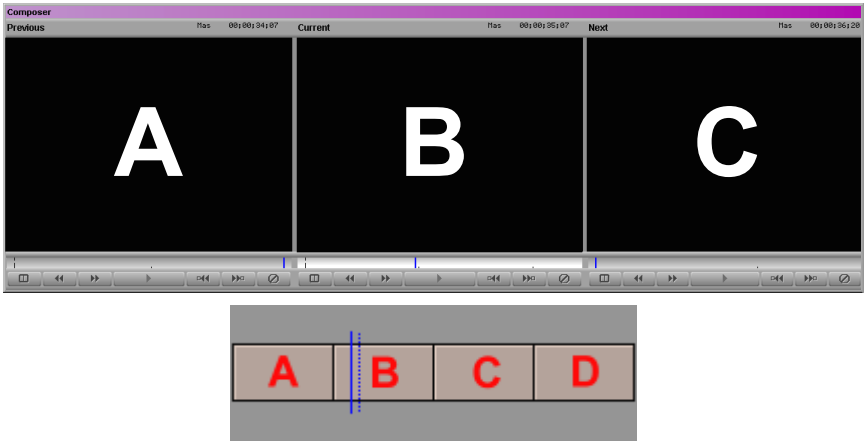
By default, the center monitor shows the current segment (the segment the position indicator is on in the Timeline). The left monitor shows the previous segment (the segment before the current segment), and the right monitor shows the next segment (the segment after the current segment).

When you move in the sequence by clicking a Composer Window button or by moving the position indicator to a new segment in the Timeline, all three monitors update to maintain the same relationship between displayed segments.

The following illustrations show the default monitor display behavior.

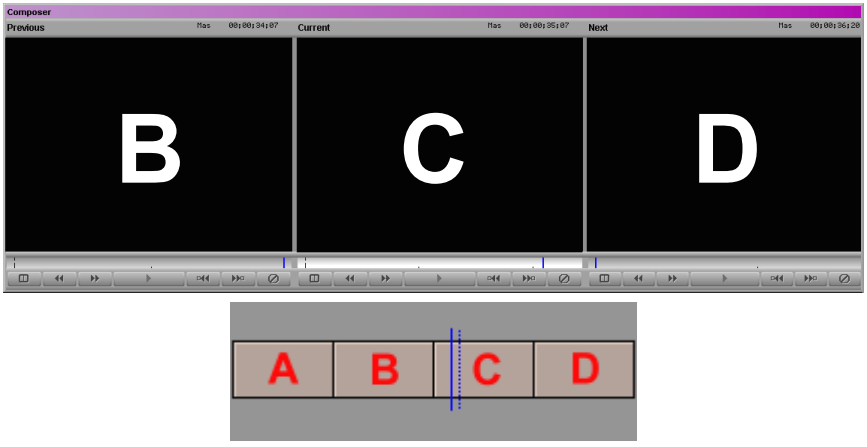
Example 1

The position indicator is on segment B in the Timeline. The three monitors display segments A, B, and C.



Example 2

The position indicator has moved to segment C. All three monitors have updated so that they now display segments B, C, and D.



Configuring Image Display in Monitors

You can configure each monitor to display those segments that are most useful for making comparisons in your project.

To configure the display in a monitor:

- Click the monitor's Source menu, and choose one of the commands described in Table 1.

Table 1 Source Menu Commands

Command	Description
Empty	Displays no image (black).
Entire Sequence	Makes the entire sequence available in the monitor. This is useful when you want to compare shots from many different places in a sequence. For example, you can display the current segment and the next segment in two monitors for immediate shot-to-shot comparison and display the entire sequence in the third monitor so that you can quickly navigate to any other part of the sequence you want to view. When you change the current segment, the entire sequence updates to that segment. *You can use the Play Loop button in the Command palette to play the whole sequence in the active monitor even if the monitor is not set to Entire Sequence. For more information, see "Using the Play Loop Button in Color Correction Mode" on page 33.*
Reference	Locks the current frame (the frame the position indicator is on) in the monitor. When the other monitors update as you navigate in the Timeline, this frame continues to display as a reference. This is useful if you want to use a specific place in your sequence as a reference against which to compare all other shots, for example, a segment that contains optimal skin tones. **To lock the current frame as a reference:** - Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Composer window or the Color Correction tool, and choose Reference Current from the shortcut menu.

Table 1 Source Menu Commands (Continued)

Command	Description
Current	Displays the current segment. This option is not available in the Source menu if another monitor is already set to Current.
Previous	Displays the segment immediately before the current segment.
Next	Displays the segment immediately after the current segment.
Second Previous	Displays the segment two segments before the current segment (the segment the position indicator is on in the Timeline).
Second Next	Displays the segment two segments after the current segment.
Waveform and Vectorscope commands	
Quad Display RGB Histogram RGB Parade Vectorscope Y Waveform YC Waveform YCbCr Histogram YCbCr Parade	These commands configure the monitor as a waveform monitor or vectorscope. The system displays the information for the currently active monitor. For more information, see "Working with the Waveform and Vectorscope Displays" on page 86.

Splitting the Image Display in Monitors

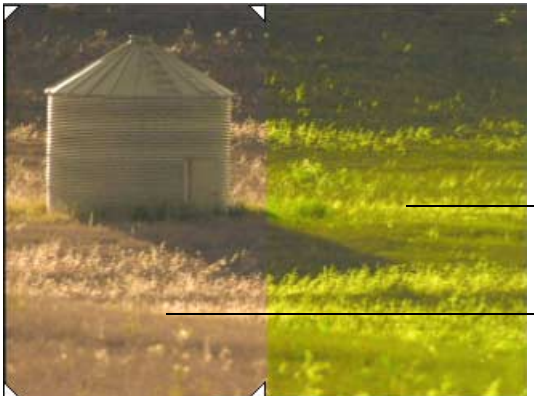
You can configure a monitor so that it splits the screen to show the image before and after the current color correction adjustments are applied.

The Dual Split display does not appear on the Client monitor.

To display uncorrected and corrected images in a split screen (Dual Split):

- Click the Dual Split button for the monitor you want to display the split screen.

  The split-screen display appears in the monitor.



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The uncorrected image appears on the left and the image with currently active corrections applied appears on the right. You can resize the box that contains the split-screen image by dragging its triangular handles in the monitor.

You can map the Dual Split button from the Command palette to the keyboard. You can then switch Dual Split on and off with a single keystroke. For more information, see "Using the Command Palette" in the chapter "Using Basic Tools" in the user's guide or the editing guide for your system.

To cancel the Dual Split display:

- Click the Dual Split button for the monitor that contains the Dual Split display.

  The monitor returns to a single-image view.

Hiding the Video in Monitors

You can hide the video image area of the monitors at any time. When the video is hidden, you see only the Source and Tracking Information Display menus and the position bars for the monitors. The other parts of the Color Correction toolset expand to fill the remainder of your screen. This might be a preferable setting if you can perform your color correction tasks by using only the Client monitor to view your image.

To hide the video in the monitors:

1. Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Composer window.
2. Choose Hide Video from the shortcut menu.

   When the video is hidden, a check mark appears beside the Hide Video command.

To display the video again:

1. Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Composer window.
2. Choose Hide Video from the shortcut menu.

   When the video is visible, there is no check mark beside the Hide Video command.

Displaying 16:9 Video in Monitors

You can display wide-screen 16:9 video as well as standard format 4:3 video in the monitors. However, you must switch to or from 16:9 display while in editing mode and then choose Color Correction mode. The 16:9 Video option is unavailable in the shortcut menu when you are in Color Correction mode.

To display 16:9 video in the monitors:

1. In editing mode, right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Composer window.

   For information on selecting editing mode, see the section on customizing the Composer window in the chapter “Viewing and Marking Footage” in the user’s guide or the editing guide for your system.

2. Choose 16:9 Video from the shortcut menu.

   When the monitors are set to display 16:9 video, a check mark appears beside the 16:9 Video command.

To display standard format 4:3 video again:

1. In editing mode, right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Composer window.
2. Choose 16:9 Video from the shortcut menu.

   When the monitors are set to display 4:3 video, there is no check mark beside the 16:9 Video command.

Using the Composer Window Buttons

The buttons in the following illustration are available for each monitor in the Composer window when you are using Color Correction mode. You can use these buttons to play footage, move around in your sequence, display a split-screen view, and remove effects.

All these buttons are available in the Command palette and can be mapped from the Command palette to the keyboard by using the procedure described in “Using the Command Palette” in the chapter “Using Basic Tools” in the user’s guide or the editing guide for your system.

You cannot map other buttons to the Composer Window button locations of the Color Correction toolset.

Table 2 describes these buttons in detail and indicates their location within the Command palette.

Table 2 Composer Window Buttons

Button	Description	Command Palette Tab
 Dual Split	Splits the screen in the monitor to show the image before and after the current Color Correction settings are applied. For more information, see “Splitting the Image Display in Monitors” on page 28. *The Dual Split display does not appear in the Client Monitor.*	Other
 Go to Previous Shot	Moves the position indicator to the first frame of the previous shot in the topmost selected video track.	Move
 Go to Next Shot	Moves the position indicator to the first frame of the next shot in the topmost selected video track.	Move
 Play	Plays the material in the monitor from the current position of the position indicator to the end of the segment. If Sequence is selected in the Source menu, clicking this button plays the material from the current position of the position bar to the end of the sequence. Clicking the button again stops play.	Play
 Go to Previous Uncorrected Shot	Moves the position indicator to the first frame of the last segment before the current segment in the topmost selected video track that has not been color corrected.	CC

Table 2 Composer Window Buttons (Continued)

Button	Description	Command Palette Tab
 Go to Next Uncorrected Shot	Moves the position bar to the first frame of the first segment after the current segment in the topmost selected video track that has not been color corrected.	CC
 Remove Effect	Removes the color correction on the current segment.	FX

Using the Play Loop Button in Color Correction Mode

The Play Loop button has a specialized function in Color Correction mode. The Play Loop button does not appear in the Composer window but does control the playback of material in the Composer window. You can access the Play Loop button from the Play tab of the Command palette or from the keyboard if it has been mapped to a keyboard location.

When you click the Play Loop button, the system plays the whole sequence in the active monitor, starting from the current position of the position indicator. Playback is not limited to the current segment alone, regardless of the Source menu command chosen for the monitor. This is useful whenever you want to view the whole sequence quickly without switching monitors or making a new Source menu choice.

Reviewing Color-Corrected Clips with the Edit Review Button

The Edit Review button has a specialized function in Color Correction mode. The system plays the current clip along with parts of the previous and next clips, allowing you to quickly review the color correction on a clip in the context of the adjoining clips.

The Edit Review button does not appear in the Composer window, but you can access the Edit Review button from the Play tab of the Command palette or from the keyboard if it has been mapped to a keyboard location.

When you click the Edit Review button, the system plays part of the previous clip, all of the current clip, and part of the next clip. When playback is complete, the position indicator returns to its location in the current clip before you clicked the button.

The amount of material the system plays from the previous and next clips is determined by the current Preroll and Postroll settings in the Play Loop tab of the Trim Settings dialog box. For more information on Trim Settings, see “Customizing Trim Mode” in the chapter “Working in Trim Mode” in the user’s guide or the editing guide for your system.

The Client Monitor in Color Correction Mode

The Client monitor is an important tool for color correction since it allows you to see your corrections as they will appear when output and displayed on a television screen. Your system’s Edit monitor does not have exactly the same color and luminance display characteristics as a television monitor.

To use a Client monitor, you must select the “High Performance (more simultaneous effects)” option in the Video Display Settings dialog box. For information about the Video Display Settings dialog box, see the effects guide for your system. For more information on using a Client monitor, see the user’s guide or the editing guide for your system.

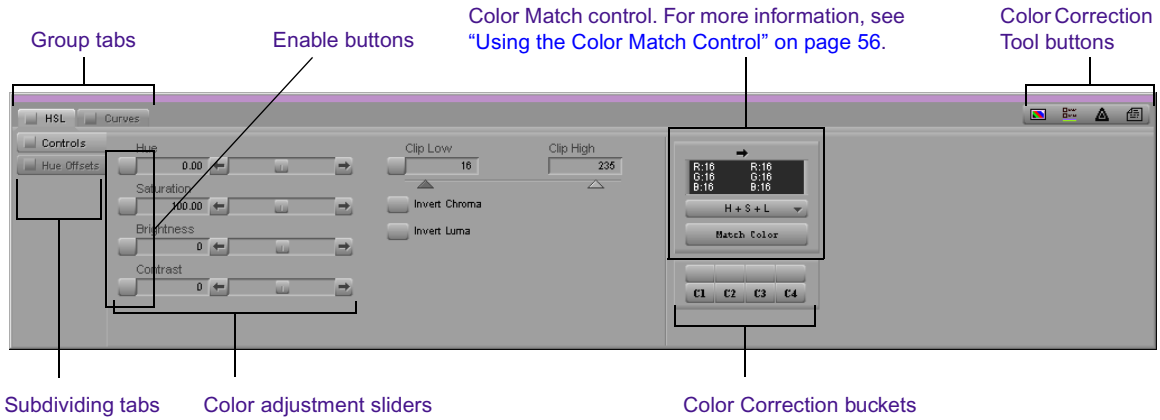
When you are using Color Correction mode, the Client monitor displays the image that is in the currently active monitor in the Composer window. By switching from one monitor to another in the Composer window, you can quickly compare whichever three images are currently displayed in the monitors. For more information on switching between monitors, see “Activating Monitors” on page 24.

The Dual Split display does not appear in the Client Monitor.

The Color Correction Tool

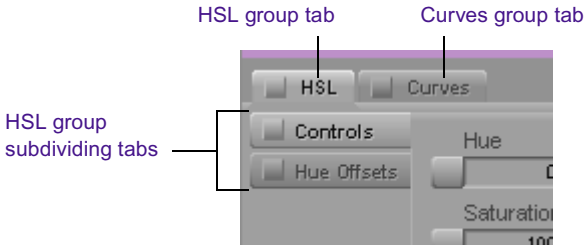
In Color Correction mode, you make adjustments in color using the Color Correction tool. The Color Correction tool is also where you control how much and what kind of material you are correcting at any one time.

The following illustration shows the Color Correction tool in its default configuration.



Working with the Group and Subdividing Tabs

The Color Correction tool contains two group tabs, the HSL (Hue, Saturation, Luminance) group tab and the Curves group tab.



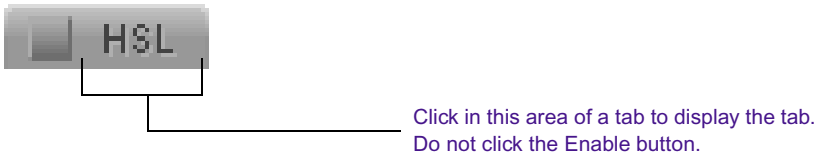
Within the HSL group are two tabs on the left side of the tool that subdivide the controls for that group. The Curves group has no subdividing tabs. For more information, see "Understanding Color Correction Groups" on page 19.

Displaying a Group Tab

To display a color correction group tab:

- Click the tab in the area containing the group name.

Do not click the Enable button when you want to display a color correction group tab.



The tab name is highlighted, the tab moves to the front, and the specific controls for that tab appear.

You can switch between the group tabs by using the Page Down key or the Page Up key.

For detailed information on adjusting color by using the controls within the color correction groups, see Chapter 3.

Displaying a Subdividing Tab

To display a subdividing tab:

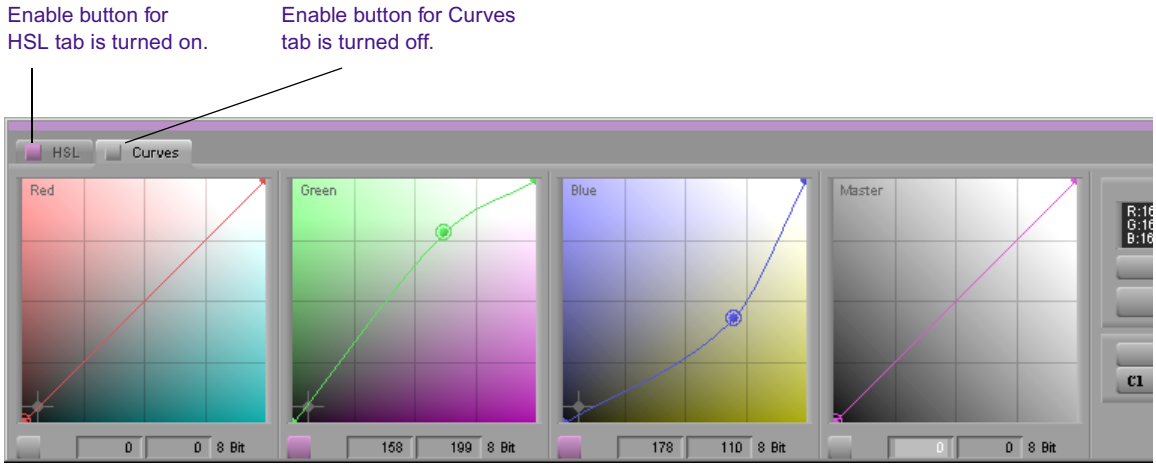
1. Click the group tab in the area containing the group name.
2. Click the subdividing tab in the area that contains the subdivision name.

   The tab name is highlighted, the tab moves to the front, and the specific controls for that tab appear.

Understanding Interaction Between Color Correction Groups

Understanding how the color correction groups work together is important. Adjustments made in each group are applied cumulatively to the current segment and its related material. If you make an adjustment in one group and then go on to make another adjustment in a different group, the image will show the cumulative effect of both adjustments.

This behavior provides you with a great deal of flexibility. For example, if you are unhappy with some of your adjustments, you can disable that group or reset its controls to default settings without disrupting the initial group. The following illustration shows an example of this kind of control over color correction groups.



The Green and Blue ChromaCurve graphs are adjusted, but the Curves tab is turned off. The Curves tab adjustments are not currently applied to the segment. Adjustments made in the HSL tab *are* applied to the segment because the HSL tab is turned on, even though the HSL controls are not currently visible.

For more information on enabling, disabling, and resetting the groups, see "Working with the Enable Buttons" on page 38.

If you make adjustments in both groups, keep in mind how the cumulative adjustments will affect the final image. Adjustments might accumulate, or cancel each other out, in ways that you do not want. Keep each stage of your correction distinct, and do not duplicate the same adjustment in both groups.

Working with the Enable Buttons

In the Color Correction tool, each group tab, subdividing tab, and individual control has an Enable button. These buttons provide an immediate visual guide to the status of the controls while you are making corrections. They also allow you to turn controls on and off in various combinations and quickly reset controls to their default values.

Turning Controls On or Off

To turn a control or tabbed group of controls on, do one of the following:

- Click the Enable button for the control or tabbed group of controls.
- Adjust any individual control that is linked to the Enable button.

  The Enable button changes to pink, and the control or tabbed group of controls becomes active. The system includes the adjustments in that control or group of controls when calculating the corrected color.

To turn a control or tab off:

- Click the Enable button for the control or tab.

  The Enable button changes to gray.

Resetting Controls

To reset a control or a tabbed group of controls to its default values:

1. Display the control or group of controls you want to reset.
2. Alt+click (Windows) or Option+click (Macintosh) the Enable button for that control or group of controls.

   The Enable button changes to gray, and all controls linked to that button return to their default values.

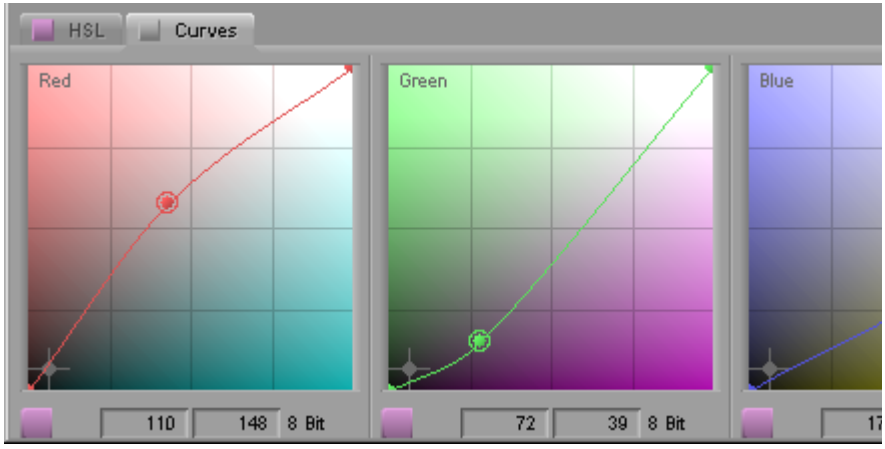
You cannot reset controls not currently displayed. If you Alt+click (Windows) or Option+click (Macintosh) the Enable button for a tab whose controls are not currently displayed, you display the controls but do not reset them. Alt+click (Windows) or Option+click (Macintosh) the button again to reset the controls.

Understanding Interaction Between Enable Buttons

The Enable buttons are linked in a hierarchical relationship that mirrors the relationship of the tabs themselves. When you change the status of an Enable button, the change can affect several levels of the hierarchy.

When you Alt+click (Windows) or Option+click (Macintosh) an Enable button to reset controls, you automatically reset all controls at a lower level in the hierarchy. For example, if you Alt+click (Windows) or Option+click (Macintosh) the Enable button for the Red ChromaCurve™ graph in the Curves tab, only that one control is reset to its default value. However, if you Alt+click (Windows) or Option+click (Macintosh) the Enable button for the Curves tab, all the controls in the Curves tab will reset to their default values.

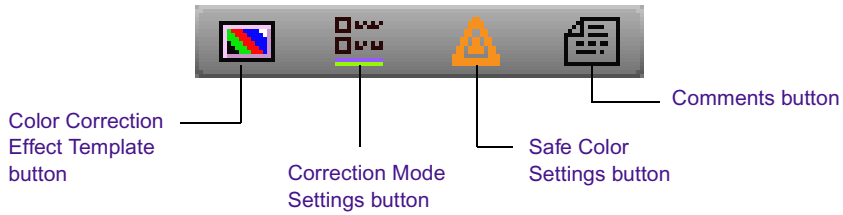
When you turn an Enable button off, the system stops including controls below that button in the hierarchy when it calculates the corrected color for the segment. Individual controls below that button retain their values and can be reactivated at any time. Their Enable buttons remain pink.



The Curves tab Enable button is turned off, so none of the adjustments in the Curves tab are applied to the correction. Individual controls inside the tab retain their values and can be reactivated by clicking the Curves tab again.

Using the Color Correction Tool Buttons

In addition to the Enable buttons, and specific control buttons within groups, the Color Correction tool has a group of buttons on the right side that control several important operations.



Use these buttons to:

- Create Color Correction effect templates.

  For more information, see “Working with Color Correction Effect Templates” on page 44.

- Customize the Color Correction tool.

  For more information, see “Customizing the Color Correction Tool” on page 40.

- Set Safe Color limits.

  For more information, see Chapter 5.

- Add comments to color-corrected segments.

  For more information, see “Adding Comments to Color Correction Effects” on page 43.

Customizing the Color Correction Tool

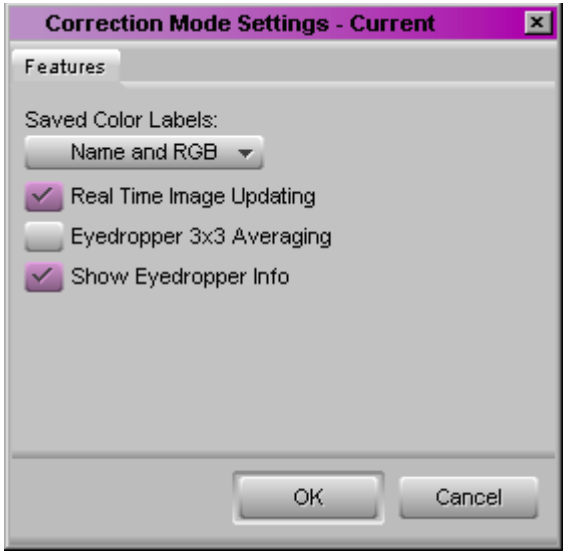
You can customize the appearance and behavior of the Color Correction tool by selecting options in the Correction Mode Settings dialog box.

To customize the Color Correction tool:

1. Do one of the following:

   - In the Color Correction tool, click the Correction Mode Settings button.
   - In the Settings scroll list of the Project window, double-click Correction.

   The Correction Mode Settings dialog box appears.



2. Select the options you want.

   Table 3 describes the options available in the Correction Mode Settings dialog box.

3. Repeat step 2 until you are satisfied with all settings.
4. Click OK.

Table 3 Correction Mode Settings Options

Option	Description
Saved Color Labels None RGB Name Name and RGB	Choose an item from the pop-up menu to control how custom colors are named in bins. For information on saving custom colors, see "Saving Custom Colors to a Bin" on page 62. When None is selected, the system does not supply a name. When RGB is selected, the system uses the 8-bit values for the red, green, and blue components as the name. When Name is selected, the system uses the name from the standard HTML color scheme that most closely matches the color you are saving. When Name and RGB is selected, the system uses both the Name and the RGB information as the name. This is the default option.
Real Time Image Updating	When this option is selected, the image in the active monitor updates on-the-fly as you move controls in the Color Correction tool. This provides instant feedback on your adjustments, but the updating process might not always be smooth due to system processing limitations. This is the default option.  *You can switch the current setting for Real Time Image Updating on and off by pressing and holding the Alt key (Windows) or Option key (Macintosh). If Real Time Image Updating is on, pressing and holding the Alt key (Windows) or Option key (Macintosh) will turn updating off temporarily. If Real Time Image Updating is off, pressing and holding the Alt key (Windows) or Option key (Macintosh) will turn updating on temporarily.*
Eyedropper 3 x 3 Averaging	When this option is selected, the system calculates the color value to pick by averaging the values of a 3 x 3 sample of pixels centered on the eyedropper's position. This is often useful for picking up a color accurately by sight because it compensates for shifts in color value from one pixel to another. When this option is deselected, the system selects the color value of the exact pixel at the eyedropper's position.
Show Eyedropper Info	When this option is selected, the numerical RGB values appear on the color swatches in the Color Match controls.

Adding Comments to Color Correction Effects

You can add comments to color-corrected segments to assist you in your work. For example, you might want to briefly note the type of adjustment you made to a segment or to make notes during a preliminary correction pass of ideas for adjustments to be done later during a final pass.

The Comments button indicates whether a comment is present on a segment.

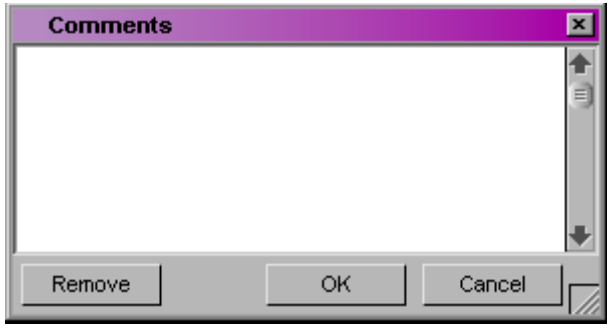
If the position indicator is on a segment that has a comment, the icon on the Comments button is yellow.

If the position indicator is on a segment that has no comment, the icon on the Comments button is not yellow.

To add a comment to a segment:

1. If you are not already in Color Correction mode, do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.
2. Move the position indicator to the segment to which you want to add a comment.
3. 
   Click the Comments button in the Color Correction tool.

   The Comments dialog box appears.



4. Type your comment in the text window, and click OK.

To remove a comment:

1. If you are not already in Color Correction mode, do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.
2. Move the position indicator to the segment from which you want to remove the comment.
3. Click the Comments button in the Color Correction tool.

   The Comments dialog box appears.
4. Click Remove.

To view or edit a comment in the Comments dialog box:

1. If you are not already in Color Correction mode, do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.
2. Move the position indicator to the segment for which you want to view the comment.
3. Click the Comments button in the Color Correction tool.

   The Comments dialog box appears and displays the text of the comment.
4. (Option) To edit the comment, click in the text window and make your edits by using standard word processing procedures.

Working with Color Correction Effect Templates

Avid Color Correction offers the following versions of Color Correction effect templates:

- The Color Correction buckets provide an easily accessible location within the Color Correction tool for the short-term storage of Color Correction effect templates.

- The Color Correction Effect Template button allows you to create a template for any color correction and save it to a bin in the same way that you save other kinds of effect templates. The Save Correction button in the CC tab of the Command palette performs the same function.

Like templates for other effects, Color Correction effect templates save all the adjustment values for a color correction so that you can apply those values quickly to another segment. You can apply all the values at once by dragging the template into the monitor containing the current segment, or you can apply the values for the controls in a single tab in the Color Correction tool by dragging the template onto the tab that contains the group of controls you want to change.

You can also save custom colors to bins. For more information, see "Using the Color Match Control" on page 56.

Understanding How Color Correction Effect Templates Save Settings

When you create a Color Correction effect template, the system saves all the Color Correction settings for the segment. The system remembers both the values set for each control and the status of each Enable button.

Templates saved to a bin or a bucket do not update when you make new adjustments to the segment. To save new adjustments, you must save a new template to a bin or a bucket.

You can specify which settings you apply in a template by dragging the template to the active tab in the Color Correction tool. This changes only those settings contained within that tab. By using this method, you can, for example, apply settings one tab at a time without applying any other settings that might also be saved in a template.

Saving a Color Correction Effect Template to a Bin

You can save a Color Correction effect template to a bin by using either the Color Correction Effect Template button in the Color Correction tool or the Save Correction button in the CC tab of the Command palette.

Color correction templates saved to a bin are saved permanently, unlike templates saved to a bucket, which are not saved beyond the current working session.

To save a Color Correction effect template to a bin:

1. If you are not already in Color Correction mode, do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.
2. Make sure that the position indicator is in the segment that contains the settings you want to save.
3. Do one of the following:

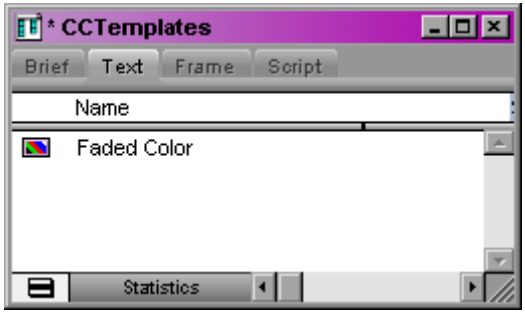
   - Click the Color Correction Effect Template button, press and hold the mouse button, and then drag the effect icon to a bin.

   - With Active Palette selected in the Command palette, click the Save Correction button in the CC tab.
   - If the Save Correction button is mapped to a key, press that key.

Effect icons for open bins are also displayed in the Effect Palette.

A new effect template appears in the bin, containing all the color correction adjustment values for the segment. The new effect template is identified in the bin by its effect icon. By default, the system names the template by using the clip name of the segment.

4. (Option) To rename the template, click the template name and type a new name.

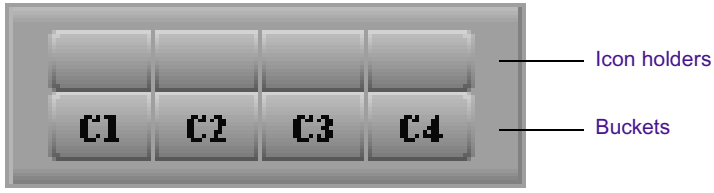


Saving a Color Correction Effect Template to a Bucket

The Color Correction tool provides four *buckets*, located below the Color Match control, that you can use to save Color Correction effect templates for the duration of a working session. You can then apply the template quickly to any segment. The buckets are labeled C1 through C4.

You can map any of the Color Correction buckets from the CC tab in the Command palette to the keyboard, for example, to a function key, by using the standard procedures for mapping buttons described in the chapter "Using Basic Tools" in the user's guide or the editing guide for your system.

The following illustration shows the Color Correction buckets.



To save a Color Correction effect template in a bucket:

1. If you are not already in Color Correction mode, do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.
2. Make sure that the position indicator is in the segment that contains the adjustment values you want to save.
3. Alt+click (Windows) or Option+click (Macintosh) the bucket in which you want to save the template.

   Choose a bucket from the range C1 to C4. Empty buckets have a blank icon holder above them. If you Alt+click (Windows) or Option+click (Macintosh) a bucket that already contains a template, you overwrite the previous template with the new adjustment values.

   The values are saved as a template and a Color Correction icon appears in the icon holder above the Color Correction bucket.

Color Correction effect templates saved to buckets do not remain from one session to another. When you end your session, the system deletes the templates. You can save an effect template in a bucket permanently by dragging the Color Correction icon from the icon holder to a bin.

Applying Color Correction Effect Templates

For help, see "Entering and Leaving Color Correction Mode" on page 22.

To apply all adjustment values in a Color Correction effect template to the current segment, do one of the following in Color Correction mode:

- Drag the effect icon for the template from the bin, the Effect Palette, or the Color Correction bucket icon holder, and drop it in the monitor containing the current segment.

For tips on working with templates in the Effect Palette, see "Saving a Color Correction Effect Template to a Bin" on page 46.

- Select the template in the bin or the Effect Palette, and then press Enter (Windows) or Return (Macintosh).
- Click the appropriate Color Correction bucket (for example, C1).
- If you have mapped the Color Correction bucket to the keyboard, press the appropriate key.

  The system applies all the Color Correction adjustments in the template to the segment that is the current location of the position indicator.

To apply adjustment values from a Color Correction effect template selectively to a single tab of color correction controls:

1. In the Color Correction tool, click the tab to which you want to apply the template.
2. Drag the effect icon for the template from the bin, the Effect Palette, or the Color Correction bucket, and drop it anywhere in the tab.

   The controls in that tab update to reflect the values in the template. Other color correction controls are not affected.

If you apply template settings to a subdividing tab (for example, the Controls tab in the HSL group), the image in the monitor does not reflect those settings until you enable the group tab (for example, the HSL tab).

If you apply a saved Color Correction effect template to a segment that already has a color correction, you overwrite the existing correction. The existing Color Correction settings are lost. If the existing correction is itself saved as a template, the template might also be lost (depending on the scope of the existing correction). Make sure that you want to replace the existing correction before you apply a saved Color Correction effect template to a clip that already has a correction. You can use the Undo command to undo the effect of a Color Correction effect template. However, once the Undo command is no longer available, you cannot recover the original Color Correction settings.

Working with Color Correction Effect Templates in the Effect Palette

The following list of reminders and suggestions can help you work quickly when you are using saved Color Correction effect templates in the Effect Palette.

- Press Ctrl+8 (Windows) or ⌘+8 (Macintosh) to open the Effect Palette or to make the Effect Palette active.

  The Effect Palette becomes inactive whenever you perform an action in another area of the interface (for example, when you move the position indicator in the Timeline). Pressing Ctrl+8 (Windows) or ⌘+8 (Macintosh) is a quick keyboard method for reactivating the Effect Palette. The Effect Palette must be active before you can use it to apply a Color Correction effect template.

- Use the Tab key to make one side or the other of the Effect Palette active.

  For example, if the effect categories list on the left side of the Effect Palette is active, press the Tab key to activate the list of templates on the right side. Press the Tab key again to activate the effect categories list. Clicking a specific item in either list also activates that side of the Effect Palette.

- To display a group of effect templates in the Effect Palette, select the bin or the color-corrected sequence that contains the templates in the effect categories list on the left side of the palette.

- Use the Up Arrow and Down Arrow keys to move through the active list.

  For example, you can quickly move from the most recent correction to the third most recent in the list by pressing the Down Arrow key twice.

- The Effect Palette remembers the currently selected item in the list of corrections even when it becomes inactive or is closed.

  For example, if you have the most recent correction in the list selected and then leave the Effect Palette to perform another operation or close the Effect Palette, that correction will be the selected correction when you reactivate or reopen the Effect Palette.

  This makes it easy to apply the same template successively to a number of segments, especially if you have navigation buttons such as Fast Forward, Rewind, Go to Next Uncorrected Shot, and Go to Previous Uncorrected Shot mapped to the keyboard. Once you have the template you want selected in the Effect Palette, you simply navigate to another segment, press Ctrl+8 (Windows) or ⌘+8 (Macintosh) to activate the Effect Palette, and then press Enter (Windows) or Return (Macintosh) to apply the template.

Chapter 3

Performing Color Corrections

This chapter describes basic procedures for making color corrections and provides a complete explanation of all the individual controls in the Color Correction tool and how to use them.

General Workflow for Making Color Corrections

Avid Color Correction gives you a great deal of flexibility when you make color corrections. The exact workflow that you employ will depend on your individual methods, your degree of familiarity with the color correction controls, and the requirements of your project. However, the basic steps to take when making a correction will be similar for all users.

The following procedure outlines a typical color correction operation. You can adapt the exact order in which steps are performed or repeated to conform to your particular needs.

To color correct a sequence:

1. In editing mode, load the sequence.
2. Do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.

   The Color Correction toolset appears.
3. (Option) If necessary, configure the toolset so that it conforms to the requirements of your project and editing style. For more information on the toolset and how to configure it, see Chapter 2.
4. Preview the material in the sequence to develop a sense of the kinds of corrections that are needed and the approach you will use to make them.

   For example, you might look for a shot that you would like to use as a reference for your adjustments and lock that shot in one of the monitors. For general guidance on what to look for when previewing material, see Chapter 4.

Some users might prefer to preview extensively and plan their corrections in advance. Others, especially those with more color correcting experience, might work by moving back and forth frequently between making corrections and assessing the material on which they are working.

5. Make sure that the Record Track button for the track on which you want to make corrections is the topmost selected button in the Track Selector panel in the Timeline.

   You can color correct any number of tracks, including nested tracks by stepping into the nest. However, you can correct only one track at a time. Color correction is applied to the topmost selected track in a sequence.

6. Use the Composer Window buttons or the position indicator in the Timeline to move to a segment you want to correct.
7. Click the appropriate tabs in the Color Correction tool to display the controls you want to use to make the correction.
8. Adjust the controls until you are satisfied with the correction.

   Remember that you can repeat steps 7 and 8 to make successive adjustments using several different groups of controls and to selectively turn them on and off while you assess their effect on the segment. You can use the Dual Split button in the monitors to view corrected and uncorrected images side by side.

9. (Option) Add a comment for the correction.
10. Repeat steps 5 through 9 for each segment you want to correct.
11. When you are satisfied with the corrections throughout the sequence, make a selection from the Toolset menu to leave Color Correction mode and return to other editing operations.

Using the Color Match Control

Each Color Correction group includes a Color Match control. This control allows you to quickly make a correction by selecting input and output colors from your images, from the Windows Color dialog box, or from the Macintosh® Color Picker.

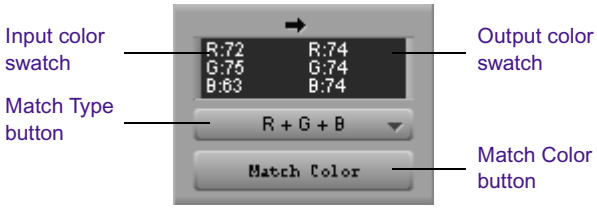
When you use the Color Match control, the system replaces the input color value with the output color value and adjusts all the other color values in the image proportionally. The system also automatically adjusts the other controls in the group to reflect the change. You can set the combination of color channels or components the system uses to determine the match by making menu selections.

For example, if you want to replace the blue sky tone in one image with that in another to match the two shots, you can use the Color Match control to pick the two colors and automate the color adjustment.

When you are working in the Curves group, the Color Match control also includes the NaturalMatch™ feature. NaturalMatch allows you to replace the hue values in an image with new output values without distorting the saturation and luminance values in the image.

You can also Alt+drag (Windows) or Option+drag (Macintosh) colors to a bin and save them as custom colors. You can then drag a custom color into the Color Match control at any time.

The following illustration shows the Color Match control.



Making a Correction with the Color Match Control

To make a correction using the Color Match control:

1. In the Color Correction tool, click the tab that includes the Color Match control with which you want to work.

   For help, see "Entering and Leaving Color Correction Mode" on page 22.

For information on the Correction Mode Settings dialog box, see "Customizing the Color Correction Tool" on page 40.

2. (Option) Select Eyedropper 3 x 3 Averaging in the Correction Mode Settings dialog box.

   When you select Eyedropper 3 x 3 Averaging, the system calculates the color value to pick by averaging the values of a 3 x 3 sample of pixels centered on the eyedropper's position. This is often useful for picking up a color accurately by sight because it compensates for shifts in color value from one pixel to another. When this option is deselected, the system selects the color value of the exact pixel at the eyedropper's position.

3. Select the input color (the color to be replaced):

   a. Move the pointer over the input color swatch.

      The pointer changes to an eyedropper.

   b. Press and hold the mouse button, and then drag the eyedropper to the area of the image in the monitor from which you want to select an input value.

      The input color swatch in the Color Match control updates as you move the cursor in the image.

   c. Release the mouse button to complete the selection.

      The input color appears in the input color swatch.

You can also select an input color from the Windows Color dialog box or the Macintosh Color Picker by double-clicking the input color swatch. However, you will usually want to select your input color from the current segment.

4. Select the output color:

   a. Move the pointer over the output color swatch.

      The pointer changes to an eyedropper.

   b. Press and hold the mouse button, and then drag the eyedropper to the area of the image in the monitor from which you want to select an output value.

      The output color swatch in the Color Match control updates as you move the cursor in the image.

   c. Release the mouse button to complete the selection.

      The output color appears in the output color swatch.

Your output color will usually be chosen from an image other than the current segment, such as the next segment or a reference frame. Alternatively, you can double-click the output color swatch and choose a color from the Windows Color dialog box or the Macintosh Color Picker. The Windows Color dialog box and the Macintosh Color Picker are useful for choosing an "ideal" replacement color such as a completely neutral gray. You can also use the Windows Color dialog box or the Macintosh Color Picker to create and store custom colors. For more information on using the Windows Color dialog box or the Macintosh Color Picker, see "Using the Windows Color Dialog Box" or "Using the Macintosh Color Picker" in the chapter "Customizing Effects in Effect Mode" in the effects guide for your system.

5. Click the Match Type button, and choose a Match Type from the pop-up menu to determine the exact nature of the match the system makes.

   The options available in the Match Type pop-up menu depend on the group in which you are working. For more information on Match Type options, see "Choosing Match Type Options" on page 59.

6. Click the Match Color button to make the correction.

   The system adjusts the current segment and resets the group controls to reflect the adjustment. The corrected image displays in the monitor that contains the current segment.

Choosing Match Type Options

The options available in the Match Type pop-up menu reflect the way in which color is handled in the group in which you are working. Table 4 describes the options available in the Match Type pop-up menu.

Table 4 Match Type Options

Group	Option	Description
HSL (Controls tab)	H + S + L	The system matches based on the hue, saturation, and luminance of the color selected in the output color swatch.
	Hue	The system matches based on only the hue of the color selected in the output color swatch.
	Saturation	The system matches based on only the saturation of the color selected in the output color swatch.
	Luminance	The system matches based on only the luminance of the color selected in the output color swatch.
HSL (Hue Offsets tab)	Highlights	The system matches based on both the hue and the saturation across the highlights portion of the tonal range.
	Midtones	The system matches based on both the hue and the saturation across the midtones portion of the tonal range.
	Shadows	The system matches based on both the hue and the saturation across the shadows portion of the tonal range.
Curves	Master	The system matches based on the luminance of the color selected in the output color swatch.
	R + G + B	The system matches based on the values of all three color channels of the color selected in the output color swatch.

Table 4 Match Type Options (Continued)

Group	Option	Description
	NaturalMatch	Switches the NaturalMatch feature on and off. Choose NaturalMatch to select or deselect the NaturalMatch feature. When this command is selected, all the match types in the Curves group use the NaturalMatch feature when making a correction and match types appear in the Color Match control with the extension (Nat). For more information on NaturalMatch, see "Understanding NaturalMatch" on page 60.

Understanding NaturalMatch

In many situations when you are correcting on a shot-to-shot basis, color matching is complicated by differences in lighting between one shot and another. For example, you might want to match the skin tone in Shot A, which is in shadow, with that in Shot B, which is brightly lit. To achieve a natural-looking correction, you need to replace the hue of Shot A while preserving luminance and saturation characteristics that suggest shadow.

NaturalMatch solves this problem by making calculations that compensate for the luminance and saturation qualities of the original image when making the correction. The correction that is made when you use NaturalMatch adopts the new hue value, preserves the original luminance value, and adjusts the saturation value in relation to the other values. NaturalMatch allows you to use the quick correction method offered by the Color Match control even when images show significant differences in lighting.

Color Match Example Using NaturalMatch

The following illustrations show an example of the use of the Color Match control and the NaturalMatch feature to correct color from shot to shot.

If you are reading a hardcopy version of this document, you will find it useful to view the color images in the Help or in the online version of this document on the online publications CD-ROM.

Uncorrected Image

This original image is very gray and shows poor skin tones. The RGB values for a point in the center of the man's forehead are R:61, G:62, B:66 — an almost completely neutral gray.

Reference Image

This image shows much better color characteristics, including good skin tones and a better color for the canvas of the tent. If we want to present these two shots next to one another in a sequence, we will almost certainly want to make their color characteristics match better. One way to do this is with the Color Match control. If we use the center of the forehead in the first image as an input value and the center of the forehead in this reference image (R:110, G:70, B:56) as an output value, and then make a color match by using NaturalMatch to automatically generate ChromaCurve graph adjustments for all three color channels, we can quickly match the skin tones in the weak image to those in the better one.

Corrected Image

Though this image would benefit from further correction (particularly to improve the contrast ratio), it is improved dramatically as a result of the color match. The skin tones and the color of the tent in the background now match the reference image well.

Saving Custom Colors to a Bin

You can save a color that you have selected in the Color Match control as an item in a bin. For example, you might want to save a skin tone that you want to match throughout your sequence. You can then load that color back into the Color Match control whenever you need to make a match based on that color.

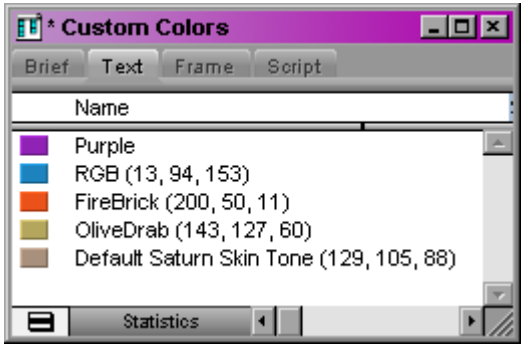
To save a color to a bin:

1. In the Color Match control, Alt+click (Windows) or Option+click (Macintosh) the swatch that contains the color you want to save, and press and hold the mouse button.

   The pointer changes to a hand, and a rectangular outline appears.

2. Drag the rectangular outline to a bin, and release the mouse button.

   The color appears in the bin as a rectangular color icon. The system assigns the color a name based on the current Saved Color Labels settings in the Correction Mode Settings dialog box. For more information, see "Customizing the Color Correction Tool" on page 40.



3. (Option) If you want to rename the custom color, click the existing name in the bin and type a new name.

To load a custom color into the Color Match control:

- Drag the color icon from the bin, and drop it on the appropriate color swatch in the Color Match control.

Getting RGB Information Using the Color Match Control

By default, the color swatches in the Color Match control display the RGB values for the selected color. This makes the Color Match control useful as an information palette to check the exact RGB value of a sample area in your image.

For example, if you have an area in your image that you know should appear white, you can sample that area by using the Color Match eyedropper and check how far its RGB values depart from a true white. If the values are R:231, G:217, B:229, then you know that a little green needs to be added to achieve white. (In other words, the image has a magenta cast.) If you want this area in the image to be exactly reference white (R,G,B:235), you know that you also need to adjust the white point slightly to increase the RGB values.

The HSL (Hue, Saturation, Luminance) Group

The HSL (Hue, Saturation, Luminance) group provides controls that allow you to alter attributes such as hue, saturation, gain, and gamma. These controls resemble those found in the Video Input tool and in the Color Effect, and, therefore, HSL is the group in the Color Correction tool that will be most familiar to experienced Avid editors.

The HSL group also allows you to specify an offset for the hue of an image, a control that is especially useful for correcting a color cast. For example, when an object in an image that should be a neutral gray appears tinged with a color, you can use the offset adjustment to restore the correct gray color.

The HSL group provides additional control by allowing you to make adjustments in three different luminance ranges — highlights, midtones, and shadows. You can define the exact scope of each of these ranges and get visual confirmation of which parts of an image fall in each range.

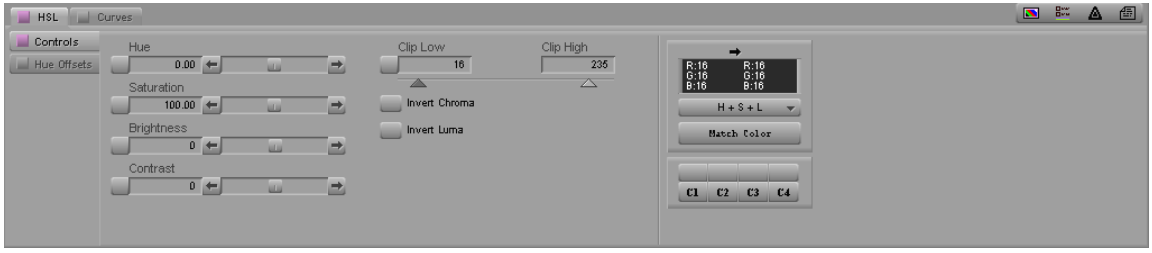
Having control over different luminance ranges is useful in a number of situations. For example, video images often contain chroma noise in the brightest and darkest areas. By using the HSL controls for the highlight and shadow ranges, you can make adjustments to reduce the noise without affecting the midtones in the image.

The HSL controls are capable of correcting a wide range of problems. If you are comfortable working with the HSL group and gain some experience using it, you might be able to make most of your common corrections without needing to employ any other group. For some kinds of adjustments, however, you might find the blending properties or the individual color channel control of other groups more suitable.

Working with the Controls Tab

The Controls tab of the HSL group includes sliders for making adjustments to hue, saturation, and luminance values. It also includes the Color Match control for making hue, saturation, and luminance adjustments automatically, based on selected input and output color values. For information on the Color Match control, see “Using the Color Match Control” on page 56.

The following illustration shows the Controls tab.

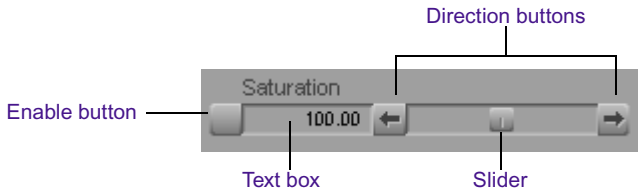


Making Corrections Using the Controls Tab

To make a correction using the Controls tab:

1. If you have not already done so:
   a. Move the position indicator to the segment you want to correct.
   b. Click the HSL tab.
   c. Click the Controls subdividing tab on the left side of the Color Correction tool.
2. Make your adjustments by doing one of the following:
   - Adjust one or more of the individual sliders or buttons. For more information, see "Using the HSL Sliders" on page 65 and "Controls Tab Controls" on page 66.
   - Use the Color Match control to make a correction by selecting input and output colors. For more information, see "Using the Color Match Control" on page 56.

Using the HSL Sliders



To adjust the HSL sliders, do one of the following:

- Type a value in the text box, and then press Enter (Windows) or Return (Macintosh).
- Drag the slider.
- Click one of the direction buttons to change the value in small increments.
- Click one of the direction buttons, and press and hold the mouse button to change the value quickly over a large range.

You can "nudge" the numerical value of a control up or down by small increments. To do this, click in the text box, and then press the Up Arrow key to increase the value or the Down Arrow key to decrease the value.

Each slider has an Enable button that you can click to turn that slider on or off or Alt+click (Windows) or Option+click (Macintosh) to reset the slider to its default value. For more information, see "Working with the Enable Buttons" on page 38.

Controls Tab Controls

Table 5 describes the individual controls available in the Controls tab of the HSL tab.

Table 5 Controls Tab Controls

Control	Description
Hue	Shifts the hues in the image around the color wheel. Values range from –180 to 180, where 0 is the default and causes no change in the image.
Saturation	Specifies the amount or intensity of color. Values range from 0 to 200, where 100 represents no change to the image, 0 represents complete desaturation (monochrome image), and 200 represents maximum saturation.
Brightness	Adjusts the luminance of the image by shifting the luminance value of every pixel by the value set in the control. Values range from –100 to 100, where –100 subtracts 100 from the 8-bit luminance value of every pixel, and 100 adds 100 to the 8-bit luminance value of every pixel. The effect of the Brightness control is very similar to that of the Offset control (on the Hue Offsets tab). One important difference, however, is that the Brightness control interacts with the Contrast control, while the Offset control interacts with the Gain and Gamma controls. If you have made a Contrast adjustment, it is better to adjust luminance further by using the Brightness slider. If you have made an adjustment using the Gain or Gamma controls, it is better to adjust luminance further by using the Offset control.

Table 5 Controls Tab Controls (Continued)

Control	Description
Contrast	Increases or decreases the amount of contrast in the image. Values range from –100 to 100, where –100 represents no contrast (all pixels mapped to neutral gray) and 100 represents maximum contrast.
Clip Low Clip High	Sets the Low clip and the High clip for the image. All pixels with the Low clip value or less are clipped to black; all pixels with the High clip value or more are clipped to white. The default settings for these controls are 16 and 235 on an 8-bit scale, representing the normal broadcast values for black and white.
Invert Chroma	Replaces the color value of every pixel in the image with the opposite color value on the color wheel. This is the equivalent of setting the Hue control to 180 or –180.
Invert Luma	Reverses the brightness level of every pixel in the image. Dark areas become light, and light areas become dark.

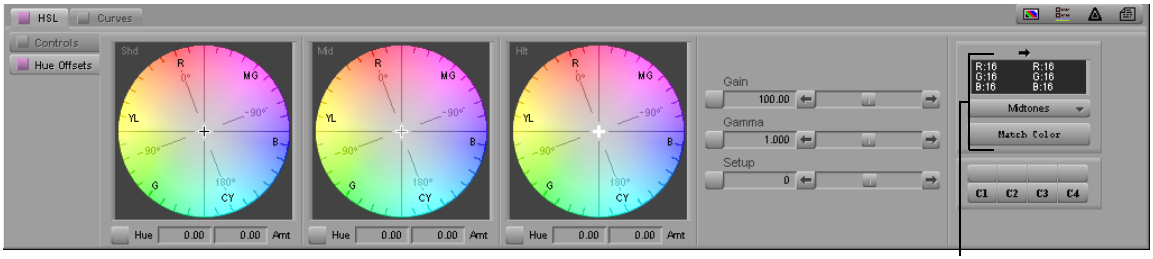
Working with the Hue Offsets Tab

The Hue Offsets tab of the HSL group includes controls for adjusting hue and saturation values at the same time by using color wheels — the three ChromaWheel™ controls — and linked text boxes. These controls are especially well-suited for correcting color casts in images.

Since the Hue Offsets ChromaWheel controls provide an adjustment method that is similar to the physical controllers on traditional color correction equipment, experienced colorists might choose to use them as their preferred controls for many color adjustments.

You can also use the Color Match control to automatically make a hue offset adjustment based on input and output colors. For information on the Color Match control, see “Using the Color Match Control” on page 56.

The following illustration shows the Hue Offsets tab.



Shadows ChromaWheel | Midtones ChromaWheel | Highlights ChromaWheel | Color Match control

Understanding the Hue Offsets Tab

The Hue Offsets tab includes three ChromaWheel controls that allow you to make adjustments across the same luminance ranges as the Controls tab. The controls are arranged in the following order from left to right: Shadows, Midtones, and Highlights.

Also on the Hue Offsets tab are controls for adjusting Gain, Gamma, and Offset. For more information, see Table 7 on page 72.

Hue Offsets ChromaWheel Controls

The ChromaWheel controls in the Hue Offsets tab are outlines that resemble the design of a vectorscope monitor, overlaid on full-color depictions that show the color represented by each area of the wheel.

Colors are oriented in the same manner as in a vectorscope monitor, with red near the top. Axes indicate the offset in degrees from the 0° point, which corresponds with red.

The Hue Offsets ChromaWheel controls are designed to create a familiar environment for users by duplicating the general appearance of a vectorscope monitor. For more information on the calibration of the Hue Offsets ChromaWheel controls, see "Understanding the Hue Offsets ChromaWheel Controls" on page 69.

The full-color depictions in the ChromaWheel controls can make it easier to understand the effect of a Hue Offsets adjustment.

Hue Offsets ChromaWheel Crosshair Pointers

Each ChromaWheel control contains a crosshair pointer that identifies the currently selected point on the wheel. Each pointer has a distinctive appearance to help you distinguish them from one another. Table 6 shows the three pointers.

Table 6 Hue Offsets ChromaWheel Crosshair Pointers

ChromaWheel Type	Pointer
Shadows	
Midtones	
Highlights	

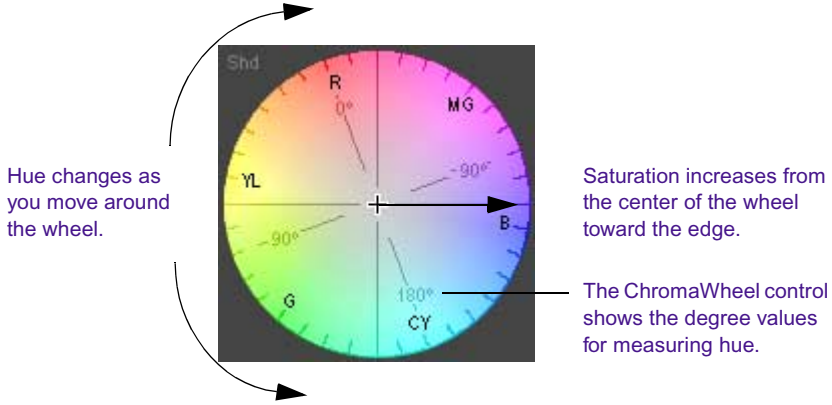
Understanding the Hue Offsets ChromaWheel Controls

A Hue Offsets ChromaWheel control is a circular graph that represents hue and saturation values. Hue values are mapped around the circumference of the wheel, with colors in the same positions that they occupy on a vectorscope. Red is at the 0° point on the wheel, and cyan is at the 180° point.

As you move around the wheel counterclockwise from red to cyan, you move through positive degree values. For example, green is at +120°. As you move around the wheel clockwise from red to cyan, you move through negative degree values. For example, blue is at –120°.

Saturation values are mapped along the radius of the wheel. The center point of the wheel represents zero saturation (neutral gray); the edge of the wheel represents maximum saturation. As you move out from the center of the wheel, you shift from less to more saturation. Saturation values are measured on a scale from 0 (zero saturation) to 100 (maximum saturation).

By picking a specific point on the wheel, you select an exact combination of hue and color intensity to add to your image. You can select a gray with a slight yellow tinge near the center of the wheel, for example, or an intensely saturated blue at the outer edge.



If you are reading a hardcopy version of this document, you will find it useful to view the color images in the Help or in the online version of this document on the online publications CD-ROM.

When you use the ChromaWheel controls to correct a color cast, you use a basic principle of color theory: you can cancel out one color in an image by adding an equal amount of the opposite color on the wheel. For example, to remove a red cast, add some cyan. To remove a yellow cast, add some blue. You do not even need to remember which colors are opposite when you have the ChromaWheel as a control. Simply add some color from the opposite side of the wheel from the color you want to remove, and then fine-tune your adjustment until you are satisfied with the result.

Making Corrections Using the Hue Offsets Tab

To make a correction using the Hue Offsets tab:

1. If you have not already done so:
   a. Move the position indicator to the segment you want to correct.
   b. Click the HSL tab.
   c. Click the Hue Offsets subdividing tab.

2. Make your adjustments by doing one or more of the following:

   - Move the crosshair pointer on the appropriate ChromaWheel control. For more information, see "Moving the ChromaWheel Crosshair Pointers" on page 72.

     As you move the pointer in the wheel, the Hue and Amount text boxes update to display numerical values for the adjustment.

   - Type values in the Hue and Amount text boxes for the appropriate ChromaWheel control to set the offset you want. You must press Enter (Windows) or Return (Macintosh) after typing a value for it to take effect.

     Hue values range from –180° to 180° where 0° is the position of red on the wheel. Amount values range from 0 to 100. When you change the Hue and Amount values, the pointer on the ChromaWheel control updates to represent the adjustment.

You can "nudge" the numerical value of a control up or down by small increments. To do this, click in the text box, and then press the Up Arrow key to increase the value or the Down Arrow key to decrease the value.

   - Use the Color Match control to calculate an offset automatically, based on input and output colors. For more information, see "Using the Color Match Control" on page 56.

   - Adjust one or more of the individual sliders or buttons. For more information, see "Using the HSL Sliders" on page 65 and Table 7 on page 72, which describes the Gain, Gamma, and Offset controls.

3. Fine-tune your adjustments until you are satisfied with the result.

   Remember that you can make adjustments on more than one ChromaWheel control and turn them on and off individually to assess their effect on the image.

Table 7 Hue Offsets Tab Controls

Control	Description
Gain	Adjusts the gain or white point for the image. Values range from 0 to 200, where 100 represents the unchanged image. The main difference between Brightness (on the Controls tab) and Gain is that Brightness adjusts by adding to the 8-bit luminance value of every pixel, while Gain makes an adjustment based on a percentage of the original luminance.
Gamma	Adjusts the midpoint of the luminance range. Values range from 0.1 to 10, where 1 represents the unchanged image. Lowering the value darkens the midtones and brings the image closer to black. Raising the value lightens the midtones and brings the image closer to white.
Offset	Adjusts the setup or black point for the image. Values range from –255 to 255, where 0 represents the unchanged image (no offset). The effect of the Offset control is very similar to that of the Brightness control (on the Controls tab). One important difference, however, is that the Offset control interacts with the Gain and Gamma controls, while the Brightness control interacts with the Contrast control. If you have made an adjustment using the Gain or Gamma controls, it is better to adjust luminance further by using the Offset control. If you have made a Contrast adjustment, it is better to adjust luminance by using the Brightness slider.

Moving the ChromaWheel Crosshair Pointers

To move the crosshair pointer in a ChromaWheel control:

1. Click anywhere in the wheel, and press and hold the mouse button.

   The standard mouse pointer disappears, and the crosshair pointer is dynamically linked to the mouse.

2. Drag the crosshair pointer around in the wheel until you are satisfied with the adjustment, and then release the mouse button.

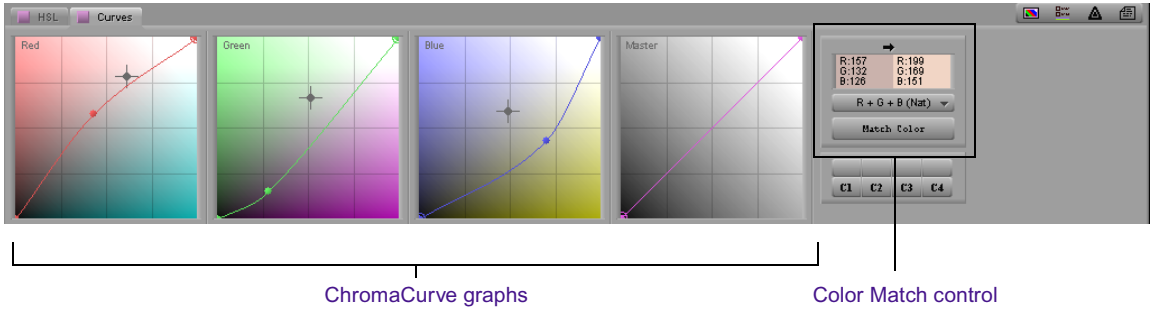
For more precise control over the movement of the crosshair pointer in the central area of the wheel, press and hold the Shift key while performing the actions in this procedure.

The Curves Group

The Curves group consists of the four ChromaCurve graphs and the Color Match control. The ChromaCurve graphs allow you to control color by placing up to four control points on a graph and then adjusting the points. For more information on ChromaCurve graphs and how they operate, see “Understanding ChromaCurve Graphs” on page 74.

You can also type numerical input and output values in text boxes or use the Color Match control to automatically add or modify a control point to the curves, based on selected input and output colors. For more information on the Color Match control, see “Using the Color Match Control” on page 56 and “ChromaCurve Graphs and the Color Match Control” on page 78.

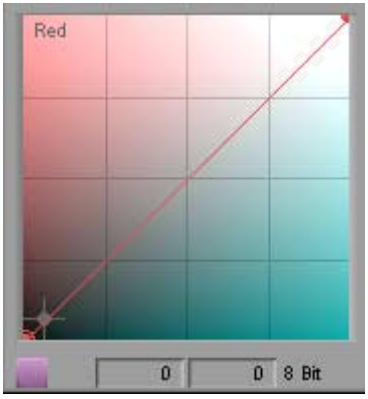
The following illustration shows the Curves tab.



Understanding ChromaCurve Graphs

A ChromaCurve graph shows the relationship of input values (on the horizontal axis) to output values (on the vertical axis). A background grid indicates the quartile points on each axis to assist you when you are reading the graph and making adjustments.

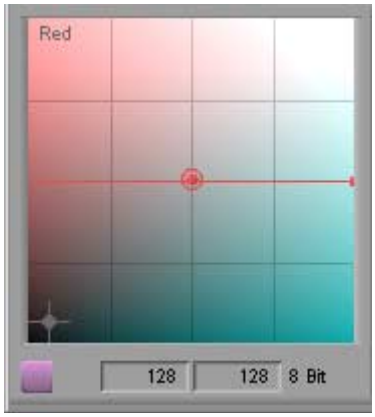
The following illustration shows the Curves tab Red ChromaCurve graph.



The default curve (before you make any adjustments) is an ascending 45° straight line, since input and output values are the same across the entire range. The control points for the two ends of the curve are set by the system, but you can change their location.

If you make an adjustment that moves part of the line below the 45° angle, you make the output values for that part of the image lower than the input values. If you make an adjustment that moves part of the line above the 45° angle, you make the output values for that part of the image higher than the input values.

If you make an extreme adjustment to a curve so that it becomes a horizontal line, you are converting all input values to the same output value. For example, in the following illustration, all input values are mapped to an output value of 128. When this adjustment is made across all three color channels, the result is a uniform, mid-gray image.



When you make less extreme adjustments, the result is a true curve, since the graph updates by calculating a curve based on the values of the control points and their positions with respect to one another.

In each ChromaCurve graph, the color of the background indicates what color in the image is adjusted if you created a curve through that part of the graph. The upper left corner of the graph is the color of the graph name (red, green, blue) and represents complete saturation in that color. The lower right corner of the graph is the complementary color (cyan, purple, yellow). The upper right corner is white and the lower left corner is black.

For examples showing how various curves affect an image, see “Examples of ChromaCurve Graph Adjustments” on page 79.

Making Corrections Using the Curves Tab

To make corrections using the Curves tab:

1. If you have not already done so:
   a. Move the position indicator to the segment you want to correct.
   b. Click the Curves tab.
2. Adjust the ChromaCurve graphs until you are satisfied with the results.

   For more information on adjusting curves, see “Adjusting ChromaCurve Graphs” on page 76.

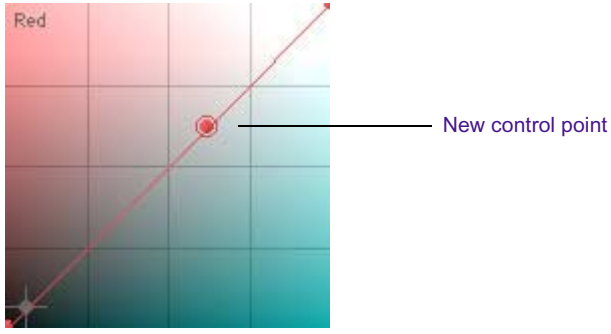
Adjusting ChromaCurve Graphs

You can have four control points in a Curves tab ChromaCurve graph. Graphs must always have at least two control points. Your Avid system sets default control points such that input and output values are the same across the entire range of colors.

To add a control point:

- Click the curve line in the graph at the point where you want the new point to appear.

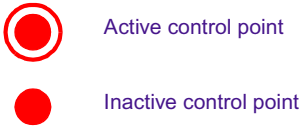
  A new control point appears with a circle around it to indicate that it is the active control point.



To select a control point:

- Click the control point you want to select.

  A circle appears around the control point to indicate that it is the active control point.



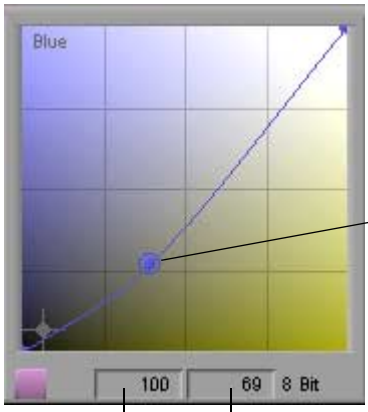
To move a control point, do one of the following:

- Click the control point, press and hold the mouse button, and drag the control point to the location on the graph where you want to place the point.

  The curve updates as you drag the control point.

- Type input and output values for the position of the control point in the Input and Output text boxes below the graph. You must press Enter (Windows) or Return (Macintosh) after typing a value for it to take effect.

You can "nudge" the numerical value of a control up or down by small increments. To do this, click in the text box, and then press the Up Arrow key to increase the value or the Down Arrow key to decrease the value.



To delete a control point:

1. Click the control point to activate it.

   A circle appears around the control point.

2. Make sure that the cursor is over the ChromaCurve graph that contains the control point you want to delete.

3. Press the Delete key.

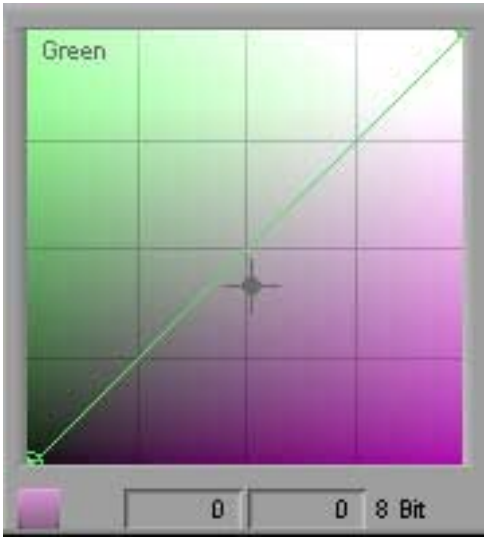
A curve is defined by at least two control points. If you have only two control points set in a ChromaCurve graph, you cannot delete one.

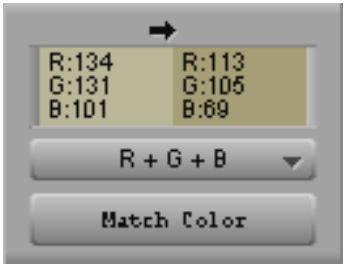
ChromaCurve Graphs and the Color Match Control

When you use the Color Match control in the Curves tab, a gray crosshair marker appears in each appropriate ChromaCurve graph to mark the intersection of the input value as defined by the input color swatch in the Color Match control and the output value as defined by the output color swatch in the Color Match control.

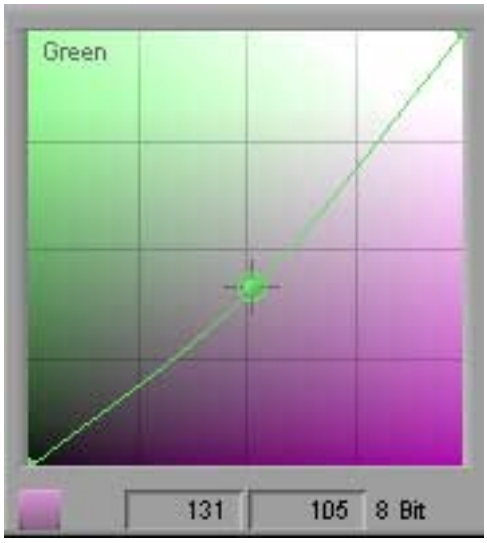
When you click the Match Color button, the system adds a new control point and updates the ChromaCurve graphs to reflect the color match. If you are not using NaturalMatch or if the ChromaCurve graphs have not received any previous adjustment, the new control point appears at the location of the crosshair marker. If you are using NaturalMatch or if the ChromaCurve graphs have already received some adjustment, the system makes a more complex calculation to reflect the input saturation and luminance values or to take earlier ChromaCurve graph adjustments into account. In these cases, the new control point does not appear at the location of the crosshair marker.

The following illustrations show this behavior both before and after you click the Match Color button.





The crosshair marker on the Green ChromaCurve graph represents the values for Green in the color swatches — Input 131, Output 105. Since R+G+B is selected as the Match Type, similar crosshair markers appear on the Red and Blue ChromaCurve graphs.



When you click the Match Color button, the system creates a new control point and updates the curve to reflect the color match. In this illustration, NaturalMatch is selected and the calculation is not complicated by other control points, so the new control point is created at the exact location of the crosshair marker. The Green input and output values as shown in the color swatches now appear in the Input and Output text boxes below the graph.

Examples of ChromaCurve Graph Adjustments

The following illustrations show a series of simple adjustments made to an image using the Red ChromaCurve graph in the Curves tab. By comparing the results of these adjustments, you will learn how curves can be used to control color across different parts of the brightness range.

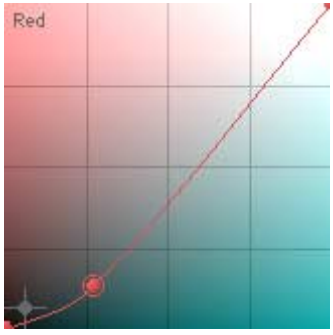
In each adjustment example, the new corrected image and the curve used to produce it are shown together with one other image from the series for the purpose of comparison.

In each example, the color of the background behind the control point represents the color change to the image. In the first example, creating a curve through the darker cyan area causes reds to be reduced in the darker parts of the image. In the second example, creating a curve through the lighter cyan area causes reds to be reduced in the lighter areas of the image.

If you are reading a hardcopy version of this document, you will find it useful to view the color images in the Help or in the online version of this document on the online publications CD-ROM.

Uncorrected Image

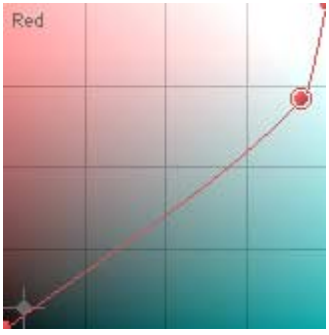
Adjustment 1



Adjustment 1. Red is reduced primarily in the shadows range (the lower part of the curve). Notice how much of the red tone is lost from the background grass, the shirt, and the lower red signpost, which loses much of its detail. The higher red signpost is relatively less desaturated, however, and some of the reddish tinge is retained in the cloud highlights in the top right.

Adjustment 1

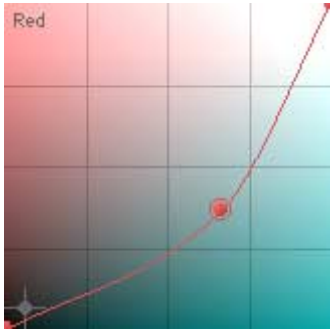
Adjustment 2



Adjustment 2. Red is reduced primarily in the highlights range (the upper part of the curve). The differences between this adjustment and adjustment 1 are most apparent in the lower signpost, which retains more redness and detail, and in the background, where the crop in the lower right retains more red tones, but the cloud highlights in the top right have lost their red tinge.

Adjustment 2

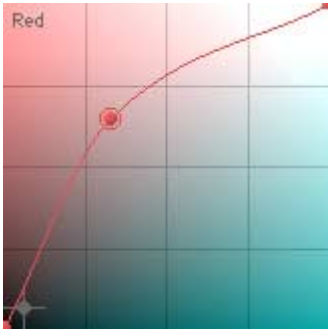
Adjustment 3



Adjustment 3. Red is reduced more evenly across the entire luminance range but with the largest change in the midtones. Though the differences between this adjustment and adjustment 2 are subtle, the strong midtone reduction in red is most noticeable in the skin tones, which appear more gray than in either adjustment 1 or adjustment 2. However, adjustment 3 retains both some detail in the lower signpost and some of the reddish highlights in the clouds.

Adjustment 3

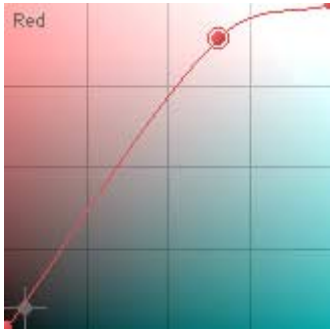
Adjustment 4



Adjustment 4. Red is boosted relatively evenly across the entire luminance range but with the largest change in the midtones. Here the difference from adjustment 3 is obvious throughout the image. The most extreme differences appear in the midtone range, for example, in the hands.

Adjustment 4

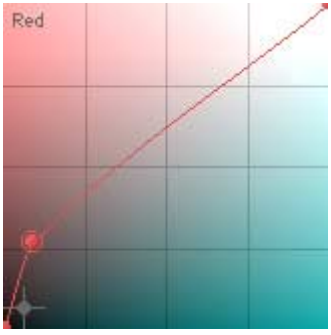
Adjustment 5



Adjustment 5. Red is boosted primarily in the highlights range. Here the most noticeable difference can be seen in the crop in the background. In adjustment 4, where red has been boosted more in the lower ranges, the crop looks more orange. In adjustment 5, where red has been boosted very little in the shadows range, the crop looks more yellow-green.

Adjustment 5

Adjustment 6



Adjustment 6. In the final adjustment, red is boosted primarily in the shadows range. In comparison with adjustment 5, there is much more of a red or orange tinge in the darker parts of the image (for example the crop in the lower right and the lower part of the shirt). Highlights in the clouds, however, have much less of a red tinge.

Working with the Waveform and Vectorscope Displays

The waveform and vectorscope commands, found in the Source menu, configure the monitor to graphically display color information about your sequence. The system displays the information for the currently active monitor.

A waveform indicates the brightness of the image. The higher the green trace goes on the scale, the brighter that part of the image is.

Waveform monitors display all the information for the current field or frame overlaid in the waveform. That is, each left-to-right trace in the waveform represents one scan line. If you see a bright object on the left side of the image, you will see its peak on the left side of the waveform. A bright object in the top left of the image produces the same waveform if it is in the bottom left of the image.

To display a waveform monitor or vectorscope:

1. Click in the monitor for which you want to display color information.

   The monitor becomes the active monitor.

2. In one of the other monitors, click the Source menu and choose a waveform or vectorscope command.

   The monitor displays the selected waveform or vectorscope information.

For more information, see “Using the Waveform and Vectorscope Displays” on page 95.

Table 8 describes each command.

Table 8 Waveform and Vectorscope Commands

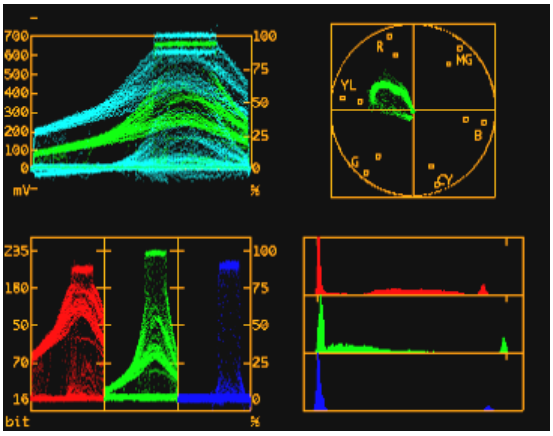
Command	Description
Quad Display	Displays the following waveform and vectorscope information in a single monitor (clockwise from the top left corner): • YC Waveform • Vectorscope • RGB Histogram • RGB Display  For information on each display, see its individual entry in this table.

Table 8 Waveform and Vectorscope Commands (Continued)

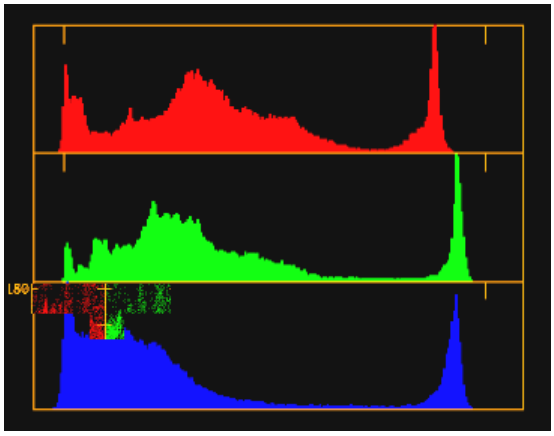
Command	Description
RGB Histogram	Displays a graph showing which RGB values in the image appear most frequently. The darkest values of red, green, and blue in the image appear as peaks on the left of the graph, and the brightest values appear as peaks on the right. The height of a peak indicates the number of pixels of that value. The width of a peak indicates how many pixels in the image have similar values. For example, if the blue histogram has many tall peaks at the left side, it shows that the image has many pixels with low blue values. However, those same pixels might appear in the image as many different colors, since they might have any red and green values.  For information on using the RGB Histogram display, see “Using the Waveform and Vectorscope Displays” on page 95.

Table 8 Waveform and Vectorscope Commands (Continued)

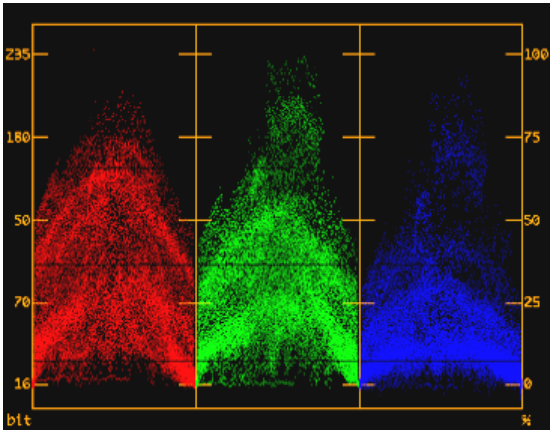
Command	Description
RGB Parade	Displays waveforms of the RGB (red, green, and blue) components side by side. Since video cameras capture in RGB, this display helps to show camera problems. It is also used for general reference to the three primary colors. RGB signals are used together to create all other colors. A white area in the image appears as peaks in all three waveforms at the same relative location. A high red level does not mean a red image, unless the green and blue levels are low. RGB Parade incorporates any safe color limits you have set. The system displays RGB values in white when the values fall outside the RGB Gamut limits. For more information on color limits, see "Safe Color Limits with Waveform Monitor and Vectorscope Information" on page 132.  For information on using the RGB Parade display, see "Using the Waveform and Vectorscope Displays" on page 95.

Table 8 Waveform and Vectorscope Commands (Continued)

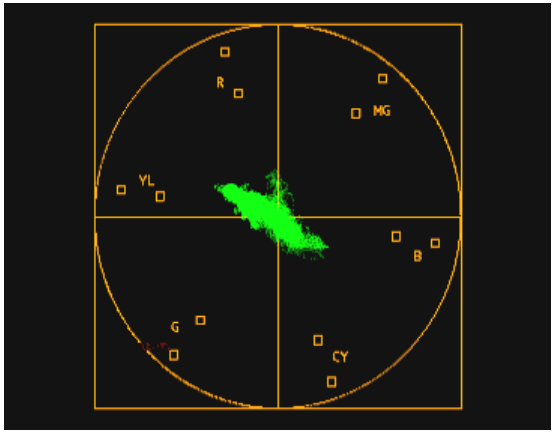
Command	Description
Vectorscope	Displays chroma information without luma information as a circular graph where the center represents no chroma and chroma increases as the trace moves away from the center. All white, black, and gray parts of the image appear at the center. Areas with more saturation appear further out from the center. Images with an overall color cast produce a vectorscope trace that is generally off-center. Colors created by various positive and negative combinations of Cb and Cr appear around the circle. Small squares mark the location of standard color bar vectors. Inner squares represent the proper values for 75% color bars, and outer squares represent 100% color bars.  For information on using the Vectorscope display, see “Using the Waveform and Vectorscope Displays” on page 95.

Table 8 Waveform and Vectorscope Commands (Continued)

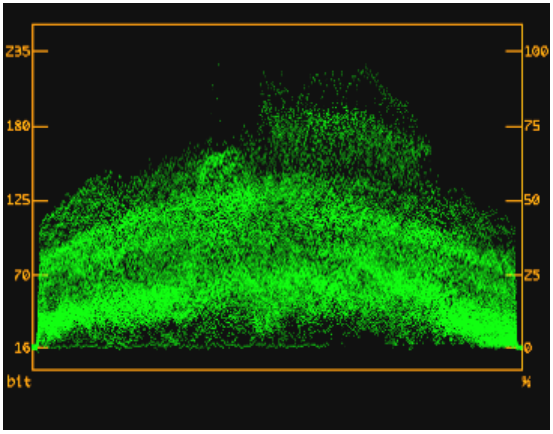
Command	Description
Y Waveform	Displays a waveform monitor with luma information. Luma is the brightness of an image without regard to color. The scale on the left is a digital level scale using a 256-step (eight-bit) range; 16 is the level for black, and 235 is the level for white. The scale on the right shows the amount of white in the image as a percentage; 0% represents black, and 100% represents white. Parts of an image can have values outside the 0% to 100% range. The digital video standard allows for *headroom* and *footroom* so that you can correct a mistake in level in the post-production process. The minimum is digital 0 or –8%, and the maximum is digital 255 or 108%. *Some external software or hardware processing can clip a signal that is outside the 0% to 100% range.* Y Waveform incorporates any safe color limits you have set. The system displays Luma values in white when the values fall outside the Luminance limits. For more information on color limits, see "Safe Color Limits with Waveform Monitor and Vectorscope Information" on page 132.  For information on using the Y Waveform display, see "Using the Waveform and Vectorscope Displays" on page 95.

Table 8 Waveform and Vectorscope Commands (Continued)

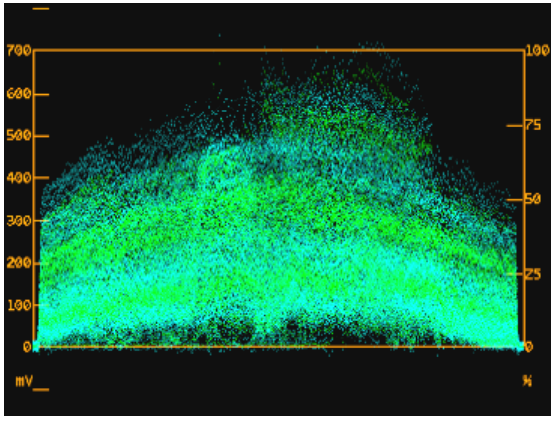
Command	Description
YC Waveform	Displays composite video information. Composite video has the C (chroma) waveform, which is derived from Cb and Cr components, riding on the Y (luma) waveform. The Y trace is green and the C waveform is a cyan (blue-green) envelope around the green trace. Because the C signal of composite video has equal positive and negative energy, the cyan bands are at an equal distance above (Y+C) and below (Y-C) the green waveform. The left side of the YC Waveform shows a scale marked either for NTSC or PAL, depending on your project. NTSC black is 7.5 IRE (except in Japan), and NTSC white is 100 IRE. PAL black is 0 millivolts (mV), and PAL white is 700 mV. *This tool does not display actual composite video output. It is an accurate software model of a perfect encoder. If you convert your material to composite form, you will see similar results.* The scale on the right shows the amount of white in the image as a percentage; 0% represents black, and 100% represents white. Composite video values above or below these limits are indicated by a red edge on the display. In addition, YC Waveform incorporates any safe color limits you have set. The system displays Composite values in yellow and Luma values in white when the values fall outside the safe color limits. For more information on color limits, see "Safe Color Limits with Waveform Monitor and Vectorscope Information" on page 132.  For information on using the YC Waveform display, see "Using the Waveform and Vectorscope Displays" on page 95.

Table 8 Waveform and Vectorscope Commands (Continued)

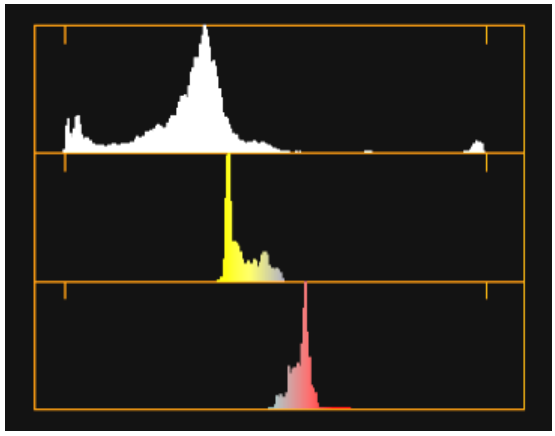
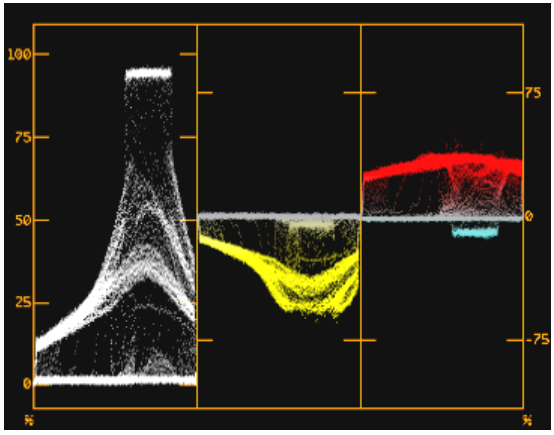
Command	Description
YCbCr Histogram	Displays a graph showing which YCbCr values in the image appear most frequently. The height of a peak indicates the number of pixels of that value. The width of a peak indicates how many pixels in the image have similar values. The upper bar of the histogram represents Y values. The darkest values are on the left and the brightest values on the right. An image with good contrast will show a good spread of values from darkest to lightest. An image with a great variety of colors appears as a wide spread in the Cb and Cr histograms. If they extend too far from the center, there is too much saturation.  For information on using the YCbCr Histogram display, see “Using the Waveform and Vectorscope Displays” on page 95.

Table 8 Waveform and Vectorscope Commands (Continued)

Command	Description
YCbCr Parade	Displays waveforms of Y, Cb, and Cr side by side. The Y in YCbCr is the same luma shown in the Y Waveform. In this display, the Y waveform is shown in white on the left side. Cb and Cr are color difference signals that represent just the color information of a signal with the luma removed. Cb and Cr values can be negative or positive. For images that are black and white, Cb and Cr are zero. You would see a flat white line halfway up the two right bands. As they increase, Cb and Cr are shown in the colors representing those vectors. The more the values increase, the more saturated the colors used to display them. Positive Cb is represented by blue hues, and negative Cb is represented by yellow hues. Positive Cr is represented by red hues, and negative Cr is represented by cyan hues. If the Cb or Cr waveforms are not centered, the cause might be a color cast to the image.  For information on using the YCbCr Parade display, see “Using the Waveform and Vectorscope Displays” on page 95.

Using the Waveform and Vectorscope Displays

Some of the ways you can use the waveform and vectorscope displays include:

- Align levels of sources using test patterns. If you capture some color bars from your source footage, you can measure them and set the color correction needed to restore the video levels to the way the program was created. Import the Test Patterns from the SupportingFiles folder of your Avid system to become familiar with the proper Waveform, Parade, and Vectorscope readings. Histograms are not as useful on test patterns. For example, with 75% color bars, the Y+C envelope for the yellow and cyan bars should match the 100% white level.
- Identify problems with source video. Typical problems include:
  - Color levels too high or too low. See "Safe Color Limits with Waveform Monitor and Vectorscope Information" on page 132.
  - Missing channels in YCbCr or RGB, indicating an equipment problem or a damaged cable.
  - Clipping in YCbCr, RGB, or YC channels. The trace appears chopped at a certain level. If this appears at a level below the maximum, it occurred before the footage was captured.
  - Images imported at the wrong level settings. If you import images at RGB levels of 0–255 that you should have imported at 601 levels of 16–235, the images will lack contrast. If the images have too much contrast, with levels exceeding the 0% and 100% markings, the opposite is likely.

With experience, you will learn how to read not only test patterns but actual content on the instruments. This facility will allow you to:

- Match scene brightness across a cut in Y Waveform.
- Put your flesh tones along a certain hue axis in the vectorscope.
- Watch the spread of the Y histogram to identify a good contrast range without clipping.
- Watch the top of the YC Waveform to make sure you do not have too much bright chroma.

- Fix white balance and black balance problems by identifying and centering those vectorscope traces.

These instruments are showing you the values of only one frame or field at a time. Move around in the clip to find the most extreme levels or those most representative of the scene.

You can also use the information in the waveform monitors and vectorscope to monitor safe color limits. See "Safe Color Limits with Waveform Monitor and Vectorscope Information" on page 132.

Using the Color Correction Effect in the Effect Palette

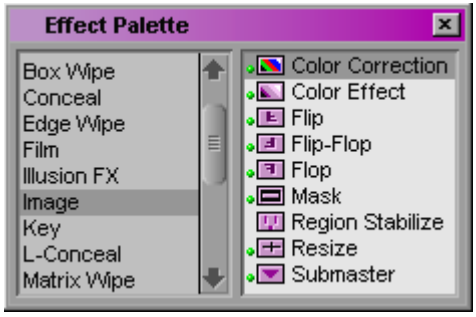
The Color Correction effect appears in the Image category of the Effect Palette. Because your system automatically applies a Color Correction effect in the Timeline when you make a correction, ordinarily you will not apply the Color Correction effect from the Effect Palette.

One exception is if you want to apply a single color correction to multiple contiguous segments.

Applying a Color Correction Effect from the Effect Palette

To apply a Color Correction effect from the Effect Palette:

1. In editing mode, Effect mode, or Color Correction mode, open the Effect Palette.
2. Click the Image category.



3. Drag the Color Correction Effect icon from the Effect Palette, and drop it in the segment in the Timeline to which you want to apply color correction.
4. If you are not in Color Correction mode, do one of the following:
   - Choose Color Correction from the Toolset menu.
   - Press Shift+F8.
5. Make adjustments in the Color Correction tool until you are satisfied with the result.

6. Enter editing mode, and render the Color Correction effect by using one of the rendering procedures described in the chapter “Playing and Rendering Effects” in the effects guide for your system.

   When your Avid system finishes rendering, the Color Correction Effect icon appears in the Timeline without a dot.

Working with the Color Correction Effect

Once you have created a Color Correction effect and have made color correction adjustments to it, you can work with that effect in the same way that you work with any other effect that is applied from the Effect Palette and that appears in the Timeline with an effect icon.

You can save the effect as a template by entering Effect mode and dragging the effect icon from the Effect Editor to a bin in the standard way described in the effects guide for your system. You can then apply the template to other segments in the sequence or to other sequences. This is useful for applying a Color Correction Effect template quickly to multiple segments.

You can also delete the effect in the standard way by selecting it in Effect mode and pressing the Delete key. For more information, see the effects guide for your system. If color corrections that were not applied from the Effect Palette are in the same segment — indicated by colored lines if Color Correction is selected in the Timeline Fast menu — those corrections cannot be deleted in Effect mode. To remove those color corrections, you must enter Color Correction mode and use the Remove Effect button.

Chapter 4

Color Correction Techniques

This chapter provides a basic introduction to color correction techniques. It suggests some general principles to keep in mind when you are assessing footage and making color corrections. The chapter then presents several examples of shots with typical color problems and detailed explanations of adjustments that improve those shots.

This information is intended primarily for users who are unfamiliar with the methods of color correction and who want some initial guidance on how to handle material that needs correction. However, since the chapter is built around specific examples of color corrections made with Avid Color Correction, it might also be useful for anyone learning to work with the tool and its controls, even an experienced colorist.

Guiding Principles for Color Correction

One useful high-level way to think about the color correction process is to define what the overall goals of the process are. Another, slightly more practical and detailed, is to break down the typical color correction workflow into clearly defined stages of adjustment. This section uses these two approaches to provide you with a set of guiding principles for color correction.

Goals of Color Correction: Restoration and Adaptation

Color correction can be thought of as having two main goals. The first is restoring the original look of the scene. The second is adapting the look of the scene to meet the demands of the project.

In some cases, the task of color correction is complete when the first goal has been met. Often, however, there will be at least some departure from the restored look to achieve shot-to-shot consistency or to convey creative concepts. The color corrections applied to any particular shot must therefore respect (to varying degrees) two different contexts: the original scene at the time the camera captured it and the final situation of the shot within a program that has particular creative or communicative aims.

Restoring the Original Look

The first task in color correction is to restore the original look of the scene that has been filmed — in other words, to make the image match as closely as possible what an observer standing beside the camera would have perceived when the scene was shot.

This is important primarily because viewers have very little tolerance for images that look unrealistic when they are supposed to represent reality. Viewers make some allowances for the fact that they are watching film or television rather than viewing the world directly, but they do not make many. For example, when a skin tone departs from our normal expectations of what skin should look like, we notice. Even when the final image is intentionally a distortion of reality, it is useful to restore the original look as a well-balanced foundation for subsequent alterations.

The color characteristics of a given shot can depart from the look of the original scene for a variety of reasons. At the time of shooting, the camera might not be correctly balanced or the scene might be imperfectly lit. During transfers (from film to tape, from one tape to another, or from tape to digitized media), inconsistencies in materials, processing methods, or calibration might alter the colors.

When you are working on an uncorrected shot, you should make intelligent decisions about what the scene originally looked like and then bring the shot into line with those decisions as much as possible. Since it is unlikely that you were present when the scene was shot, this might seem to require a great deal of guesswork, but, in fact, it can be accomplished with sufficient accuracy by using the following two basic guidelines.

- The human visual system generally maximizes the tonal range available in a scene. For example, in low light we adjust to perceive a greater range of dark tones.
- The human visual system generally perceives color accurately and compensates for color casts. For example, we perceive a white shirt as white even if it is being illuminated by slightly pink light.

Generally, you can restore the original look of a shot (or at least create a believable approximation of the original look) by opening up the tonal range as much as reasonably possible and by ensuring that colors look accurate. For more detailed information on how to achieve this with adjustments, see “Correcting Tonal Range” on page 102 and “Neutralizing Color” on page 104, and the examples later in this chapter.

Adapting the Original Look

An adaptive adjustment deliberately departs from the original look of the scene in some way. Such an adjustment might be relatively subtle, for example, lightening one shot to make it match another. In this case, you are departing from your commitment to the original look in order to achieve shot-to-shot consistency in your sequence. Other kinds of adaptive adjustment might be much more dramatic, for example, applying a gold tint to an entire sequence for an advertising spot or applying extreme adjustments such as posterization or chroma inversion for a music video.

Generally, it is a good idea to achieve an effective restorative adjustment before you begin adaptive adjustments. You will then be building on an image that has good color characteristics. Most viewers can probably perceive the difference between a restored, well-balanced image with a strong blue tint applied and an unrestored, poorly lit image with a strong blue tint applied (and prefer the former).

Stages of Color Correction

A typical color correction for a shot will probably include the following main stages of adjustment:

- Correcting the tonal range (or contrast ratio)
- Neutralizing color casts
- Achieving consistency between the shots in a sequence
- Achieving a final look

Different kinds of projects will lead to different emphases among these stages and might even make some of them unnecessary. Different working habits will also affect how these stages are handled. A more experienced colorist might work in a manner that blurs the distinctions between them. For a beginner, it might be better to keep them distinct and achieve an acceptable result for each one before moving on to the next.

The following sections provide some guidelines for each of the main stages.

Correcting Tonal Range

Correcting the tonal range usually requires two steps. In the first step, you reset the white and black points to make the range of values between the lightest part of the image and the darkest part of the image as large as possible. In the second step, you adjust the gray point to control how much of the total tonal range falls above and how much below the middle value.

Setting White and Black Points

Setting the white point and the black point is often relatively straightforward, since the shot will include an area that should obviously be very light and another area that should be very dark. You simply look for what should be the lightest area of the image and adjust controls until it becomes as light as possible, and then do the same for the area that needs to be black. You can dramatically improve the quality of shots taken using insufficient or excessive light just by making white and black point adjustments.

In some cases, however, the shot should have less range of brightness (for example, when the whole scene was originally in shadow or was shot at sunset). In such cases, you need to be careful to expand the range as much as possible without making parts of the image unrealistically light or dark.

Avoid clipping any significant part of the image. You want the range between your lightest value and your darkest value to be as large as possible, but in most circumstances you don't want to lose detail by reducing all your very light values to white or all your very dark values to black.

Do not use intense reflected spots of light (known as *speculars*) to judge where your white point should be. If you do so, you define white by an artificial standard that probably occurs in only a tiny fraction of the image. A true white object such as an item of clothing might appear dull and gray by this standard.

You have a number of choices for controls to use to make white point and black point adjustments, including the Gain and Offset sliders in the Hue Offsets tab of the HSL group.

Adjusting the Gray Point

Once you have established the range from the brightest part of the image to the darkest part, you can adjust the gray point if necessary. When you make a gray point adjustment, you define how much of the overall tonal range is between black and mid-gray, and how much is between mid-gray and white.

The most obvious effect of a gray point adjustment is that it either lightens or darkens the overall look of the image. Large adjustments of the gray point toward either the black point or the white point are almost always undesirable because they leave the whole image much too dark or too light.

Smaller, well-chosen gray point adjustments, however, can be useful for fine-tuning the overall brightness of the image. Also, since a gray point adjustment expands the tonal range on one side of the midpoint and contracts it on the other, it can be useful for improving contrast and detail overall. For example, some images look better if more contrast is available in the range between gray and white, even though the price paid for that extra contrast is a reduction in contrast between gray and black.

The main control for making gray point adjustments is the Gamma slider in the HSL group.

Neutralizing Color

Neutralizing color involves returning the colors in an image to the colors that a viewer would have perceived when standing beside the camera. Most film or video images depart from that ideal to some degree, and some depart from it dramatically.

One way to think about neutralizing color is to imagine working on a project where every shot includes a large card that we know is, when viewed in ideal lighting conditions, a perfectly neutral mid-gray color. If you can correct each image so that the card appears mid-gray when your audience views the final program, all other colors in the images should be correct also.

Though you cannot normally have such a perfect measuring device in your images, it is useful to choose an area of each image as a target for your color neutralizing adjustments. If you focus on getting the color in that area right, color in the rest of the image should fall into place. In some images, there might be an object or area that should be neutral gray, or nearly so, and you can use that area as your principal target as you make adjustments. In other images, you might not have any gray color at all, but you will almost certainly have some other area where even a small departure from

neutral color is noticeable. Human skin is probably the most common example. Or you might choose to focus on an area where you know the true color, such as a person's hair.

In addition to identifying parts of your image on which to concentrate your attention, it is useful to establish how the uncorrected image departs from neutral color before you attempt to correct it.

Sometimes this is obvious. You cannot mistake an image with an extreme pink or yellow cast. When the problem is more subtle, you can sample a few areas with the Color Match eyedropper to get information about the color characteristics of the image. Areas that should be white or black are particularly helpful, since these are easily identifiable colors that should have nearly identical values for red, green, and blue. If the red value is higher than the other two, the image has a red cast. If red and green are higher than blue, the image has a yellow cast.

You can neutralize color by using different controls in the Color Correction tool. For example, you can use the Curves tab to adjust the proportions of each color. Or you can use the Hue Offsets ChromaWheel controls, which allow you to quickly locate the sector of the wheel that represents the color cast in the image, and then adjust in the opposite direction to that color.

The more experienced you become as a colorist, the better you will get at judging even subtle color problems by eye and knowing intuitively what kinds of adjustments to make.

You will usually make final corrections of this kind by applying color correction to a filler track or a higher timeline track, or extended parts of sequences defined by IN and OUT points. It is not possible to generalize about which controls to use to make such adjustments. You might be called upon to use any combination of color correction controls. The only effective preparation for such work is practice using the Color Correction tool and a good understanding of the more specific corrections discussed in the sections above.

Achieving Shot-to-Shot Consistency

The most common reason for departing from the look of the original shot is to achieve simple shot-to-shot consistency in the finished program. If a scene in a drama that is supposed to take place at one time is shot over two days, and lighting conditions have changed from one day to the next, you clearly want to adjust all the shots so that they appear to be taking place at the same time.

Adjustments for shot-to-shot consistency are relatively straightforward in most cases. You simply need to compare shots in the Composer window and then adjust them to match. If you have already adjusted tonal range and neutralized color well, a small change to relative brightness might be all that is needed.

The Dual Split with Reference option provides a particularly good way of comparing a reference shot with your correction to another shot to confirm that the two match. Small adjustments in relative brightness from one shot to another are also easily made with the Color Match control.

Achieving a Final Look

Some projects might require final adjustments to create a finished look. For example, you might slightly increase saturation across the whole sequence to create richer-looking colors or slightly darken all the shots to enhance a mood of tension or suspense. In certain circumstances, you might make substantial changes to the color values of the whole sequence or remove color entirely from some parts of it.

It is not possible to generalize about which controls to use to make such adjustments. You might be called upon to use any combination of color correction controls. The only effective preparation for such work is practice using the Color Correction tool and a good understanding of the more specific corrections discussed in the sections above.

Examples of Color Correction Problems

The remainder of this chapter presents three typical color correction problems. The original images are chosen as good illustrations of the kind of color correction work that needs to be done to restore a good approximation of what an observer at the scene would have perceived when the camera was shooting. They require corrections to improve tonal range and to neutralize color casts.

Each example provides the following information:

- An analysis of the original image
- Step-by-step descriptions of the corrections with illustrations (including split-screen displays in some instances)
- Sample RGB values that illustrate the results of the corrections
- Suggestions for alternative ways to achieve similar results with the Color Correction tool

Remember that these examples are presented as aids to learning, not as inflexible instructions for making corrections or models of what a perfect corrected image looks like. Each example shows only one possible way of making a correction and one possibility for a final corrected image. As you develop your own color correcting skill and judgment, you might prefer to use different combinations of controls and to aim for a slightly different final look.

Example 1

Uncorrected Image

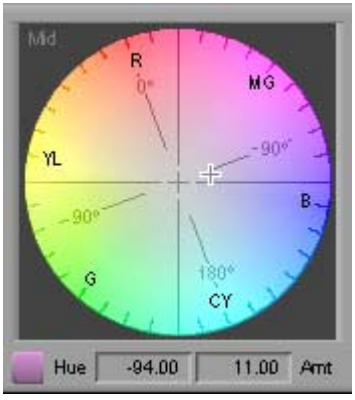
Analysis of original image: This image has two obvious problems. First, it lacks contrast and detail because it does not have a full tonal range. A correction is required to improve sharpness and detail in areas such as the shirt and the man's hair. Second, the image has a strong yellow-green cast. This leads in particular to a very unnatural skin tone.

Step 1: Contrast Correction

Split Screen: Uncorrected Image and Step 1 Correction

Step 1 of this correction is an adjustment to the Contrast slider in the Controls tab of the HSL group. This adjustment (which sets the Contrast slider value to 11) illustrates one of the simplest ways to affect the tonal range of an image. Despite its simplicity, the correction improves the image noticeably. Compare the look of the man's hair on either side of the split-screen dividing line.

Step 2: Correction to Neutralize Color



Split Screen: Uncorrected Image and Image After All Corrections

Step 2 of this correction eliminates the color cast by making a single adjustment on the Midtones ChromaWheel control on the Hue Offsets tab of the HSL group. Since the image is obviously too green, the correction is made by moving the crosshair pointer away from green. The adjustment shown is Hue:–94, Amount:11. (This places the crosshair between the magenta and blue parts of the wheel, opposite a point between green and yellow. The sample RGB values below confirm that we are reducing both yellow and green in the image.) This successfully restores a good skin tone and reveals the man's shirt to be blue.

Sample RGB values: A sampling of an area of the man's shirt before and after the corrections shows the following values:

Before: R:37, G:56, B:61

After: R:14, G:26, B:55

These numbers reinforce the nature of the corrections that have been made. The hue offset adjustment has reduced the red and green levels significantly while preserving the amount of blue in the image.

Alternative techniques: This example uses simple corrections that apply across the full luminance range. Another method for correcting this image would involve making individual adjustments in different ranges such as highlights and shadows. For an illustration of this approach, see "Example 2" on page 111. The contrast adjustments could be made using the Gain, Gamma, and Offset sliders as an alternative to the one adjustment

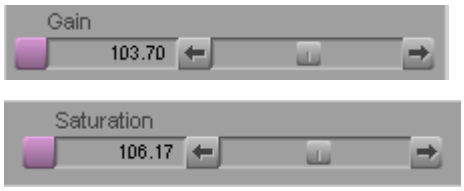
on the Contrast slider. Another alternative for making the contrast adjustment would be to use the Master ChromaCurve graph in the Curves tab.

Example 2

Uncorrected Image

Analysis of original image: This example has less glaring problems than Example 1, but it is still an image that can be improved with color correction. The highlight areas of the image (primarily the shirts) are not particularly bright, and the shadow areas (such as the underside of the cap brim) could be darker. Rebalancing white and black will improve contrast and sharpen the image throughout. Also, the image has a red cast, apparent in the slightly pink tone of the shirts. A good color-neutralizing correction will eliminate that cast without taking too much red out of the skin tones. Since the skin tones are relatively good in the image already, successful corrections will not disturb the midtones very much. The corrections in this example are therefore made primarily in the highlights and shadows luminance ranges.

Step 1: Corrections in Gain and Saturation

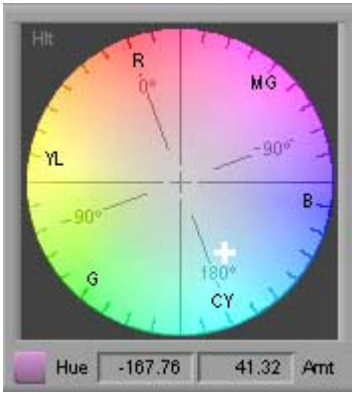


Step 1 of this correction adjusts the Gain slider in the Hue Offsets tab and the Saturation slider in the HSL Controls tab. Gain is increased to 103.70, Saturation to 106.17. This brightens the whole image slightly, and intensifies color throughout to correct the slightly dull look of the original.

Step 2: Correction in Gain

Step 2 makes a large adjustment to the Gain slider in the Hue Offsets tab. Gain is increased to 148.15. This brightens the highlight areas considerably and brings much more sharpness and contrast into the lighter areas of the cap and into the shirt in the lower right corner.

Step 3: Correction to Neutralize Color



Step 3 neutralizes the color cast in the highlights range by making a large adjustment in the Highlights ChromaWheel control. The adjustment values are Hue:–167.76, Amount:41.32. This removes the pink look in the shirts. Since the adjustment is made in the highlights range only, it doesn't result in an extreme loss of the red component of the skin tones.

Split Screen: Uncorrected Image and Image After All Corrections

Sample RGB values: A sampling of the darkest shadow area of the cap before and after the corrections shows the following values:

Before: R:24, G:24, B:22

After: R:14, G:15, B:17

These values confirm that corrections in the shadows area have resulted in shadows that are a more intense black.

Alternative techniques: The Curves tab is the only other part of the Color Correction tool that allows adjustments that affect luminance ranges differently in the manner of this example.

Example 3

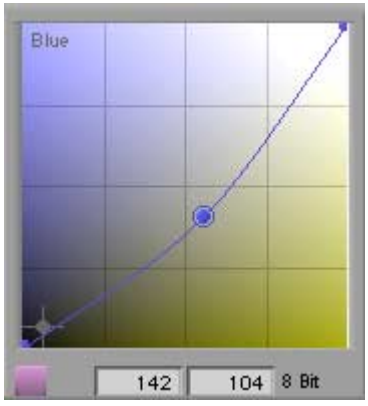
Uncorrected Image

Reference Image

Analysis of original image: In this example, two different cameras have been used to shoot the rock climbers. The second camera is correctly balanced and shows good color characteristics. In comparison, the images from the first camera show a pronounced blue cast. Also, the image from the first camera is too dark. Because the images from the two cameras look so different from one another, and because the first image is intrinsically weak, corrections are needed to neutralize color and raise the brightness level in the first image. The image from the good camera can be used as a

reference as these corrections are made. In this example, the corrections are made in the Curves tab. One advantage of Curves tab adjustments, if you are practiced and comfortable with them, is that you can make quite complex changes without having to alter many controls. The corrections in this example are made by adding and moving a single control point in each of two ChromaCurve graphs.

Step 1: Correction to Neutralize Color



Split Screen:
Uncorrected Image and Step 1 Correction

Step 1 of this correction removes the excess blue in the image by adjusting the Blue ChromaCurve graph in the Curves tab. A control point is placed near the center of the curve since the adjustment needs to apply relatively

evenly across the whole luminance range. The control point is then dragged down to reduce blue. The input and output values for this adjustment are 142 and 104 respectively.

Step 2: Correction to Match Brightness of Reference Image

Split Screen:
Uncorrected Image and Step 2 Correction

Step 2 of this correction increases the brightness of the image by making an adjustment on the Master ChromaCurve graph in the Curves tab. The control point is placed three-quarters of the way up the curve and moved up and to the left. The input and output values for this adjustment are 178 and 213 respectively. The resulting curve increases brightness throughout

the image but increases it most in the highlights range. This creates more contrast in the lower three-quarters of the luminance range (in a ChromaCurve graph, contrast is greater where the curve is steeper).

The following illustration compares the corrected image to the reference image from the good camera. Some fine-tuning is still possible to match the shots more precisely, but the images from the two cameras are now much closer to one another and will look more acceptable when viewed in the sequence.

Reference Image and Corrected Image

Sample RGB values: A sample of one of the climber's white helmets before and after the correction and in the reference image shows the following values:

Before: R:113, G:139, B:211

After: R:142, G:152, B:174

Reference: R:146, G:174, B:185

Though these samples might not be from precisely the same part of the helmet in all three cases, they clearly confirm the nature of the correction. They indicate a relative gain in red and green levels, a reduction in blue levels, and a much closer match with the levels in the reference frame.

Alternative techniques: The Blue ChromaCurve graph correction could be made in the Hue Offsets tab or even with a series of adjustments to the HSL sliders in the Controls tab. The brightness and contrast adjustment could be made in the HSL tab (using similar techniques to those in examples 1 and 2).

Chapter 5

Safe Colors

This chapter describes the Safe Colors feature of your Avid system's color correction tools. Safe Colors allows you to set safe limits for the colors that display in your images — that is, limits beyond which the system issues a safe color warning.

Overview of Safe Color Limits

Your system allows you to set three different types of safe color limits — limits beyond which the system issues a safe color warning. You can set warning limits for the composite signal range, the luminance range, and the RGB gamut.

Most broadcasting companies set specific limits for the composite signal and the luminance range. Programs that do not meet these limits are not normally accepted for broadcast. For example, a typical set of limits for broadcast in the United States might restrict the composite signal to a range from –20 IRE to 110 IRE and limit the maximum luminance to approximately 100 IRE. Some broadcast standards might be even stricter than these values, while others might be somewhat more permissive.

The composite signal for a program intended for broadcast should never exceed 120 IRE, which is the highest level that can be broadcast.

If you are working on a program intended for broadcast, you should determine what the safe limits for composite and luminance are and type them in the appropriate areas of the Safe Color Settings dialog box. You can then instruct the system to warn you when those limits are exceeded. For more information, see “Setting Safe Color Limits” on page 123.

RGB gamut refers to the intensity of each individual color channel — red, green, and blue. This measure of a safe color is less likely to be subject to specific broadcast standards, but it is still an important limit type. Colors that have extremely low or high gamut values might not display well on television screens.

Setting Safe Color Limits

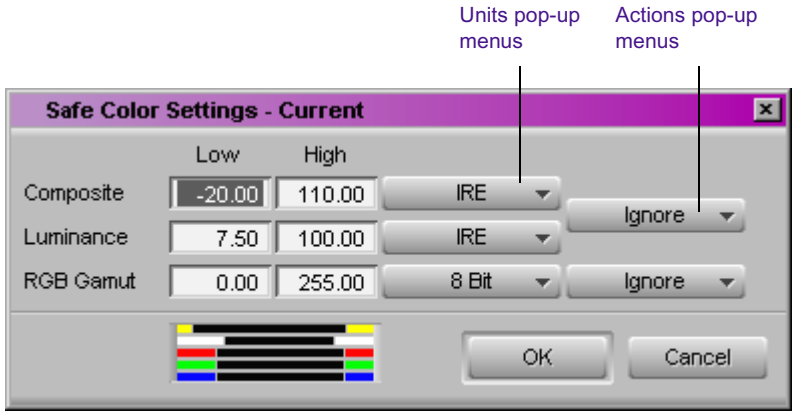
You set safe color limits and control how those limits are applied by selecting options in the Safe Color Settings dialog box.

To select safe color options:

1. Open the Safe Color Settings dialog box by doing one of the following:
   - In the Settings scroll list of the Project window, double-click Safe Colors.
   -  In the Color Correction tool, click the Safe Color Settings button.

The Safe Color Settings button in the Color Correction tool provides a visual indication of the status of the Safe Colors feature. If Warn is selected in one or more of the Actions pop-up menus, the icon on the Safe Color Settings button appears orange to indicate that at least some of the Safe Colors options are active. Otherwise, the icon on the Safe Color Settings button appears black.

The Safe Color Settings dialog box appears.



2. For each limit type, set the limits at which you want the system to issue a warning by doing the following:
   a. Choose the unit of measurement you want to use from the Units pop-up menu.
   b. Type low and high safe color values that you want in the Low and High text boxes.
   c. Choose the action that you want the system to take from the Actions pop-up menu.

      Table 9 provides more information on the options available in the Safe Color Settings dialog box. The graphical view at the bottom of the Safe Color Settings dialog box shows the current limits in relation to the default limits in an easy-to-read format. For more information, see "Understanding the Graphical View of Safe Color Settings" on page 126.
3. Click OK.

Table 9 Safe Color Settings Options

Option	Description
Composite	Sets safe color values for the composite video signal.
Luminance	Sets safe color values based on brightness.
RGB Gamut	Sets safe color values based on color range.

Table 9 Safe Color Settings Options (Continued)

Option	Description
Units pop-up menus	Define the units of measurement for the three types of safe color values. The Composite Units pop-up menu allows you to choose between **IRE** and **mVolts** (millivolts). The Luminance and RGB Gamut pop-up menus allow you to choose from the following options: **8 Bit** — Measures the adjustment on a scale from 0 to 255. *The RGB value for a color in the Color Correction tool will not be identical to the RGB value for the same color in a graphics application such as Adobe® Photoshop®. For example, the 8-bit RGB values for reference black and reference white are 16 and 235 respectively.* **Percent —** Measures the adjustment on a percentage scale from 0 to 100. **IRE —** Measures the adjustment in IRE units. **mVolts —** Measures the adjustment in millivolts.
Actions pop-up menus	Define how the system implements the safe color settings. The top menu controls both the Composite and the Luminance limit types; the bottom menu controls the RGB Gamut limit type. Each Actions menu allows you to choose from the following options: **Ignore** — The system does not limit based on these settings. This is the default setting. **Warn** — The system provides warnings when these limits are exceeded. For more information on safe color warnings, see "Understanding Safe Color Warnings" on page 128.

Understanding the Graphical View of Safe Color Settings

The Safe Color Settings dialog box includes a graphical indication of the current limit values in relation to the default values. This allows you to quickly check that your limits are consistent with one another and within an acceptable range without having to read all the numerical limit values and remember the default values.

The following illustration shows the location of this graph within the Safe Color Settings dialog box. All settings in this illustration are at their default values.

The graph shows colored bars that represent the current low and high levels for each limit type. The colors are the same as those used to display safe color warnings in the monitors. It also displays gray vertical lines that represent the default high and low levels for each limit type.

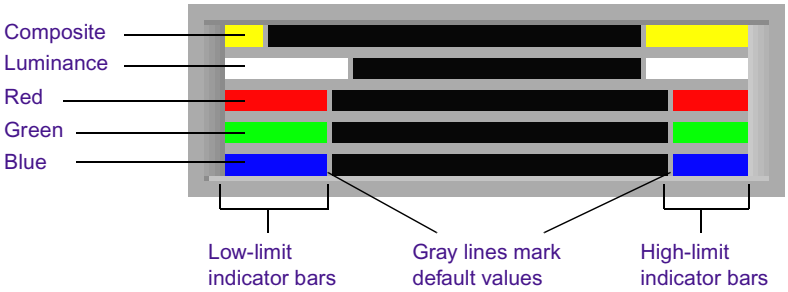
The following illustrations present two graphs in detail — the first showing default levels and the second showing adjusted levels — and explain how to interpret the graphs.

Default Safe Color Settings

On the default Safe Color Settings graph, all the color bars are aligned with the gray vertical lines that represent the default numerical values.

	Low	High
Composite	-20.00	100.00
Luminance	7.50	100.00
RGB Gamut	0.00	255.00

Default settings values



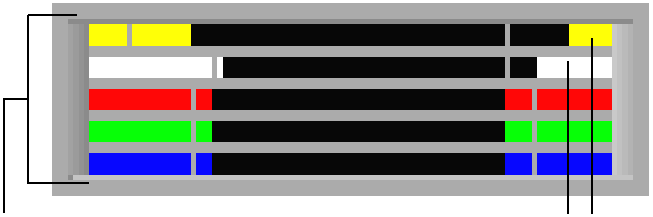
Default settings graph

Adjusted Safe Color Settings

On the adjusted Safe Color Settings graph, colored bars that extend beyond the gray lines toward the middle of the graph indicate more restrictive settings than the defaults. Bars that retreat from the gray lines toward the outside of the graph indicate more permissive settings than the defaults.

	Low	High
Composite	0.00	120.00
Luminance	10.00	110.00
RGB Gamut	16.00	235.00

Adjusted settings values



Adjusted settings graph

All low limit settings (and RGB high settings) are now more restrictive than the defaults represented by the gray lines.

High composite and luminance settings are now more permissive than the defaults represented by the gray lines.

Understanding Safe Color Warnings

If the Warn option is selected in the Actions pop-up menu for one or more of the types of safe limit, the system displays warnings in the monitors when material exceeds the limits you have set. Warnings appear in the Color Match control for RGB Gamut limits only.

Warning indicators do not appear unless color levels exceed at least one of the limits currently set to Warn.

When your system displays safe color warnings, you have the following options:

- Leave your color correction adjustments at the current settings.

  In this case, your program will continue to exceed some or all of the safe color levels you have set.

- Make manual color correction adjustments to bring levels within limits. For more information, see "Making Adjustments to Achieve Safe Color Values" on page 131.

  When all levels are within limits, the warning indicators no longer appear.

Safe Color Warnings in the Monitors

In Color Correction mode, the Safe Color Warning icon (an orange triangle) appears in the top corner of a monitor in the Composer window if the frame currently displayed in that monitor exceeds the safe limits you have set.

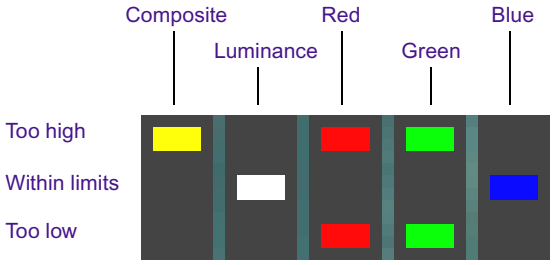
Safe color warnings appear when you exceed limits in either field of the frame if you are working with two-field media. To move through video material one field at a time and see histograms for every field, use the Step Forward One Field button or the Step Backward One Field button. In Color Correction mode, these buttons are available on the Move tab of the Command palette. You can also map these buttons to your keyboard to use them quickly while using Color Correction mode.

Alongside the Safe Color Warning icon, color-coded warning indicators provide a visual indication of the limits that are being exceeded. There are three rows for these indicators. An indicator appears in the top row if the limit is being exceeded at the high end and in the bottom row if the limit is being exceeded at the low end. If a limit type is within safe limits, an indicator appears in the center row. Table 10 lists the limit types and their associated colors as they appear left to right in each row.

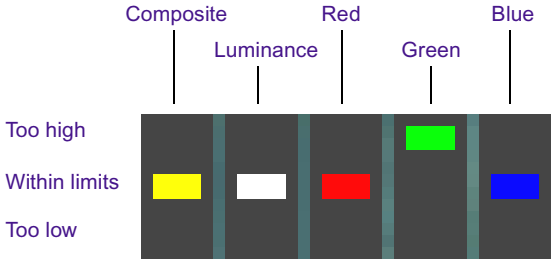
Table 10 Safe Color Warning Indicators

Limit Type	Color Code
Composite	Yellow
Luminance	White
RGB Gamut: Red	Red
RGB Gamut: Green	Green
RGB Gamut: Blue	Blue

The following illustrations show the layout of the Safe Color Warning display in the monitors, with examples of two typical presentations of Safe Color information.



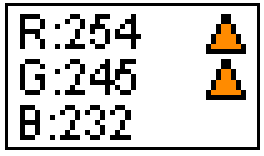
In this example, the Red and Green levels exceed limits at both the high and low end, the Composite levels exceed limits at the high end, and the Luminance and Blue levels are within limits.



In this example, the Green level exceeds limits at the high end while all other levels are within limits.

Safe Color Warnings in the Color Match Control

If the Warn option is selected in the Actions pop-up menu for the RGB Gamut limit type, the system displays warnings in the color swatches of the Color Match control when values exceed the limits you have set. If you use the eyedropper to select an input or output color that exceeds limits, a warning triangle appears beside the color information in the appropriate color swatch. The following illustration shows a swatch with typical Safe Color warnings.



In this example of a swatch for an intense white, both the Red and Green levels exceed the High RGB Gamut setting of 235 and warning triangles appear. The Blue value remains just within the limit.

Making Adjustments to Achieve Safe Color Values

If some of your color levels exceed limits, you can return them to safe color values by adjusting the color correction controls in any combination. The following procedures show how to make various adjustments using the Controls subgroup and the Curves tab.

To bring luminance within safe limits:

1. Click the Controls tab in the HSL group.

   The Controls tab appears.

2. Click the Enable button for the HSL group and the Controls tab.
3. Click the Enable button for Clip Low and Clip High controls to activate them.
4. Type 16 in the Clip Low text box, and press Enter (Windows) or Return (Macintosh).
5. Type 235 in the Clip High text box, and press Enter (Windows) or Return (Macintosh).

   Luminance values are clipped to safe levels.

To bring RGB values within safe limits:

1. In the Master ChromaCurve graph of the Curves tab, click the lower left control point to select it.

   A circle appears around the point.

2. Under the Master ChromaCurve graph, type 16 in both the input text box and the output text box.

   The control point moves to 16, 16. The system adjusts RGB values under 16 up to 16.

3. In the Master ChromaCurve graph of the Curves tab, click the upper right control point to select it.

   A circle appears around the point.

4. Under the Master ChromaCurve graph, type 235 in both the input text box and the output text box.

   The control point moves to 235, 235. The system adjusts RGB values above 235 down to 235.

To bring composite levels within safe limits:

1. First adjust luminance and RGB levels using the procedures above.

   If composite levels do not fall within safe limits, continue with step 2.

2. Click the Curves tab.
3. If the composite high warning is on, do the following:
   - In the Master ChromaCurve graph, Shift+click the upper right control point, and drag it down the curve until the composite high warning turns off.
4. If the composite low warning is on, do the following:
   - In the Master ChromaCurve graph, Shift+click the lower left control point, and drag it up the curve until the composite low warning turns off.

Safe Color Limits with Waveform Monitor and Vectorscope Information

To stay well within the limits of television transmitters, cable systems, satellite links, DVD encoders, and so on, broadcasters or distributors often issue safe color limits for video levels. Video levels outside safe color limits are generally known as “illegal.” Of course, no law is broken if you exceed the specified limits, but the program might be rejected on technical grounds or the image quality might suffer with further processing. If you know that your delivery master is a VHS tape that does not handle high chroma well, set some reasonable limits by yourself.

In Y (luma only) waveforms, reference white of 100% corresponds to a digital level of 235, an NTSC level of 100 IRE, and a PAL level of 700 mV. White excursions up to 108% are technically possible.

In Y (luma only) waveforms, reference black of 0% corresponds to a digital level of 16, an NTSC level of 7.5 IRE, and a PAL level of 0 mV. Black excursions down to –8% are technically possible.

With both white and black levels, further signal processing (down the line from your Avid system) might clip the peaks in your material. In addition, you might be required by delivery specifications to limit the white peaks to a lower level and the black peaks to a higher level.

Use Y Waveform to see the black and white levels of your image. Sometimes, particularly with white levels, keeping the white peaks within the 100% limit will not produce a pleasing level for the rest of the image. This is particularly common with backlit subjects, where the sky or a window is in the background and the lighting on the foreground is insufficient. In these cases, you might want to adjust for the foreground and leave the background too bright.

Chroma peaks are easiest to see on the vectorscope. The theoretical maximum is the circle around the outer edge, but to be safe you might like to keep vectors closer to the center than the 75% color bar squares.

Saturated bright or dark colors might have very low or high luma values, together with a lot of chroma. Even if neither luma nor chroma alone is excessive, the combination can be illegal. For example, vivid yellow and cyan in an image can produce composite levels that are too high, and those from vivid blue might be unacceptably low. The YC Waveform is a good way to see how far these levels extend. In general, avoid levels above approximately 120 IRE or 850 mV, and those below –20 IRE or –200 mV.

If you are producing a master for broadcast delivery, ask for delivery specifications. To ensure that you meet particular standards, use a legalizer such as the Safe Color Limiting feature of Avid Symphony™ or a third-party AVX™ plug-in.

These instruments do not measure analog outputs. If your Avid system or other device uses analog connections, use an external waveform monitor to verify levels.

The Y Waveform, YC Waveform, and RGB Parade displays incorporate any safe color limits you have set. Table 11 describes the colors used to represent various conditions. “Legal” means the value is within the safe color limits. “Illegal” means the value is outside (either above or below) the safe color limits.

Table 11 Safe Color Limits in Waveform Displays

Display	Component	Value	Display Color
Y Waveform	Luma	Legal	Green
		Illegal	White
YC Waveform	Composite	Legal	Cyan
		Illegal	Yellow
	Luma	Legal	Green
		Illegal	White
	Composite or Luma	Outside display boundaries	Red
RGB Parade	Red	Legal	Red
		Illegal	White
	Green	Legal	Green
		Illegal	White
	Blue	Legal	Blue
		Illegal	White

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