Avid® Symphony™

Conform and Finishing Guide

Avid®

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Contents

Using This Guide

This guide contains the task-oriented instructions, conceptual information, and reference material you need to use the conform and finishing features of your Avid Symphony™ system. These features include project transfer, HD support, tracking and stabilization parameters, and Symphony color correction.

This guide is intended for all users who need information for the conform and finishing processes..

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

The documentation describes the features and hardware of all models and applies to both the Windows and Mac OS X operating systems. Your system might not contain certain features and hardware that are covered in the documentation, and might not be available on both Windows and Mac OS X.

Symbols and Conventions

Avid documentation uses the following symbols and conventions:

Symbol or Convention	Meaning or Action
	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.
	A warning describes an action that could cause you physical harm. Follow the guidelines in this document or on the unit itself when handling electrical equipment.

Symbol or Convention	Meaning or Action
>	This symbol indicates menu commands (and subcommands) in the order you select them. For example, File > Import means to open the File menu and then select the Import command.
▶	This symbol indicates a single-step procedure. Multiple arrows in a list indicate that you perform one of the actions listed.
(Windows), (Windows only), (Macintosh), or (Macintosh only)	This text indicates that the information applies only to the specified operating system, either Windows or Macintosh OS X.
Bold font	Bold font is primarily used in task instructions to identify user interface items and keyboard sequences.
Italic font	Italic font is used to emphasize certain words and to indicate variables.
`Courier Bold font`	Courier Bold font identifies text that you type.
Ctrl+key or mouse action	Press and hold the first key while you press the last key or perform the mouse action. For example, Command+Option+C or Ctrl+drag.

If You Need Help

If you are having trouble using your Avid product:

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 latest information that might have become available after the documentation was published:
   - If the latest information for your Avid product is provided as printed release notes, they ship with your application and are also available online.

     If the latest information for your Avid product is provided as a ReadMe file, it is supplied on your Avid installation CD or DVD as a PDF document (README_*product*.pdf) and is also available online.

   You should always check online for the most up-to-date release notes or ReadMe because the online version is updated whenever new information becomes available. To view these online versions, select ReadMe from the Help menu, or visit the Knowledge Base at www.avid.com/readme.

3. Check the documentation that came with your Avid application or your hardware for maintenance or hardware-related issues.
4. Visit the online Knowledge Base at www.avid.com/onlinesupport. Online services are available 24 hours per day, 7 days per week. Search this online Knowledge Base to find answers, to view error messages, to access troubleshooting tips, to download updates, and to read or join online message-board discussions.

Accessing the Online Library

The Online Library for your Avid editing application contains all the product documentation in PDF format, including a Master Glossary of all specialized terminology used in the documentation for Avid products.

The Online Library for your Avid editing application is installed along with the application itself.

You will need Adobe® Reader® to view the PDF documentation online. You can download the latest version from the Adobe web site.

To access the Online Library, do one of the following:

- From your Avid editing application, select Help > Online Library
- (Windows only) From the Windows desktop, select Start > All Programs > Avid > *Avid editing application* > Online Library
- Browse to the Online Library folder, and then double-click the MainMenu file.

  The Online Library folder is in the same location as the application itself, for example:

  (Windows) C:\Program Files\Avid*Avid editing application*\Online Library

  (Macintosh) MacintoshHD/Applications/*Avid editing application*/Online Library

Accessing the Goodies Folder

Avid supplies a Goodies folder located on the editing application DVD. Access the Goodies folder by browsing the DVD. This folder contains programs and files you might find useful when trying to perform functions beyond the scope of your Avid editing application.

The information in the Goodies folder is provided solely for your reference and as suggestions for you to decide if any of these products fit into your process. Avid is not responsible for the manufacture, support, or sales of these products. Avid is also not responsible for any loss of data or time, or any other adverse results related to the use of these products. All risks of using such products or accessing such Web sites are entirely your own. The Web sites listed in the Goodies folder are not under the control of Avid, and Avid is not responsible for their content, any changes or updates to them, or the collection of any personal data or information by the operators of such Web sites. All information and product availability is subject to change without notice.

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Section I
Conforming and Mastering

The following chapters contain information to help you conform and master your project:

1 Conforming and Transferring Projects

Avid offers a range of editing applications for editing film, video, and audio. Within the Avid family of editing and finishing products, you can work at the system most appropriate for your task. When you are ready for the next step in the process, you can easily move your work to another system. For example, you might start your project on a Media Composer® offline system and then move it to a Symphony or Avid DS online system when you are ready for finishing. You can also send audio media to a Digidesign® Pro Tools® system and edit the finished audio into the final sequence.

The following sections contain information about conforming and transferring projects.

- Compatibility Between Applications
- Preparations for Conforming
- Conforming Workflow
- Conforming Sequences with Color Correction
- Transferring Project and Media Files

Compatibility Between Applications

Avid editing products are designed so you can easily move projects and media from one system to another and preserve your edits and effects. In a typical offline-to-online workflow, you create a program on one Avid editing system—choosing the footage, making edits, adding effects—and then transfer your program to another Avid system for final finishing. This re-creation of the offline project on an online system is called *conforming,* and Avid's solution is called *Total Conform*. Finishing might involve recapturing in a final resolution, making color corrections, adjusting effects, and outputting the final master.

Alternatively, you can use the same media for offline and online editing. You can access the media in several ways, such as sharing media in an Avid Unity™ environment, or transferring removable drives from one system to another. The clips and sequences automatically link to the media, and you can complete the final finishing.

Specific information for transferring projects to Avid DS is contained in the Avid DS Conform Guide*, which is available from the Avid DS Support Center or the Avid Customer Support Knowledge Base. To access the Knowledge Base, go to www.avid.com/onlinesupport.*

If you are moving from one Avid editing product to another in the current release, or from a product in a previous release to a product in the current release, you can move project files and media without losing any of your work.

However, when you move projects from a product in the current release to a product in the previous release, some effects that have been created with features that are new for a particular release do not appear, or appear as unknown effects.

Preparations for Conforming

The following topics provide information that you should review before you begin the transferring and conforming process described in "Conforming Workflow" on page 30.

If possible, work with the offline editor to plan the online edit. Planning the online edit makes the online session easier and more efficient.

Delivery Requirements for Final Masters

The requirements for your final masters determine factors such as the project type used during the offline edit. Ideally, the offline edit is done with the online edit in mind.

The most important delivery requirements are the formats and frame rates. A broadcast network might require a range of formats: NTSC, PAL, and HD, at 4:3 and 16:9. Avid's Universal Mastering provides you with the ability to output multiple versions from the same source file—see "Step 10: Create the Final Masters" on page 40. Make sure that the offline edit is done at the same frame rate, or a compatible frame rate, as the online edit.

If you are delivering an HD project, and the offline will be done in SD, consider how the SD media will be downconverted. If the project requires complex effects, use an anamorphic downconvert, rather than center-cut or letterbox, to reduce the adjustments required in the final conform.

Offline Formats for HD

If your project requires final mastering in HD, use the corresponding SD project for offline editing, as listed in the following table.

When you start the online session, you can create a new project in the final format, or use the original project and change the project format. See "Understanding Options for Changing the Project Format" on page 64.

HD Online	SD Offline
720p/23.976	23.976p NTSC
720p/25	25p PAL
720p/29.97	30i NTSC
720p/50	25p PAL
720p/59.94	30i NTSC
1080p/23.976	23.976p NTSC or 24p NTSC
24p NTSC sequences require additional conversion. See "Converting a 24p NTSC Sequence to 1080p/23.976" on page 69.	
1080p/24	24p NTSC or 24p PAL
1080p/25	25p PAL
1080p/29.97	30i NTSC
1080i/50	25i PAL
1080i/59.94	30i NTSC

File Transfer for the Online Session

Before you begin moving project files between Avid editing applications, consider the following.

- **What files will you transfer?** Determine if you need to transfer project information, video media, audio media, or all three. See "Step 1: Transfer Files" on page 30.
- **How will you transfer the files?** Determine the most appropriate method for transferring your project files. See "Devices and Methods for Transferring Files" on page 48.

System Compatibility for the Online Session

Make sure that files transfer correctly between editing systems, and that both systems include the necessary applications. Consider the following:

Frame Rates

Make sure both editing systems support the same frame rates. For example, some offline systems support 24p projects and some do not. You might require a 24p project to deliver multiple output formats.

File Naming

To make it easier to move files between products and across platforms, use the following guidelines when naming files:

- Do not use the following characters in project, bin, or other file names:

  / \ : * ? ” < > |

  The Windows system does not recognize these characters in file names and substitutes other characters, possibly making the file name unrecognizable.

You can use these characters in bin names if you are sharing bins between Symphony, Media Composer, Avid Xpress, or NewsCutter® products. You cannot use these characters in bins you share with Avid DS or Pro Tools.

- Do not add spaces at the beginning or end of a file name. The Windows system displays such files but might be unable to open them.
- Do not use a period at the end of a file name. The Windows system displays such files but might be unable to open them.
- On Macintosh® systems, beginning with v7.2, you can enable a setting in your Avid editing application that prevents you from using restricted characters in file names. This setting automatically adds the correct file name extensions to files for your project. The Use Windows Compatible File Names setting in the General Settings dialog box is selected by default. With this setting selected, the file name extension .avp is added to project files and .avb is added to bin files when they are saved. These file name extensions are also attached to existing files.

Title Fonts

If the project includes titles and you are moving between Macintosh and Windows systems, make sure you have the same font with exactly the same name (preferably from the same supplier) on both the Macintosh and Windows systems. Check the font carefully because the same font can have slightly different names. For example, Times New Roman on the Macintosh system is named Times New Roman Regular on the Windows system.

If you open a title on the online system that does not have a matching font, a dialog box opens that allows you to substitute the font in the title with a font that exists on your system.

For best results, use OpenType® fonts, which reduce problems when transferring projects from one platform to another.

AVX Plug-Ins

If your project contains AVX™ plug-in effects and you are moving across platforms, make sure the same plug-ins are available on both the Macintosh and Windows systems. If the same AVX plug-in effect is not available, you can mix down or render the effect to a high-quality resolution and then transfer it using an OMFI or an AAF file. However, you cannot change the parameters of the effect.

Preparing Graphics for the Online Session

The most critical step when preparing graphics for online is to make sure that the elements you are going to import are created correctly. The following table summarizes various requirements.

Aspect	Requirement	Notes
Frame size (4:3)	Square pixels: 648 x 486 (NTSC) 640 x480 (NTSC DV) 768 x 576 (PAL)	These are the preferred sizes for NTSC and PAL. 720 x 540 can also be used, in some situations, for both NTSC and PAL. These are stored by the application as non-square pixels. For more information, see “Preparing Graphics Files for Import” in the Help.
Frame size (16:9)	Square pixels: 864 x 486 (NTSC anamorphic) 1024 x 576 (PAL anamorphic) 1280 x 720 (HD) 1920 x 1080 (HD)	Preferred sizes. SD media is stored by the application as non-square pixels.

Aspect	Requirement	Notes
Alpha channel	White foreground (transparent), black background (opaque)	This is the standard used by graphics, animation, and compositing packages. The graphics need to have the alpha channel inverted on import.
Color mode	RGB ITU-R 601 ITU-R 709	Other formats, including CMYK, can cause import errors. ITU-R 601 is used for SD and ITU-R 709 is used for HD. In HD projects, your Avid editing application automatically converts the media.
File format	Various	Your Avid editing application accepts many file formats for input. TIFF (.tif) and PICT (.pct) are commonly used formats. See “Import Specifications for Supported Graphics File Formats” in the Help.
File field order	Odd (Upper field first) Even (Lower field first)	For interlaced media, your Avid editing application uses the following order: • NTSC (601 and DV): lower field first • PAL 601: upper field first • PAL DV: lower field first • HD Interlaced: upper field first If the field order of the graphic is not correct, select the field order of the graphic during import and the application reverses the fields appropriately. Field order does not apply to progressive media. See “Field Ordering in Graphic Imports and Exports” in the Help.

Preparing Effects for the Online Session

In general, effects from older systems are automatically conformed by newer systems. However, be aware of the following issues:

- If you’re working in an offline SD project with complex effects and you plan to conform as HD, the media should be downconverted anamorphically. Media downconverted as 4:3 or letterbox causes problems when you conform effects such as picture-in-picture.
- If you are conforming a sequence that includes effects created with Avid FX, mix down or render the effects to a high-quality resolution on the offline system and then transfer them using an OMFI or an AAF file. You cannot adjust an Avid FX effect on a Symphony system.
- Wipes that include borders that were created in Media Composer Adrenaline v2.2.x or earlier, or Avid Xpress Pro v5.2.x or earlier do not conform precisely. In these versions, borders for the wipes end on screen; in Symphony borders end off screen.

Preparing Titles for the Online Session

You have the option to save titles in multiple aspect ratios. If you're working with anamorphically downconverted media, save the title as 16:9. After opening the sequence in an HD project, re-create title media, see "Step 7: Re-create Title Media" on page 35. This method lets you correctly create titles that fit in the 4:3 center cut or that extend beyond the center cut.

If you're working with media downconverted to center cut or letterbox, save the title as 4:3. In this case the titles will appear centered, within the 4:3 center cut.

If you are working in 23.976p, 24p, or 25p projects, you can output your project in both NTSC and PAL video formats, and in both 4:3 and 16:9 aspect ratios. You need to save a title at each aspect ratio you need for your output requirements, but video format conversion is handled automatically by your system's hardware. For more information, see "Saving Multiple Format Titles" in the Help.

Preparing Audio for the Online Session

Your project might involve audio that is exported from the offline system, sweetened in an audio application such as Pro Tools, and imported into the online system, see "Step 5: Import and Lay in the Final Audio Mix" on page 34.

If you are sharing files with Pro Tools, you can use the WAVE or AIFF-C format. Pro Tools v6.9 or later also supports MXF files For more information, see "Transferring Audio Files" on page 44.

DigiTranslator™ v2.0 is required on the Pro Tools system for import and export of OMF and AAF files.

You can also transfer files to Pro Tools through Interplay. For more information, see "Using Pro Tools and Interplay" in *Avid Interplay Best Practices*.

If you are sharing files between Macintosh and Windows systems, avoid using Sound Designer II™, which is a Macintosh format. For more information, see "Transferring Sound Designer II Audio Files from Macintosh Systems" on page 45.

Conforming Workflow

The following topics provide information to help you transfer projects from one Avid editing system to another and conform the sequence to create one or more finished masters. These steps are based on an offline-to-online workflow that uses Symphony as the online system. For projects that you plan on finishing on an Avid DS online system, refer to the product documentation that comes with Avid DS.

Before you start the process described in the following topics, you should review the information provided in "Preparations for Conforming" on page 24 to ensure that your offline materials are ready for transferring and conforming.

- Step 1: Transfer Files
- Step 2: Open the Project
- Step 3: Measure the Video Signal
- Step 4: Recapture Media
- Step 5: Import and Lay in the Final Audio Mix
- Step 6: Batch Import Graphics
- Step 7: Re-create Title Media
- Considerations when Re-creating Title Media
- Redefining a Font Replacement
- Step 8: Refine Effects and Perform Color Correction
- Step 9: Render Effects as Needed
- Step 10: Create the Final Masters

For specific information about HD workflows, see "Working with HD Media" on page 55. For specific information about film-based workflows, see "Working in a Film Project" in the Help.

If you are transferring projects and media but not performing an online edit, refer to "Transferring Project and Media Files" on page 43.

Step 1: Transfer Files

There are several different methods for transferring project files and media files, depending on the requirements of your project.

Transferring Project Information Only

Project information includes the information about the components of your project (such as settings, bins, master clips, edited sequences, and so on), but does not include the media for these components. This project information is sometimes called *metadata*. Transfer only project information if you are planning to recapture media (for example, from an offline resolution to an online resolution) or relink media in an Avid Unity environment.

Options for transferring project information include:

- Transferring a project folder from one desktop to another. This option allows you to transfer complete project information, but you need to use the desktop operating system to copy and transfer files. See "Transferring Project Files and Media Files Using Nonshared Storage" on page 46.
- Creating an OMFI or an AAF file (composition only). This option allows you to export from the Avid editing application, but is limited to a single sequence or master clip. See "Exporting OMFI and AAF Files" in the Help.
- Sharing project information in an Avid Unity environment. See "Transferring a Project Using Shared Storage" on page 46.
- Creating an AFE file. This option allows you to transfer complete project information, but is currently limited to transfers to an Avid DS system. See "Exporting Projects and Bins Using AFE Files" in the Help.

Transferring Project Files and Media Files

Transfer project files and media files if you want to transfer media files to another Avid editing system, for example, if the offline sequence uses a broadcast-quality resolution and you want to add Symphony color correction. Options include:

- Transferring a project folder along with a removable media drive. This option allows you to transfer complete project information, but you need to use the desktop operating system to copy and transfer files. See "Transferring Project Files and Media Files Using Nonshared Storage" on page 46.
- Creating an OMFI or an AAF file that references a removable media drive. This option allows you to work within the Avid editing application, but is limited to a single sequence or master clip. You can link to media files that you have copied or consolidated to a single drive. See "Exporting OMFI and AAF Files" in the Help.
- Creating an OMFI or an AAF file with embedded media. This option allows you to create a single OMF or AAF file, which you can consolidate onto a single drive.

If you want to transfer audio media to a digital audio workstation, such as a Pro Tools, system, see "Transferring Audio Files" on page 44 or "Using Pro Tools and Interplay" in *Avid Interplay Best Practices*.

Step 2: Open the Project

Depending on the project requirements and your personal preference, you can open a project in the following ways:

- Start a new project.
  - Use the Select Project dialog box to create a new project with the format you want to use for final mastering. Starting a new project lets you configure the project settings and eliminate any errors or problems caused by the offline project's settings.

    You can then use the File > Open Bin command to open the bins that you've transferred from the original project and load the final sequence. If you are finishing an HD project, and the offline project was done in SD, use the Modify command to change the sequence format, see "Understanding Options for Modifying the Sequence Format" on page 66.
  - If you transferred an OMFI or an AAF file with embedded media, create a new project and bin and import the OMFI or the AAF file. The sequence automatically links to the media.

If the clips and sequences do not link automatically, select File > Refresh Media Directories.

- Open a transferred or shared project.
  - If you transferred project files, the original project appears in your list of projects. (Depending on the location into which you copied the files, you might need to use the Browse button in the Select Project dialog box to locate the project.) Open the project, and all project settings and bins are displayed.
  - If you transferred both project files and media, and your media is compatible, the original project appears in your list of projects. Open the project and all project settings and bins are displayed. Clips and sequences automatically link to the media.
  - If you are finishing an HD project, and the offline project was done in SD, change the project format, see "Understanding Options for Changing the Project Format" on page 64 and then change the sequence format. See "Understanding Options for Modifying the Sequence Format" on page 66.
  - For information about working with shared projects and media in an Avid Unity environment, see "Transferring a Project Using Shared Storage" on page 46.

Step 3: Measure the Video Signal

When working with analog material, measure the actual video signal during both input and output to make sure the signal does not exceed the broadcast specification.

For SDI or HD-SDI formats, you cannot adjust input or output levels by using the video controls in your Avid editing application. For HD media, you can calibrate only HD component output, which is usually used for monitors.

For more information, see the following topics in the Help:

- Preparing for Video Input
- Calibrating for Video Output
- Advanced Video Output Calibration

Symphony requires that the deck and the Avid Nitris hardware be genlocked to the same timing source when capturing or outputting. For more information, see "Selecting the Sync Source for Capture" and "Selecting the Sync Source for Output" in the Help.

Step 4: Recapture Media

If you did not transfer media, or you need to recapture your media at a higher resolution, use one of the following options:

- **Recapture master clips:** Offers complete flexibility to make revisions, but takes the most time and disk space.
- **Recapture a sequence:** Provides a one-step process, but limits your options during capturing. You can make revisions using only assigned handle lengths.
- **Decompose the sequence and recapture the new clips:** Captures only enough media to re-create the sequence. You can specify the length of handles, which you can use for minor revisions. This method is more flexible than capturing from the sequence because new clips are created, which you can sort and selectively capture. This method uses minimal storage and can be one of the fastest methods for recapturing.

  In most cases, do not decompose clips created from imported graphics, which is an option in the Decompose dialog box. These decomposed clips might cause problems when batch importing, particularly if the sequence uses only part of an imported animation.

- **Use the Show Reference Clips option:** Lets you reveal the source clips of a sequence in a single bin by selecting the “Show reference clips” option in the Bin Display dialog box, and then recapturing the source clips. This method can be faster than recapturing a sequence or decomposing if the lengths of the new audio and video clips created differ from the original master clips. Because two passes are necessary to capture audio and video from a single source if the lengths are not the same, it is sometimes faster to capture a slightly longer master clip than to capture the new clips once for audio and once for video. This method also gives you more opportunity for revisions. However, this method uses more disk space and capturing can take longer. It can be a good compromise between capturing all the original clips and capturing only the clips needed to re-create the source.

For instructions on recapturing, see “Recapturing Your Material” in the Help.

When you recapture from SD source tapes, Avid recommends that you readjust the video levels. You can transfer video input settings from another system, but the existing settings have been calibrated to a different set of hardware and might not operate properly.

If you are capturing serial digital video (SDI), your Avid editing application ignores the video input settings.

Step 5: Import and Lay in the Final Audio Mix

In most cases, the final audio mix was done as part of the offline edit or was done by an audio editor on a digital audio workstation, possibly using Digidesign Pro Tools. In either case, import the OMFI or the AAF file. For more information, see “Transferring Audio Files” on page 44, “Importing Files” in the Help, and “Using Pro Tools and Interplay” in *Avid Interplay Best Practices*.

After importing the audio mix, calibrate the audio hardware and channels as described in the following topics in the Help:

- “Changing the Audio Hardware Calibration Setting”
- “Calibrating Audio Input Channels”
- “Calibrating Audio Output Channels”

Then use the Audio tool to monitor the audio levels. See “Understanding the Audio Tool” in the Help.

You can quickly check the peak values of the sequence. See “Using the Console Window to Check Audio Levels” in the Help.

Step 6: Batch Import Graphics

If you are working with master clips or sequences that contain imported material, you can use the Batch Import command to reimport the source files. For example, you might want to:

- Upgrade the video resolution of the imported files to an online resolution.
- Replace low-quality material with high-quality material finished with other applications.
- Create new media files when the media files are lost or accidentally deleted.

Reimporting requires your original source files. Do not delete the media files for imported files unless you have access to the source files.

Here are two tips for making batch importing easier:

- Placing a “graphics” folder inside the project folder of your offline project makes the batch import process easier because the path will be the same, or at least faster to find.
- It is easy to edit revised graphics into your project by giving them the same names as the original graphics, copying the revised graphics to the folder that contains the original graphics, and batch importing the revised graphics. You can also edit new graphics into your project by deleting the media for your original graphics, batch importing your sequence, and pointing the old clips to the revised graphics files.

For instructions on batch importing, see “Reimporting Files” in the Help.

Step 7: Re-create Title Media

After you transfer or import all files, you might need to re-create title media if you did not render the titles, or if you want to change the resolution of the titles.

For more information related to the re-creation of title media, see “Considerations when Re-creating Title Media” on page 36.

To re-create the title media:

1. Select all video tracks that contain titles.
2. Mark an IN point and an OUT point to create a segment that includes all your titles.

3. Select Clip > Re-create Title Media.
   - If you have the same font on both systems, the equivalent font appears automatically.

     Because the mapping process changes the exact appearance of the font, check your titles carefully. It might be easier to check your titles from the bin than from the sequence.
   - If a title opens and the system does not recognize the font, you see a dialog box that allows you to substitute the font in the title for one that is installed on the system.

     This replacement creates a font mapping, which is saved as a Site setting. For information on changing the font mapping, see "Redefining a Font Replacement" on page 37.

     If more than one font in the title needs replacement, the dialog box remains open after you click OK, and a new message identifies the next font that needs replacement.
4. Select a drive and resolution for the re-created title media, and click OK.

   For more information, see "Re-creating Title Media" in the Help.

Considerations when Re-creating Title Media

You should be aware of the following when re-creating title media:

- For best results, use OpenType fonts, which reduce problems when transferring projects from one platform to another.
- If you are moving across platforms and the transferred title text uses a single style (the same font and type size), the title text aligns as closely as possible to its original position. The size of the text bounding box adjusts to accommodate the differences between the Macintosh and Windows versions of the font used. You might see a changed leading value in the Title Tool leading field to adjust for multiline text.

  Because the Macintosh and Windows systems handle fonts differently, you might see variations in the appearance of titles between the two systems. If necessary, adjust the size of the bounding box, leading values, or kerning information.

  For example, bounding boxes that were set on a Macintosh system might appear in a different size on a Windows system. Some clipping of the new text might occur and words can be lost. If this clipping occurs, you need to open the title, select the text box, and manually change the size of the text box or the size of the fonts to display all the text.

  For more information on differences between the Macintosh and Windows versions of a font, contact the font supplier.

- If the original system used any applications to manipulate font display (such as Adobe Type Manager®), the enhancements these applications provided on the original system (such as character anti-aliasing or character spacing) will not transfer to a system not using the application.
- Titles created in an offline project with anamorphically downconverted media should be saved as 16:9. See "Preparing Titles for the Online Session" on page 29.

Redefining a Font Replacement

You can redefine a font replacement at any time. However, your new font choice is applied only to a title currently in the Title tool and future replacements. It does not affect the font replacement information in titles you have worked with previously.

Font relationships are saved as a site settings file named AvidFontSub.avt. This file is located in the Settings folder, which is located in the Avid Symphony folder on your internal drive.

Once you have defined a font replacement, your Avid editing application uses that definition across all projects and all users of the system. If you want to switch to a different replacement font for a title, you must redefine the font replacement.

If you replace the font for a title and return that title to an Avid editing application on a Macintosh system, the new font information will be associated with the title. You must reapply the Macintosh font to restore the title to its original Macintosh style.

To redefine a font replacement:

1. Open a title in the Title tool.
2. Select Object > Font Replacement.

   The Font Replacement dialog box opens.
3. Click the Unknown Fonts menu on the left, and select the original font.
4. Click the Available Fonts menu on the right, and select the replacement font you want to use.

   When you select a font from the Available Fonts menu, a preview of that font appears in the text boxes.
5. Click OK.

   The system updates the font in the open title and records the new replacement information for future use.

Step 8: Refine Effects and Perform Color Correction

After reviewing the sequence, you might find you need to adjust effects, add effects, or perform color correction.

Color Correction: You can use Symphony Color Correction tools for a variety of tasks, including review and adjustment of the chroma and luma levels and color adjustments to selected areas (secondary color correction). For more information, start with "Symphony Color Correction: Basics" in the Help and then see the chapters in Section II of this guide.

For information about conforming sequences that contain color correction, see "Conforming Sequences with Color Correction" on page 40.

Motion Effects: You might need to choose a different rendering method for motion effects after recapturing media in a final online resolution. If a traditional motion effect is used, consider promoting it to a Timewarp effect. For more information, see "Playing and Rendering Motion Effects" in the Help.

Chroma and luma keys: Chroma and luma keys conform in Symphony as they were created in the offline system. However, you might find problems with the keys, especially when working in an uncompressed resolution. For maximum options in adjusting keys, promote 2D keys to 3D. The 3D Warp effect in Symphony includes parameters for the SpectraMatte effect. For more information, see "Creating Key Effects" in the Help.

The following topics in the Help provide information about other finishing tools:

- "Motion Tracking and Stabilization" in the Help.
- "Using the Reformat Effects" in the Help
- "Understanding the Intraframe Effects" in the Help
- "Getting Started with the Paint and AniMatte Effects" in the Help
- "Scratch Removal" in the Help

For complete information about effects, see the Avid Advanced Effects Guide, which is included in the Help and is also available as a PDF file in the Avid Online Library.

Conforming Sequences Created on Other Avid Editing Systems

A few effects created on other Avid editing systems might not match exactly when conformed on Symphony. You should check these effects carefully as part of the online conform process:

- Borders for wipes or PIPs: Border position might vary. For wipes created on Media Composer Adrenaline v2.2.x or earlier, or Avid Xpress Pro v5.2.x or earlier, borders end on screen; for wipes created on or conformed on Symphony, borders end off screen.
- ChromaKey, Luma Key: Due to changes in hardware processing, a key created on a Symphony Meridien™ system might not be properly keyed on a more recent Symphony system. Promote all Chroma Keys to SpectraMatte keys and remake the effects. Promote all Luma keys to 3D Warp Luma Keys and remake the effect using the Luma Range parameters.
- Color Effect: For Color effects created on Media Composer or Avid Xpress Pro, the Chroma Adjust parameter values might not match.
- 3D Effects Parameters: 3D effects on Meridien systems include additional shapes that are not included on Symphony. The supported shapes might behave differently than they do on Meridien systems. This is especially true for Page Folds when applied with a backing, to a title, or to an imported graphic. For more information, see “3D Effects Parameters” in the Help.

Step 9: Render Effects as Needed

On a Symphony system, most effects play in real time. However, you might need to render some complex effects or plug-in effects. For more information, see “Real-Time Playback of Video Effects” and “Basics of Effects Rendering” in the Help.

The ExpertRender feature includes a special setting called Prepare for Digital Cut. For more information, see “ExpertRender” in the Help.

Step 10: Create the Final Masters

Avid's Universal Mastering features offer you a range of output formats you can use for your final master. The output formats that are available depend on the format of your source footage.

- If your source footage is 23.976p, 24p or 25p, you can use the Digital Cut tool to output broadcast masters in NTSC and PAL formats, both from the same sequence. You can use the Reformat effect or the Pan and Scan effect to create 4:3, 14:9, and 16:9 versions of the sequence. In addition, the Digital Cut tool includes the option to automatically output titles as 4:3 or 16:9 to match your sequence. You can also output versions for special purposes, such as NTSC 24, for recording audio at the film rate.
- If your source footage is HD, you can use the Video Output Tool to crossconvert to a compatible HD format, and downconvert to an NSTC or PAL format. For more information, see "Preparing for Converting HD Formats" in the Help.
- All formats let you use the Export tool to output in popular file formats, including QuickTime and Windows Media. Avid codecs for QuickTime let you input and output files quickly, and you can install the codecs on graphics workstations for the most efficient input and output. For more information, see "Exporting Frames, Clips, or Sequences: Advanced" in the Help.
- You can use FilmScribe™ to create cut lists and change lists, and EDL Manager to create an EDL. For more information, see "Using FilmScribe" and "Using EDL Manager" in the Help.

Conforming Sequences with Color Correction

The following topics explain how sequences with color correction conform as they are moved between Symphony and certain other Avid editing applications, and how you can transfer color correction adjustment values from one type of color correction to another in cases where color corrections do not conform as you want.

Conforming Color Correction Sequences with Symphony Meridien Systems

In Symphony, if you open a Symphony Meridien sequence containing relationship color corrections, a message box appears informing you that you are attempting to open a sequence with an older type of color correction. You can choose to continue working with the existing sequence or to create a duplicate sequence with updated color corrections.

- If you continue to open the original sequence, the older relationship color corrections do not appear on the Timeline and cannot be played or adjusted.
- If you choose to create an updated duplicate sequence, Symphony converts the older relationship color corrections to color corrections that you can view, play, and further adjust in Symphony. The unaltered original sequence is also retained.

In Symphony, if you open a Symphony Meridien sequence containing Color Correction effects, those effects conform correctly in Symphony and are available for further adjustment.

Color corrections created in Symphony have limited backward compatibility with Symphony Meridien systems. In a Symphony Meridien system, if you open a Symphony sequence, you see the following behavior with color corrections:

- Color Correction effects appear and are available for further adjustment.

You must enter Color Correction mode and click one of the Segment Mode buttons to see the parameter settings in the Color Correction tool.

- Relationship color corrections appear as Color Correction effects, not as relationship color corrections, so the relationship aspect of the corrections is lost. However, you can usually recreate the relationships using color correction templates, as described in "Transferring Color Corrections with Color Correction Templates" on page 42.
- When segments contain both a Source and a Program relationship color correction, only one of those corrections (the one applied first in time) appears as a color correction effect.

You can also use a Console command to convert Symphony sequences with color correction relationships, and then transfer them to a Symphony Meridien system.

To convert a Symphony sequence with Color Correction relationships and transfer it to a Symphony Meridien system:

1. Load the sequence you want to transfer into the Timeline.
2. Select Tools > Console.
3. In the Console command line, type:

   ```
   backrevcc
   ```
4. Press Enter.
5. Transfer the sequence to the Symphony Meridien system.
6. On the Symphony Meridien system, render the effects.

You cannot convert sequences that contain Color Correction relationships applied to Freeze Frames and Motion Effect Strobe effects.

Conforming Color Correction Sequences with Media Composer or Avid Xpress Pro Systems

In Symphony, if you open a sequence created on a Media Composer or Avid Xpress Pro system, all existing Color Correction effects conform. You can view and play the Color Correction effects in the Timeline, and you can make further adjustments to the Color Correction effects in the Color Correction tool.

If you want to convert existing Color Correction effects to relationship color corrections, you can do so using color correction templates, as described in "Transferring Color Corrections with Color Correction Templates" on page 42.

In an Avid editing application that works with Media Composer or Avid Xpress Pro, if you open a Symphony sequence, you see the following behavior with color corrections:

- All color corrections (whether relationship or Color Correction effect) that use color correction controls available in Media Composer or Avid Xpress Pro conform as Color Correction effects.
- Color correction adjustments that are unique to Symphony, for example adjustments on the Channels, Levels, or Secondary tabs, do not conform in Media Composer or Avid Xpress Pro. A color correction that uses these adjustments appears in the Timeline (and if it also contains HSL or Curves adjustments they are available), but you cannot view or further adjust the adjustments that are unique to Symphony.
- When segments contain both a Source and a Program relationship color correction, only one of those corrections (the one applied first in time) appears as a color correction effect.

Transferring Color Corrections with Color Correction Templates

In many situations where a color correction does not conform between one Avid editing application and another in the way that you want, all of the color correction adjustment values that you need are still intact, so you can work around the problem by using color correction templates to transfer the color correction adjustment values to a new type of correction. The following procedure provides an example of one typical transfer.

To convert a Color Correction effect in a sequence originally created in an Avid Media Composer product to a relationship color correction:

1. In Color Correction mode, move the position indicator to the Color Correction effect whose adjustment values you want to transfer, and make sure that you are monitoring the track in the Timeline that contains the effect.
2. Drag the Color Correction template icon from the Color Correction tool to a bin.

   The application saves a color correction template in the bin. If you want, you can rename the template to clarify its origin.
3. Click the Remove Effect button to remove the original Color Correction effect from the segment.
4. (Option) If you intend to use a relationship color correction that will apply to multiple segments, taking the place of multiple individual Color Correction effects, you might need to move to each of the other segments and remove the existing Color Correction effects from each.
5. In the Correction Type menu, select the relationship color correction you want to use.
6. Do one of the following:
   - To apply all of the adjustment values stored in the template, drag the Color Correction template icon that you created in step 2 from the bin, and drop it on the monitor containing the current segment.
   - To apply only those adjustment values from the template that appear in one Color Correction tool tab, drag the Color Correction template icon that you created in step 2 from the bin, and drop it on the appropriate tab in the Color Correction tool.

     For example, drop the icon on the Curves tab to apply only Curve adjustments to the new relationship.

Transferring Project and Media Files

The following topics describe the options and methods you can use to transfer project files and media between Windows systems, between Macintosh systems, and between Windows and Macintosh systems:

- Transferring Audio Files
- Transferring Sound Designer II Audio Files from Macintosh Systems
- Working with Sound Designer II Audio Files on Macintosh Systems
- Transferring a Project Using Shared Storage

- Transferring Project Files and Media Files Using Nonshared Storage
- Devices and Methods for Transferring Files
- Nonshared Storage Issues for Cross-Platform Collaboration
- Transferring Media Files from Media Composer Version 7.2 or Avid Xpress Version 2.1

Transferring Audio Files

You might need to transfer audio separately from video. One workflow might involve sending audio from an offline system to a Pro Tools system for sweetening, and then sending the finished audio to a Symphony system for syncing with final video.

When you are moving your sequence to an audio-editing application, you need to export the sequence as an OMFI or an AAF file, see "Exporting OMFI and AAF Files" in the Help. If you are working with a Pro Tools system, you can streamline your workflow by using the Send To feature, see "Send To Digidesign Pro Tools" in the Help. The Send To Digidesign Pro Tools templates export an AAF file.

- If the audio-editing application to which you are moving your sequence supports the audio format used to create your sequence, you can export the sequence as an OMFI or an AAF composition without audio media and move the original media files to the audio-editing workstation.
- If the audio editing application to which you are moving your sequence does not support the audio format in your sequence, you must export the sequence as an OMFI or an AAF composition with audio media and convert the audio media to the appropriate format.

  OMFI files have a 2-GB file-size limit.

The following table lists Pro Tools support for embedded audio. Pro Tools does not support embedded video.

Pro Tools Version	Audio embedded in OMFI			Audio embedded in AAF		
	AIFF-C	WAVE	MXF	AIFF-C	WAVE	MXF
Pro Tools v7 or later	Yes	Yes	No	Yes	Yes	Yes
Pro Tools v6.9 or later	Yes	Yes	No	Yes	Yes	No
Pro Tools v6.7 or earlier	Yes	Yes	No	No	No	No

For information on importing into and exporting from the audio-editing application, see the documentation for the audio-editing application.

DigiTranslator v2.0 is required on the Pro Tools system for import and export of OMF and AAF files.

For information about working with Sound Designer II audio files, see “Transferring Sound Designer II Audio Files from Macintosh Systems” on page 45 and “Working with Sound Designer II Audio Files on Macintosh Systems” on page 45.

For information on working with ProTools in an Interplay environment, see “Using Pro Tools and Interplay” in *Avid Interplay Best Practices*.

Transferring Sound Designer II Audio Files from Macintosh Systems

Sound Designer II audio media is a Macintosh format and is not supported on Windows.

To transfer Sound Designer II media to a Windows system, export an OMFI or AAF composition that includes the media and convert the media to AIFF-C or WAVE. Use the Export command or the Send To command.

Working with Sound Designer II Audio Files on Macintosh Systems

Sound Designer II audio media has limited support on Media Composer Macintosh systems.

The following features are supported:

- You can play Sound Designer II audio that was created on another system and transferred.
- You can export audio as Sound Designer II media through the Audio option of the Export command.

The following features are not supported:

- You cannot select Sound Designer II as the file format for a project or output Sound Designer II media in a digital cut.
- You cannot export or convert Sound Designer II media through OMF or AAF.

You can use the Consolidate or Transcode feature to convert Sound Designer II media to another audio file format, or you can convert it as part of an OMF or AAF export.

Transferring a Project Using Shared Storage

If you are using your Avid editing system in an Avid Unity environment, you can use Avid Interplay to share media files, projects, and bins between systems. For more information, see your Avid Unity and Avid Interplay documentation.

You can also share bins and projects in an Avid Unity environment that does not use Avid Interplay. See "Sharing Bins and Projects in an Avid Unity Environment" in the Help and in the Avid Unity documentation.

Transferring Project Files and Media Files Using Nonshared Storage

To transfer project files (information about the components of your project, such as bins, master clips, edited sequences, and so on) and user profiles between Avid systems, you must transfer specific folders directly into the Avid Projects or Avid Users folder before starting the application. You can also transfer the Site Settings file between systems.

For information about these files and folders, see "Avid Projects and Avid Users Folders" in the Help.

If the media is compatible, you can transfer media files between systems by using a removable media drive. For information about media compatibility, see "Compatibility Between Applications" on page 23. For information on devices for transfer, see "Devices and Methods for Transferring Files" on page 48.

Transferring a project folder does not transfer accompanying media files.

To transfer project files and associated media files to another Avid system:

1. (Option) Consolidate the media for the project onto an appropriate drive for transfer to the other system.

   For more information on consolidating, see "Consolidating Media" in the Help.

   For more information on devices for transfer, see "Devices and Methods for Transferring Files" on page 48.

Do not rename the folder named OMFI MediaFiles or Avid MediaFiles (for MXF files) located on the media drive. The target system uses the folder name to locate the media files.

2. Select the project folder, user folder, or Site Settings file you want to transfer (the folder uses the project name or user name you provide). You do not need to copy the Statistics folder, which is located in the project folder. This folder can be large and is not needed by the transferred project.

   The default locations for application folders are listed in the following tables.

Folder or File	Location
Project folder	Private projects: • (Windows) *drive*:\Documents and Settings*Windows login name*\My Documents\Avid Projects • (Macintosh) Macintosh HD/Users/*Mac login name*/Documents/Avid Projects Shared projects: • (Windows) *drive*:\Documents and Settings\All Users\Shared Documents\Shared Avid Projects • (Macintosh) Macintosh HD/Users/Shared/*Avid editing application*/Shared Avid Projects
	For information about private projects and shared projects, see "Select Project Dialog Box" in the Help.
User folder	(Windows) *drive*:\Program Files\Avid*Avid editing application*\Avid Users (Macintosh) Macintosh HD/Users/Shared/*Avid editing application*\Avid Users
Site Settings file	(Windows) *drive*:\Program Files\Avid*Avid editing application*\Settings (Macintosh) Macintosh HD/Applications/*Avid editing application*/Settings

The exact location depends on your Avid editing application, its version, and how it was installed on your system. Older versions store projects in an Avid Projects folder that is located in the same folder as the application.

3. Copy the folders or files you want to maintain at the new location onto a storage device or a location on a server.

   Alternatively, create a folder at the top level of the media drive and copy the folders or files to that folder.

4. If you are transferring a removable drive, quit your Avid editing application and shut down your system.
5. Remove the drives containing the media files, and take them and the storage device to the new location.
6. With the system at the new location turned off, insert or connect the drives and start the system.
7. Copy the folders or files to the appropriate folder.

The folder locations might be slightly different, depending on the product and how it was installed. Ignore any Resource folders or files that appear.

8. Start your Avid editing application.

   The new project appears in the Project window. New user settings appear in the Users list. Site settings are active for all projects at the new location.

Do not open a project directly from the transfer device. You must copy the folder to the system drive first.

9. Select a user, open the project, and resume work.

Your Avid editing application reconstructs the MediaFiles database the first time you start the application to incorporate the new media into the system's internal directory.

Do not rename the project folder. The project settings do not link to the project if you rename the project folder.

Devices and Methods for Transferring Files

Options for transferring files vary depending on the source and destination systems. The following tables provide options for moving project files, media files, or both. These tables list the various ways to transfer data, the prerequisite hardware or software, and any restrictions.

For specific information about cross-platform transfers, see "Nonshared Storage Issues for Cross-Platform Collaboration" on page 52.

Transferring Files Between Macintosh Systems

The following table shows the available methods for transferring files between Macintosh systems.

Method	Requirements	Restrictions
All Files (Can be used as media drives)		
External SCSI drive	None	For compatibility information, see the Avid Drive Striping Tables, which are available on the Avid Customer Support Knowledge Base. See also “Getting Information About Striped Drives” in the Help.
Fibre Channel drive	None	For compatibility information, see the Avid Drive Striping Tables.
External 1394 (FireWire) drive	HFS+ format	Cannot be used as a media drive for Symphony. For compatibility information, see the Avid Drive Striping Tables.
Project Files, OMF Files, and AAF Files (including embedded media)		
Server-based network	None	None.
External 1394 (FireWire) drive or USB2 drive	HFS+ format	Size of the disk.
Floppy disk	Macintosh-formatted disk	Holds 1.4 MB.
CD-ROM	None	HFS+ format is recommended. Do not use ISO 9660 format, which truncates file names. Do not use hybrid CD-ROMs, unless you create them with the Joliet extension, which supports long file names.
DVD	None	None, if you use the native DVD format.
E-mail	E-mail software that supports attachments	See the documentation for the e-mail software.
FTP	Network access and FTP software on both systems	For the Fetch application, one system must be set to “Server” mode. This method can be very slow.
AppleShare	Network access on both systems	Activate AppleShare on the sending system to allow a guest or registered user to log in.
DigiDelivery™	Installation of DigiDelivery hardware and software	None. See www.digidesign.com/products/digidelivery/.

Transferring Files Between Windows Systems

The following table shows the available methods for transferring files between Windows systems.

Method	Requirements	Restrictions
All Files (can be used as media drives)		
External SCSI drive	None	For compatibility information, see the Avid Drive Striping Tables, which are available on the Avid Customer Support Knowledge Base.
Fibre Channel drive	None	For compatibility information, see the Avid Drive Striping Tables.
External 1394 (FireWire) drive	None	Cannot be used as a media drive for Symphony. For compatibility information, see the Avid Drive Striping Tables.
Project Files, OMF Files, and AAF Files (including embedded media)		
Server-based network	None	None.
External 1394 (FireWire) drive or USB2 drive	None	Size of the disk.
Floppy disk	PC-formatted disk	Holds 1.4 MB.
CD-ROM	None	Do not use ISO 9660 format, which truncates the file names. Files copied from a CD-ROM to a Windows system retain the read-only attribute. To change this attribute, see the Windows documentation
DVD	None	None, if you use the native DVD format. Files copied from a DVD to a Windows system retain the read-only attribute. To change this attribute, see the Windows documentation.
E-mail	E-mail software that supports attachments	See the documentation for the e-mail software.
FTP	Network access and FTP software on both systems	See the FTP software documentation.
DigiDelivery	Installation of DigiDelivery hardware and software	None. See www.digidesign.com/products/digidelivery/.

Transferring Files Between Macintosh and Windows Systems

The following table shows the available methods for transferring files between Macintosh and Windows systems.

Method	Requirements	Restrictions
All Files (can be used as media drives)		
Macintosh external drive (SCSI or Fibre Channel)	HFS+ format and an application that enables the Windows system to read Macintosh drives.	See “Nonshared Storage Issues for Cross-Platform Collaboration” on page 52. For compatibility information, see the Avid Drive Striping Tables, which are available on the Avid Customer Support Knowledge Base.
External 1394 (FireWire) drive	HFS+ format and an application that enables the Windows system to read Macintosh drives.	Cannot be used as a media drive for Symphony. For compatibility information, see the Avid Drive Striping Tables.
Project Files, OMF Files, and AAF Files (including embedded media)		
Server-based network	Macintosh and Windows integration	Rename files to avoid problems with illegal characters. See “System Compatibility for the Online Session” on page 26.
External 1394 (FireWire) drive or USB2 drive	HFS+ format	Size of the disk.
Floppy disk	PC-formatted disk	Holds 1.4 MB.
CD-ROM	An application that enables the Windows system to read Macintosh drives.	HFS+ format is recommended. Do not use ISO 9660 format, which truncates the file names. Do not use hybrid CD-ROMs, unless you create them with the Joliet extension, which supports long file names. Properly created hybrid CD-ROMs do not require an application that enables the Windows system to read a Macintosh-formatted CD-ROM. Files copied from a CD-ROM to a Windows system retain the read-only attribute. To change this attribute, see the Windows documentation.
DVD	None	None, if you use the native DVD format. Files copied from a DVD to a Windows system retain the read-only attribute. To change this attribute, see the Windows documentation.

Method	Requirements	Restrictions
E-mail	E-mail that supports attachments	See the documentation for the e-mail software.
FTP	Network access and FTP software on both systems	For more information on using Fetch on Macintosh systems, see www.fetchsoftworks.com.
DigiDelivery	Installation of DigiDelivery hardware and software	None. See www.digidesign.com/products/digidelivery/.

Nonshared Storage Issues for Cross-Platform Collaboration

When you share media files by using a nonshared storage device—either peer-to-peer, over a network, or using removable storage—the following restrictions apply:

- NTFS drives formatted on a Windows system can be read only on Macintosh systems running Mac® OS X 10.4 or later.
- Striped or nonstriped drives formatted as HFS or HFS+ on a Macintosh system can be read on a Windows system, if an application that lets Windows systems read the drives is installed on the Windows system.

To avoid problems when reading a connected HFS or HFS+ drive, do the following:

- On the Macintosh system, after transferring the media files to the HFS or HFS+ drive, give the media folder a name other than “OMFI MediaFiles” or “Avid MediaFiles”. You cannot change the name of the OMFI folder after you connect the drive to the system.
- Make sure the permissions on the HFS or HFS+ volume allow access by other users:
  a. Select the drive in the Finder.
  b. Select File > Get Info
  c. Select “Ignore ownership on this volume.”
- On the Windows XP system, after connecting the drive and transferring the media files to an NTFS drive, turn off the system, disconnect the drive, reboot, and then restart the Avid system.

Transferring Media Files from Media Composer Version 7.2 or Avid Xpress Version 2.1

Video media from Media Composer v7.2 or Avid Xpress v2.1 is not directly compatible with later releases, so you must export with specific format settings. The import process might be slow, and your media loses some quality.

For more information about working with Media Composer v7.2, Avid Xpress v2.1, and other versions of Avid editing products released before July, 2001, see the *Avid Products Collaboration Guide*, which is available on the Avid Customer Support Knowledge Base.

To transfer video media from v7.2 or Avid Xpress v2.1 to a later release:

- In the Export Format dialog box, select OMFI Composition Standard -AIFC, Video Only, OMFI 1.0, With Media. You can then import the OMFI file.

2 Working with HD Media

Avid editing applications include support for capture, editing, and output of high-definition (HD) media in the following resolutions:

- 1:1 HD (uncompressed 8-bit and 10-bit)
- Avid DNxHD (8-bit and 10-bit)

  Avid DNxHD encoding technology delivers mastering-quality HD media at standard definition (SD) data rates and file sizes.
- DVCPRO HD
- HDV
- XDCAM HD

Depending on the model of your Avid editing application and on your Avid input/output hardware, some of these resolutions might not be available.

Avid editing applications capture and process DVCPRO HD media and HDV media in its native format, through a 1394 port on your computer. On a Windows system with an Avid Adrenaline or an Avid Mojo, the 1394 port must be on an optional IEEE-1394 card installed on a bus separate from the one used by the Avid Adrenaline or Avid Mojo.

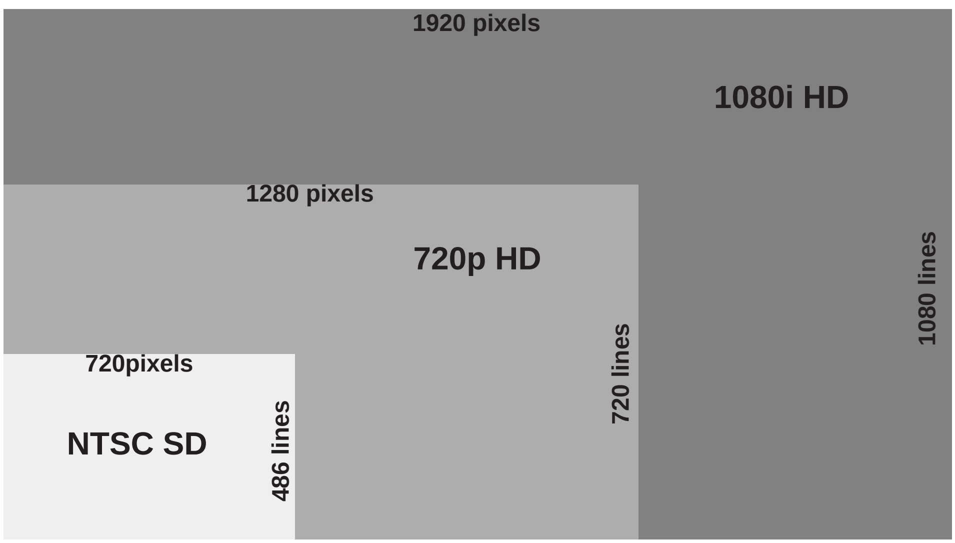
The following sections describe the features and options that let you capture, edit, and output HD media:

High-Definition Television

High-definition television (HDTV) is a digital broadcasting technology that delivers a larger, clearer, more detailed picture than standard definition television (SDTV). HDTV refers to specific digital television (DTV) formats that have been standardized by the Advanced Television Systems Committee (ATSC) and adopted by the United States Federal Communications Commission (FCC). HDTV for PAL has been standardized by the Digital Video Broadcasting (DVB) consortium.

For a table that lists the HDTV digital formats and resolutions that are supported in your Avid editing application, see "Resolution Specifications: HD" in the Help.

HDTV uses a 16:9 aspect ratio in place of the standard definition 4:3 ratio. The following illustration compares the pixel size of the most common HD formats — 720p and 1080i — to that of the digital version of standard definition NTSC media (ITU-R 601). Both 1080i and 720p formats fill the 16x9 screen on HD television sets.



For more information about HD technology, see the *Avid HD Handbook: An A to Z Guide*, which is available on the Avid web site, www.avid.com.

HDTV Workflows

This section describes three common workflows for creating HDTV output:

- Creation of film-based television programs
- Creation of video-based television programs
- Creation of video graphics for broadcast

For a more detailed description of the conform workflow, see “Conforming Workflow” on page 30.

HD Workflow: Film-Based Television Workflow

The following workflow describes the steps in creating film-based television programs that originate on film footage and that are planned for NTSC HDTV broadcast. This workflow uses features that let you change the project and sequence format, eliminating the need to create a new project and sequence. Modifying the format of the sequence lets you keep both offline SD material and online HD material available in the same project.

For PAL broadcast, transfer film at 1080p/25, edit offline in a 25p PAL project, and edit online in a 1080p/25 project.

“Offline Workflow: 24-fps Film Source for HDTV” on page 59 shows the offline stage of the workflow for such programs, and “Online Workflow: 24-fps Film Source for HDTV” on page 60 shows the online stage.

For a more detailed description of the conform workflow, see “Conforming Workflow” on page 30.For a more detailed description of the conform workflow, see “Conforming Workflow” in the Help.

To create a film-based HDTV program:

1. Use a telecine process to transfer 24-fps film footage to HD 1080p/23.976 video at 1:1.

   The transfer should also create a shot log (for example, a FLEx file).
2. Create a 23.976p SD project in any Avid editing application that supports a 23.976p project.
3. Convert the shot log file with ALE and import it into the project to create one or more bins.

4. Use a 24p deck to downconvert the HD video to ITU-R 601 SD video and batch capture the logged clips in an offline resolution, based on the shot log.

   The deck adds 2:3 pulldown (NTSC) or 4.1% speedup (PAL). The Avid system removes the extra pulldown fields and creates 23.976p media.

5. Edit at 23.976 fps, apply effects, and create a final sequence.

6. (Option) If a retransfer is needed, use FilmScribe to create an OCN (original camera negative) pull list for another telecine process, to retransfer footage used in the final edit.

7. (Option) Export an OMFI or AAF file to a Pro Tools digital audio workstation to create a final audio mix.

   For more information, see "Transferring Audio Files" on page 44.

8. A negative cutter uses the pull list to create a reel of selects from the original negative (picture only).

   The telecine process uses the assembled reel to create a full color-corrected or flat-grade transfer to tape. The process also creates a new transfer file.

9. Transfer the project files to an Avid editing application.

   If you are using an Avid Unity shared storage system, the project links to the existing SD media. If you are not using Avid Unity, transfer the SD media for reference.

10. Open the project and change its format to 1080p/23.976.

    See "Understanding Options for Changing the Project Format" on page 64. Review the offline sequence. Then modify the format of the sequence to create a new 1080p/23.976 sequence. See "Understanding Options for Modifying the Sequence Format" on page 66.

11. Convert the transfer file with ALE and import it.

12. Relink by KeyKode: relink the 1080p/23.976p sequence and clips by key numbers (FTFT). Then batch capture clips as HD media, using an HD resolution.

13. (Option) Import the final audio mix.

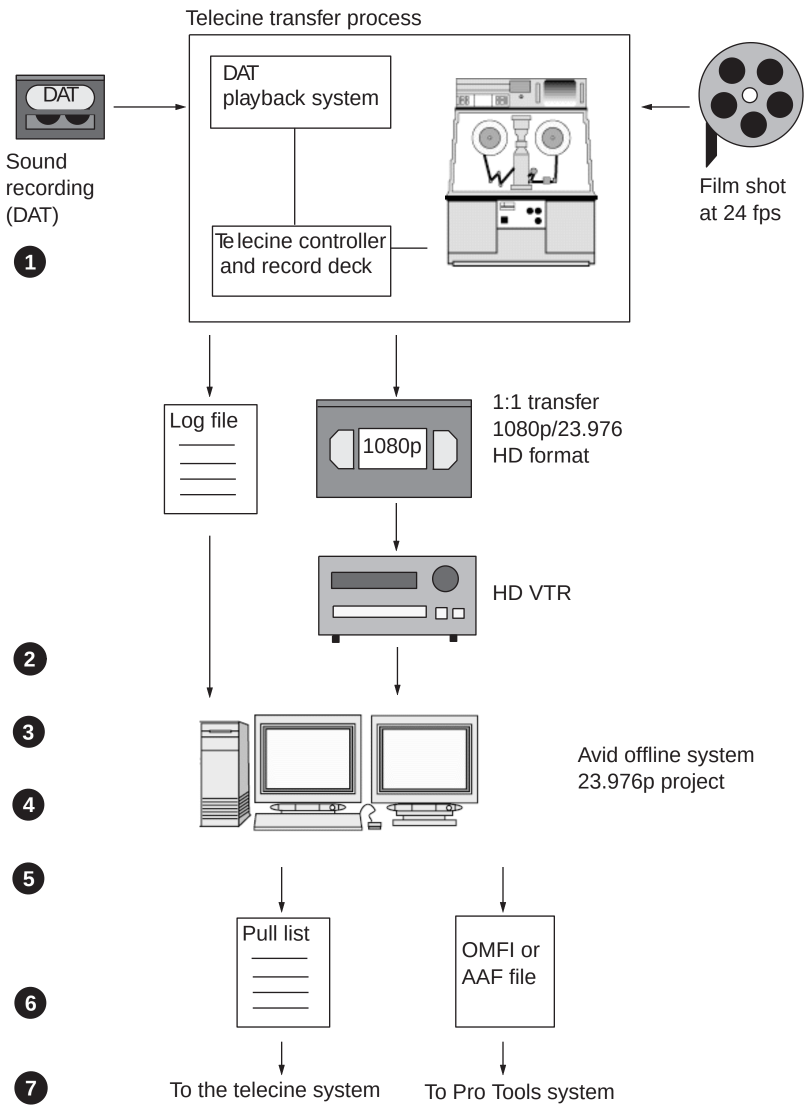
14. Complete any other finishing, using the original offline sequence for reference.

15. Use the Digital Cut tool to output a 1080p/23.976 master tape. Then convert the master tape to 720p/59.94 or 1080i/59.94 for broadcast.

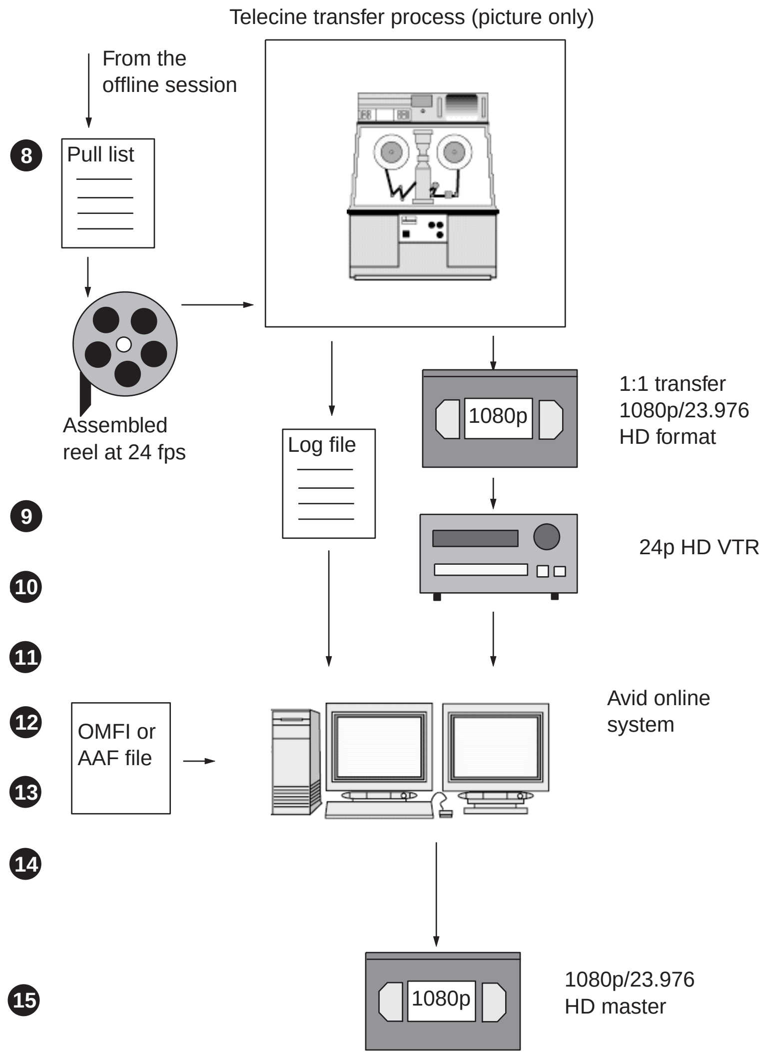
    Optionally, use the Avid editing application to crossconvert to 720p/59.94 or 1080i/59.94 for preview or reference. The HD VTR can also create 1080i/50 for PAL broadcast.

    See "Offline Workflow: 24-fps Film Source for HDTV" on page 59 and "Online Workflow: 24-fps Film Source for HDTV" on page 60.

Offline Workflow: 24-fps Film Source for HDTV



Online Workflow: 24-fps Film Source for HDTV



HD Workflow: Video-Based Television Workflow

The following workflow describes the steps in creating video-based television programs that originate on video footage and are planned for HDTV broadcast.

The workflow for creating such programs uses a single system for offline and online editing, but you can adapt it to use one system for offline editing and another for online editing. This workflow uses features that let you change the project and sequence format, eliminating the need to create a new project and sequence. Modifying the format of the sequence lets you keep both offline SD material and online HD material available in the same project.

You can use this workflow for video footage shot at 720p/23.976, 720p/59.94 or 1080p/29.97. In these cases, however, you cannot simply change the project format (step 6). Instead, you need to create a new project that matches the source footage, open the bin or bins from the NTSC 30i project, change the sequence format, decompose, and batch capture.

For a more detailed description of the conform workflow, see "Conforming Workflow" on page 30.For a more detailed description of the conform workflow, see "Conforming Workflow" in the Help.

To create a video-based HDTV program:

1. Shoot HD video.
2. Use an HD VTR to downconvert the source tape to 30i NTSC, 25i PAL, or 25p PAL.
3. Create an offline project, as shown in "Offline Formats for HD" on page 25.

   For example, if you plan to finish at 1080i/59.94, create a 30i NTSC project.
4. Capture your material. Edit, apply effects, and create a final sequence.
5. (Option) Export an OMFI or AAF file to a Pro Tools digital audio workstation to create a final audio mix.

   For more information, see "Transferring Audio Files" on page 44.For more information, see "Transferring Audio Files" in the Help.
6. Change the project format to the corresponding HD online format.

   For more information, see "Understanding Options for Changing the Project Format" on page 64.
7. Duplicate the final sequence, and then modify the format of the sequence to create a new sequence in the corresponding HD format.

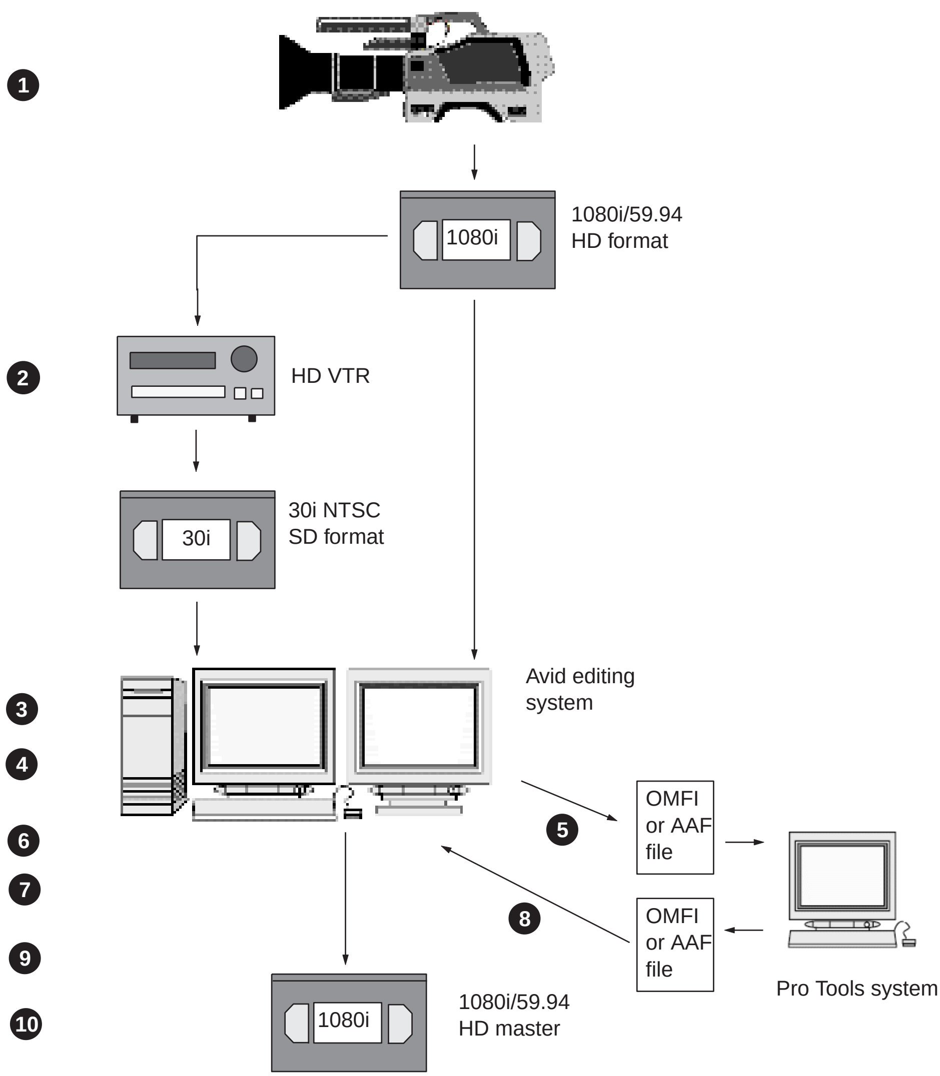
   For more information, see "Understanding Options for Modifying the Sequence Format" on page 66.
8. Decompose the new HD sequence and batch capture from the source tape.
9. (Option) Import the final audio mix.

10. Finish the sequence by batch capturing graphics, recreating title media and reviewing the program for effects that need fine-tuning.

    Use the original offline sequence for reference.

11. Render all effects and output a master tape.

    The following illustration shows an offline/online workflow using an HD video source for HDTV



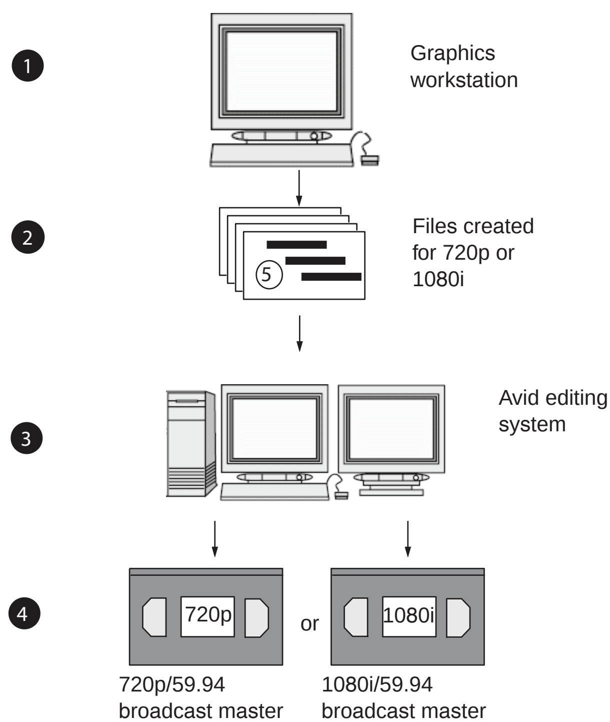
HD Workflow: Broadcast Graphics Workflow

Another HDTV workflow produces graphics, such as bumpers and promos that are created in graphics programs for HDTV broadcast.

To create a graphics-based HDTV program:

1. Create files on a graphics workstation, using either 1280x720 for 720p or 1920x1080 for 1080i.
2. Export the files to a location that the Avid editing system can access.
3. Create a 720p or 1080i project, import the files, edit, and finish.
4. Create a broadcast master tape in the desired format. Cross-convert to output an alternative format.

   The following illustration shows a broadcast graphics workflow.

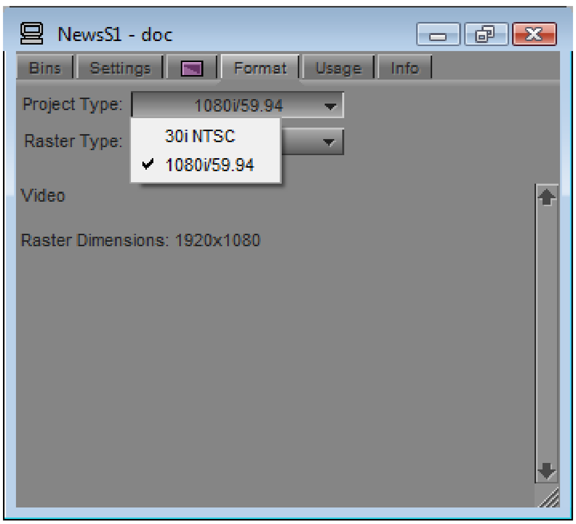


Editing in HD

The following sections describe features that are specific to HD projects.:

Understanding Options for Changing the Project Format

The Format tab in the Project window lets you change the format of the project to another format that shares the same frame rate. On systems with supported Avid input/output hardware, you can also change the raster type to improve performance as you edit HD projects.



Changing formats is especially useful if you are working with downconverted HD material in an offline-to-online workflow, see "HD Workflow: Video-Based Television Workflow" on page 61. Each HD format has an equivalent SD format that you can use for offline editing, as shown in the following table.

HD Online	SD Offline	Notes
720p/23.976	23.976p NTSC	You cannot change between these project formats because the edit rates are different. See "Converting a 23.976p NTSC Sequence to 720p/23.976" on page 70.
720p/25	25p PAL or 25i PAL	Change the project format and modify the sequence.

HD Online	SD Offline	Notes
720p/29.97	30i NTSC	You cannot change between these project formats because the edit rates are different. Use an NTSC 30i project for offline editing, then open a new 720p/29.97 project for online editing. Open the desired NTSC 30i bins and modify the final sequence, as described in “Understanding Options for Modifying the Sequence Format” on page 66.
720p/50	25p PAL or 25i PAL	You cannot change between these project formats because the edit rates are different.
720p/59.94	30i NTSC	You cannot change between these project formats because the edit rates are different, see “Editing at 60 fps” on page 72. Use an NTSC 30i project for offline editing, then open a new 720p/59.94 project for online editing. Open the desired NTSC 30i bins and modify the final sequence, as described in “Understanding Options for Modifying the Sequence Format” on page 66.
1080p/23.976	23.976p NTSC or 24p NTSC	For 23.976p NTSC, change the project format and modify the sequence. 24p NTSC sequences require additional conversion. See “Converting a 24p NTSC Sequence to 1080p/23.976” on page 69.
1080p/24	24p NTSC or 24p PAL	Change the project format and modify the sequence.
1080p/25	25p PAL or 25i PAL	Change the project format and modify the sequence.
1080p/29.97	30i NTSC	You cannot change between these project formats because the edit rates are different. Use an NTSC 30i project for offline editing, then open a new 1080p/29.97 project for online editing and open the desired NTSC 30i bins. You do not need to modify the sequence. Duplicate the sequence. Then batch capture the duplicated sequence or decompose and batch capture.
1080i/50	25i PAL or 25p PAL	Change the project format and modify the sequence.
1080i/59.94	30i NTSC	Change the project format and modify the sequence.

Another use for this feature is if you are working in an HD project and need to capture SD material. In an HD project, you can capture only HD material, and in an SD project, you can capture only SD material. Temporarily changing from an HD project to an SD project gives you access to the SD compressions. You can capture the material you need, then change back to the HD project and work with both SD and HD clips, see "Mixing SD and HD Material in a Project" on page 71.

Changing the Project Format

When you change the project format, the following changes take place:

- The hardware changes to support input and output for the new project.
- The available resolutions and, for some configurations, raster types change to those of the new project.
- Any new sequences you create use the format of the new project.

If necessary, you can then modify the format of an existing sequence, see "Understanding Options for Modifying the Sequence Format" on page 66.

To change the project format:

1. Click the Format tab on the Project window.
2. Select the corresponding format for your workflow.

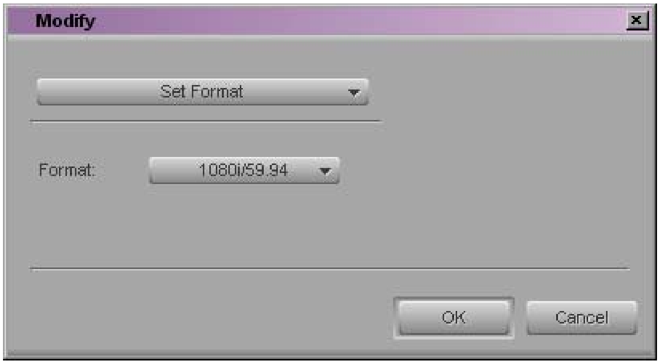
You can select only projects with the same edit rate.

3. If available, click the Raster Type menu and select a raster type.

   For information on raster types and raster sizes, see "Raster Types" in the Help.

Understanding Options for Modifying the Sequence Format

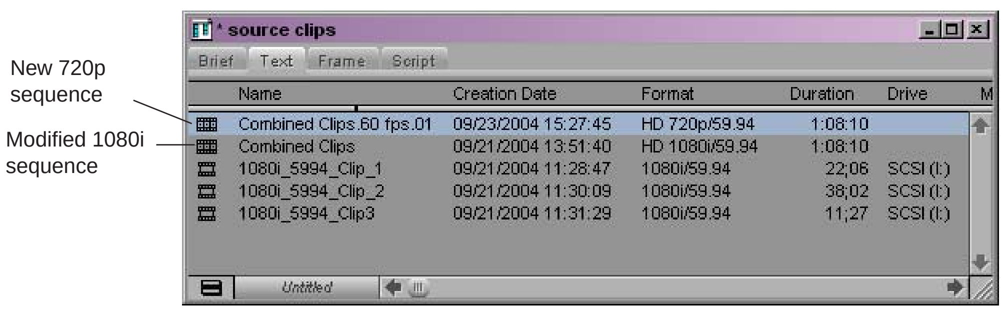
When your Avid editing application creates a sequence, it uses the format of the current project. You can change the format of an existing sequence by selecting Clip > Modify. See "Modifying the Format of a Sequence" on page 69.



The choice of formats is limited to compatible frame rates of the sequence. For example, you can change an NTSC 30i sequence to 1080i/59.94 or to 720p/59.94, but not to 1080p/23.976. (You can, however, convert a 24p NTSC sequence to 23.976p. See "Converting a 24p NTSC Sequence to 1080p/23.976" on page 69).

In some cases, where the timecode format needs to be changed, your Avid editing application creates a new, modified sequence. Media for this new sequence is offline. In other cases, where the timecode format does not need to be changed, the application modifies the existing sequence and media stays online.

You can check the format of the sequence in the Format column of the bin. (For instructions on adding a column to a bin, see "Displaying Formats in a Bin" on page 71.)



The following table shows the choices you have for modifying sequences and how each type of sequence is modified.

Original Sequence	Choices for Modifying	How Sequence is Modified
23.976p NTSC	1080p/23.976	Existing sequence is duplicated with the extension 1080p. Media in the duplicated sequence is offline. To convert to 720p/23.976, see "Converting a 23.976p NTSC Sequence to 720p/23.976" on page 70.
24p NTSC	1080p/24	Existing sequence is duplicated with the extension 1080p. Media in the duplicated sequence is offline.
	23.976 NTSC	Existing sequence is duplicated with the extension 23.976 fps. Media is offline. See "Converting a 24p NTSC Sequence to 1080p/23.976" on page 69.
24p PAL	1080p/24	Existing sequence is duplicated with the extension 1080p. Media in the duplicated sequence is offline.
25p PAL	1080p/25	Existing sequence is modified. Media remains online.
25i PAL	1080i/50	Existing sequence is modified. Media remains online.
30i NTSC	720p/59.94	Existing sequence is duplicated with the extension 60 fps. Media in the duplicated sequence is offline.
	1080i/59.94	Existing sequence is modified. Media remains online. Not available in 720p projects. For 1080p/29.97 projects, you can work with the 30i NTSC sequence without converting it.
	1080i/50	Existing sequence is modified. Media remains online.

To modify the format of clips not used in the sequence, create a sequence of the selected clips and then modify the sequence. One way to create a sequence of clips is to select the clips, hold down the Alt key, and select Bin > AutoSequence. See "Using the AutoSequence Command" in the Help.

Modifying the Format of a Sequence

To modify the format of a sequence:

1. (Option) Duplicate the sequence.
2. Select the sequence you want to modify.
3. Select Clip > Modify.

   The Modify dialog box opens.
4. Select Set Format from the top list.
5. Select the format to which you want to convert from the Format menu.
6. Click OK.

   A message box tells you whether the sequence has been duplicated or modified.

   Your Avid editing application changes the format of the sequence. In cases where timecode needs to be converted, the application creates a new sequence and unlinks the media. No media is converted. For more information, see "Understanding Options for Modifying the Sequence Format" on page 66.

Converting a 24p NTSC Sequence to 1080p/23.976

The most efficient offline format for a project that needs to be delivered as 1080p/23.976 is 23.976p (NTSC). In some cases, however, you might need to edit the offline sequence at 24 fps — for example, if the offline system does not support 23.976p NTSC projects. To convert a 24p NTSC sequence to 1080p/23.976p, you need to take an intermediate step and first convert it to 23.976p NTSC.

Several limitations apply to this conversion:

- Audio captured without pulldown (60 Hz) needs to be recaptured with pulldown (NTSC reference at 59.94 Hz).
- Media for the new 23.976p sequences and clips is offline. Sequences and clips cannot be linked to the original 24p media.
- You need to batch capture and import media. In most cases, you would do this after converting the sequence to 1080p/23.976.

The last two limitations also apply to other sequence conversions that create new sequences.

To convert a 24p NTSC sequence to 1080p/23.976:

1. On the HD online system, open a 1080p/23.976p project or create a new one.
2. Switch the project format to 23.976p NTSC.
3. Open the bin that contains the original 24p sequence and select the sequence.

4. Select Clip > Modify.

   The Modify dialog box opens.

5. Select Set Format from the top list and select 23.976 NTSC from the Format menu.
6. Click OK.

   The application creates a new sequence labeled with the extension 23.976 fps.

7. Switch the project format back to 1080p/23.976p project.
8. Select the new 23.976p sequence.
9. Select Clip > Modify.
10. Select Set Format from the top list and select 1080p/23.976 from the Format menu.
11. Click OK.
12. Batch capture, import graphics, and finish the sequence.

Converting a 23.976p NTSC Sequence to 720p/23.976

Because the source edit rates are different for these formats, you cannot simply change the project and sequence format. The following sequence is based on source material shot or transferred to 720p/23.976 and edited offline in a 23.976p NTSC project.

To convert a 23.976p NTSC sequence to 720p/23.976:

1. In the 23.976p NTSC project, duplicate the final sequence and move it to a new bin.
2. Decompose the sequence.
3. Select the master clips and export them as a shot log file.
4. Create a 720p/23.976p HD project.
5. Import the shot log file into a bin.
6. Batch capture the clips.
7. Open the SD bin containing the duplicated sequence.
8. Relink the SD sequence to the new HD clips.

   See “Relinking Clips to a New Project Format” in the Help.

Mixing SD and HD Material in a Project

You can mix SD and HD material in the same project. You can even mix SD and HD material in the same Timeline if the edit rates match. For example, you can edit both NTSC 30i and 1080i/59.94 into the same sequence and then play the sequence in real time. This feature is useful if you want to preview SD material in an HD project. For more information, see “Mixing Resolutions” and “Mixing Video Formats in a Sequence” in the Help.

- In an HD sequence, an SD image is stretched to fill a 16:9 monitor.
- In an SD sequence, an HD image is anamorphically squeezed to fit the 4:3 monitor.

You cannot output a sequence that mixes SD and HD material. To output a mixed sequence as HD, you need to transcode the clips that use the unsupported resolution to an HD resolution, see “Transcoding HD Media” on page 72. All master clips then share the same format.

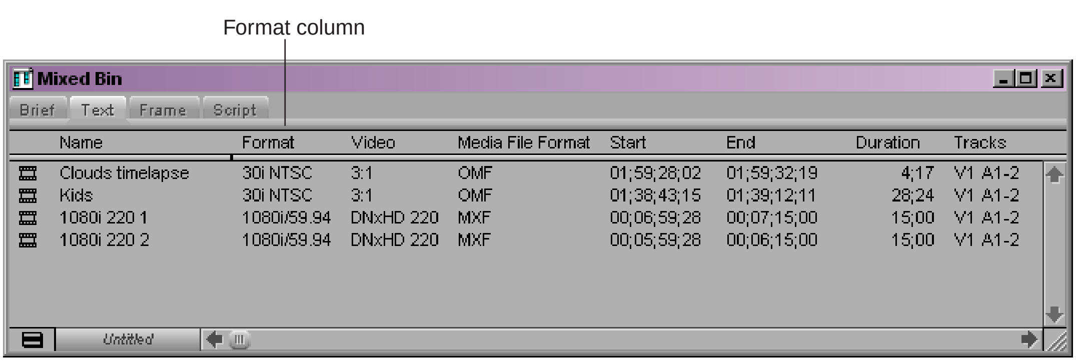
You might also need to apply an effect, such as Reformat or Resize, in which case you need to render the effects. This process creates new media in the format of the sequence.

You can set an option to highlight clips that do not match the project format. See “Highlighting Clips in a Mixed-Format (SD and HD) Timeline” in the Help.

If you have a sequence that mixes SD and HD clips, and you need to recapture the SD clips in an HD resolution, you can create a subsequence of the SD clips, modify the format of the subsequence, see “Understanding Options for Modifying the Sequence Format” on page 66, decompose, and recapture.

Displaying Formats in a Bin

The Format column displays the format of a clip or sequence as determined by the project type, such as 30i NTSC or 1080i/59.94. This is especially useful if you have both SD and HD clips in the same bin.



For information on displaying a column, see “Manipulating Bin Columns” in the Help.

Editing at 60 fps

The project type 720p/59.94 uses a screen resolution of 1280 x 720 at a frame rate of 60 frames per second. Editing at 60 fps is similar to editing at 24 fps because both resolutions are progressive — they use full frames instead of interlaced fields. Note the following:

- Single-frame step commands move at 1/60th of a second. Single-field step commands are deactivated; if you click a button, the application beeps.
- You can mark IN and OUT points at 1/60th of a second increments.
- You can trim at 1/60th of a second increments.
- Transition effects default to one-second duration (60 frames).
- Deck control for capture and digital cut is limited to 30 fps. A message box warns you if you try to mark an odd timecode value (such as 01:00:00:03).

1080i/50 and 1080i/59.94 are interlaced resolutions that you edit at 25 frames per second and 30 frames per second.

Working with True 24 FPS Timecode

Avid HD editing applications support direct device control at 24 fps, enabling you to capture true 24-fps timecode from HD decks. When you are capturing 23.976-fps or 24-fps material in HD, the Capture tool displays 24-fps timecode for the Mark IN and Mark OUT points. After you capture a clip, the Start and End timecodes are also shown as 24-fps timecode.

Transcoding HD Media

For HD projects, the Consolidate/Transcode dialog box lists compatible HD resolutions. For resolution information, see “Resolution Specifications: HD” in the Help. For information on transcoding media, see “Using the Transcode Command” in the Help.

Using HD Universal Mastering

Some combinations of an Avid editing application and Avid input/output hardware provide HD Universal Mastering capabilities.

HD Universal Mastering allows 1080p high-definition sequences (both NTSC and PAL) edited at one frame rate to be played back in real time at a different frame rate and with audio conversion that matches the video conversion.

If you create a sequence in one frame rate (for example, 24 fps), you can then output the sequence at an alternate frame rate (for example, 25 fps). This modifies the duration of the sequence to roughly 96% of its original length.

HD Universal Mastering preserves synchronization with the converted video by remastering audio at a different sample rate to generate replacement audio tracks from previously mixed-down audio clips. Once replacement audio tracks have been generated, you can edit them into a new sequence, or edit them into the original sequence as alternative tracks, and then use the Digital Cut tool to output the sequence.

The following frame rates are supported for HD Universal Mastering of sequences (sample rates are included as examples of remastered audio):

Original Frame Rate	Mastered Frame Rate	Original Sample Rate	Mastered Sample Rate
23.976 fps	24 fps	48000	47952
23.976 fps	25 fps	48000	46034
24 fps	23.976 fps	48000	48048
24 fps	25 fps	48000	46080
25 fps	24 fps	48000	50000
25 fps	23.976 fps	48000	50050

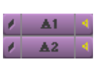
HD Universal Mastering applies only to sequences created in a 1080p project format, and the audio quality is best if you are working with 48 kHz audio.

Converting Audio for HD Universal Mastering

Before you output your sequence with HD Universal Mastering, you need to convert the audio tracks so that they match the frame rate of the video tracks

To prepare audio tracks for HD Universal Mastering:

1. Load a sequence in the Record monitor or the Timeline.



2. Click the Track buttons in the Track Selector panel in the Timeline to select the audio tracks you want to mix down.

3. Perform an audio mixdown.

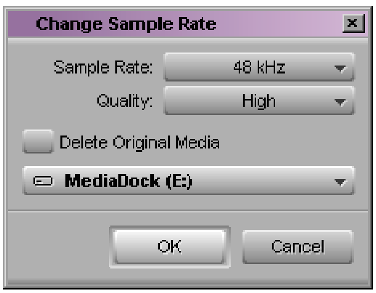
   For information on how to mix down audio, see "Mixing Down Audio Tracks" in the Help.

   The audio is mixed down, and your Avid editing application displays the new master clip in the bin.

4. Select the mixed-down audio clip in the bin, and do one of the following:

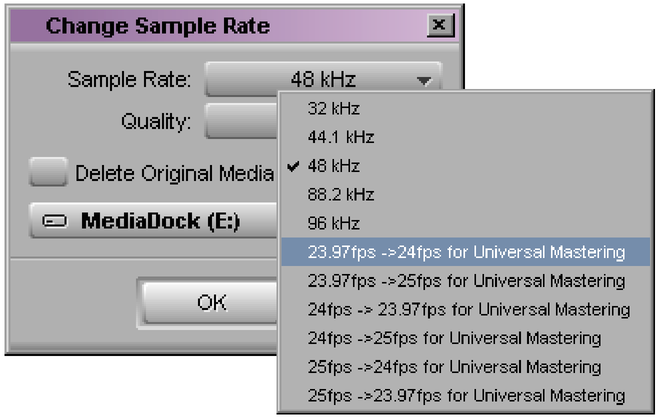
   - Select Clip > Change Sample Rate.
   - Right-click the clip and select Change Sample Rate.

   The Change Sample Rate dialog box opens.



5. Click the Sample Rate menu, and select the appropriate conversion option:

   - 23.97fps -> 24fps for Universal Mastering
   - 24fps -> 25fps for Universal Mastering
   - 24fps -> 23.97fps for Universal Mastering
   - 25fps -> 23.97fps for Universal Mastering
   - 25fps -> 24fps for Universal Mastering
   - 23.97fps -> 25fps for Universal Mastering



6. (Option) Click the Quality menu and select one of the following conversion quality options:
   - High
   - Medium
   - Low

Avid recommends you accept the default Quality setting of High. Selecting a lower Quality setting might lead to degraded audio quality in your media output.

7. (Option) Select the Delete Original Media option if you want the system to delete the original media automatically after the conversion process is complete.
8. (Option) Click the Target Drive menu and select a drive for the new media files different from the drive setting in the Audio Project settings. For more information on Audio Project settings, see “Audio Project Settings for Capture” in the Help.

   Make sure that you choose a target drive with enough storage space for the generated media files and the ability to play back media.
9. Click OK.
10. Select Clip > New Audio Track twice to create two new audio tracks in the Timeline.
11. Use the Track Selector buttons to select only the two new audio tracks.
12. Mark an IN point on the first frame of the sequence.
13. Make sure the position indicator in the Timeline is on the first frame of the sequence.
14. Click the Overwrite button to add the converted audio to original sequence.

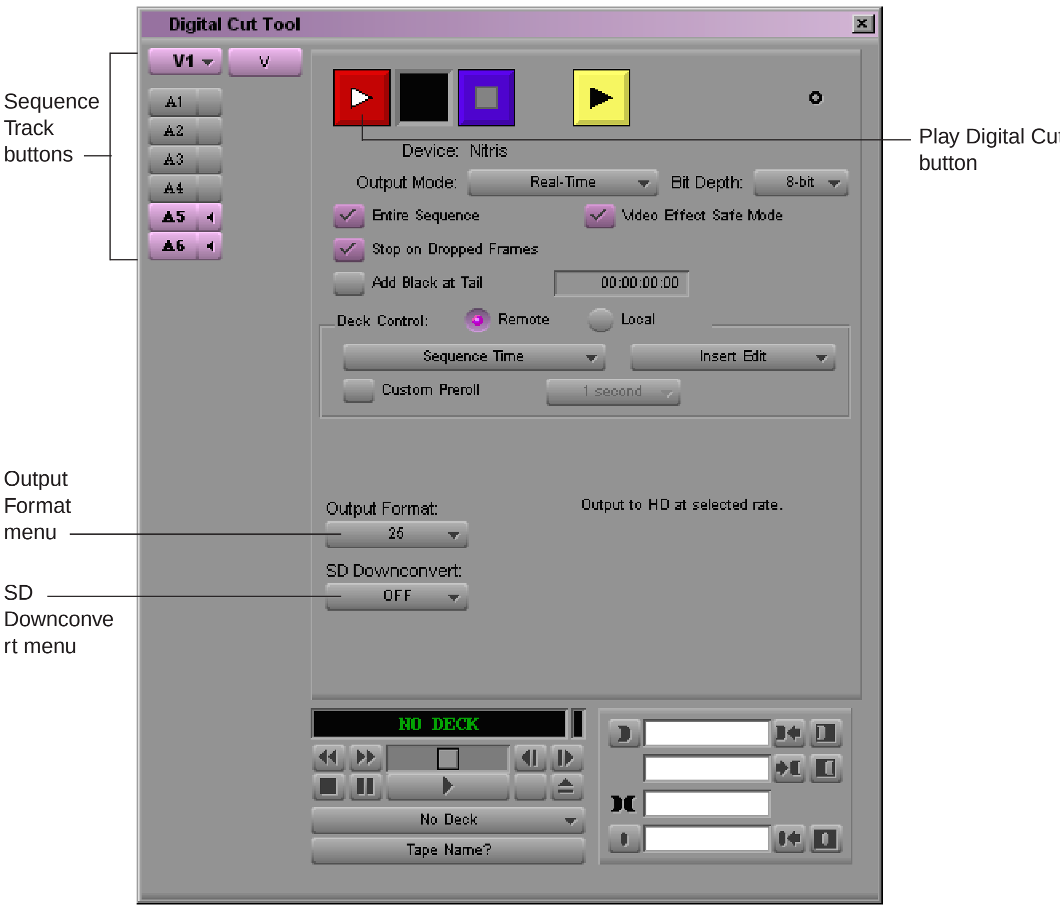
Performing a Digital Cut with HD Universal Mastering

Once you have mixed down your audio tracks and added the new audio clip to your sequence, you can output your sequence at a new frame rate by performing a digital cut.

To perform a digital cut with HD Universal Mastering:

1. Make sure your sequence is loaded in the Source monitor.
2. Select Output > Digital Cut.

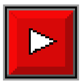
   The Digital Cut tool opens.



3. Select the video tracks you want represented in the digital cut by using the Sequence Track buttons.
4. Deselect all audio tracks except the converted tracks by using the Sequence Track buttons (see "Converting Audio for HD Universal Mastering" on page 73).

5. Click Output Format, and select the appropriate frame rate option:
   - 23.976
   - 24
   - 25
6. (Option) Click SD Downconvert, and select the appropriate resize option. The options available depend on the selected Output Format option. For more information on SD Downconvert, see “Video Output Tool Settings: HD Tab” in the Help.
7. Select the appropriate options for your digital cut.

   For more information on using the Digital Cut tool, see “Using the Digital Cut Tool” in the Help.



8. Click the Play Digital Cut button.

   Your Avid editing application cues the record deck, then plays and records the sequence at the remastered frame rate. The playback appears in the Record monitor and in the Client monitor. Once the digital cut completes (or is aborted), the input/output hardware resets to the original project frame rate.

If you select a deck or tape for your digital cut that is set for a frame rate different from the current sequence format, a message reminds you to switch the genlock signal to match the selected output rate and indicates the genlock changes that best match the output. Also, there might be a slight delay in playback as the input/output hardware adjusts the frame rate.

Video Color Space for HD

Color space determines how the color components of the video signal are stored and processed. HD video uses an international specification for the YCbCr color space called ITU-R 709. It is an expansion of the earlier YCbCr specification for SD called ITU-R 601. ITU-R 601 and ITU-R 709 share some information: for example, for 8-bit components, black is mapped to 16 and white is mapped to 235. However, color values can change when you are converting from SD to HD, and vice versa. Avid HD editing applications automatically compensate for these differences.

YCbCr and YPbPr refer to the same color space. Avid editing systems use YPbPr to designate HD analog output, both in the Video Output tool and on the back of Avid input/output hardware. The HD tab of the Video Output tool provides sliders to adjust the YPbPr analog output through the YPbPr connectors on the back of the Avid hardware

Working with HDV

Avid editing applications provide the following High Definition Video (HDV) project types. For HDV projects, you should select HDV as the raster type. (Some project types are not available for some Avid input/output hardware configurations.)

- 720p/23.976
- 720p/25
- 720p/29.97
- 720p/50
- 720p/59.95
- 1080i/50
- 1080i/59.94

You can capture from an HDV device, edit in native HDV, and export to an HDV device using these project types.

You can also use HDV in other project types, but Avid editing applications are more efficient and perform better with the dedicated HDV project types. The other project types you can use include:

- PAL 25i
- NTSC 30i

You cannot capture or export native HDV in the non-HDV project types.

Understanding HDV

HDV is a low-cost prosumer format that allows you to record HD video onto standard DV videocassettes. This is achieved through the use of interframe compression, where a given frame in the video stream can be composed of information from adjacent frames. Frames are grouped into a sequence called a "Group of Pictures," or GOP. Long-GOP (also known as IPB encoding) refers to the structure of HDV media.

A GOP contains several different types of compressed frames:

- I frames, which are compressed frames that do not depend on any frames around them. I frames anchor the beginning of the GOP.
- P (predictive) frames and B (bidirectional) frames, which depend on the frames around them.

Interframe compression is more efficient than frame-based schemes (such as DV 25), allowing high-bandwith HD images to be contained on media designed for standard definition (SD). However, HDV is more difficult to edit since frames are not independent of one another. Avid provides a workflow that allows you to edit natively with HDV-compressed video without requiring a transcode to frame-based media, and without limiting where you make your cuts.

The Avid editing application uses a technique called long-GOP splicing when encoding an HDV MPEG-2 sequence for export. For more information, see "Long-GOP Splicing for HDV Encoding" on page 83.

HDV uses MPEG-2 video encoding and MPEG-1 audio encoding. 1080i records at about 25Mbps and 720p records at about 19Mbps. Sony provides HDV cameras that record at 1080i/59.94 and 1080i/50. JVC® cameras record at 720p/29.97 and 720p/23.976.

In the 1080i formats, the data rate of the video is reduced before compression by horizontally resizing the video display (raster) from 1920 x 1080 pixels to 1440 x 1080 pixels. In contrast, 720p projects use the standard HDV raster size of 1280 x 720. A special resolution, DNxHD-TR (for Thin Raster), improves the performance of 1080i HDV editing. This resolution matches the 1080i HDV raster size, reducing artifacts that would come from repeated compressions when rendering effects and graphics.

HDV Basic Workflow

A basic workflow for an HDV project is as follows:

To work with HDV:

1. Select one of the following Avid project types depending on the format in which your HDV camera records and the project types available for your input/output hardware:
   - 720p/23.976
   - 720p/25
   - 720p/29.97
   - 720p/50
   - 720p/59.94
   - 1080i/50
   - 1080i/59.94
2. Click the Raster Type menu, and select HDV.

3. Do one of the following:
   - Capture HDV material.
   - Import an HDV file.

   The media is brought in as one video track and two 48-kHz audio tracks.
4. Edit the material.
5. Select the sequence.
6. Output the sequence back to the HDV device using the Export to HDV Device dialog box.

   You can also export the file in other formats or use Windows Media 9 for export to a third-party HD-DVD authoring system, See "Exporting HDV as Windows Media" on page 86.

Capturing and Importing HDV

You can capture HDV only through a IEEE 1394 port, as described in "Capturing HDV" on page 80.

You can import an HDV transport stream file (.m2t). Transport streams combine video and audio for transmission through an IEEE-1394 port. Your Avid editing application separates the transport stream after import or capture into the video and audio for editing.

After import or capture, the master clips in the Avid editing application contain HDV long-GOP MPEG-2 video in MXF format and 2 channels of uncompressed 48 kHz 16-bit audio.

Capturing HDV

How you capture HDV material depends on your system configuration:

- On a system with Avid Mojo SDI input/output hardware, use the 1394 port on the Mojo SDI.
- On other systems, use a 1394 port on the computer (Host 1394). On a Windows system using Avid Adrenaline or Avid Mojo input/output hardware, this 1394 port must be on an optional IEEE-1394 card installed on a bus separate from the one used by the Avid Adrenaline or Avid Mojo.

The Sony 1080i HDV cameras mark accurate timecode and can be used for batch capturing.

The JVC 720p/29.97 HDV camera restarts timecode every time the system starts to capture. You cannot batch capture HDV material with a JVC 720p/29.97 HDV camera.

For more information, see “Capturing DV Media Directly from a DV Device” in the Help.

To capture HDV material:

1. Set up an HDV project, depending on the format in which your HDV camera records.
2. If you are using Avid Adrenaline, Avid Mojo, or Avid Mojo SDI input/output hardware, do one of the following:
   - Select Special > Device > IEEE 1394.
   - 

     Click the DNA/1394 button on the Timeline to show 1394.
3. Select Tools > Capture.

   The Avid system automatically selects the correct resolution for native HDV.
4. Select other options, and start to capture.

   For more information about capturing, see “Capturing Media: Basics” in the Help.

Importing HDV

To import HDV media, you must import an HDV transport stream. You cannot import transport stream types other than HDV.

The file name extension .m2t does not indicate if the transport stream contains HDV media.

To import an HDV transport stream:

1. Select File > Import.

   The Import As dialog box opens.
2. Select Files of Type > HDV files (*.m2t).
3. Select the target drive (no other import options are needed).
4. Click Open.

   Your Avid editing application copies the media in a fast import as native HDV.

Mixing SD and HD Resolutions with HDV

You can mix SD resolutions and HD resolutions in the same Timeline with HDV as long as they have compatible frame rates and raster sizes. See “HDV Compatibility Guidelines” on page 88.

Playing Back HDV Media

Depending on your input/output hardware, there might be some limitations when you play back HDV media. With a DV device connected in IEEE-1394 mode, you can play back to the DV device in Draft Quality and Best Performance quality only. With no device connected, you can play back as Full Quality and use the full-screen playback monitor. You can play back to the DV device as Full Quality only if you first transcode the material to DNxHD or DNxHD-TR. For more information, see the table in "Rendering and Transcoding HDV Media" on page 82.

In a 1080i HDV project you can play back through some Avid input/output hardware configurations (including through a non-1394 output on an Avid Mojo SDI) by changing the project type.

If you have a system with Avid Nitris DX input/output hardware, you do not need to transcode your HDV media or change your project type for playback.

To play back HDV media:

- In the Project window, click the Format tab. From the Project Type menu, select a project type as follows.
  - For 1080i/50 projects, select 25i PAL.
  - For 1080i/59.94 projects, select 30i NTSC

  The media is downconverted and plays in SD with an anamorphic squeeze.

Rendering and Transcoding HDV Media

You cannot render to an HDV resolution. Also, you might need to transcode the HDV sequence (see "Outputting HDV through Avid Input/Output Hardware" on page 85). The following table provides information on which resolutions are used for rendering and transcoding in each project type when you select HDV as the raster type.

HDV Project Type	Renders or Transcodes to
720p/23.976	DNxHD 60, DNxHD 90, DNxHD 90x, DVCPro HD
720p/25	DNxHD 60, DNxHD 90, DNxHD 90x, DVCPro HD
720p/29.97	DNxHD 75, DNxHD 110, DVCPro HD
720p/50	DNxHD 120, DNxHD 185, DNxHD 185x, DVCPro HD
1080i/50	DNxHD–TR 120
1080i/59.94	DNxHD–TR 145

For more complete information on rendering and transcoding, see “Basics of Effects Rendering” and “Using the Transcode Command” in the Help.

Outputting HDV

To send your edited HDV sequence back to an HDV device, you need to use a transport stream. You can use an existing transport stream or create a new one. To create a digital cut to go out to other devices, you need to first transcode the sequence.

Long-GOP Splicing for HDV Encoding

Your Avid editing application uses a technique called long-GOP splicing when encoding an HDV MPEG-2 sequence for export. When you export to an HDV device, the application uses splicing to reconstruct only the edited sections of the media, such as cut points, transitions, and segments that contain effects. Other areas of the sequence are copied intact. The result is faster encoding at higher quality.

Exporting to an HDV Device

The Export to HDV Device dialog box lets you create a transport stream file. You cannot use the standard Digital Cut tool to output HDV. You must use a IEEE 1394 port to output the transport stream file back to the HDV device. You can export an entire sequence or the marked section between IN and OUT points.

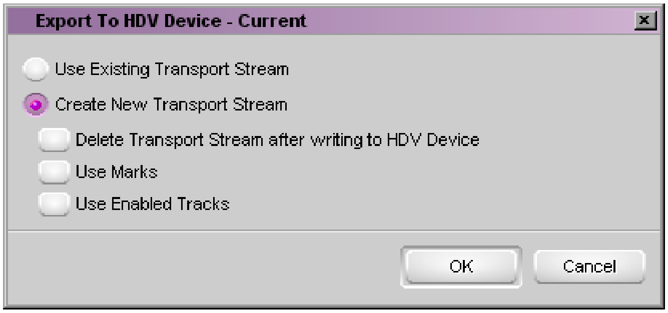
To export the HDV material to an HDV device:

1. If you are using Avid Adrenaline, Avid Mojo, or Avid Mojo SDI input/output hardware, do one of the following:
   - Select Special > Device > IEEE 1394.
   - 

     Click the DNA/1394 button on the Timeline to show 1394.
2. Select the sequence or marked section.

3. Select Output > Export to Device > HDV.

   The Export to HDV Device dialog box opens.



4. Select options as described in the following table:

Option/Suboption	Description
Use Existing Transport Stream	Select this option if you previously exported or output a transport stream and saved it.
Create New Transport Stream/ Delete Transport Stream after writing to HDV Device	Not available if you use an existing transport stream. Select to create a transport stream and then save it.
Create New Transport Stream/ Use Marks	Not available if you use an existing transport stream. When you select this option, the system uses current IN and OUT points in the selected clip or sequence to determine starting and ending frames for the export. To output the entire clip or sequence, deselect this option.
Create New Transport Stream/ Use Enabled Tracks	Not available if you use an existing transport stream. When this option is selected (default), the system uses tracks that are enabled in the Timeline. To output the entire clip or sequence, deselect this option.

5. Click OK.

   The transport stream file is created (or saved, if you used an existing transport stream).

Outputting HDV through Avid Input/Output Hardware

You can use Avid input/output hardware to output a sequence created with HDV media, but you must transcode the sequence and then use the standard Digital Cut tool.

To perform a digital cut on a system using Avid input/output hardware:

1. If you are using Avid Adrenaline, Avid Mojo, or Avid Mojo SDI input/output hardware, do one of the following:
   - Select Special > Device > Avid DNA.

   - Click the DNA/1394 button on the Timeline to show DNA.
2. Select the sequence or marked section.
3. Transcode the sequence as described in “Rendering and Transcoding HDV Media” on page 82.
4. Select Output > Digital Cut
5. Proceed as with any digital cut.

   See “Using the Digital Cut Tool” in the Help.

Exporting an HDV Transport Stream

You can export an HDV transport stream for use in other applications.

To export an HDV transport stream:

1. Select the sequence or marked section.
2. Select Export in the Settings tab of the Project window.

   The Export Settings dialog box opens.
3. Select Export As > HDV.
4. Select Use Marks and Use Enabled Tracks as desired.

   See “Export Settings: HDV” in the Help.
5. Click OK.

   You can also export to other formats, such as QuickTime movie, or use the Send To function to send the sequence to an application such as Sorenson Squeeze. You can also export to Windows Media 9 for finishing to HD-DVD.

To export to other formats:

- Export the sequence or use the Send To function as usual.

  See “Exporting Frames, Clips, or Sequences” or “Improving Workflow Using Send To” in the Help.

Exporting HDV as Windows Media

Use the following samples as a guide when exporting an HDV sequence as Windows Media for use on the Web or for use in DVD authoring:

To export HDV as Windows Media for use on the Web:

1. Select the sequence or clips you want to export.
2. Select File > Export.

   The Export As dialog box opens.
3. Click the Options button.

   The Export Settings dialog box opens.
4. Select Export As > Windows Media.
5. Set the following:

Setting	Value
Width	720
Height	540
FPS	60
Video Type	Progressive
Pixel Aspect Ratio	16:9
Codec	Windows Media 9
VBR	Enabled and set to Quality
Audio Settings	Leave set at defaults

6. Click Save to export the sequence.
7. In the Export As dialog box, select the destination folder for the file.
8. Click Save.

   The sequence is exported using the selected settings.

To export HDV as Windows Media for use in DVD authoring:

1. Select the sequence or clips you want to export.
2. Select File > Export.

   The Export As dialog box opens.
3. Click the Options button.

   The Export Settings dialog box opens.
4. Select Export As > Windows Media.
5. Set the following:

Setting	Value
Width	1440
Height	1080
FPS	60
Video Type	Progressive
Pixel Aspect Ratio	16:9
Codec	Windows Media 9
VBR	Enabled and set to Quality
Audio Settings	Leave set at defaults

6. Click Save to export the sequence.
7. In the Export As dialog box, select the destination folder for the file.
8. Click Save.

   The sequence is exported using the selected settings.

Finishing HDV on DS Nitris

The following procedure outlines the steps to take if you want to finish an HDV sequence on an Avid DS Nitris system.

To finish an HDV sequence on an Avid DS Nitris system:

1. When in a 1080i/59.94 HDV project, transcode your sequence to DNxHD 145.
2. Export as an AFE.
3. Import the AFE file to Avid DS Nitris v7.6 QFE 3 or later. To access Avid DS updates, go to www.softimage.com/avidds and click Download > QFE and other fixes.

To create an AFE file from an Avid editing product running on a Macintosh system, copy the project folder from the Macintosh system to the Avid DS Nitris system. Then use MediaLog on the Avid DS Nitris system to create the AFE file. For more information, see the Avid DS Nitris Conform Guide*.*

HDV Compatibility Guidelines

You can change the format of a project using the Project Type menu in the Format tab of the Project window. You can also mix certain formats in the Timeline as long as they are at the same frame rate. The following table describes which formats are compatible with HDV material that you capture.

HDV captured at	Can change in Project Type menu to	Can mix in Timeline with
720p/23.976	Cannot change format	DNxHD-TR DVCPRO HD All 23.976 NTSC resolutions (DV 25, 1:1, and so on)
720p/25	25p PAL 1080p/25	DNxHD
720p/29.97	1080p/29.97	DNxHD
720p/50	Cannot change format	DNxHD
1080i/50	25i PAL	DNxHD-TR DVCPRO HD All 25i PAL resolutions (DV 25, 1:1, and so on)
1080i/59.94	30i NTSC	DNxHD-TR DVCPRO HD All 30i NTSC resolutions (DV 25, 1:1, and so on)

Section II
Finishing Tools

Avid Symphony offers a wide range of tools for adding the finishing touches to your project. The following chapters describe features that are unique to Symphony:

- Motion Tracking and Stabilization
- Symphony Color Correction
  - Understanding Color Correction Mode
  - Performing Color Corrections
  - Managing Color-Corrected Sequences
  - Color Correction Techniques
  - Spot Color Correction
  - Safe Colors

For information about other tools and features you might use, see the following topics in the Help:

- Using the Reformat Effects
- Understanding the Intraframe Effects
- Getting Started with the Paint and AniMatte Effects
- Scratch Removal

3 Motion Tracking and Stabilization

Your Avid editing application can track the motion of a selected area in an image over time. Once you have obtained tracking data, you can use it to control the motion of a digital video effect such as a Picture-in-Picture or a Paint effect. You can also use tracking data to stabilize an image to compensate for camera motion.

This chapter includes the following main topics:

Understanding Motion Tracking

This section includes conceptual information that helps you to understand how tracking works and when you might want to use it.

Understanding the Tracking Process

Motion tracking works by searching for a distinctive pattern of pixels in each frame of a video segment. As the pattern moves over time, your Avid editing application records the movement as a series of points, one for each frame or field in the segment. For example, if a car is moving across a segment, you can track a distinctive pattern on the side of the car, such as the shape of its side mirror. The result is a set of tracking data points that represent the movement of the car over time.

Once you have a set of data points, you can associate them with an effect parameter to control how an effect moves. For example, if you need to hide the identity of the person driving the car in your segment, you can associate the tracking data with the Position parameter of a Blur effect. The tracking data then controls the movement of the Blur effect so that the blurred area remained over the person's head throughout the segment.

Each set of data points is contained within a structure called a tracker. Depending on the kind of motion you need to track, you might need one, two, or more trackers. For simple two-dimensional movement, a single tracker is sufficient. If you need to track rotational movement or scaling information, you need two trackers so that the system can calculate the position of one point in the image relative to a second point. For even more complex motion, such as that involved in corner pinning an image, you might need three or four distinct points to correctly track perspective or the angle at which the image is tilted.

Uses of Motion Tracking

One common use for motion tracking is to replace a moving area in one image with new material. For example, you can track the motion of a distinctive area on a vehicle and then use that data to replace an advertising sign on the vehicle or to replace or blur the license plate. In many cases, especially when the motion of the vehicle is complex, using tracking data to control the movement of the foreground replacement is much quicker than using keyframes to define the movement by hand. For an example of this use of motion tracking, see "Example 1: Replacing the License Plate on a Moving Vehicle" on page 141.

Sometimes a shot is designed from the outset with motion tracking in mind. A director might attach a target to the moving vehicle so that it can be tracked easily. You could create a replacement sign as a graphic and import it or shoot a replacement sign against a keying background. During editing, you use tracking data to control the movement of the replacement material in a Picture-in-Picture or a chroma key effect promoted to 3D Warp.

Another use for motion tracking is to create an effect in which a foreground object follows a background object but remains offset from it. For example, you might track the movement of a hand in a background clip and then use that tracking data to control the movement of a foreground object so that the object's movement appears to be controlled by the moving hand.

When you stabilize an image, you use tracking information somewhat differently. By tracking an object that should be motionless — for example, part of a building — you collect information about the movement of the camera from one frame to the next. The Stabilize effect then applies the inverse of that movement to each frame in order to eliminate the camera motion.

Motion Tracking and Footage Characteristics

The motion tracking tools in your Avid editing application allow you to track movement in many kinds of footage successfully.

However, there will always be some footage that is difficult or even impossible to track successfully. There might be no consistent pattern to track across multiple frames, or insufficient distinction between the pattern you want to track and the surrounding material. Typically, tracking requires a distinct edge in the target area, for example the edge of a moving vehicle against a background, or the edge of an advertising sign against the body of a vehicle.

In some cases, you might be able to temporarily apply a color correction or a Color Effect that you can use to make a pattern more distinct. For example, if a blue vehicle does not track well against a sky background that is a similar shade of blue, you could use a secondary color correction on the vehicle to change its color temporarily.

Workflow for Motion Tracking

The following workflow outlines the main stages of the motion tracking process and indicates where to find more detailed information and procedures for each stage.

Motion tracking provides considerable workflow flexibility. As you become a more experienced user of motion tracking, you can modify the order of these stages or merge them together to suit your editing style and the requirements of a particular project.

1. (Option) Before you begin working with the motion tracking tools, develop a general concept and design for the effect you want to create.

   In some cases, you can design your shoot itself with tracking in mind, for example, by attaching a distinctive target to a moving object that you can later track and replace with an effect.

2. Set up the effect that you want to control using tracking information.

   You access motion tracking from within an effect parameter for a specific effect, so you must set up the effect first. For more information, see "Setting Up an Effect for Tracking" on page 102.

3. Prepare to generate tracking data by creating trackers and customizing how the system will conduct the tracking operation.

   For more information, see "Preparing to Generate Tracking Data" on page 104.

4. Generate tracking data.

   Depending on the complexity of the movement you want to track, you might need to track one, two, or more distinct points in the image. Also, if you are not able to track one target area successfully throughout your segment, you might need to add one or more additional tracker regions and track each additional region.

   For more information, see "Generating Tracking Data" on page 114 and "Performing Offset Tracking" on page 117.

5. If necessary, process or modify the tracking data.

   For example, you might want to smooth the path of the tracking points, or adjust some of the points by hand. For more information, see "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124 and "Modifying Tracking Data" on page 124.

6. Play back the effect.

   The system calculates the motion of the effect by incorporating the tracking data and displays the result. For more information, see "Playing Effects That Use Tracking Data" on page 130.

7. If necessary, continue to adjust the tracking information or other effect parameters until you are satisfied with the look of the effect.

Effects and Effect Parameters That Use Tracking Data

You can enable tracking and use tracking data for most segment effects that can move over time, including Picture-in-Picture, keys, Intraframe™ effects, titles, and all 3D effects. In some cases, you must promote an effect to 3D to access tracking for the effect or to access the full range of tracking options.

Effect parameters that can use tracking data divide into two groups:

- The Position, Scaling, and Rotation parameters allow you to use tracking data to control the specific kinds of motion associated with each parameter. You can work with tracking enabled in any combination of these parameters at the same time. For example, you can work with tracking enabled in both the Position and the Scaling parameters to control both the position of an effect on the X and Y axes and the size of the effect.
- The Tracking parameter category provides a more flexible way to define and use tracking data by allowing you to enable up to four trackers. The Tracking parameter is the only parameter that allows you to work with more than two trackers at one time and is therefore the only option for controlling complex motions that involve perspective changes or tilting of the effect.

  You can also use the Tracking parameter with only one or two trackers enabled to control simpler motions such as position and scaling. This is the only option for such control in effects that do not have Position, Scaling, and Rotation parameters, such as Intraframe effects. This is also an alternative method for controlling simpler motions in effects that do have Position, Scaling, and Rotation parameters.

It is important to understand that the two groups of parameters that use tracking data are mutually exclusive. When you enable the Tracking parameter, tracking is automatically disabled in the Position, Scaling, and Rotation parameters. When you enable tracking in the Position, Scaling, or Rotation parameters, the Tracking parameter is automatically disabled.

The following table provides a complete list of the effects and effect parameters that can use tracking data. For reference information on these effects and their parameters, see “Effects Reference” and “Effects Parameter Reference” in the Help.

Effect	Available Parameters
Picture-in-Picture (2D)	Position, Scaling
Paint AniMatte Blur Effect Mosaic Effect Scratch Removal Spot Color Correction (Symphony only)	Tracking
Stabilize	Position, Scaling, Tracking
Matte Key effect (applied from Key category in the Effect Palette)	Position, Scaling
Imported Matte Key clip (2D)	Position, Scaling
Titles (2D)	Position, Scaling
3D Warp (including promoted Picture-in-Picture effects, keys, 3D Xpress shape effects, and titles)	Position, Rotation, Scaling, Tracking

Understanding the Tracking Interface

The interface items that you use when tracking divide into three groups according to their locations:

- The Effect Editor

  For more information, see "Tracking Controls in the Effect Editor" on page 97.

- The Effect Preview monitor

  For more information, see "Tracking Controls in the Effect Preview Monitor" on page 97.

- The Tracking window

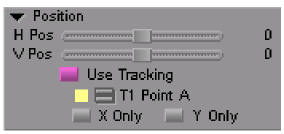
  For more information, see "Opening The Tracking Window" on page 98 and "Tracking Window Components" on page 98.

Tracking Controls in the Effect Editor

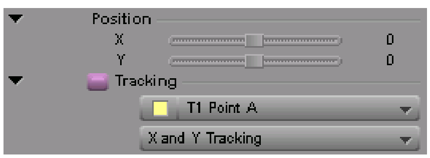
The Effect Editor includes tracking controls within those effect parameter categories that can use tracking information. These controls allow you to enable tracking for the parameter and to define which trackers apply to that parameter.

The appearance of tracking controls in the Effect Editor varies depending on whether or not the effect has been promoted to advanced keyframes.

The following illustration shows the tracking controls for the Position parameter category in both standard keyframes and advanced keyframes.



Tracker controls for Position parameter category — effect with standard keyframes



Tracker controls for Position parameter category — effect promoted to advanced keyframes

For more information, see:

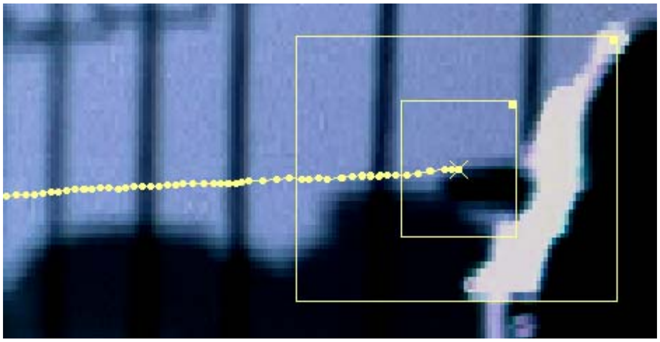
- “Effects and Effect Parameters That Use Tracking Data” on page 95
- “Enabling Tracking in the Effect Editor” on page 104
- “Creating and Mapping Trackers” on page 107

Tracking Controls in the Effect Preview Monitor

The Effect Preview monitor displays tracking controls that you can manipulate directly. The monitor displays the tracking boxes that you use to define the target area and the search area on the first frame or field of the region that you want to track. As tracking takes place, the monitor displays the generated data points for each frame or field. Once tracking data has been generated, you can display tracking data points in various ways and manipulate them in the monitor. For more information, see the following sections:

- “Setting Up Tracking in the Effect Preview Monitor” on page 109
- “Tracking Data in the Effect Preview Monitor” on page 118
- “Customizing Tracking Data Display” on page 120
- “Modifying Tracking Data” on page 124

The following illustration shows a typical display of tracking boxes and data points.



Opening The Tracking Window

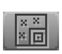
Many of the controls that you use to create, customize, and modify trackers are located in the Tracking window.

For more information on the features of the Tracking window, see "Tracking Window Components" on page 98.

To open the Tracking window, do one of the following in the Effect Editor:

- Enable tracking in an effect parameter for a tracker that is not currently mapped.

  For more information, see "Creating and Mapping Trackers" on page 107.



- Click the Tracking Tool button.

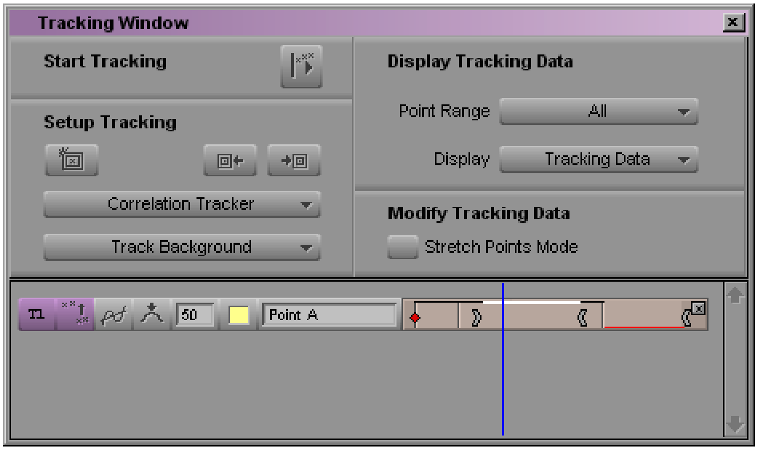
  You might need to resize the Effect Editor to see the Tracking Tool button in the column of buttons on the right side.

Tracking Window Components

The Tracking window has the following main features:

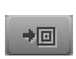
- An area containing controls for setting up and performing tracking, controlling the display of tracking data, and modifying tracking data
- A timeline representation of each tracker for the current effect

The following illustration shows the Tracking window.



The following table provides a brief description of each interface item in the window and indicates where to find more detailed information.

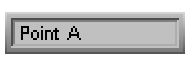
Tracking Window Components

Control		Description
Start Tracking		Starts a tracking operation from the current location of the position indicator. For more information, see “Generating Tracking Data” on page 114.
New Tracker		Creates a new tracker. For more information, see “Creating and Mapping Trackers” on page 107.
Go to Previous Region and Go to Next Region	 	Click one of these buttons to move to the previous or next region boundary in the tracker timelines. For more information, see “Moving to a Tracking Region” on page 117.
Tracking Engine		Allows you to choose between the two available tracking engines, Correlation Tracker and FluidTracker. For more information, see “Understanding Tracking Engines” on page 113.

Tracking Window Components (Continued)

Control		Description
Track Background/Foreground		Allows you to choose between tracking the background shot and tracking the foreground shot, In the great majority of cases, you will want to track the background shot. For more information, see “Setting Up Tracking in the Tracking Window” on page 112.
Point Range		Controls how many of the tracking data points appear in the Effect Preview monitor. For more information, see “Customizing Tracking Data Display” on page 120.
Display		Controls the display in the Effect Preview monitor, allowing you to view either the tracking data or the results of the effect. For more information, see “Customizing Tracking Data Display” on page 120.
Stretch Points Mode		Allows you to stretch data points. For more information, see “Stretching a Range of Tracker Data Points” on page 128.
Enable Tracker button (Tracker timeline displays)	 	When the Enable Tracker button is active for a tracker, tracking boxes and tracking data points display in the Effect Preview monitor. Also, when the Enable Tracker button is active for a tracker, the system generates tracking data for that tracker during a tracking operation. The button is purple when active and gray when inactive. For more information, see “Enabling, Disabling, and Deleting Trackers” on page 108.
Offset Tracking (Tracker timeline displays)		When this option is selected, the tracker uses offset tracking to calculate a continuous motion for the effect from multiple regions of tracking data. For more information, see “Offset Tracking” on page 115.

Tracking Window Components (Continued)

Control	Description
SteadyGlide (Tracker timeline displays) 	When this option is selected, the tracking data for the tracker is processed to remove unwanted jittery motion while preserving underlying smooth movement such as a camera pan or zoom. The value set in the Smoothing Value text box controls the extent of the processing. For more information, see "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124.
Smoothing (Tracker timeline displays) 	When this option is selected, the tracking data for the tracker is processed to smooth the path between selected points. The value set in the Smoothing Value text box controls the amount of smoothing applied. For more information, see "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124.
Smoothing Value (Tracker timeline displays) 	Enter a value in this text box between 1 and 100 to control the amount of smoothing performed by the SteadyGlide or Smoothing processes. The larger the value, the more smoothing is performed. For more information, see "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124.
Tracker Color box (Tracker timeline displays; also visible in the Effect Editor) 	Shows the color the system uses to display information for this tracker in the Effect Preview monitor and allows you to change the tracker's display color. For more information, see "Customizing Tracking Data Display" on page 120.
Tracker Name text box (Tracker timeline displays; also visible in the Effect Editor) 	Shows the name of the tracker and allows you to change the name of the tracker. For more information, see "Creating and Mapping Trackers" on page 107.

Tracking Window Components (Continued)

Control		Description
Tracker timeline (Tracker timeline displays)		Shows information about the tracking data in the tracker. Color coding indicates the status of the data. For more information, see “Setting Up Tracking in the Effect Preview Monitor” on page 109 and “Tracking Data in the Tracker Timelines” on page 118.
Tracker Close button (Tracker timeline displays)		Closes the tracker and permanently deletes any information within it. For more information, see “Enabling, Disabling, and Deleting Trackers” on page 108.

Setting Up an Effect for Tracking

The first stage of the motion tracking workflow is to set up the effect to which you want to apply tracking data. To do this, you need to edit the necessary footage into a sequence and apply the effect. In most cases, you will also want to make initial parameter adjustments to the effect.

Understanding Video Layers and Motion Tracking

Since motion tracking either controls the movement of an effect in relation to a moving area in a clip or controls the stabilization of a clip, you need one of the following situations for motion tracking to be useful:

- Two (or more) layers in the Timeline, where one contains the video you intend to track and another contains the material to which you will apply the effect (that material might be video, an imported graphic, or a title clip).
- A single video layer on which you draw one or more Intraframe objects. When you track movement in the video, you can use that tracking data to control the movement of the Intraframe objects.
- For stabilizing only, a single video layer that you intend to stabilize.

In most circumstances when you are working with two video layers, the material you intend to track forms the background layer and the effect is on the foreground layer. However, the system can track either the foreground or the background layer, so you can place the material you want to track on top of the material that receives the effect if necessary.

Applying an Effect for Motion Tracking

You apply an effect for motion tracking in the same way that you apply any effect that either operates on a multilayer sequence or allows you to draw a foreground object on top of a video layer. For more information, see “Applying Effects” in the Help.

Making Non-Tracking Parameter Adjustments to an Effect

The final look of an effect that uses tracking is almost always the result of combining the tracking data with standard effect parameter adjustments. You will usually need to define the appearance of the effect in the first frame or field of the segment; you might also need keyframe adjustments at other points in the segment.

In most cases, you can choose whether to make these adjustments before or after you generate the tracking data itself. As long as the standard adjustments as well as the tracking data are in place when you play the effect, you see the final result of all the adjustment data.

For example, if you are replacing a sign on a moving vehicle, you need to use standard effect parameter adjustments to set the initial size, shape, and position of the sign. Depending on the complexity of the material, you might make these adjustments using basic parameters such as Position and Scaling, or you might need to place each corner independently using the Corner Pin parameter.

If you want the effect to be offset from the moving area that you plan to track, you can establish that offset by adjusting the Position parameters. The final motion of the effect maintains that offset from the tracking data points as it moves. If you want the size of the effect to change in a manner that is not dependent on changes in the moving area, you can set up that change in size by using keyframes and the Scaling parameters.

When you are working with Intraframe effects, you must draw the foreground object that you want to control with tracking information and select it with the Selection tool before you can generate tracking data. As with other effects, however, you can establish the precise size, shape, and position of the object either before or after generating tracking data.

You can choose which frame in a tracked segment is the reference frame — the frame at which the tracking data makes no change to the look of the effect. For more information, see “Setting the Reference Frame for a Tracker” on page 121.

Preparing to Generate Tracking Data

There are several procedures that you need to follow before you can generate tracking data. These procedures control how the system operates as it creates the tracking data.

Enabling Tracking in the Effect Editor

The first step in creating tracking data is to enable tracking for an effect parameter in the Effect Editor. Once you do this, other tracking controls become available.

The basic procedure for enabling tracking in an effect parameter is simple, but there are slight variations depending on:

- The parameter type
- Whether the effect you are working with is 2D or 3D
- Whether the effect you are working with is using standard keyframes or advanced keyframes

For Intraframe effects, trackers can be enabled only when an Intraframe object is selected.

To enable tracking for an effect parameter:

▶ Perform the appropriate steps for your effect type and effect parameter, as described in “Options for Enabling Tracking in the Effect Editor” on page 105.

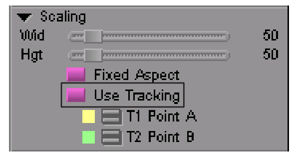
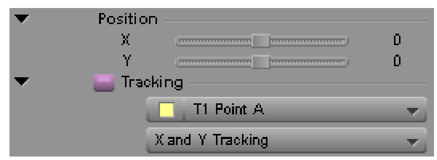
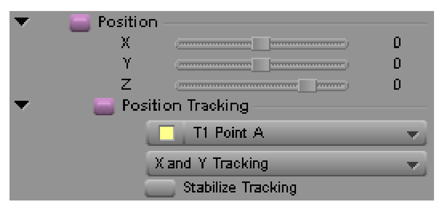
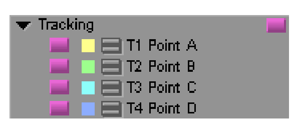
Once you have enabled tracking for a parameter, the Tracking window opens. For more information on the Tracking window, see “Tracking Window Components” on page 98.

When you first enable tracking for a parameter, the system creates appropriate default trackers and maps them to the parameter, as described in the table. For more information, see “Creating and Mapping Trackers” on page 107.

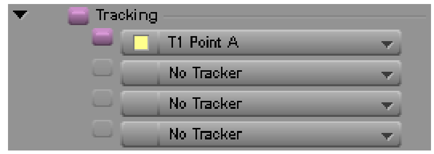
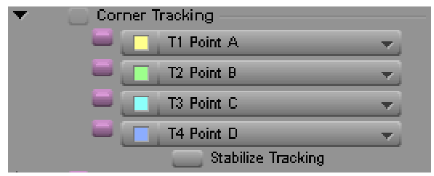
Options for Enabling Tracking in the Effect Editor

The following table describes the available methods for enabling tracking in the Effect Editor.

Options for Enabling Tracking in the Effect Editor

Parameter and Keyframe Type	Procedure and Result	Illustration
Position, Rotation, or Scaling in any effects using standard keyframes	• Click the Use Tracking button. The application creates an appropriate number of trackers (one for Position, two for Rotation or Scaling) and maps them to the parameter.	
Position or Scaling in 2D effects using advanced keyframes	• Open the Position or Scaling category, then click the enable button for the Tracking subcategory. The application creates an appropriate number of trackers (one for Position, two for Scaling) and maps them to the parameter. You must open the Tracking subcategory to see the list of mapped trackers and any additional controls.	
Position, Rotation, or Scaling in 3D Warp effects using advanced keyframes	• Open the Position, Rotation, or Scaling category, and then click the enable button for the Position Tracking, Rotation Tracking, or Scale Tracking subcategory. The application creates an appropriate number of trackers (one for Position, two for Rotation or Scaling) and maps them to the parameter. You must open the Position Tracking, Rotation Tracking, or Scale Tracking subcategory to see the list of mapped trackers and any additional controls.	
Tracking in any effect using standard keyframes	• Click one or more of the individual tracker enable buttons. The application creates and maps a tracker for each tracker enable button you click, and also enables the Tracking parameter category.	

Options for Enabling Tracking in the Effect Editor (Continued)

Parameter and Keyframe Type	Procedure and Result	Illustration
Tracking in 2D effects using advanced keyframes	• Open the Tracking parameter category, and then click one or more of the individual tracker enable buttons. The application creates and maps a tracker for each tracker enable button you click, and also enables the Tracking category.	
Tracking in 3D Warp effects using advanced keyframes	• Open the Corner Tracking parameter category, and then click one or more of the individual tracker enable buttons. The application creates and maps a tracker for each tracker enable button you click, and also enables the Corner Tracking category.	

Understanding Tracker Selectors and Tracker Function

Each parameter includes a number of tracker selectors appropriate to its function in controlling movement. When you enable tracking in a parameter, the application looks for existing trackers and maps them to the parameter’s tracker selectors. If trackers do not yet exist, the system creates them and then maps them to the parameter’s tracker selectors. In the Tracking parameter category, new trackers are created and mapped as you enable individual tracker selectors.

When you are working in the Position, Scaling, and Rotation parameters, the number of trackers you can use is limited by the type of movement controlled by the parameter. For example, the Position parameter includes a single tracker selector since only one point is required to define movement in X and Y.

When you are working in the Tracking parameter, you can use any number of trackers up to a total of four. The following table describes the kinds of motion that you can control with a given number of trackers.

Number of Trackers	Description
One	Allows control of position on the X and Y axes only. Use one tracker if you want your effect to move in only two dimensions on the plane of the screen.
Two	Allows control of position, scaling, and rotation. Use two trackers if you want your effect to change size or rotate.
Three	Allows control of position, scaling, rotation, and skew. Skew refers to a transformation that tilts or squashes an object along one axis while retaining its orientation along the other axis. This has the effect, for example, of transforming a rectangle into a parallelogram. Use three trackers if you want your effect to skew in this manner.
Four	Allows control of position, scaling, rotation, skew, and perspective. Perspective refers to the way parallel lines appear to converge and changes depending on the angle from which an object is viewed. Use four trackers if you want to control perspective for your effect.

Creating and Mapping Trackers

Your Avid editing application performs initial tracker creation and mapping automatically when you first enable tracking for an effect parameter.

For most tracking work, there is no need to create additional trackers beyond those that are created automatically by the system. Accepting the defaults and creating your tracking information with them is quicker and more straightforward.

In some situations, however, you might want to create extra trackers. For example, you might want to track more than the minimum number of points necessary for a parameter so that you can experiment with different combinations of tracking points. You also might want to change the mapping of trackers so that an effect parameter uses a different tracker or combination of trackers from that originally created by the application. For more information about the uses of different tracker combinations, see "Understanding Tracker Selectors and Tracker Function" on page 106.

The system allows up to eight trackers for each effect.

To create a new tracker manually:

1. In the Tracking window, click the New Tracker button.

   For more information, see "Opening The Tracking Window" on page 98.

   A new tracker timeline display appears in the bottom area of the Tracking window. The system names the tracker using the next letter of the alphabet that is not already in use, up to the letter D. If all of the letters A through D are in use, subsequent new trackers are named "Untitled Tracker."

2. (Option) If you want to rename the new tracker, click the Tracker Name text box, and type a new name.

   The new tracker appears as an option in all the tracker selector Fast menus in the Effect Editor.

To map a tracker manually, do one of the following, depending on the interface style in the Effect Editor:

- Click the Fast Menu button for the appropriate tracker selector in the parameter, and then select the tracker you want.
- Click the tracker selector in the parameter, and then select the tracker you want.

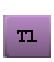
Enabling, Disabling, and Deleting Trackers

Once you have created a tracker, you can enable and disable it as necessary. Enabling and disabling a tracker has a different effect depending on whether you do it in the Tracking window or in the Effect Editor.

- When you enable or disable a tracker in the Tracking window, you control whether or not the tracker displays in the Effect Preview monitor and whether or not your application generates tracking data for that tracker.
- When you enable or disable a tracker in the Effect Editor, you control which sets of tracking data your application uses to control the effect. This allows you to compare the look of an effect under the control of different tracker combinations.

You can also delete existing trackers. When you do so, you permanently erase that tracker and any tracking data associated with it.

To enable or disable a tracker in the Tracking window:



- Click the Enable Tracker button for the tracker in the tracker's timeline.

To enable or disable all trackers at once:

- Alt+click (Windows) or Option+click (Macintosh) the Enable Tracker button for any tracker.

To enable or disable a tracker in the Effect Editor:

- Click the Enable button for the appropriate tracker selector.

In the Tracking (or Corner Tracking) parameter category, clicking the Enable button that controls the whole parameter disables all the trackers at the same time but does not change the enable status or the mappings of the individual trackers. When you click the Enable button for the whole parameter again, the system reenables all the individual trackers.

To delete a tracker:

- In the Tracking window, click the Close button in the top right corner of the tracker's timeline.

Setting Up Tracking in the Effect Preview Monitor

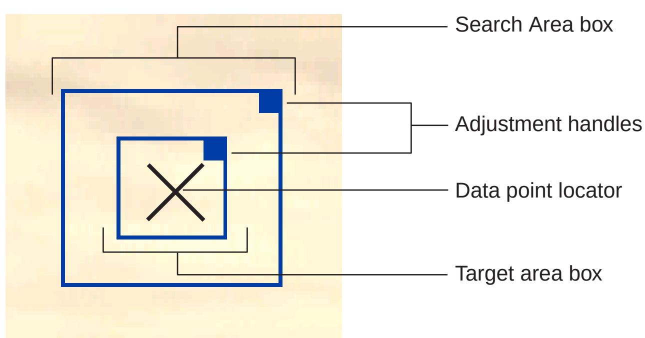
You define the region of interest (the area of an image that each tracker tracks) and the larger area it searches within by making direct adjustments to the tracking box display in the Effect Preview monitor.

Each tracking box display includes three elements:

- An inner rectangle used to define the target area
- An outer rectangle used to define the search area
- A data point locator, which appears at the center of the rectangles

Each rectangle has a corner adjustment handle.

The following illustration shows the tracking box display.



You can change the color of the tracking boxes display for a tracker. This might make it easier to see the display against the background image. For more information, see *"Customizing Tracking Data Display" on page 120.*

To display tracking boxes in the Effect Preview monitor:

1. If you have not already done so, enable, create, and map the trackers with which you want to work.
2. In the Display Tracking Data area of the Tracking window, make sure that Tracking Data is selected in the Display menu.
3. 

Make sure that the Enable Tracker button is active (purple) in the tracker timeline display of the Tracking window for each tracker that you want to display.
4. Make sure that you are monitoring the track in the Timeline that contains the material you want to track.
5. Move the position indicator to the first frame or field of the segment, or to the first frame or field of the tracker region.

   A tracking box display appears in the Effect Preview monitor for each tracker. For more information on tracking regions, see "Performing Offset Tracking" on page 117.

To move a tracking box display in the monitor:

▶ Click anywhere within the boxes except the adjustment handles, and drag the boxes to a new position.

To resize a box in a tracking box display:

▶ Drag the adjustment handle for the box.

For more information on what to consider when making these adjustments, see "Guidelines for Positioning Tracking Boxes" on page 110.

If you have multiple trackers enabled, you might find it difficult to select one. You can disable some of the trackers temporarily in the Tracking window to simplify the display in the Effect Preview monitor and make it easier to select and manipulate a particular tracker.

Guidelines for Positioning Tracking Boxes

When you position tracking boxes, consider the following factors:

- Locating the boxes over material that the system can track successfully
- Locating the boxes so that the tracking data you generate accurately represents the movement you want to track

The system tracks most successfully on an area of the image that is easily distinguishable from the parts of the image that surround it. For example, a bright dot tracks extremely well if it is generally surrounded by darker material. You will often need to scrub through the entire clip to get a sense of which areas are good candidates for tracking.

To represent the movement you want to track accurately, you need to consider the geometry of the motion that you want to achieve. For complex movement such as controlling a replacement sign for a bus that is receding into the distance as well as moving across the screen, you need to track enough points to represent the change in shape and size of the sign over time. Tracking two corners allows you to control changes in scale and rotation (the corners should be diagonally opposite if scaling on the X axis differs from scaling on the Y axis). Adding third and fourth trackers fills in the other two corners as needed for more complex transformations.

Remember that you do not have to track points at the exact location where you want the finished effect to appear. You can track any set of points that represent the right movement. For example, you might want to add a small sign to the door of a moving car. Since the door panel is a uniform surface you cannot track areas on it. However, you can gather tracking data to control the positioning and scaling you need for the sign, for example by tracking two or more of the corners of the car's window.

Guidelines for Resizing Tracking Boxes

When you make adjustments to resize either of the tracking boxes, you should consider the following factors:

- Defining material that the system can track successfully
- Ensuring that tracking proceeds successfully from frame to frame or from field to field throughout the range of frames or fields you are tracking
- Minimizing the length of time the system spends generating tracking data

In general, the smaller you can make the boxes, the less image information the tracking engine has to search and the faster it can work. However, if you set the boxes too small, you increase the possibility that the system will lose the search pattern between one frame or field and the next.

You can also refine how the system follows a target area by setting controls in the Tracking window. For more information, see *"Setting Up Tracking in the Tracking Window" on page 112**.*

Size the Target Area box so that it is as small as possible while still enclosing a distinct area to track. Remember that the pattern needs to remain distinct throughout the range you are tracking.

Size the Search Area box so that it is as small as possible while remaining large enough to encompass the movement of the target area from one frame or field to the next. You will probably need to scrub through the clip you are tracking to check how much a prospective target area moves from one frame or field to another.

Setting Up Tracking in the Tracking Window

In addition to defining the search criteria for a tracker in the Effect Preview monitor, you can also set up the following aspects of tracking behavior in the Tracking window.

- Choose which tracking engine to use

  For more information on available tracking engines, see "Understanding Tracking Engines" on page 113.

- Choose whether the region to track is in the background or the foreground clip.

  You can choose to track either the background or foreground for a multilayer effect. In the great majority of situations you will want to track the background to define the movement of an effect or painted object layered above the background shot.

  One situation in which you need to choose Track Foreground is when you are stabilizing an image using a 3D Warp effect promoted to advanced keyframes. For more information, see "Stabilizing an Image" on page 132.

The following illustration shows the area of the Tracking window that contains these controls.

To switch the tracking engine:

▸ In the Setup Tracking area of the Tracking window, select the tracking engine you want to use from the Tracking Engine menu.

To switch between background and foreground tracking:

▸ In the Setup Tracking area of the Tracking window, select the option you want to use from the Track Background/Foreground menu.

Understanding Tracking Engines

The term *tracking engine* refers to the calculation methods that your application uses to recognize a moving pattern and generate data for it. Your Avid editing application lets you choose between two tracking engines:

- Correlation Tracker

  This is the same tracking engine that is used in Avid DS Nitris systems.

- FluidTracker

  This tracking engine uses the same motion analysis methods used in FluidMotion Timewarp.

In most cases, both tracking engines produce accurate tracking data when the target area is distinctive. The difference between the two trackers is primarily one of speed. In general, the Correlation Tracker generates tracking data faster than the FluidTracker when the area being searched is small. If you need to search a larger area, you might find that the Correlation Tracker becomes too slow to be useful, in which case you should switch to the FluidTracker.

In the following two specific situations, FluidTracker usually produces more accurate data than the Correlation Tracker:

- When the points you want to track start outside the visible area of the frame
- When you are using four trackers to control the corner-pinning of an image

Understanding How to Generate Tracking Data

When you have made all the preparations necessary to set up the tracking operation, you can generate tracking data.

You can generate tracking data for any number of the available trackers in a single operation.

You can generate tracking data for the entire length of the segment, or for any part of the segment starting from the location of the position indicator. This allows you to stop tracking at any point in the segment and resume later, or to retrack over any part of the segment whenever you need to do so.

You can also create separate tracking regions for different parts of your segment, and define a different target area for each region. This is primarily useful for performing offset tracking. Once you have created a region, you can move the position indicator to the start of that region and generate tracking data for the region. For more information, see “Offset Tracking” on page 115.

As the system generates tracking data, it updates the tracker timeline displays to show the status of tracking data over time. For more information on the tracker timeline display, see "Understanding Generated Tracking Data" on page 118.

Generating Tracking Data

To generate tracking data:

1. In the Tracking window, click the Enable Tracker button for each tracker you want the system to track.

Alt+click (Windows) or Option+click (Macintosh) the Enable Tracker button for any tracker to enable all trackers at once.

2. Move the position indicator to the location where you want to start generating tracking data.

   This location can be at any point in the segment, but in most cases, the position indicator will be either:

   - At the beginning of the segment.
   - At the beginning of a region.
   - At the location where you stopped generating tracking data and from where you want to resume tracking.

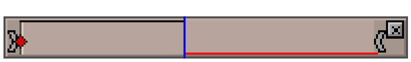
   For information about moving to the beginning of a tracking region, see "Moving to a Tracking Region" on page 117.

3. Click the Tracking button.

   The system begins to generate tracking data.

   As the tracking operation proceeds:

   - The Effect Preview monitor displays each frame or field on which tracking is being performed, and shows the tracking data point for that frame or field as a cross.
   - The application updates the timeline for each tracker to indicate the status of the tracking data over time. If you are tracking where there is no existing tracking data, the application replaces the red bar at the bottom of the line with a black bar at the top as data is generated, as shown in the following illustration. If you are retracking where tracking data already exists, you see no change in the tracker timeline, but the old tracking data is being replaced with new data.



When you start tracking from the beginning of a tracking region, your Avid editing application steps back one frame from the region boundary before it starts tracking. This is normal behavior to ensure that motion at the region boundary is tracked correctly.

To stop a tracking operation, do one of the following:

- Press the space bar.
- Press Ctrl+period (Windows) or Command+period (Macintosh).
- Click any element of the application's interface.

  The tracking operation stops.

Offset Tracking

You can use your application's offset tracking capabilities to create smooth effect motion from tracking data that you generate using more than one target area. This lets you track motion successfully when a single target area is not available for the full duration of a segment.

Understanding Offset Tracking

The simplest case for motion tracking is when you can track a single distinct area for the full length of a segment. For example, if a bus is moving through the scene and the entire side of the bus is visible throughout the segment, you can select any area or set of areas on the side of the bus and track them throughout the segment.

Other situations might be more complex. For example, if a bus is moving slowly through the scene but is also relatively close to the camera, you might find that an area you choose to track at the beginning of the segment is no longer visible later in the segment because it has moved out of the frame. Or perhaps you have a shot where a bus moves through a scene but passes behind a foreground sign, again with the result that an area you choose to track at the beginning becomes unavailable later in the segment.

In these situations, you can generate useful tracking data by using offset tracking. Offset tracking lets you track one target area until it becomes unavailable because it leaves the frame or is hidden by another object, then track another target area that shows the same kind of motion as the first. Your application calculates the offset from the first set of tracking points to the second, and takes account of this offset when animating the final effect. The result is an effect that follows a continuous path.

If necessary, you can track more than just two targets. You can also track one target, switch to a second (for example, when the first becomes temporarily hidden), and then return to the first when it becomes visible again.

To track more than one target area in a segment, you add a new tracker region to a tracker timeline. You can then set a new target area in the first frame or field of the new region and track that target area.

Adding and Deleting Tracker Regions

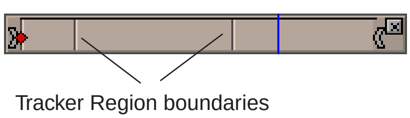
If you have a situation where you cannot track a single target area successfully for the whole length of a clip, you can add one or more new tracker regions to the tracker timeline and track a new target area for each of the regions.

In most cases, you use tracker regions in combination with the offset tracking feature, so that your finished effect combines the tracking data from more than one target area into one continuous motion. For more information on the concept of offset tracking, see "Understanding Offset Tracking" on page 115.

To add a new tracker region for a tracker:

1. In the tracker's timeline, move the position indicator to the location where you want the new region to start.
2. Right click in the tracker's timeline, and select Add New Tracker Region.

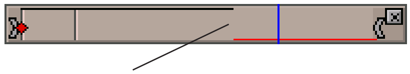
   Your application creates a new region that extends from the location of the position indicator to either the start of the next tracker region or the end of the timeline. The start of the new region appears as a vertical bar in the tracker timeline.



To delete a tracker region for a tracker:

1. In the tracker's timeline, move the position indicator to any location within the region.
2. Right-click in the tracker's timeline, and select Delete Tracker Region.

   Your application deletes the tracker region. The region's vertical boundary bar disappears from the timeline, and any tracking data for the region is deleted. A red bar appears at the bottom of the tracker's timeline for the duration of the old region, indicating that you need to retrack these frames to get new tracking data, as shown in the following illustration.

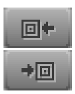


Location of start of deleted tracker region boundary. Previous tracking data has been deleted from this point to the end of the deleted region, as indicated by the red bar.

Moving to a Tracking Region

When you have multiple tracking regions in the tracker timelines, you can move between them by using the Go to Previous Region and Go to Next Region buttons.

To go to the beginning of the previous or next tracking region:



- Click the Go to Previous Region or Go to Next Region button.

Performing Offset Tracking

To perform offset tracking:

1. Make sure that offset tracking is enabled for each tracker you plan to use.

   Offset tracking is enabled by default, and the Offset Tracking button is purple when offset tracking is enabled.

2. In the first frame or field of your segment, set up a tracker for your first target area, as described in “Preparing to Generate Tracking Data” on page 104.

3. Begin generating tracking data, as described in “Generating Tracking Data” on page 114.

4. When the target area disappears, stop tracking by pressing the space bar.

5. (Option) If necessary, step back a few frames or fields in the segment until the position indicator is on the last frame or field with a good tracking data point.

6. Right-click in the tracker timeline and select Add New Tracker Region.

   A vertical bar appears in the tracker timeline to show the beginning of the new region, and the tracking boxes for the tracker appear in the Effect Preview monitor.

7. Drag the tracking boxes to the location of your second target area and size them as necessary.

8. Begin tracking from the start of the new region by clicking the Tracking button.

When you start tracking from the beginning of a tracking region, your Avid editing application steps backward one frame from the region boundary before it starts tracking. This is normal behavior to ensure that motion at the region boundary is tracked correctly.

9. (Option) If necessary, repeat steps 3 through 7 for additional target areas (or to return to tracking the original target area when it becomes visible again).

Understanding Generated Tracking Data

Once the system has completed generating tracking data, a set of tracking data points exists for each tracker enabled during the tracking operation. You can display these points in the Effect Preview monitor. You can also view information about the status of the tracking data in the tracker timeline display.

Tracking Data in the Effect Preview Monitor

Tracking data points display in the Effect Preview monitor.

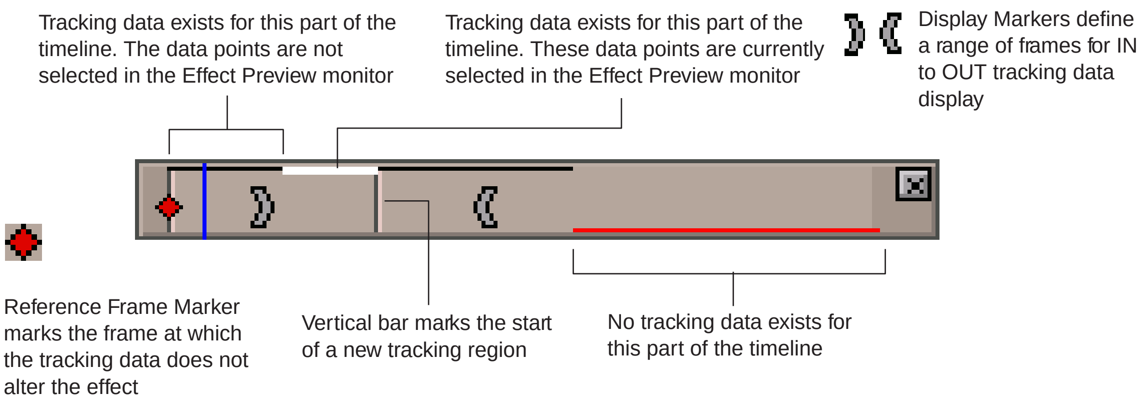
While tracking is taking place, your application shows the location of the current tracking data point as a cross.

Once tracking has stopped, your application displays, by default, every point created during the tracking operation. The data point for the current frame or field displays as a flashing cross; all other data points display as solid dots.

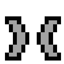
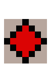
You can control which sets of data points display and how many of the points display. You can also manipulate the points directly in the monitor in a variety of ways. For more information, see "Modifying Tracking Data" on page 124.

Tracking Data in the Tracker Timelines

The tracker timeline display shows you the status of tracking data over the length of the effect.



The following table describes the display options.

Color	Description
Black Line at top of timeline	Tracking data exists for this part of the segment, and the data points for this part of the segment are not currently selected in the Effect Preview monitor. For more information, see “Generating Tracking Data” on page 114.
White Line at top of timeline	Tracking data exists for this part of the segment, and the data points for this part of the segment are currently selected in the Effect Preview monitor. For more information, see “Selecting Tracker Data Points” on page 125.
Red Line at bottom of timeline	Tracking data does not exist for this part of the segment.
Vertical Bar	Marks the start of a new tracking region. For more information, see “Offset Tracking” on page 115.
Display Markers 	Define the beginning and end of a range of frames. When In to Out is selected in the Point Range menu, the Effect Preview monitor only shows tracking data points for this range of frames. For more information, see “Customizing Tracking Data Display” on page 120.
Reference Frame Marker 	Marks the location of the reference frame — the frame at which the tracking data does not modify the effect. For more information, see “Setting the Reference Frame for a Tracker” on page 121.

Customizing Tracking Data Display

You can customize how your application displays tracking data in the following ways:

- You can enable or disable display for each tracker
- You can customize the color used to display each tracker
- You can control how many of the tracking data points display
- You can control whether the Effect Preview monitor shows tracking data or shows the results of applying the tracking data to the effect

To turn the tracking display on or off for a tracker:

▸ In the Tracking window, click the Enable Tracker button for the appropriate tracker.

The Enable Tracker button is purple when the display is on.

Alt+click (Windows) or Option+click (Macintosh) the Tracking Box Display button for any tracker to turn the display on or off for all trackers at once.

To customize the display color for a tracker:

▸ Click the Tracker Color box, and then on the Color palette click the color you want to use.

To define the range of data points in the display:

1. (Option) If you want to define a range of frames for which you want data points to display, do one of the following:

   ▸ Drag the Display Markers in any one of the tracker timelines to define the beginning and end of the range you want.

   ▸ Use the position indicator in the tracker timelines along with the Mark IN and Mark OUT buttons to define the beginning and end of the range you want.

   The Display Markers move to the beginning and end points you establish.

2. In the Display Tracking Data area of the Tracking window, click the Point Range menu, and then select an option.

Option	Description
Current	Displays the data point at the current location of the position indicator for each enabled tracker.
In to Out	Displays the data points for the range currently defined by the Display Markers in the Tracking window for each enabled tracker. Shows the points for the current frame or field as flashing crosses.
All	Displays every data point for each enabled tracker. This is the default option. Shows the points for the current frame or field as flashing crosses.

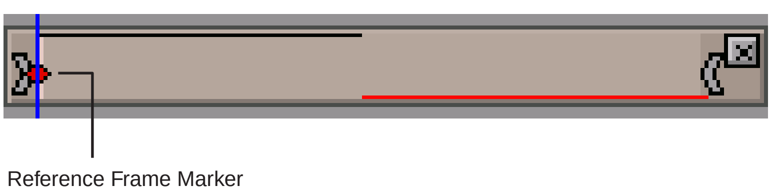
To choose Tracking Data or Effect Results display:

- In the Display Tracking Data area of the Tracking window, select the option you want to use from the Display menu.

The Display menu affects what you see in the Effect Preview monitor once tracking data is available and while you are parked on a frame or are stepping through the effect. The Display menu does not affect what you see in the Effect Preview monitor while tracking is taking place (when you always see the current data point represented as a cross). Also, when you play an effect with tracking data, for example by clicking the Play button in the Effect Preview monitor, you always see the results of the effect.

Setting the Reference Frame for a Tracker

The reference frame for a tracked segment is the frame at which the tracking data makes no change to the appearance of the effect. For example, for a Stabilize effect, the reference frame is the frame at which the tracking data causes no change in the position of the image. The location of the reference frame is marked on the tracker timeline by a red diamond.



By default, your Avid editing application considers the first frame of a tracked segment to be the reference frame. In every frame after the first, the effect is modified by the tracking data for that frame.

You can choose to set the reference frame to any other frame in the segment. This can be useful when trimming changes the location of the head frame for the segment, or in other circumstances where the position of the reference frame influences the final look of the effect. For example, if you set the reference frame for a Stabilize effect to the frame at the midpoint of the segment, the tracking data at that frame causes no change in the position of the image. In all earlier and all later frames, the effect is modified by the tracking data for that frame.

To set the reference frame for a tracker:

1. In the tracker timeline, move the position indicator to the frame you want to set as the reference frame.
2. Right-click the tracker timeline, and select Set Reference Frame.

   The red diamond reference frame marker moves to the location of the position indicator.

Understanding the SteadyGlide and Smoothing Options for Tracking

Your Avid editing application provides two options for processing the tracking data in a tracker to smooth the motion it represents. You can turn these options on or off at any time, and you can control the extent of the processing they perform by setting a smoothing value. The original set of tracking data points is not changed in any way by the processing. For information on using these options, see "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124.

SteadyGlide™

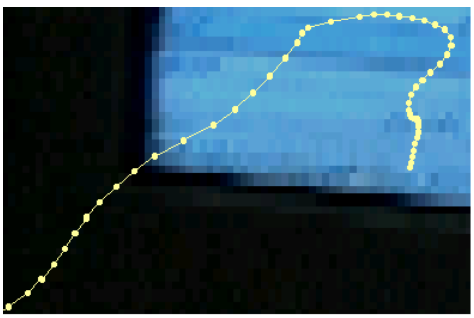
SteadyGlide processes tracking data to reduce abrupt, jittery movements without affecting underlying motion. SteadyGlide is particularly useful as a tool for stabilizing unwanted camera motion without eliminating desirable motion. You typically use SteadyGlide with the Stabilize effect, or with Stabilize Tracking turned on for an effect parameter in the 3D Warp effect. For example, you can use SteadyGlide to reduce any jittery motion in a pan shot with a hand-held camera while retaining the underlying motion of the pan itself. For more information on stabilizing, see "Stabilizing an Image" on page 132.

When you are using SteadyGlide, the display shows a graph of the jittery motions that your application is removing. It is not easy to assess the final look of the effect from this information, so you should view the effect results to determine whether you need to adjust the smoothing value further.

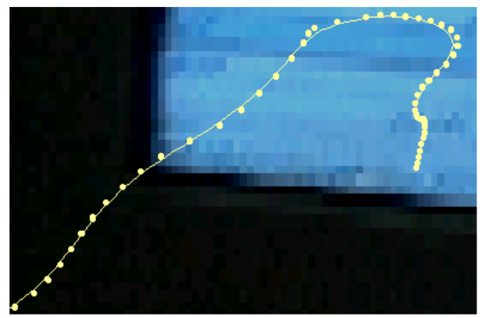
Smoothing

Smoothing processes tracking data to smooth out the path between the tracking data points. The higher the Smoothing value you define, the smoother the path becomes. You typically use Smoothing when compositing an image or a paint object over a tracked region of a moving background, for example, when the motion of the tracked region is not completely smooth but you want the motion of the image or paint object to be smooth.

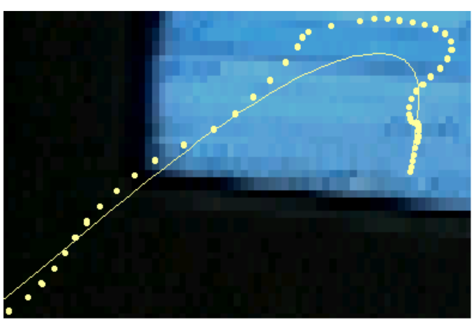
When you are using Smoothing, the display shows the smoothed curve that results from the processing, which gives a useful visual indication of the amount of smoothing your application is applying. The following illustrations show typical results for Smoothing using different smoothing values.



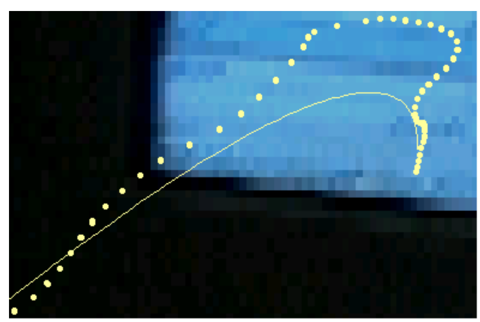
Tracking points before smoothing



Smoothing with Smoothing Value = 10



Smoothing with Smoothing Value = 50



Smoothing with Smoothing Value = 90

Using SteadyGlide or Smoothing to Process Tracking Data

To use SteadyGlide or Smoothing:

1. In the tracker timeline, click the SteadyGlide button or the Smoothing button.

   The button is purple when the processing option is turned on.

SteadyGlide and Smoothing are mutually exclusive processing operations. You cannot perform both SteadyGlide and Smoothing at the same time, and if you turn on one, the other will automatically be turned off if it was on previously.

2. In the Smoothing Value text box, type a smoothing value between 1 and 100.

   The smoothing value controls the extent of the smoothing performed by both the SteadyGlide and the Smoothing options. The larger the value, the more smoothing is performed.

   If you are displaying tracking data in the Effect Preview monitor, the display updates to show the results from the processing.

3. (Option) If necessary, check the effect results and adjust the smoothing value until you are satisfied with the results, or click the SteadyGlide or Smoothing button again to turn off the processing if you decide you do not want it.

Modifying Tracking Data

You can manipulate tracking data points in the Effect Preview monitor in a variety of ways. You can select individual data points or ranges of data points. You can delete points, move one or more points, and stretch a range of points. If necessary, you can move points outside the limits of the frame to extend the movement of an effect smoothly out of the frame.

Unlike the processing performed by SteadyGlide and Smoothing, these kinds of adjustments change the tracking data itself. They are reversible only by using your application's Undo feature, or by retracking to generate a new set of tracking data points.

Depending on the speed of the motion you have tracked, your tracking data points might be very close together at normal magnification and therefore hard to distinguish from one another. You can use your Avid editing application's standard methods for zooming and panning in the Effect Preview monitor to zoom in on your tracking data and view it more clearly. For more information, see "Using the Effect Preview Monitor" in the Help.

Finding a Specific Tracker Data Point

Whenever multiple data points are displaying for a tracker (when In to Out or All is selected in the Point Range menu), the data point for the current frame or field displays as a flashing cross in the Effect Preview monitor. This makes it easy to see the current data point even when a set of points are very close together.

To find a specific data point:

- Move the position indicator to the frame or field for which you want to find the data point.

  The data point for that frame or field flashes in the Effect Preview monitor.

  To isolate the point further, you can select Current in the Point Range menu in the Tracking window, so that the point for the current frame or field is the only point that appears in the Effect Preview monitor.

Selecting Tracker Data Points

To select a single data point:

- Click the point in the Effect Preview monitor.

  The point is highlighted with a circle in the monitor, and the corresponding part of the tracker timeline display changes to white.

To select a single data point and move to the frame or field for that point:

- Double-click the point in the Effect Preview monitor.

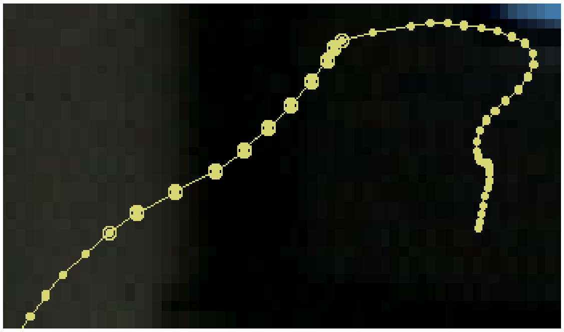
  The point is highlighted with a circle in the monitor and with a flashing cross, the corresponding part of the tracker timeline display changes to white, and the system automatically moves to the frame or field for that point.

To select a contiguous range of data points, do one of the following:

- Click the first data point in the range you want to select, and then Shift+click the last data point in the range you want to select.
- Drag the pointer across the range of data points that you want to select to lasso them.

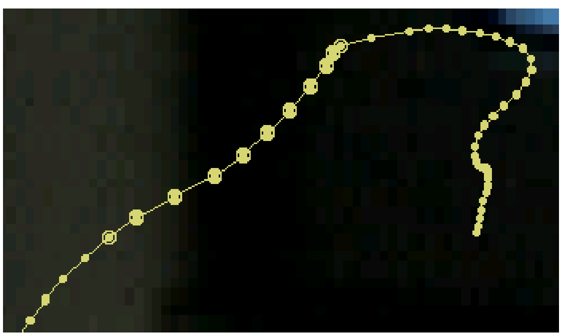
  The points in the range are highlighted with a circle and the corresponding part of the tracker timeline display changes to white.

  The following illustration shows a range of selected data points.

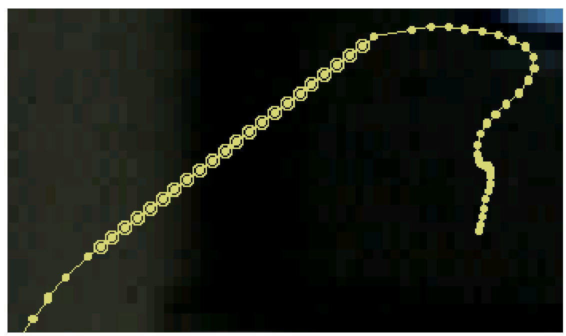


Deleting Tracking Data From Points

You can delete the tracking data generated by the tracking engine for a single data point or for a range of data points. When you do this, your application repositions the selected point or points onto a straight line between the two unselected points that bound your selection. The data points remain fully functional. They display in the Effect Preview monitor at their newly calculated locations, and they remain available for you to modify further.



Selected points before deleting



Result of deleting — points are repositioned in a straight line between the unselected bounding points

To delete one or more selected data points:

- Press the Delete key.

  The system repositions the selected data points along a straight line between the two unselected points that bound the selected points.

Moving Tracker Data Points

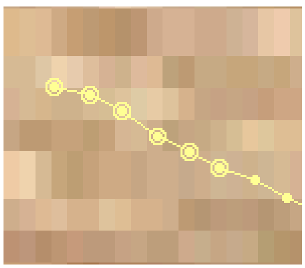
To move a single selected data point:

▶ Drag the point to a new location.

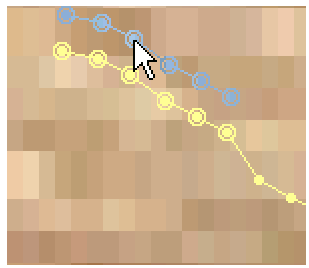
To move a range of selected data points:

▶ Drag any one of the points in the range to a new location.

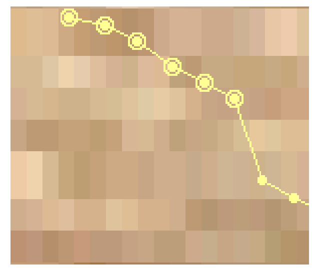
All the selected data points move along with the one you drag and maintain their positions relative to one another, as shown in the following illustrations.



Selected range of data points before move.



Selected range of data points during move. The points move as a group and maintain their positions with respect to one another.



Selected range of data points after move.

Moving Tracker Data Points Outside the Frame Boundary

If you track a target area that moves out of the frame, the tracking engine can no longer track the target area and generates invalid data points. You have two options to ensure consistent motion if you want your effect to move smoothly out of the frame.

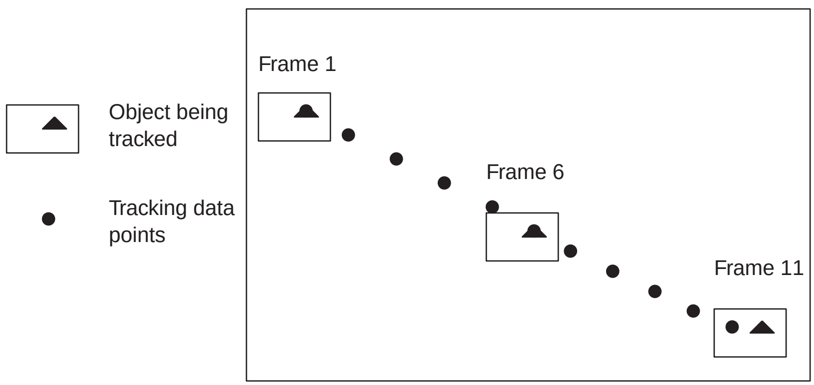
- You can use offset tracking to track a second target area that does not leave the frame until the end of the segment. For more information, see "Offset Tracking" on page 115.
- You can move the very last data point outside the boundary of the frame so that it extends the line of motion that has been successfully tracked earlier in the segment. (You need to reduce the magnification in the Effect Preview monitor to less than 100% to view the area outside the frame.) You can then delete all of the invalid points between that final point and the last valid data point. Your application repositions the points you delete on a straight line. When the effect plays back, the repositioned data points ensure that the effect moves smoothly out of the frame. If the motion you are tracking is, for example, simple straight line movement, this might be quicker than setting up an extra tracking region.

Stretching a Range of Tracker Data Points

You can select a range of data points and then stretch them into a new position. In contrast to simply moving a range of points, the stretching process uses one moving point and one or two anchor points. As you move the moving point, all the other points in the selected range stretch to new relative positions.

This feature is particularly useful when the system generates tracking data points that are slightly offset from the area you are tracking but otherwise represent the motion you are tracking accurately. For example, if you are tracking an area on a moving vehicle, a combination of changes in the image from frame to frame and the system's updating of the target area might yield tracking data points that lag behind the area you are tracking.

The following illustration shows this behavior.



This illustration represents data points created by tracking an area across 11 frames. Until Frame 6, the system tracks the object accurately. After Frame 6, a small amount of error is introduced. By Frame 11, the data point lags behind the object being tracked somewhat. Stretching the points between 6 and 11 so that the last point is placed over the last triangle quickly creates a complete set of usable points.

You can select a range of points that are slightly out of the ideal position in this way and stretch them so that they more exactly represent the path of the object you want to follow. This enables you to achieve the motion you need for your effect without retracking or moving many data points individually.

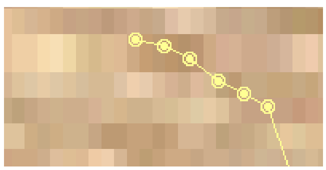
To stretch a range of data points:

1. Select the range of points as described in “Selecting Tracker Data Points” on page 125.
2. In the Modify Tracking Data area of the Tracking window, click Stretch Points Mode.

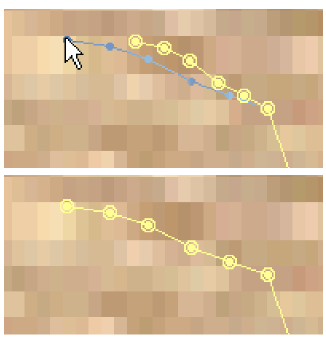
   The button is purple when Stretch Points mode is turned on.
3. Drag one of the selected points to a new location.

   The points in the selected range are relocated proportionally along the path between the point you have moved and the anchor point or points. If you move a point at either end of the selected range, the point at the opposite end becomes the anchor. If you move a point in the middle of the range, the two end points become anchors.

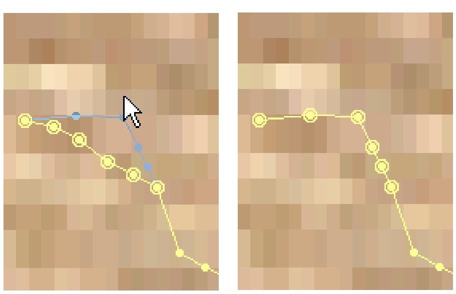
   The following illustrations show these two behaviors.



Original range of selected points before stretching.



When you stretch by moving one end point, the point at the other end of the range becomes the anchor while you drag the moving point. After the stretching process, all the selected points are relocated proportionally between the point you have dragged and the anchor point.



When you stretch by moving a point in the middle of the range, both end points of the range become anchors while you drag the moving point. After the stretching process, all the selected points are relocated proportionally between the point you have dragged and the two anchor points.

Limiting the Effect of Position Tracking Data to a Single Axis

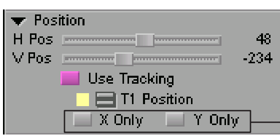
In some circumstances, you might want to track an area to generate data on its X, Y position but then control the movement of the effect on only one axis. You can limit the effect of Position tracking data to one axis to achieve this effect.

Limiting Position motion to a single axis is also an option when you want to stabilize a shot without eliminating camera motion in one direction, such as a pan. However, a more flexible approach to handling this scenario for most shots is to use data from both axes and then use SteadyGlide to process the data. *For more information, see "Stabilizing an Image" on page 132 and "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124.*

To limit the effect of Position tracking data to a single axis:

1. In the Effect Editor, open the Position parameter category.
2. Click the Enable button for X Only or Y Only.

   The Enable button changes to pink when selected.



X Only and Y Only buttons

Playing Effects That Use Tracking Data

Once you have generated tracking data and have modified it to create acceptable sets of data points, you can play the effect to check its movement over time.

The real-time status of an effect is not altered when it uses tracking data. If an effect is normally real time, it remains real time when it uses tracking data. If an effect normally requires rendering, it continues to require rendering when it uses tracking data. Playback of an effect while still in Effect mode also follows the normal behavior of the effect.

To play an effect that uses tracking data:

1. Move the position indicator to the beginning of the effect.
2. Click the Play button.

3. (Option) If you are not satisfied with the appearance of the effect, you can do one or more of the following to further modify its movement:
   - Adjust the effect's keyframe parameters.

     For more information, see "Changing a Standard Keyframe's Parameters" in the Help.
   - Modify the existing tracking data.

     For more information, see "Modifying Tracking Data" on page 124.
   - Retrack all or part of the segment to generate new tracking data.

     For more information, see "Generating Tracking Data" on page 114.

Understanding Stabilizing

Stabilizing allows you to track an object in a shot that should not be in motion and then use the tracking data to keep that object stationary and eliminate the unwanted motion. (Objects such as buildings, telephone or light poles, and fixed objects in nature such as rocks, are good candidates for tracking when you use the Stabilize effect.) This process exposes black around the edges of the repositioned frames, so you might need to resize or reposition the clip to remove the exposed edges.

If you use stabilizing and also process the tracking data using SteadyGlide, you can eliminate unwanted jittery movement while retaining underlying camera motion such as a pan. For more information, see "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124.

You can also use stabilizing to create unusual special effects. For example, if you stabilize an object that is actually moving in a clip, you force other parts of the clip to move from frame to frame. You can take a clip of a person running down a street, stabilize on that person, and force the buildings in the shot into motion.

Unlike other effects that use motion tracking, stabilizing works with only one layer of video, using the tracking data to move each frame of the video as much as is needed to keep the tracked object stationary.

Clips that contain extreme camera motion might be hard to stabilize successfully since they need to be resized substantially to remove exposed edges. As a result, you might lose so much of the image information that the clip is no longer useful.

Stabilizing an Image

If you need to eliminate unwanted motion in a video clip, such as motion from an unstable camera or even more subtle motion such as that introduced during the telecine process as a result of gate weave, you can use:

- The Stabilize effect
- The Stabilize Tracking parameter control in a 3D Warp effect promoted to advanced keyframes.

The Region Stabilize effect is an alternative option for stabilizing a clip. For more information, see *"Using the Region Stabilize Effect" on page 134.*

To stabilize a segment:

1. Do one of the following:
   - Apply the Stabilize effect from the Image category in the Effect Palette.
   - Apply the 3D Warp effect from the Blend category in the Effect Palette (or promote an effect that uses tracking data to 3D), and then promote the effect to advanced keyframes by clicking the Promote to Advanced Keyframes button in the Effect Editor.

The Stabilize effect itself is one of the effects that you can promote both to 3D and to advanced keyframes, so you can stabilize an image using the Stabilize effect and then promote it to access additional effect functionality. When you promote the Stabilize effect to 3D and to advanced keyframes, Stabilize Tracking is automatically activated for all effect parameters that use tracking data.

2. Enable and prepare one or more trackers, by doing one of the following:
   - For the Stabilize effect, open the Tracking parameter category and click the Enable button for one or more trackers.
   - For the 3D Warp effect promoted to advanced keyframes, open the Position Tracking, Rotation Tracking, Scaling Tracking, or Corner Tracking parameter categories, then click the Stabilize Tracking button, and then enable one or more trackers.

   For more information, see "Preparing to Generate Tracking Data" on page 104. For specific information on the number of trackers to use when stabilizing, see "Guidelines for Using Multiple Trackers When Stabilizing" on page 133.
3. (Option) If you are using the 3D Warp effect, in the Tracking window, choose Track Foreground from the Track Background/Foreground menu.

4. Generate the tracking data.

   For more information, see “Generating Tracking Data” on page 114.

5. Click the Play Loop button to play the segment repeatedly.

   The system repositions each frame or field in the segment so that the object you have tracked remains in the same position that it occupies in the first frame or field.

6. (Option) Use SteadyGlide with your trackers if you want to remove jittery motion, such as that in a hand-held camera shot, while retaining underlying motion such as a pan.

   For more information, see “Using SteadyGlide or Smoothing to Process Tracking Data” on page 124.

7. As the segment plays, notice where black has been exposed at the edges of the frame by the stabilizing process.

8. When you have finished reviewing the stabilized segment, press the space bar to stop playback.

9. (Option) If necessary, recenter the image using the Position parameter sliders in the Effect Editor.

This step is useful if you see more exposed edge material on one side of the image than on the opposite side. By recentering the image, you can balance the size of the exposed edges on either side and reduce the amount of resizing needed to eliminate the edges.

10. (Option) If necessary, adjust the Scaling parameter sliders in the Effect Editor to enlarge the image enough to eliminate the exposed edges.

11. Continue to review the effect and adjust parameter controls until you are satisfied with the final look.

Guidelines for Using Multiple Trackers When Stabilizing

As with other effects that use motion tracking, the number of trackers that you need when stabilizing depends on the complexity of the motion you want to stabilize. However, multiple trackers might introduce unnecessary additional motion that is detrimental to the final look of the clip, so you should use them only when they are absolutely necessary.

When the motion of an unstable camera is limited to movement on the X and Y axes only, you need only one tracker (enabled either in the Position parameter category or in the Tracking parameter category). Even when you see a small amount of rotational movement or change in scale in an image you want to stabilize, you will probably find that a single point stabilizes the image well enough to give an acceptable result without introducing unwanted motion.

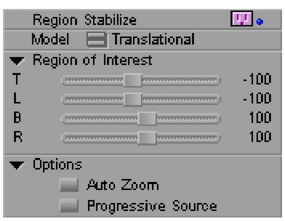
If you are stabilizing a clip that shows significant changes in scaling, rotational, or other movement, or if you are using the Stabilize effect to create a special effect, you might need to use two or even more tracking points.

Using the Region Stabilize Effect

The Region Stabilize plug-in effect provides an alternative option for stabilizing an image. Although the Region Stabilize effect provides fewer controls than the Stabilize effect or the Stabilize Tracking option in 3D Warp, its simplicity makes it easier to use, and it might be all you need in some circumstances. Region Stabilize also provides two options that are unavailable in Stabilize:

- The AutoZoom option automatically resizes and repositions the segment to remove exposed black around the edges of frames repositioned as a result of the stabilization process.
- The Progressive Source option allows you to specify that the footage you are tracking is progressive material so that it is tracked correctly in an interlaced project.

The following illustration shows the Region Stabilize parameters.



For a reference summary of the Region Stabilize effect and its parameters, see “Image: Region Stabilize” in the Help.

Stabilizing an Image with the Region Stabilize Effect

You apply the Region Stabilize effect from the Image category in the Effect Palette.

To stabilize a clip with the Region Stabilize effect:

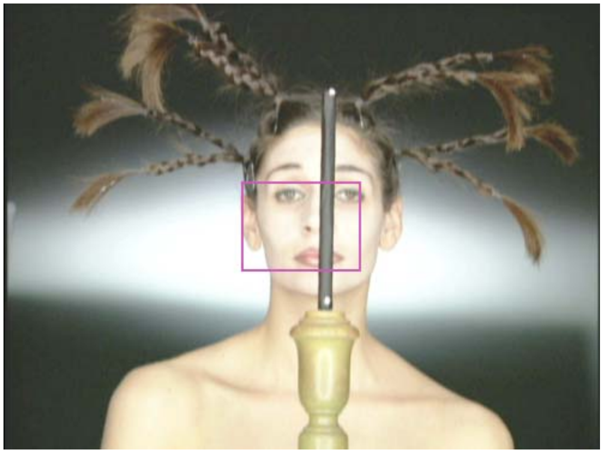
1. Enter Effect mode by selecting Toolset > Effects Editing.

   For more information, see “Entering Effect Mode” in the Help.

   The Effects Editing toolset appears.
2. In the Effect Palette, click the Image category.
3. Drag the Region Stabilize Effect icon to the segment you want to stabilize.

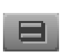
4. Move the effect position bar to the segment with the Region Stabilize effect.

   A wire frame appears in the Effect Preview monitor to indicate the region of interest. This is the area you want to use in stabilizing the image.

5. Reposition and resize the wire frame by doing one of the following:
   - Use the sliders in the Region of Interest parameter category.
   - Click the wire frame, and drag it in the Effect Preview monitor.

   Select a region that contains one or more features that do not change much from frame to frame, for example, objects such as buildings or rocks. Another approach is to shoot the scene with stabilization in mind: include an object, such as a reflective sticker, that you intend to use as your region of interest.



6. Click the Model Fast Menu button, and select the type of stabilization:

Option	**Description**
Translational	Keeps the region of interest steady along both the horizontal and the vertical axes.
Horizontal	Constrains horizontal motion in the region of interest. Features in the region of interest can move vertically but not horizontally.
Vertical	Constrains vertical motion in the region of interest. Features in the region of interest can move horizontally but not vertically.

7. (Option) Turn on Auto Zoom:

   a. Click the triangular opener for the Options parameter category.

   b. Select Auto Zoom.

   Stabilization exposes black around the edges of the repositioned frames. Auto Zoom compensates by resizing and, if necessary, repositioning the clip to remove the exposed edges.

8. (Option) Select Progressive Source:

   a. Click the triangular opener for the Options parameter category.

   b. Select Progressive Source.

   Select Progressive Source if your footage was captured or converted to progressive footage (not interlaced). If your sources are progressive, selecting Progressive Source produces smoother results.

Progressive Source has no effect in 24p projects because the application assumes that you are using progressive footage.

If you click the Progressive Source button and your underlying source is not progressive, you may see motion artifacts between fields in the rendered effect.

9. Render and review the effect.

   If the rendered clip does not perform as expected, see "Making Adjustments to the Region Stabilize Region of Interest" on page 136.

10. (Option) Add keyframes to further refine the motion of the stabilized clip.

11. Continue to review and refine the effect until you achieve the results you want.

12. (Option) Resize and, if necessary, reposition the clip to eliminate black edges.

Making Adjustments to the Region Stabilize Region of Interest

If the Region Stabilize effect does not perform as expected, it might be due to one of the following:

- **Large motion —** If an object in your region of interest moves too far away from the region from one frame to the next, the rendered clip might display unexpected results.
- **Extraneous motion —** An object in your region of interest might move over the course of the clip in a way that unpredictably affects the stabilization.
- **Insufficient texture —** The region of interest might not have enough features to allow Region Stabilize to track it effectively.

If the Region Stabilize effect does not perform as expected, experiment with the following adjustments:

- Increase the size of the region of interest, or reposition it, to encompass large motion.
- Decrease the size of the region of interest to eliminate extraneous motion that is affecting the stabilization.
- Select a new region of interest.
- Add keyframes to reestablish or refine the region of interest over the course of the clip.

Editing Segments That Use Tracking Data

Once tracking data exists for a segment, you can edit that segment in a number of standard ways without losing the tracking data and having to retrack.

Segment Mode Editing with Segments That Use Tracking Data

Tracking data persists during Segment mode editing. For example, if you shift the position of a segment that contains tracking data, or copy a segment to another point in your sequence, the data is still available. If you lift a portion of the segment out of your sequence, tracking data is preserved on all parts of the segment for the range of frames in each part.

Remember, however, that if you move only the foreground layer of a multilayer effect, the tracking data will be useful only to the extent that it corresponds, or can be made to correspond, to the background layer at its new location. For example, if you shift an effect segment with tracking data a few frames with respect to the background material beneath it, you might be able to continue to use the tracking data to follow the background area (perhaps by selecting all the points and moving them a little). If you shift the effect segment substantially, or even place it over a different background clip, the tracking data remains available but has no practical use.

In some situations, it might be useful to create a multilayer effect with motion tracking as a nested effect. If you do this, you can move or divide the nested effect during segment editing and be sure that the effect will stay in sync with the tracked material. For more information, see "Nesting Effects" in the Help.

Trimming Segments That Use Tracking Data

If you trim in from the edges of a segment, tracking data is preserved for both the new length of the segment and for the material you have trimmed. If you later trim the edges of the segment back out, the tracking data is still available to control the motion of your effect.

If you trim out beyond the tracked data for an effect, you must track over the range of these new frames to generate data for them.

If you edit a segment into a sequence by marking it to be longer than you will finally need, you can track the whole segment, trim it in, and know that you can adjust the trims back out when fine-tuning your sequence without having to retrack. This might be a useful approach if you know that a clip is likely to be trimmed.

Adding Transition Effects to Tracked Segments

If you add a transition effect to a tracked segment, you usually need to track the additional frames that are used by the transition. For example, if you add a standard one-second, centered-on-cut dissolve at the beginning of a tracked segment, the dissolve will use one-half-second of new material from the tracked segment's master clip.

It might be difficult to track these additional frames after you apply the transition effect because the Effect Preview monitor displays the combination of outgoing and incoming media created by the transition effect. In the case of a dissolve, for example, the monitor shows the blend of outgoing and incoming frames, which often obscures the pattern you need to track.

You can avoid this problem by doing the following:

1. Trim the tracked segment out by the number of frames that the transition requires.
2. Track the frames added by this trim.
3. Trim the tracked segment back in to the original edit point.
4. Add the transition effect.

Reusing Existing Tracking Data

Once you have created tracking data for an effect, that data is available for reuse in several different contexts. You can reuse tracking data within the same effect. You can also copy and paste tracking data to another effect, as described in "Copying and Pasting Tracking Data" on page 139.

Trackers initially created and mapped to one effect parameter are available for use in any other parameter in the effect that can use tracking data. For example, you might create a single tracker with the default Point A name in the Position parameter category. This tracker is available for use in other parameters such as Scaling.

The Tracking parameter and the Position, Scaling, and Rotation parameter categories form two mutually exclusive groups. You cannot have tracking enabled in both groups at the same time. For more information, see *"Effects and Effect Parameters That Use Tracking Data" on page 95.*

You are less likely to want to use tracking information outside the effect for which it was created since the information refers specifically to the motion in one particular background clip. No other background clip is likely to contain exactly the same movement. However, there are some circumstances in which you might want to move tracking data to a new effect, such as the following two examples:

- You might want to move tracking data to an additional effect applied over the same background clip in the sequence. This might be a duplicate use of the background at another point in the sequence or an extra effect layered above the first (such as a second Picture-in-Picture effect tied to the same background movement).
- You might want to destabilize a stable shot so that it has a handheld look. To do this, you can track a segment that does have unsteady camera motion, and then copy the resulting tracking data to an effect on the segment you want to destabilize.

Copying and Pasting Tracking Data

You can copy one or more trackers and their associated tracking data and then paste those trackers into another effect. You can also copy one or more trackers and paste them within the same effect to create two versions of a tracker. This might be useful if you want to make two different sets of modifications to tracking data and then compare how each set changes the effect.

To copy and paste tracking data into another effect:

1. Enable the trackers you want to copy in the Tracking window.
2. Do one of the following:
   - Select Edit > Copy.
   - Press Ctrl+C (Windows) or Command+C (Macintosh).
3. Move the position indicator to the effect to which you want to copy the trackers.
4. Make sure that the Tracking window is active.
5. Do one of the following:
   - Select Edit > Paste.
   - Press Ctrl+V (Windows) or Command+V (Macintosh).

   The trackers appear in the Tracking window below any existing trackers. For example, if you are pasting into an effect that has trackers T1 and T2, the pasted trackers are numbered T3 and T4.
6. (Option) If existing trackers in the effect have the same name or color as the trackers you paste, you might want to rename the trackers that have duplicate names or change their assigned colors to avoid confusion.

To copy and paste tracking data within the same effect:

1. Enable the trackers you want to copy in the Tracking window.
2. Do one of the following:
   - Select Edit > Copy.
   - Press Ctrl+C (Windows) or Command+C (Macintosh).
3. Do one of the following:
   - Select Edit > Paste.
   - Press Ctrl+V (Windows) or Command+V (Macintosh).

   Duplicate copies of the enabled trackers appear in the Tracking window with new tracker numbers.
4. Rename the duplicate copies, and change their assigned colors so that you can continue to distinguish between the different versions.

Conforming Symphony Meridien Sequences with Tracking Data

Tracking data in sequences originally created on Symphony Meridien systems is available for use when those sequences are opened in your Avid editing application. You can manipulate the data in all the ways described in "Using SteadyGlide or Smoothing to Process Tracking Data" on page 124 and "Modifying Tracking Data" on page 124. You can also add new regions to the tracker timelines, for example, to perform offset tracking.

Neither of the tracking engines used by current Avid editing applications works in the same way as the tracking engine used in Symphony Meridien systems. As a result, if you retrack all or part of a segment containing tracking data created on a Symphony Meridien system, the new data that you create does not match the old data exactly.

Examples of Effects Using Motion Tracking

This section includes two illustrated examples of typical uses of motion tracking to control effects. Studying these examples will help you to understand how you can use motion tracking in your own work.

If you find it difficult to distinguish details in the printed versions of the following illustrations, you can view them in full color in the online version of this guide available from the Online Library for your application.

Example 1: Replacing the License Plate on a Moving Vehicle

This example uses motion tracking to track the license plate on a truck and then replace the plate with an imported graphic.

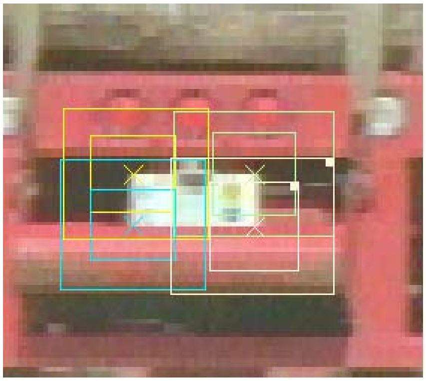
In this case, the license plate in the footage is white and the surrounding areas of the truck are generally dark, so the exact corners of the license plate are good targets for the tracking operation. However, if tracking the exact corners of the plate is difficult, you can track other points on the back of the truck to achieve the same control over the changing size and shape of the replacement plate. For more information, see "Guidelines for Positioning Tracking Boxes" on page 110.

All four corners of the license plate have been tracked for this example to ensure that any skew and perspective changes are recorded by the tracking data. In fact, changes in perspective are relatively small in this clip since the plane of the back of the truck remains at almost exactly the same angle with respect to the plane of the screen. You might be able to achieve an acceptable finished look for this clip by using three trackers or even just two trackers on opposite corners of the license plate, especially since the replacement object is small.

Original Material

These illustrations show the original materials used for this example. On the left is the first frame of the video clip. The effect will replace the white license plate. On the right is the graphic used as the replacement license plate. A blur has been applied to the graphic so that it will blend in with the clip. (You could do this in a graphics application or use Blur mode in the Paint Effect.) In the finished effect, a softened border is also applied to disguise the sharp edge of the graphic.

Tracking Information



This illustration shows the location of the four tracking boxes at the four corners of the license plate.

This illustration shows the tracking data points that the system generates for the four trackers. As the truck moves into the distance and the plate gets smaller, the points move closer together.

Comparison of Original Video and Finished Effect

These illustrations show images from the beginning, middle, and end of the clip. The images on the left are from the original clip; the images on the right show the final effect with the replacement license plate. The replacement plate is positioned and sized manually in the first frame of the clip. The size and shape of the replacement changes under the control of the tracking data in the remaining frames of the clip.

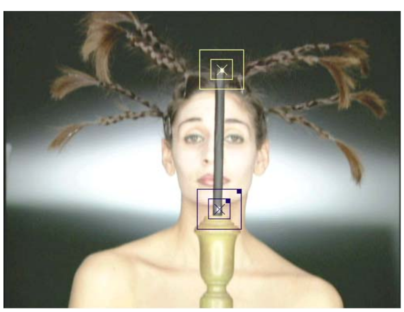
Example 2: Special Effects Using Targets for Motion Tracking

This example uses special effects footage that has been specifically created to make use of motion tracking. White targets have been placed in the shot to be tracked. After tracking these targets, you can use the tracking data to control the movement of an effect layer, for example, a keyed video image or an object created with the Paint Effect. In this example, the tracking data controls the movement of an object created with the Paint Effect.

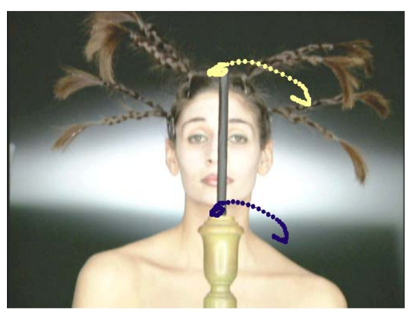
Original Material

These two illustrations show the first frame of the clip. On the left is the original video showing the target white dots on the wand. On the right is the image with the Paint object added.

Tracking Information



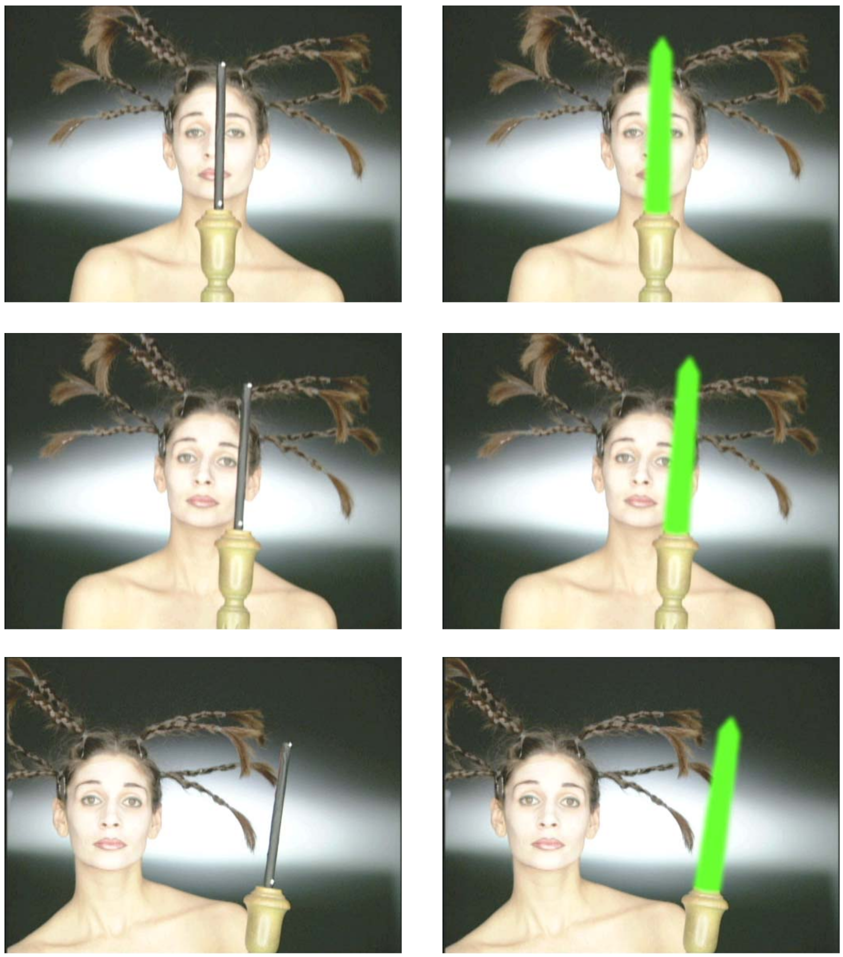
This illustration shows the two tracking boxes located over the targets.



This illustration shows the generated tracking data points for the entire clip.

Comparison of Original Video and Finished Effect

These illustrations show images from the beginning, middle, and end of the clip. The images on the left are from the original clip; the images on the right show the final effect with the Paint object.



4 Understanding Color Correction Mode

As it does with other modes (such as Trim mode and Effect mode), your Avid editing application changes the screen display to provide a specialized interface for Color Correction mode. This interface includes the Color Correction tool itself (containing the controls for adjusting color), and a reconfigured monitor window that allows you to view several segments in your sequence side-by-side.

"Color Correction Mode Basics" in the Help provides basic information on how to enter Color Correction mode and descriptions of the main elements of the Color Correction mode display.

The following main topics in this chapter provides more detailed information on how to control and customize the Color Correction mode display:

- Color Correction Monitors
- The Color Correction Tool
- Working with Color Correction Effect Templates
- Displaying Color Correction Information in the Timeline
- Understanding Color Correction Indicator Lines in the Timeline

Color Correction Monitors

The monitor window in Color Correction mode displays three monitors. The default display and basic behavior of these three monitors is described in "Understanding Color Correction Monitors" and "Using Monitor Buttons in Color Correction Mode" in the Help.

- Understanding Image Display in Color Correction Monitors
- Customizing Image Display in Color Correction Monitors
- Source Menu Commands in Color Correction Monitors
- Adjusting the Dual Split Image Display in Color Correction Monitors
- Displaying 16:9 Video in Color Correction Monitors
- Using the Play Loop Button in Color Correction Mode

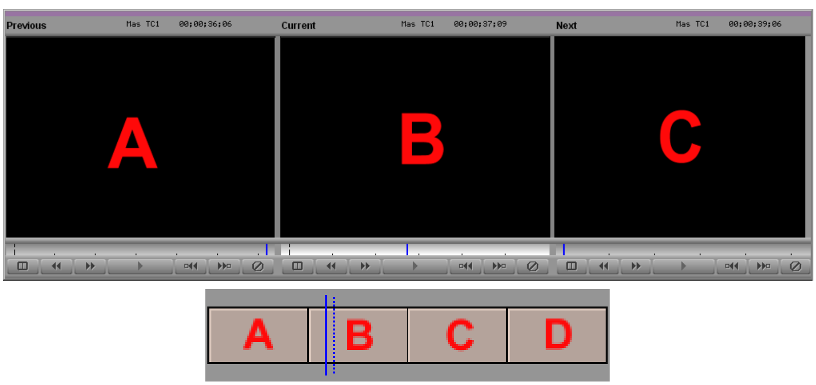
- Reviewing Color-Corrected Clips with the Edit Review Button
- Controlling Frame Display in the Monitor Window

Understanding Image Display in Color Correction Monitors

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).

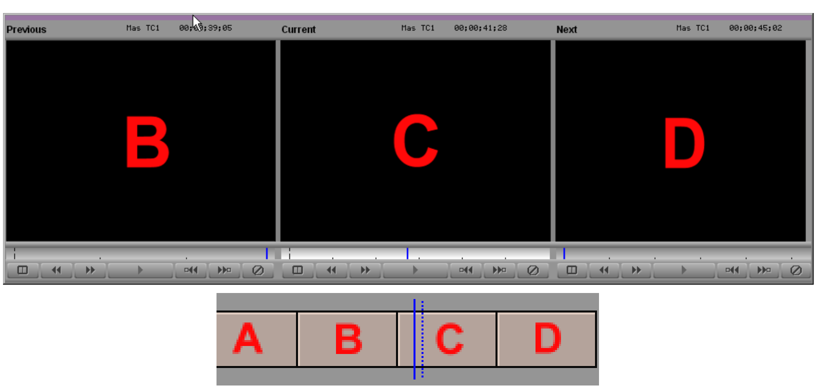
When you move in the sequence by clicking a monitor button or by placing the position indicator on a new segment in the Timeline, all three monitors update to maintain the same relationship between displayed segments.

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.

Customizing Image Display in Color Correction Monitors

You can customize the type of image that displays in each monitor in Color Correction mode. For example, you can display segments other than the default previous, current, and next segments, or you can display the entire sequence in one monitor. You can also replace video image display with a waveform or vectorscope display to help you analyze images as you correct.

To configure the display in a monitor:

- Click the monitor's Source menu, and select one of the commands described in "Source Menu Commands in Color Correction Monitors" on page 149.

Source Menu Commands in Color Correction Monitors

The following table describes the commands available in the Source menu for monitors in Color Correction mode.

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 151.*
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. *If you use the right monitor to display a reference image and keep the current segment in the center monitor, you can use the convenient Escape key shortcut to switch between these two monitors. For more information, see "Switching Between Current and Reference Monitors Using the Escape Key" in the Help.* 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 select Reference Current.

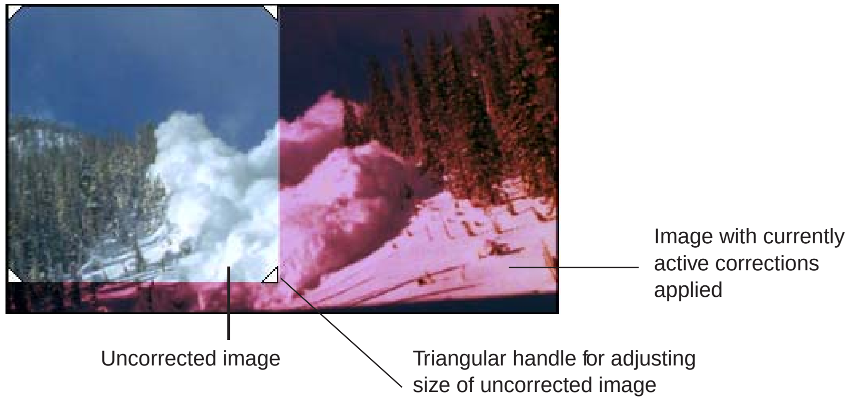
Command	Description
Current	Displays the current segment. This option is not available in the Source menu if another monitor is already set to Current.
Previous	Displays the segment immediately before the current segment.
Next	Displays the segment immediately after the current segment.
Second Previous	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 monitor. Your Avid editing application displays the information for the currently active monitor. For more information, see “Working with the Waveform Monitors and the Vectorscope Monitor” on page 276.

Adjusting the Dual Split Image Display in Color Correction Monitors

You can use the Dual Split button below a monitor to split the image display so that it shows the image before and after the current color correction adjustments are applied. For information on this basic procedure, see “Using Monitor Buttons in Color Correction Mode” in the Help.

Most Avid editing applications support the display of this split-screen view in the Client monitor as well as in the monitor window.

When Dual Split is turned on, the uncorrected image appears on the left and the image with currently active corrections applied appears on the right, as shown in the following illustration.



If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

To resize the box that contains the split-screen image:

- Drag one of the box's triangular handles in the monitor.

Displaying 16:9 Video in Color Correction Monitors

The monitor window in Color Correction mode can display wide-screen 16:9 video as well as standard format 4:3 video in the monitors, just as it can in other modes.

For more information on switching to or from 16:9 display, see "Using the 16:9 Display Format" in the Help.

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 monitor window but does control the playback of material in the monitors. 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, your Avid editing application 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 selected 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. Your Avid editing application 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 monitor 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, your AVid editing application 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 your application 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 “Trim Settings” in the Help.

Controlling Frame Display in the Monitor Window

You can control the behavior of the Go to buttons in the monitor window (Go to Previous Shot, Go to Next Shot, Go to Previous Uncorrected Shot, and Go to Next Uncorrected Shot) by selecting options in the Fast Forward and Rewind area of the Composer Settings dialog box.

You can set your application to jump to the first frame of the relevant segment (the default setting), the last frame, or the frame that is marked with a locator. For more information, see “Composer Settings: FF/REW Tab” in the Help.

Although the default first-frame behavior might be acceptable in many circumstances, the availability of the option Stop at Locators makes it possible to mark a reference frame for each segment in your sequence before you begin color correction. As you move around in your sequence, you always see the reference frame in the monitors.

You can add locators while in Color Correction mode by mapping the Add Locator button to the keyboard or by using the Command palette in Active mode. However, you cannot change Composer settings while in Color Correction mode.

To control frame display with locators:

1. In Source/Record mode, add a locator to your chosen reference frame for each segment of the sequence.

   For more information, see “Using Locators” in the Help.

To navigate successfully in the sequence while in Color Correction mode, you must place a locator in every segment. You should not have more than one locator in any segment.

2. In the Settings tab of the Project window, double-click Composer.

   The Composer Settings dialog box opens.

3. In the FF/REW tab, select Stop at Locators, and then click OK.

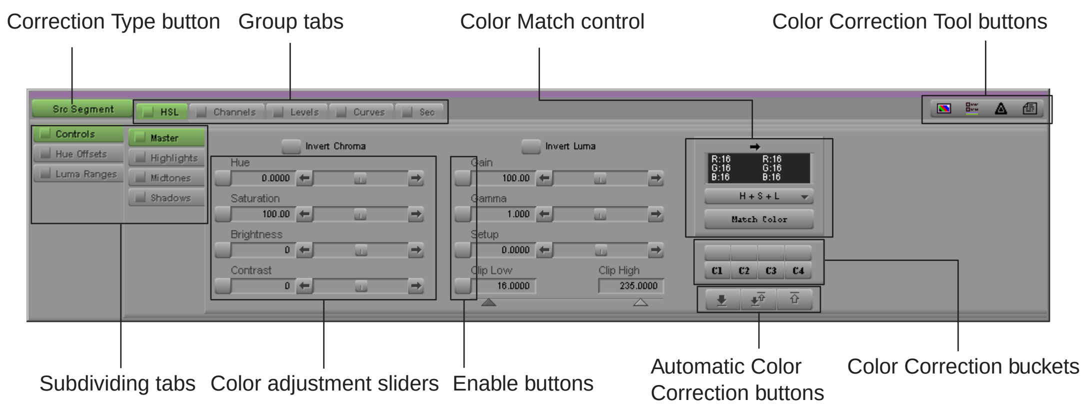
4. Enter Color Correction mode by clicking the Color Correction Mode button at the bottom of the Timeline.

   As you use the Composer Window buttons to move around in your sequence, the Composer window changes to display the frame marked by the locator in each segment.

The Color Correction Tool

In Color Correction mode, you make adjustments to color using the Color Correction tool. It 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.



Selecting Correction Types

The Color Correction tool has a Correction Type button that you use to select the type of color correction you want to make. Selecting a correction type is one of the first and most important steps you take when making any color correction in the Color Correction tool.

When you move the position indicator to a segment that has color correction, the Correction Type button changes to indicate the type of correction that is applied to that segment. If you click the Correction Type button, the correction type for the segment is highlighted in the Correction Type menu.

To select a correction type:

- Click the Correction Type button, and select the type you want from the menu.

  The options available in the Correction Type menu fall into two categories:

  - Relationship color corrections: All but one of the options allow you to select a relationship so that you can apply a correction to a group of related clips in one operation. For more information, see "Understanding Relationship Color Corrections" on page 154 and "Options for Relationship Color Corrections" on page 156.
  - Color Correction effect corrections: The last option allows you to make a color correction using the Color Correction effect. There are some situations where you need to use a Color Correction effect rather than a relationship color correction to make a correction. For more information, see "Using the Color Correction Effect" on page 286.

Understanding Relationship Color Corrections

Relationship color corrections allow you to define the scope of any correction you make. For example, if all the material from one source tape in your project needs the same color correction because the camera had poor white balance, you can make that correction to every segment in a sequence that you captured from that source tape in one operation.

Relationship color corrections also distinguish between Source corrections and Program corrections. You can make both a Source correction and a Program correction on a segment, allowing you to make two different correction passes on the same material. A common use of this feature is to make color corrections for different purposes at different stages in your editing workflow. For example, you might make a set of corrections specifically to correct problems with the color in your source footage, and then later make a separate set of corrections to make final adjustments for artistic or editorial purposes. The terms "Source" and "Program" reflect this kind of workflow.

The Color Correction tool uses color coding on both the Correction Type button and the active Color Correction tabs to indicate the type of correction you are applying or the type of correction that currently exists for a segment:

- Green indicates Source corrections.
- Blue indicates Program corrections.
- Gray indicates a Color Correction effect correction.

Relationship color corrections appear in the Timeline with green dots, indicating that they will play back in real time, subject to the playback capabilities and constraints of your system. Like any other effect, you might need to render a relationship color correction to ensure real-time, full-quality playback in some circumstances. For more information, see "Real-Time Preview of Video Effects" in the Help.

Your Avid editing application processes relationship color corrections before all other effects, with the exception of Timewarp effects. (Timewarp effects are processed first to ensure that they do not become unrendered when you apply a color correction.) This processing order can determine how you choose to apply color corrections in combination with other effects, and is one of the factors that might require you to use a Color Correction effect rather than a relationship color correction. For more information, see "Using the Color Correction Effect" on page 286.

You can also apply a Source Segment or a Program Segment correction to the material between marked IN and OUT points. For more information, see "Customizing Color Correction Mode Settings" on page 165.

You can apply a relationship correcton and a color correction effect on the same segment. This results in two distinct corrections. The relationship correction is applied first, and its result is the input to the color correction effect.

This approach differs from applying two corrections by applying one on the Source side and another on the Program side. In this case, a single correction is made using the merged values from the Source and Program sides.

Options for Relationship Color Corrections

The following table describes the relationship color correction options available in the Correction Type menu.

Relationship	Description
Src (Source) Tape	Corrects the current segment and all other segments in the sequence that use material from the same source tape.
Src (Source) Clip Name	Corrects the current segment and all other segments in the sequence that have the same clip name. (This relationship ignores clip name extensions — *.new* and any subsequent characters — created during decomposing and batch capturing.) For more information on using this option, see "Using the Source Clip Name Relationship" on page 156.
Master Clip	Corrects the current segment and all other segments in the sequence that use material from the same master clip.
Sub Clip	Corrects the current segment and all other segments in the sequence that use material from the same subclip.
Src (Source) Segment	Corrects only the current segment (the segment the position indicator is on in the Timeline).
Prog (Program) Track	Corrects the current segment and all other material on that segment's track.
Prog (Program) Segment	Corrects only the current segment.

Using the Source Clip Name Relationship

For many project situations, the Source Tape, Master Clip, and Sub Clip relationships are sufficient to allow you to make any Source color corrections to groups of related clips.

When a sequence is moved from another Avid editing application, however, a common workflow involves decomposing the sequence and recapturing. This destroys the original clip relationships by creating a new master clip (with a *.new.xx* extension) for every segment in the sequence. For more information on this process, see "Using Decompose When Recapturing" in the Help.

The Src (Source) Clip Name relationship is designed to allow you to make related corrections after decomposing and recapturing by referencing the clip name. It applies a correction to the current segment and to any other segment that has the same clip name. The Source Clip Name relationship ignores the clip name extensions that are created during the decomposing and recapturing cycle.

As long as the clip names are consistent, this relationship effectively allows you to color correct by the original master clip relationship even though that relationship is not directly available to you. If you use the Source Clip Name relationship in this way, you should check the clip names before color correcting and verify that they are consistent. If you find names that are in conflict, you can rename them so that they will be correctly referenced by the Source Clip Name relationship.

Converting Relationship Color Corrections

You can convert one kind of Source relationship correction to another, or one kind of Program relationship correction to another.

You cannot directly convert a Source relationship correction to a Program relationship correction, or a Program relationship correction to a Source relationship correction. However, you can use your application's color correction effect template capabilities to make such a conversion indirectly.

To convert a Source relationship correction to another Source relationship correction, or a Program relationship correction to another Program relationship correction:

1. Move the position indicator to the segment that carries the correction you want to convert.
2. Click the Correction Type button, and choose a new type from the menu.

To convert a Source relationship correction to a Program relationship correction, or a Program relationship correction to a Source relationship correction:

1. Move the position indicator to the segment that carries the correction you want to convert.
2. Save the adjustment values for the existing correction as a template, for example by dragging from the Color Correction Effect Template button to a bin.
3. Click the Remove Effect button to remove the existing correction.
4. Click the Correction Type button and select the new correction type you want.
5. Drag the color correction effect template that you saved in step 2 from the bin, and drop it in the monitor displaying the current segment.

   For full information on working with color correction effect templates, see "Working with Color Correction Effect Templates" on page 171.

Understanding the Group and Subdividing Tabs

The Color Correction tool uses a tabbed design to arrange its controls and to indicate their relationship to one another. At the top level of the hierarchy are five tabs that contain the controls for each main color correction group. Within some of these group tabs are one or more additional sets of tabs, arranged vertically on the left side of the tool, that subdivide the controls for that group.

You can hide any of the top-level tabs (along with their subdividing tabs) so that they do not appear in the Color Correction tool. This is useful if you normally use only a small number of the tabs. For more information, see "Customizing Color Correction Mode Settings" on page 165.

Group tabs at the top of the Color Correction tool with a Source correction type selected. The Correction Type button and the active tab are colored green

Group tabs at the top of the Color Correction tool with a Program correction type selected. The Correction Type button and the active tab are colored blue

Subdividing tabs on the left side of the Color Correction tool, shown in relation to the higher level HSL group tab. The active tabs are green. Names on the inactive tabs appear dimmed.

The complete hierarchical structure of the Color Correction tool is shown in the following illustration:

Group tab — for example, HSL

↓

Group subdividing tab — for example, Controls within HSL (The HSL group has a second level of subdividing tabs — for example, Highlights within Controls.)

↓

Individual control — for example, Brightness slider within the Highlights pane of the Controls subdividing tab within the HSL group.

For more information on the detailed organization of each group and the controls within each tab, see the chapter "Performing Color Corrections" on page 181.

Displaying Group and Subdividing Tabs

To display a color correction group tab:

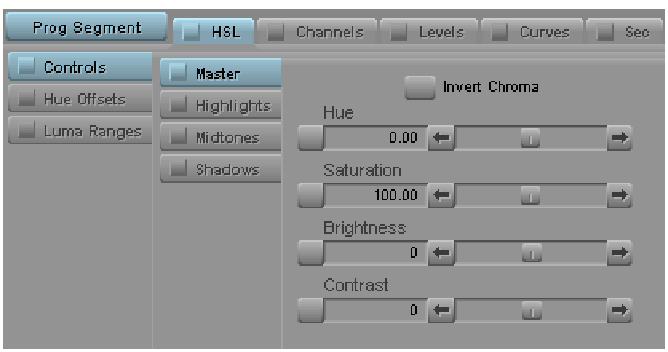
- Click the tab in the area containing the group name.

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

Click in this area of a tab to display the tab. Do not click the Enable button.

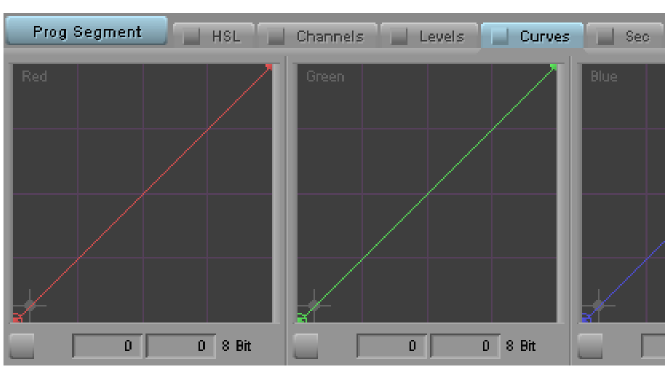
The tab name is highlighted and colored based on the correction type, the tab moves to the front, and the specific controls for that tab appear.

The following illustrations show how the display changes when the Curves tab is clicked.



Before

The Curves tab name appears dimmed, and the tab displays behind the currently active HSL tab. The active HSL tab appears blue.



After

The Curves tab appears blue, and the tab displays in front of the other group tabs. The curves controls are now visible in the tab.

To switch between group tabs using the keyboard:

- Press the Page Down key (to cycle from left to right) or the Page Up key (to cycle from right to left).

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 and colored based on the correction type, the tab moves to the front, and the specific controls for that tab appear.
3. (Option) If necessary, click the second-level subdividing tab in the area that contains the second-level subdivision name.

   This step is necessary when you want to display the second-level subdividing tabs within the Controls and Luma Ranges subdivisions of the HSL group.

To display a group or subdividing tab using a Tab button:

1. Enter Color Correction mode, for example, by clicking the Color Correction Mode button at the bottom of the Timeline.
2. Select Tools > Command Palette.
3. Click the CC tab.
4. Select Active Palette.
5. Click the Tab button with which the group or subdividing tab is associated.

   For information on associating group and subdividing tabs with Tab buttons, see "Associating Group and Subdividing Tabs with Tab Buttons" on page 160.

   In the Color Correction tool, the tab is highlighted, the tab moves to the front, and the specific controls for the tab appear.

You can also map the Tab buttons to any mappable key on your keyboard or to any mappable button location in the user interface. For more information, see "The Command Palette" in the Help.

Associating Group and Subdividing Tabs with Tab Buttons

The Command palette contains twelve Tab buttons that you can use to provide one-click access to specific tab displays. For example, if you adjust the Luma Ranges graphs frequently as part of your color correction work, you can configure three Tab buttons to display the three Luma Ranges tabs (Highlights, Midtones, and Shadows).

To associate a Color Correction tab with a Tab button:

1. In the Color Correction tool, click the tab that you want to map to a Tab button.

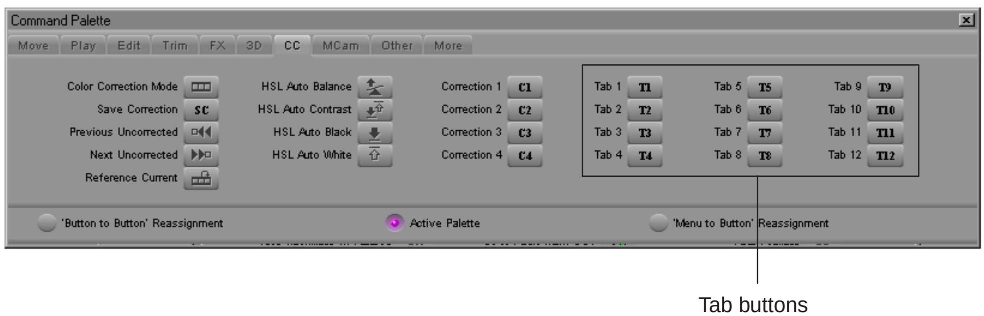
   For example, click the Highlights tab within the Luma Ranges tab within the HSL group to assign that specific subdividing tab.

2. Select Tools > Command Palette.

   The Command palette opens.

3. Click the CC tab.

   The Color Correction buttons appear, including the twelve Tab buttons.



4. At the bottom of the Command palette, select Active Palette.

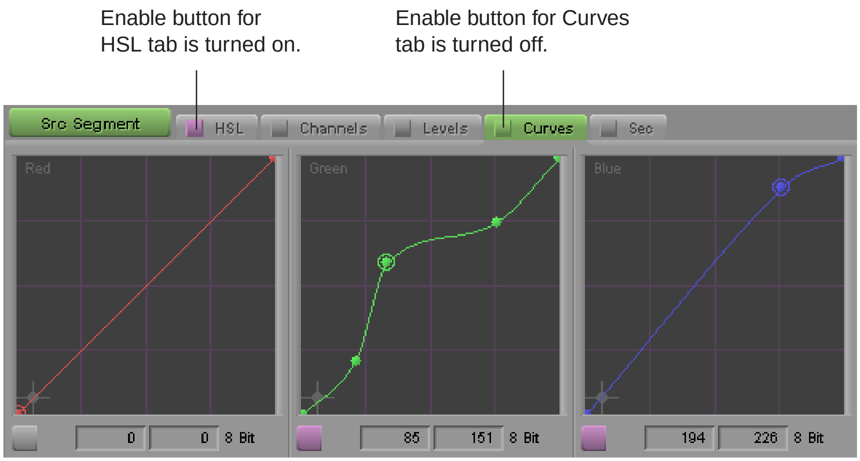
5. Alt+click (Windows) or Option+click (Macintosh) the Tab button with which you want to associate the Color Correction tab.

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, you can use one group of controls to make relatively broad initial adjustments and then switch to another group to fine-tune your correction. If you are unhappy with some of your finer 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 curves 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.

You effectively have up to five layers of correction available for a Source correction, and potentially another five if you also apply a Program correction to the same segment. For more information on enabling, disabling, and resetting the groups, see "Working with the Enable Buttons" on page 162.

If you make adjustments in multiple 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

Each group tab in the Color Correction tool, each subdividing tab and individual control within each group, and each color vector within the Secondary groups, 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.

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.

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. Your Avid editing application 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.

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.

   All controls linked to that button return to their default values.

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 turn on an individual control, for example, you automatically turn on all related Enable buttons at higher levels in the hierarchy. By enabling an individual slider in the HSL group, you enable not only the button for that slider but also the buttons for all the associated tabs, up to and including the HSL group tab itself. The following illustration shows an example of this behavior.

When the Enable button for the Hue slider is turned on, the Master tab, Controls tab, and HSL tab Enable buttons are also turned on.

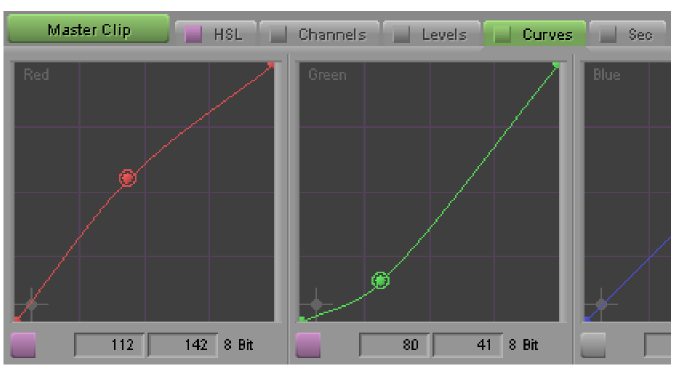
When you Alt+click (Windows) or Option+click (Macintosh) an Enable button to reset controls, you automatically reset all controls at a lower level in the hierarchy. For example, if you Alt+click (Windows) or Option+click (Macintosh) the Enable button for the Red ChromaCurve™ graph in the Curves tab, 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, your Avid editing application 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.

A small number of controls in the Color Correction tool appear in more than one tab as a convenience for users who prefer to remain in a single tab whenever possible, but their enable behavior remains tied to the tab that is their primary home. For example, several HSL slider controls also appear in the Curves tab. If you adjust one of these sliders in the Curves tab, you turn on the Enable buttons for the HSL > Controls > Master tab hierarchy.

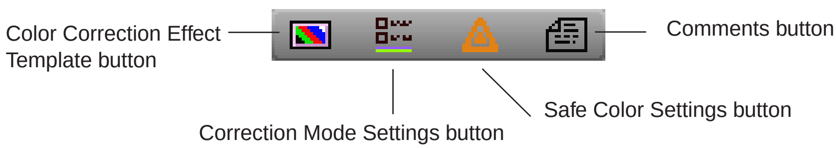
If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

In the following illustration, 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 Enable button 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 171.

- Customize the operation of color correction.

  For more information, see “Customizing Color Correction Mode Settings” on page 165.

- Set Safe Color limit values.

  For more information, see “Safe Color Basics” and “Safe Colors” in the Help.

- Add comments to color-corrected segments.

  For more information, see “Adding Comments to Color Correction Effects” on page 170.

Customizing Color Correction Mode Settings

You can customize the appearance and behavior of Color Correction mode by selecting options in the Correction Mode Settings dialog box. For example, you can control which of the group tabs display, allowing you to remove from the tool any group that you do not normally use.

To customize Color Correction mode:

1. Do one of the following:

   - In the Color Correction tool, click the Correction Mode Settings button.
   - In the Project window, click the Settings tab, and then double-click Correction.

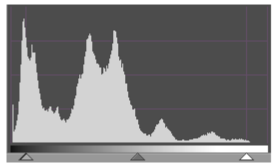
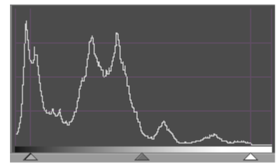
   The Correction Mode Settings dialog box opens.

2. Select the options you want, as described in “Correction Mode Settings” on page 166.
3. Click OK.

Correction Mode Settings

The following table describes the options available in the Correction Mode Settings dialog box.

Tab	Option	Description
Tabs	HSL Channels Levels Curves Secondary	Define which group tabs appear in the Color Correction tool. Select the groups that you want to display in the Source tab.
Units	RGB Hue Saturation/Gain Luma Composite	For each type of color adjustment, select an item from the menu to define the unit of measurement used for that adjustment type in the Color Correction tool. The following units of measurement are available in one or more of the menus: • 10 Bit: Measures the adjustment on a scale from 0 to 1024. • 8 Bit: Measures the adjustment on a scale from 0 to 255. • 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. • Degree: Measures the adjustment on a scale of degrees that represent a position on the color wheel. 0/360 represents the existing hue; 180 represents the opposite hue on the wheel (inverts the hue). *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 10-bit RGB values for reference black and reference white are 288 and 726 respectively. The 8-bit RGB values for reference black and reference white are 16 and 235 respectively.* *The 10-bit and 8-bit options for RGB units provide different measurement scales for the adjustment, but do not change the degree of precision with which the correction is made. For more information, see "How Color Correction Handles Color Space and Bit Depth" on page 169.*

Tab	Option	Description
Levels	Solid Histograms	When this option is selected, the histograms in the Levels tab of the Color Correction tool display as solid forms. When this option is deselected, the histograms display as a line graph.  Solid histogram selected  Solid histogram deselected
	Color Histograms	When this option is selected, histograms that represent a single color channel display in the color of that channel. For example, histograms in the Red tab display in red.
	Dynamic Histograms	When this option is selected, the histograms update on-the-fly as you move other controls such as triangular sliders and control points on the Curve graph. This provides instant feedback on your adjustments, but the updating process might not always be smooth due to system processing limitations. When this option is deselected, the histograms do not update until you release the controls you are adjusting.
	Use Full Ranges	When this option is selected, some histograms redraw to display the full 10-bit range of level values on the horizontal axis. The option applies to the Red, Green, Blue, and Master histograms. You then have additional headroom and footroom available for making adjustments beyond the normal range of values. This is sometimes useful when dealing with extreme color deficiencies in analog video material, such as very low RGB levels. It is not usually necessary to use full ranges with digital material since digital video has built-in headroom and footroom limits.

Tab	Option	Description
Features	Secondary Vectors	Controls which color vectors appear on the input vector color wheel in the Secondary group. Select one of the following values: • Show All • Show Standard • Show Custom • Show Enabled For more information and illustrations of these options, see “Customizing the Display of Secondary Color Correction Vectors” on page 257.
	Saved Color Labels	Select an item from the 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 199. • None: Your Avid editing application does not supply a name. • RGB: Your application uses the 8-bit values for the red, green, and blue components as the name. • Name: Your application uses the name from the standard HTML color scheme that most closely matches the color you are saving. • Name and RGB: Your application uses both the Name and the RGB information. This is the default option.
	Use Marks for Segment Correction	When this option is selected, the system applies either Source Segment or Program Segment color correction to all segments between marked IN and OUT points. If the IN and OUT points are in the middle of segments, the system includes the whole segments when it makes the correction. This option is deselected by default.
	Eyedropper 3 x 3 Averaging	When this option is selected, your Avid editing application 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.

Tab	Option	Description
Features (continued)	Eyedropper Picks from Anywhere in Application	When this option is selected, the eyedropper can pick a color from anywhere in your Avid editing application's interface, for example the swatch for a custom color in a bin.
	Show ChromaWheel and ChromaCurve Graphs	When this option is selected, the system displays color backgrounds for the ChromaWheels in the Hue Offsets tab of the HSL group and for the ChromaCurve graphs in the Curves tab. These backgrounds can make it easier to understand the effect that an adjustment will have on an image. When this option is deselected (the default option), the system does not display the color backgrounds. You might prefer to use this option when you are working since it allows you to assess color in your video images without interference from other brightly colored on-screen elements.
AutoCorrect		Contains three menus for defining the automatic color corrections that are made when you apply the Color Correction effect from the Effect Palette. For information on the options available in the AutoCorrect tab of the Correction Mode Settings dialog box, see "AutoCorrect Options" on page 186.

How Color Correction Handles Color Space and Bit Depth

When your Avid editing application makes some color correction adjustments, it converts the YCbCr color information in the media stored on disk into RGB color information (a better format for many color corrections) and then converts the information back to the original format for playback and storage. This round-trip conversion takes the color information from an 8-bit or 10-bit YCbCr color space into a 12-bit RGB color space and then back to 8-bit or 10-bit YCbCr. The 12-bit RGB color space that your application uses is designed to preserve color information as fully as possible during this process. Clipping of the original color values is virtually eliminated, and round-off errors from the two conversions are minimized.

The options for measuring units available in the Correction Mode Settings dialog box are a convenience that allows you to make adjustments using the units that are most useful or familiar to you. When your application makes the color correction adjustments, it always uses the 12-bit RGB color space and always works with the same degree of accuracy.

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.

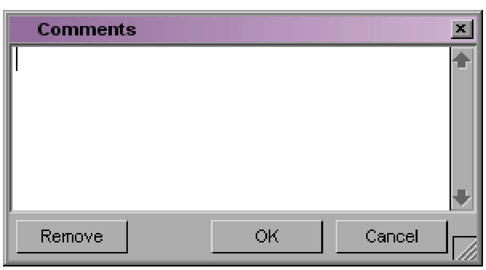
To add a comment to a segment:

1. In Color Correction mode, move the position indicator to the segment to which you want to add a comment.

   For information on entering Color Correction mode, see "Entering and Leaving Color Correction Mode" in the Help.

2. In the Color Correction tool, click the Comments button.

   The Comments dialog box opens.



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

To remove a comment:

1. In Color Correction mode, move the position indicator to the segment from which you want to remove the comment.

   For information on entering Color Correction mode, see "Entering and Leaving Color Correction Mode" in the Help.

2. In the Color Correction tool, click the Comments button.

   The Comments dialog box opens.

3. Click Remove.

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

1. In Color Correction mode, move the position indicator to the segment for which you want to view the comment.

   For information on entering Color Correction mode, see “Entering and Leaving Color Correction Mode” in the Help.

2. In the Color Correction tool, click the Comments button.

   The Comments dialog box opens and displays the text of the comment.

3. (Option) To edit the comment, click in the text window and make your edits using standard word processing procedures.

To display comments in the Timeline:

▸ Click the Timeline Fast Menu button, and select Clip Text > Comments.

  Your Color Correction comments appear in the Timeline.

Working with Color Correction Effect Templates

Your Avid editing application offers the following versions of Color Correction effect templates:

- The Automatic Effect Templates feature saves recent corrections automatically and lists them in the Effect Palette.
- 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 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 apply a Color Correction effect template to multiple segments at once by selecting the segments and then double-clicking the effect template icon in the bin or in the Effect Palette. To do this, you must be in editing or Effects mode.

You can also save custom colors to bins. For more information, see "Saving Custom Colors to a Bin" on page 199.

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. This is true whether the template is created automatically by the system or manually by saving to a bin or a bucket. The system remembers both the values set for each control and the status of each Enable button.

Automatic templates update when you make new adjustments on the same segment. For example, when you have made only a single adjustment, the template contains the value of that adjustment. If you make another Source side adjustment to the same clip, the template updates to include the value of the new adjustment. In contrast, templates saved to a bin or a bucket do not update when you make new adjustments to the segment. To save the new adjustments you must save a new template to a bin or a bucket.

If you make multiple corrections on the same segment (for example, a Source correction and a Program correction), the template includes all those adjustments. When you apply the template globally by dragging it into the active monitor, you apply all corrections that the template includes.

Since this behavior might lead to confusing results, it reinforces the need in most circumstances to keep Source and Program color corrections completely separate. In general, you should use Program corrections only for final adjustments, which are often made across a whole track. For more information on keeping Source and Program corrections separate, see the note at the end of "General Workflow for Making Color Corrections" on page 181.

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. 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.

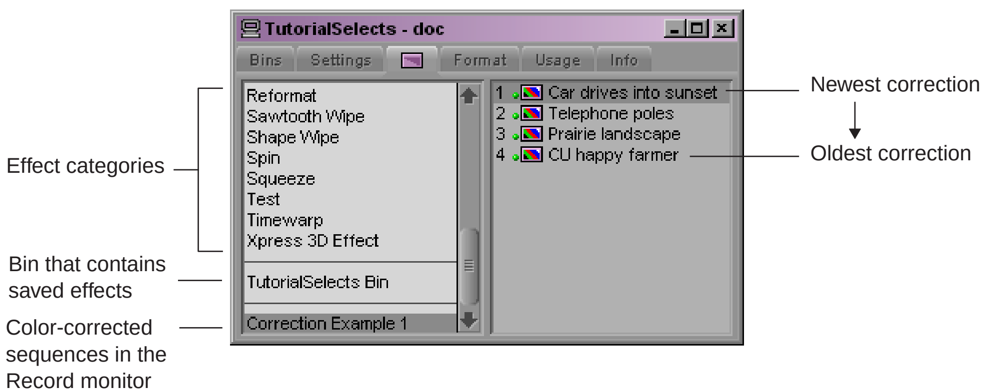
If you make a Source color correction on a clip and then make a Program correction, the system saves a second template in the Effect Palette list. This second template is a duplicate. The two templates are identical in the information they contain — each contains both the Source and the Program information — and applying either to a new segment will apply all the saved information.

Using Automatic Effect Templates

Your Avid editing application saves the most recent color corrections made in a sequence (up to a limit of 16 corrections) and makes them available in the Effect Palette. This provides you with automatically created templates for all your most recent corrections. You can quickly apply any one of these templates to another segment in the sequence by dragging it or simply by highlighting it in the Effect Palette and pressing Enter (Windows) or Return (Macintosh).

The Effect Palette lists all color-corrected sequences that are loaded in the Record monitor at the bottom of the scrollable list of effect categories. The effect categories list might therefore contain effect categories, bins that contain saved effects, and color-corrected sequences.

The following illustration shows an effect categories list containing all three of these items.



When you select a color-corrected sequence in the effect categories list of the Effect Palette, a list of templates for the most recent corrections made to that sequence appears in the right side of the Effect Palette.

Each template is named using either the clip name of the segment on which it was originally made or, if a comment is associated with that segment, the text of the comment. For more information on comments, see "Adding Comments to Color Correction Effects" on page 170.

The templates are ordered in the Effect Palette based on the time at which they were created, with the most recently created template at the top of the list. The templates are also numbered to indicate the order of their creation, with the most recently created template always numbered "1."

The list is limited to the 16 most recent corrections. If the list already contains 16 templates, the system removes the oldest template from the list when you make a new correction.

Saving a Color Correction Effect Template to a Bin

You can save a Color Correction effect template to a bin 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, or automatic templates, which are deleted when you have made 16 more recent corrections.

To save a Color Correction effect template to a bin:

1. In Color Correction mode, make sure that the position indicator is in the segment that contains the settings you want to save.

   For information on entering Color Correction mode, see “Entering and Leaving Color Correction Mode” in the Help.

2. 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.

   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, your Avid editing application names the template using the clip name of the segment. Effect icons for open bins are also displayed in the Effect Palette.

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

To permanently save a color correction effect template currently stored in a bucket:

- Click the color correction icon in the bucket and drag it to a bin.

  For more information, see “Saving a Color Correction Effect Template to a Bucket” on page 174.

Saving a Color Correction Effect Template to a Bucket

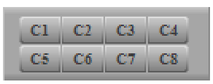
The Color Correction tool provides eight *buckets*, located below the Color Match control, that you can use to save Color Correction effect templates for the duration of a working session. You can then apply the template quickly to any segment.

The buckets are initially labeled C1 through C8. When you fill a bucket with a Color Correction effect template, a Color Correction icon appears on the bucket.

Color Correction effect templates saved to buckets do not remain from one session to another. When you end your session, your Avid editing application deletes the templates. However, you can save an effect template from a bucket permanently by dragging it to a bin. For more information, see “Saving a Color Correction Effect Template to a Bin” on page 174.

The Color Correction buckets are also available as buttons in the CC tab of the Command Palette. You can map these buttons to any mappable key on your keyboard or to any mappable button location in the user interface. For more information, see “The Command Palette” in the Help.

The following illustration shows the Color Correction buckets.



All buckets empty

Buckets C1 and C2 filled (Color Correction icon appears)

To save a Color Correction effect template in a bucket:

1. In Color Correction mode, make sure that the position indicator is in the segment that contains the settings you want to save.

   For information on entering Color Correction mode, see “Entering and Leaving Color Correction Mode” in the Help.

2. Alt+click (Windows) or Option+click (Macintosh) the bucket in which you want to save the template.

   You can click any one of the eight buckets to save to it. Empty buckets have a label that begins with the letter “C,” for example, C5. Buckets that already contain a template have a Color Correction icon. 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. If the bucket was previously empty, a Color Correction icon replaces the “C” label on the bucket.

Clearing Color Correction Effect Templates from Buckets

You can clear a Color Correction effect template from a bucket without having to overwrite the template with a new one.

To clear a Color Correction bucket of its saved correction during an editing session:

- Move the position indicator to any uncorrected segment in the Timeline and then Alt+click (Windows) or Option+click (Macintosh) the bucket.

  The template information is cleared from the bucket. A label beginning with the letter "C," for example, C3, replaces the Color Correction icon on the bucket.

Applying Color Correction Effect Templates

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

- Click the effect icon for the template in the bin, the Effect Palette, or the Color Correction bucket, and drag it to the monitor containing the current segment or to the segment in the Timeline.

  For information on entering Color Correction mode, see "Entering and Leaving Color Correction Mode" in the Help.

For tips on working with templates in the Effect Palette, see "Saving a Color Correction Effect Template to a Bin" on page 174.

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

  Your Avid editing application 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. Click the effect icon for the template in the bin, the Effect Palette, or the Color Correction bucket, drag it to the tab, 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 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.

Color Correction Effect Templates and Relationship Type Selections

If you save a relationship color correction effect to a bin as an effect template, the relationship type of the original effect is saved as part of the template. However, depending on how you apply the effect template to another segment, the new color correction might use the relationship saved as part of the template, or it might use the currently selected relationship in the Correction Type menu. You should choose one of the following methods for applying a color correction effect template based on whether you need the relationship type saved with the template or the relationship type currently selected in the Correction Type menu.

- When you apply the effect template by dragging it to a segment in the Timeline, the new color correction uses the relationship type saved with the template.
- When you apply the effect template by dragging it to the Current monitor in the Composer window, the new color correction uses the relationship type saved with the template. However, a Color Correction Effect icon is also added to the clip. This is a duplicate of the color correction that you can remove.
- When you apply the effect template by double-clicking it in the bin or by dragging it to an individual tab in the Color Correction tool, the new color correction uses the relationship type currently selected in the Correction Type menu.
- In addition, when you apply a color correction saved in a bucket by clicking the bucket, the new color correction uses the relationship type currently selected in the Correction Type menu.

Displaying Color Correction Information in the Timeline

The Timeline works the same way in Color Correction mode as it does in other modes. You can move the position indicator from one place to another in your sequence, select and deselect tracks, and perform other normal Timeline operations.

The Timeline has one control that is specific to color correction: the Color Correction option in the Timeline Fast menu. When you select Color Correction, the Timeline displays indicator lines to show which segments have relationship color corrections. For more information on color correction indicator lines in the Timeline, see "Understanding Color Correction Indicator Lines in the Timeline" on page 178.

To display color correction information in the Timeline:

- Click the Timeline Fast Menu button, and select Color Correction.

  The Timeline display updates to show the color correction indicator lines.

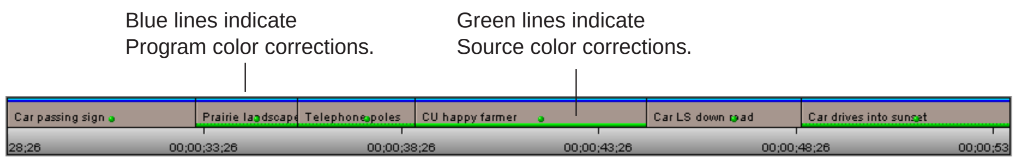
Understanding Color Correction Indicator Lines in the Timeline

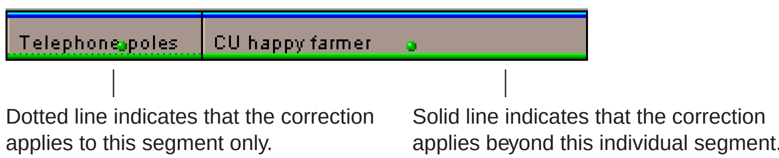
A segment in the Timeline that has Source color correction is marked with a green line at the bottom of the segment; a segment that has Program color correction is marked with a blue line at the top of the segment. For information on displaying or hiding color correction indicator lines in the Timeline, see "Displaying Color Correction Information in the Timeline" on page 178.

The appearance of the indicator line indicates the relationship that applies to the correction on that segment. A dotted line indicates a correction that applies only to that segment (Source Segment or Program Segment relationship); a solid line indicates a correction that applies beyond the individual segment (Source Tape, Source Clip Name, Master Clip, Sub Clip, or Program Track).

Color Correction is available in the Timeline in all modes, but it might be most useful while you are working in Color Correction mode as a guide to which segments have already received either Source or Program adjustment.

As effects that normally play in real time, all relationship color corrections appear with green dots in the Timeline unless they have been rendered. These dots continue to display in the Timeline even if the Color Correction option is dselected in the Timeline Fast menu.





5 Performing Color Corrections

This chapter describes all procedures for making color corrections that are not covered in "Color Correction: Basics" in the Help. It also 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

The Color Correction tool gives you a great deal of flexibility when you make color corrections. The exact workflow that you employ depends 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 steps outline a typical color correction operation. You can adapt the exact order in which steps are performed or repeated to conform to your particular needs.

In general, you should not attempt to make Source relationship corrections and Program relationship corrections as part of the same corrective operation or to use Program corrections for your first color correcting pass. If you do so, you lose flexibility and control for later stages of your project and you reduce the power of the Color Correction tool. Even if you expect to need only one color correction pass (and could use Program relationships for that pass), you should make that pass using Source relationships. If your needs for the project change, you will still be able to make a second set of corrections using Program relationships.

1. In Source/Record mode, load the sequence into a monitor.

2. Click the Color Correction Mode button below the Timeline to enter Color Correction mode.
3. (Option) If necessary, configure the Color Correction mode display so that it conforms to the requirements of your project and editing style.

   For more information on the display and how to configure it, see "Color Correction Mode Basics" in the Help and "Understanding Color Correction Mode" on page 147.
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. You might also make decisions about the Source or Program relationships that you want to use as you work. For general guidance on what to look for when previewing material, see "Color Correction Techniques" on page 303.

You might prefer to preview extensively and plan your corrections in advance. If you have more color correcting experience, you might work by moving back and forth frequently between making corrections and assessing the material on which you 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. Select a relationship to control the scope of the corrections, or choose to apply a Color Correction effect correction.

   Depending on your circumstances, you might use the same relationship throughout the sequence, or you might select different relationships for different segments. For more information, see "Selecting Correction Types" on page 154.

8. Click the appropriate tabs in the Color Correction tool to display the controls you want to use to make the correction.

   For more information, see "Understanding the Group and Subdividing Tabs" on page 158.

9. 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.

10. (Option) Add a comment for the correction.

11. Repeat steps 5 through 10 for each segment you want to correct.

12. When you are satisfied with the corrections throughout the sequence, click one of the mode buttons (Source/Record, Trim, or Effect) or make a selection from the Toolset menu to exit Color Correction mode and return to other editing operations.

Using Automatic Color Corrections

Both color correction groups include buttons that allow you to make automatic color corrections to correct contrast problems, balance color, or remove color casts by identifying areas of an image that should be color neutral.

You can also apply up to three automatic color corrections in a single operation by selecting options in the AutoCorrect tab of the Correction Mode Settings dialog box and applying the Color Correction effect from the Effect Palette to one or more segments in a sequence. For more information, see "Correcting Color Automatically Using the Color Correction Effect" in the Help and "Setting AutoCorrect Options" on page 184.

The Color Match control also corrects automatically by adjusting an image so that a poor color value matches a better one. You select the colors on which you want Color Match to operate using an eyedropper. For more information, see "Using the Color Match Control" on page 191.

Understanding Automatic Color Correction

Automatic color correction simplifies the work of correcting common color problems in video images. When you use one of the automatic color corrections, Symphony analyzes the existing color characteristics of an image and makes adjustments to color correction controls that usually eliminate or at least significantly reduce a specific color problem.

You will often want to begin your color correction work by using automatic color corrections, especially if you do not have time for detailed manual adjustments, if you only need to correct basic color problems such as color casts, or if you lack experience with the manual controls in the Color Correction tool.

Since automatic color correction adjusts controls in the Color Correction tool just as you would when making manual corrections, you are always free to make additional adjustments manually if you need to fine-tune the correction. Also, automatic color corrections can help you learn how to recognize color problems in images and what kinds of adjustments you might make to correct images manually. For example, if the Auto Balance automatic correction in the Hue Offsets subdividing tab adjusts an image by adding yellow in the ChromaWheels, then the analysis of that image revealed a blue color cast.

Automatic color corrections operate within normal limits for legal video levels. For example, an automatic color correction does not make an adjustment that takes a significant area of an image beyond legal luminance levels.

Setting AutoCorrect Options

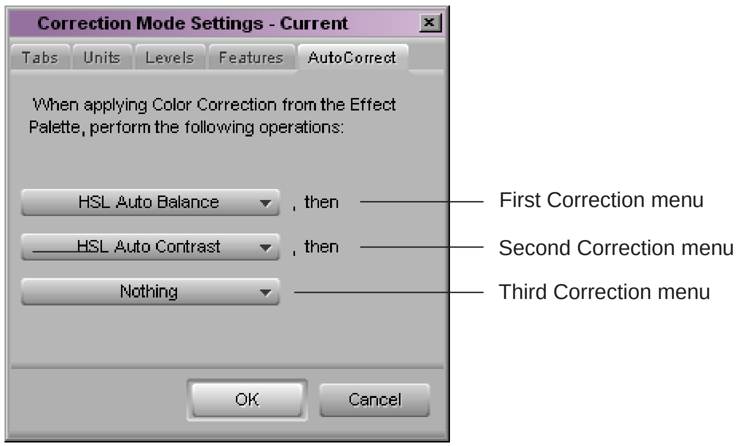
You control how Color Correction makes automatic corrections when you apply the Color Correction effect from the Effect Palette by choosing options in the AutoCorrect tab of the Correction Mode Settings dialog box.

For information on applying the Color Correction effect from the Effect Palette, see “Correcting Color Automatically Using the Color Correction Effect” in the Help.

To set AutoCorrect options:

1. Do one of the following:
   - In the Settings tab of the Project window, double-click Correction.
   - In the Color Correction window, click the Correction Mode Settings button.

   The Correction Mode Settings dialog box appears.



2. Click the AutoCorrect tab.
3. Select an option from each of the three menus to define the first, second, and third automatic color correction that Avid Color Correction makes when you apply the Color Correction effect from the Effect Palette.

   For detailed information on the options available, see "AutoCorrect Options" on page 186.

   For information to help you to decide on the best order for these corrections, see "Considerations When Using Automatic Color Correction" on page 190.

AutoCorrect Options

The following table describes the available options in the AutoCorrect tab of the Correction Mode Settings dialog box.

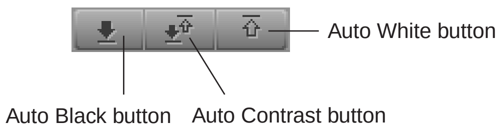
Option	Description
Nothing	Makes no adjustment. For example, if you only want to make two automatic corrections when you drag the Color Correction effect from the Effect Palette, set the Third Correction menu in the AutoCorrect tab to Nothing.
HSL Auto Balance	Makes adjustments to the three ChromaWheels to balance the colors in the image. The equivalent of clicking the Auto Balance button in the Hue Offsets subdividing tab of the HSL tab.
HSL Auto Black	Adjusts the Setup slider in the Hue Offsets subdividing tab of the HSL tab to make the darkest areas of the image as dark as possible. The equivalent of clicking the Auto Black button in the Hue Offsets subdividing tab of the HSL tab.
HSL Auto Contrast	Adjusts the Gain and Setup sliders in the Hue Offsets subdividing tab of the HSL tab to maximize the tonal range in the image. The equivalent of clicking the Auto Contrast button in the Hue Offsets subdividing tab of the HSL tab.
HSL Auto White	Adjusts the Gain slider in the Hue Offsets subdividing tab of the HSL tab to make the brightest areas of the image as bright as possible. The equivalent of clicking the Auto White button in the Hue Offsets subdividing tab of the HSL tab.
Curves Auto Balance	Makes adjustments to the Red, Green, and Blue curves to balance the colors in the image. The equivalent of clicking the Auto Balance button in the Curves tab.
Curves Auto Contrast	Makes an adjustment to the Master curve to maximize the tonal range in the image. The equivalent of clicking the Auto Contrast button in the Curves tab.

Adjusting Contrast and Balance Automatically

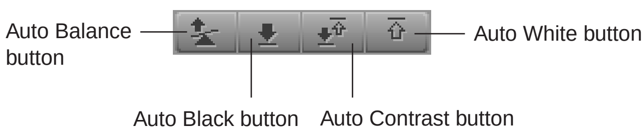
You can adjust the contrast and balance the color automatically for an image simply by clicking buttons. An automatic contrast adjustment expands the tonal range of the image, which usually improves sharpness and detail. An automatic balance adjustment evens out the influence of the different color channels in the image, which usually greatly reduces or even eliminates any color cast.

Automatic contrast and balance buttons appear in the Color Correction tool in the following locations:

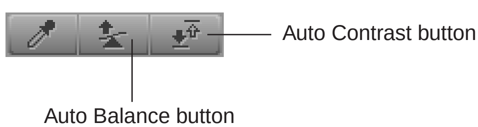
- The HSL > Controls > Master tab, as shown in the following illustration:



- The HSL > Hue Offsets tab, as shown in the following illustration:



- The Curves tab, as shown in the following illustration:



For information on correcting contrast or balance automatically in the Hue Offsets subdividing tab, see “Correcting Color Automatically in the Hue Offsets Tab” in the Help.

To make an automatic contrast or balance adjustment in the Curves tab:

1. Enter Color Correction mode, for example, by selecting Toolset > Color Correction.
2. In the Timeline, make sure that the Record Track button for the video track on which you want to make corrections is the topmost selected track.

3. In the Timeline or in the Composer window, navigate to the segment you want to correct.
4. In the Curves tab of the Color Correction tool, click either the AutoBalance or the AutoContrast button.
   - Auto Balance: Makes adjustments to the Red, Green, and Blue curves to balance the colors in the image. This eliminates any color cast for most images.
   - Auto Contrast: Makes an adjustment to the Master curve to maximize the tonal range in the image. The brightest areas of the image and made as bright as possible and the darkest areas of the image are made as dark as possible.

   The system analyzes the currently selected frame in the segment and adjusts the appropriate color correction controls.

Understanding the Remove Color Cast Buttons

You can remove a color cast automatically by clicking a Remove Color Cast button and using an eyedropper to identify an area in your image that you want to be color neutral (white, black, or a shade of gray). Symphony analyzes the current color characteristics of the area you have selected and then adjusts color correction controls to make that area color neutral.

Remove Color Cast buttons provide more precise control over color cast removal than Auto Balance buttons because their adjustments are limited either by luminance range or by the impact that they have on existing curve graphs. However, Remove Color Cast buttons are only useful when you are working with an image that has areas that should be color neutral.

Remove Color Cast buttons appear in the Color Correction tool in the following locations:

- Below each of the three ChromaWheels in the Hue Offsets subdividing tab of the HSL tab, as shown in the following illustration:

Remove Color Cast button

- In the Curves tab, as shown in the following illustration:

Remove Color Cast button

Each ChromaWheel Remove Color Cast button is associated with the wheel above it. Adjustments are made only to that wheel; only the parts of the image that fall within the luminance range controlled by that wheel are changed. You choose which ChromaWheel to adjust based on the luminance level of the area you want to identify, as follows:

- To make white or light gray areas of an image color neutral and remove a cast throughout the lightest part of the image, use the Remove Color Cast button below the Highlights ChromaWheel.
- To make mid-gray areas of an image color neutral and remove a cast throughout the midtones of the image, use the Remove Color Cast button below the Midtones ChromaWheel.
- To make black or dark gray areas of an image color neutral and remove a cast throughout the darkest parts of the image, use the Remove Color Cast button below the Shadows ChromaWheel.

The Curves tab Remove Color Cast button works by adding a point to each of the Red, Green, and Blue curves that makes the area you identify with the eyedropper color neutral. You can use the Curves tab Remove Color Cast button repeatedly to identify multiple areas that you want to be color neutral. Each new use adds another point to each of the three curves. (You can add new points up to the 16-point limit, although once several points are distributed along the curve, further points are unlikely to improve the image significantly.)

The effect of each added point on the image as a whole varies depending on the shape of the entire curve. In general, each new point affects the image most in areas with similar luminance values to the area you identify with the eyedropper, and affects the image least in areas with very different luminance values.

Using the Remove Color Cast Buttons

To use a Remove Color Cast button:

1. Enter Color Correction mode, for example, by selecting Toolset > Color Correction.
2. In the Timeline, make sure that the Record Track button for the video track on which you want to make corrections is the topmost selected track.
3. In the Timeline or in the Composer window, navigate to the segment you want to correct.
4. Do one of the following:

- Click the Remove Color Cast button below a ChromaWheel in the Hue Offsets subdividing tab of the HSL tab.

- Click the Remove Color Cast button in the Curves tab.

The button appears highlighted.

5. Drag the pointer into the image.

   The pointer changes to an eyedropper.

6. Continue to drag the eyedropper until it is over the part of the image you want to become color neutral, and then release the mouse button.

   Avid Color Correction analyzes the part of the image you have identified and adjusts the controls to remove the color cast.

Considerations When Using Automatic Color Correction

Although automatic color corrections are much simpler to learn and perform than manual corrections, practice and experience will still improve your ability to correct a range of images with different color characteristics. If one set of automatic corrections does not produce good results, remove it and try a different combination. Remember also that some images might require manual correction in addition to or instead of automatic correction.

The following tips and suggestions will help you to achieve the best possible results when using automatic color correction:

- The Auto Contrast correction is most useful for images that should have areas of strong highlight (white or close to white) as well as areas of strong shadow (black or close to black). If you make an Auto Contrast correction on an image that should not have such a full tonal range (many close-ups fall into this category), the correction might introduce too much contrast. When an image requires strong highlights but not strong shadows (or the reverse), you can use the Auto White or the Auto Black button to set the white or black point without making the overall range of tones too extreme.
- When you perform both an Auto Contrast and an Auto Balance correction, the order in which you perform these two operations affects the final quality of the correction. In most cases, you achieve the best results for most images by doing the following:
  - In the Hue Offsets subdividing tab of the HSL tab, use Auto Contrast first, and then use Auto Balance
  - In the Curves tab, use Auto Balance first, and then use Auto Contrast

- There is usually no gain in performing an automatic correction more than once on the same image, even if the second correction would be made in a different group from the first. For example, once you have performed an Auto Balance in the Curves tab, you do not usually see any improvement in the color balance of the image if you perform a second Auto Balance either in the Curves tab or in the Hue Offsets subdividing tab of the HSL tab.
- If an Auto Contrast and Auto Balance combination has improved an image but some color cast remains, you can often fine-tune the correction using one or more of the Remove Color Cast buttons.
- Automatic corrections you make in the Hue Offsets subdividing tab of the HSL tab and those you make in the Curves tab do not produce identical results for most images (and might produce markedly different results for some images). This is because the methods for calculating the corrections are different and because the controls that are being adjusted operate differently. Automatic corrections in the Curves tab often work well for correcting basic problems caused by incorrect camera color balancing. Automatic corrections in the Hue Offsets subdividing tab of the HSL tab are often better for more extreme problems such as bad lighting conditions. However, there are no rules that cover all situations. If automatic correction in one color correction group does not yield good results, remove it and try a correction in the other group.

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, or from the Windows Color dialog box or the Macintosh Colors panel.

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.

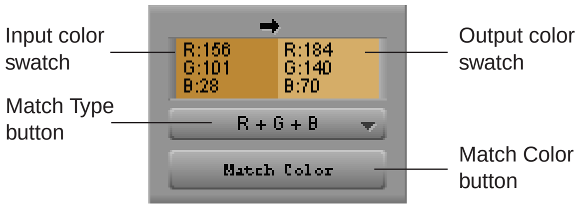
When you are working in the Curves group, the Color Match control also includes the NaturalMatch™ feature. NaturalMatch allows you to replace the hue values in an image with new output values without distorting the saturation and luminance values in the image.

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.

Slightly different versions of the Color Match control also appear as effect parameters in the Spot Color Correction effect and the Paint Effect. For more information on spot color correction, see the chapter *"Spot Color Correction" on page 321.*

Making a Correction with the Color Match Control

The following illustration shows the Color Match control.



To make a correction using the Color Match control:

1. If you have not already done so, click the Color Correction Mode button below the Timeline to enter Color Correction mode.
2. In the Color Correction tool, click the tab that includes the Color Match control with which you want to work.
3. (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.

For information on the Correction Mode Settings dialog box, see *"Correction Mode Settings" on page 166.*

4. 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.

   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.

5. 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 eyedropper in the image.

   c. Release the mouse button to complete the selection.

      The output color appears in the output color swatch.

Your output color is usually selected 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 select 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 selecting 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 "Adjusting a Color Parameter" in the Help.

6. Click the Match Type button, and select a Match Type to determine the exact nature of the match the system makes.

   The options available in the Match Type menu depend on the group in which you are working. For more information on Match Type options, see "Match Type Options" on page 193.

7. 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.

Match Type Options

The options available in the Match Type menu reflect the way in which color is handled in the group in which you are working. The following tables describe the options available in the Match Type menu.

HSL Group (Controls Tab) Match Type Options

The following table describes the Match Type options for the HSL group in the Controls tab.

Option	Description
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.
H + S	The system matches based on both the hue and the saturation of the color selected in the output color swatch.
H + L	The system matches based on both the hue and the luminance of the color selected in the output color swatch.
S + L	The system matches based on both the saturation and the luminance of the color selected in the output color swatch.

HSL Group (Hue Offsets Tab) Match Type Options

The following table describes the Match Type options for the HSL group in the Hue Offsets tab.

Option	Description
Master	The system matches based on both the hue and the saturation across the full tonal range.
Highlights	The system matches based on both the hue and the saturation across the highlights portion of the tonal range as defined in the Luma Ranges tab.
Midtones	The system matches based on both the hue and the saturation across the midtones portion of the tonal range as defined in the Luma Ranges tab.
Shadows	The system matches based on both the hue and the saturation across the shadows portion of the tonal range as defined in the Luma Ranges tab.

Channels Tab Match Type Options

The following table describes the Match Type options for the Channels tab.

Option	Description
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.
Red	The system matches based on only the value of the Red color channel of the color selected in the output color swatch.
Green	The system matches based on only the value of the Green color channel of the color selected in the output color swatch.
Blue	The system matches based on only the value of the Blue color channel of the color selected in the output color swatch.
R + G	The system matches based on the values of the Red and Green color channels of the color selected in the output color swatch.
R + B	The system matches based on the values of the Red and Blue color channels of the color selected in the output color swatch.
G + B	The system matches based on the values of the Green and Blue color channels of the color selected in the output color swatch.

Levels Tab Match Type Options

The following table describes the Match Type options for the Levels tab.

Option	Description
Black Point	The system adjusts the black point of the image to the brightness value of the color selected in the output color swatch.
Gray Point	The system adjusts the gray point of the image to the brightness value of the color selected in the output color swatch.
White Point	The system adjusts the white point of the image to the brightness value of the color selected in the output color swatch.

Curves Tab Match Type Options

The following table describes the Match Type options for the Curves tab.

Option	Description
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.
Red	The system matches based on only the value of the Red color channel of the color selected in the output color swatch.
Green	The system matches based on only the value of the Green color channel of the color selected in the output color swatch.
Blue	The system matches based on only the value of the Blue color channel of the color selected in the output color swatch.
R + G	The system matches based on the values of the Red and Green color channels of the color selected in the output color swatch.
R + B	The system matches based on the values of the Red and Blue color channels of the color selected in the output color swatch.
G + B	The system matches based on the values of the Green and Blue color channels of the color selected in the output color swatch.
NaturalMatch	Select NaturalMatch to select or deselect the NaturalMatch feature. When this command is selected, all the match types in the Curves and Secondary groups use NaturalMatch 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 197.

Secondary Tab Match Type Options

The following table describes the Match Type options for the Secondary tab.

Option	Description
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.
H + S	The system matches based on both the hue and the saturation of the color selected in the output color swatch.
NaturalMatch	Select NaturalMatch to select or deselect the NaturalMatch feature. When this command is selected, all the match types in the Curves and Secondary groups use NaturalMatch 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 197.

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 black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

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 using NaturalMatch to automatically generate Curves 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

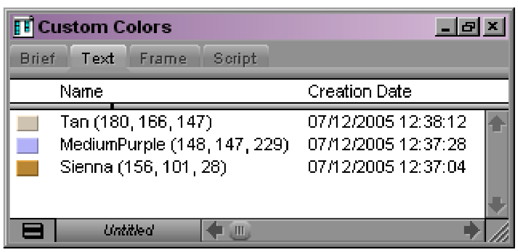
You can save a color that you have selected in the Color Match control as an item in a bin. For example, you might want to save a skin tone that you want to match throughout your sequence. You can then load that color back into the Color Match control whenever you need to make a match based on that color.

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 drag the rectangular outline to a bin.

   While you drag, the pointer changes to a hand, and a rectangular outline appears.

   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 Color Correction Mode Settings" on page 165.



2. (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:

- Click the color icon in the bin, and drag it to 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 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 the color adjustment controls found in the Video Input tool and in the Color Effect.

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. 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.

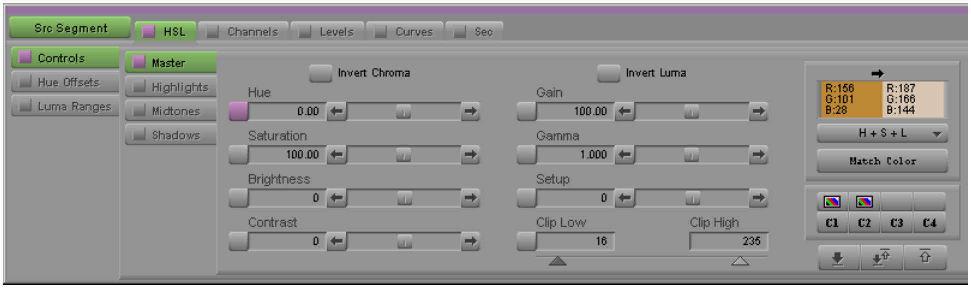
You can invert both the chrominance and luminance values in an image with a single click. You can also set clipping values for both the High and Low ends of the luminance range.

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.

Making Corrections Using the Controls Tab in the HSL Group

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 191.

The following illustration shows the Controls tab.



To make a color 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 Correction Type button and select a correction type.
   c. Click the HSL tab.

For more information on correction types, see "Selecting Correction Types" in the Help.

2. Click the Controls subdividing tab in the first vertical group on the left side of the Color Correction tool.
3. Click the appropriate subdividing tab in the second vertical group on the left side of the Color Correction tool.

   This tab selection determines the brightness range across which your adjustments will apply. The following table describes the available options.

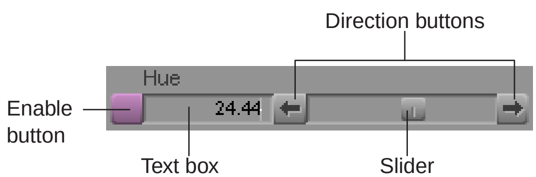
Tab	Description
Master	Adjustments apply to the whole image.
Highlights	Adjustments apply to the brightest parts of the image only.
Midtones	Adjustments apply to the midrange of brightness values only.
Shadows	Adjustments apply to the darkest parts of the image only.

By default, highlight, midtone, and shadow ranges represent equal one-third subdivisions of the full brightness range. You can customize these ranges using the controls in the Luma Ranges tab. For more information, see *"Understanding the Luma Ranges Tab" on page 211.*

4. 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 Sliders in the HSL Group" on page 202 and "Controls Tab Controls" on page 203.
   - 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 191.

Using the Sliders in the HSL Group

The following illustration shows the Hue slider.



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 and hold one of the direction buttons 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.

You can also use the mouse scroll wheel to change values in the Color Correction tool. Click a slider or click in a value text box, then press the Ctrl key and use the scroll wheel to change the value in small increments, or press the Ctrl and Shift keys (or the Ctrl and Alt keys) and use the scroll wheel to change the value in increments of -10 or +10.

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 162.

Controls Tab Controls

The following table describes the individual controls available in the Controls tab of the HSL tab.

Control	Description
Invert Chroma (Master subdividing tab only)	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.
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. When applied in the Master subdividing tab, a value of 120 shifts red to blue, and a value of –120 shifts red to green.
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. *The Master subdividing tab Saturation slider is also available as the Master Saturation slider in the Curves tab. Adjusting the Master Saturation slider in the Curves tab enables the HSL > Controls > Master tab hierarchy.*
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 Setup control. One important difference, however, is that the Brightness control interacts with the Contrast control, while the Setup control interacts with the Gain and Gamma controls. If you have made a Contrast adjustment, it is better to adjust luminance further using the Brightness slider. If you have made an adjustment using the Gain or Gamma controls, it is better to adjust luminance further using the Setup control.
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.
Invert Luma (Master subdividing tab only)	Reverses the brightness level of every pixel in the image. Dark areas become light, and light areas become dark.

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 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.
Setup	Adjusts the setup or black point for the image. Values range from –255 to 255, where 0 represents the unchanged image. The effect of the Setup control is very similar to that of the Brightness control. One important difference, however, is that the Setup 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 using the Setup control. If you have made a Contrast adjustment, it is better to adjust luminance further using the Brightness slider. *The Master subdividing tab Gain, Gamma, and Setup sliders are also available in the Curves tab as the Master Gain, Master Gamma, and Master Setup sliders. Adjusting any of these sliders in the Curves tab enables the HSL tab, the Controls subdividing tab, and the Master brightness subdividing tab.*
Clip Low	Sets the Low clip for the image. All pixels with the Low clip value or less are clipped to black. The default setting is 16 on an 8-bit scale, representing the normal broadcast value for black.
Clip High	Sets the High clip for the image. All pixels with the High clip value or more are clipped to white. The default setting is 235 on an 8-bit scale, representing the normal broadcast value for white.

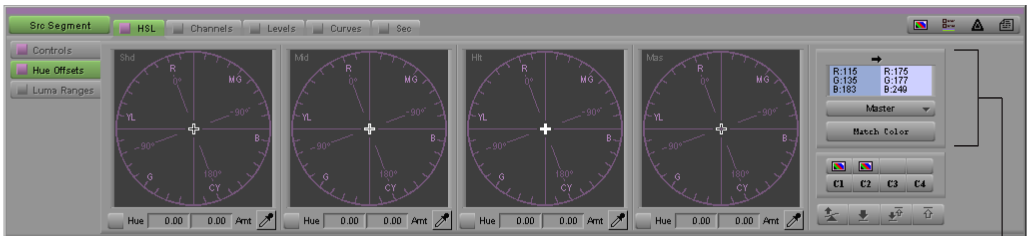
Understanding the Hue Offsets Tab

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

Since the ChromaWheels provide a control 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 191.

The following illustration shows the Hue Offsets tab.



Shadows ChromaWheel
Midtones ChromaWheel
Highlights ChromaWheel
Master ChromaWheel
Color Match control

Understanding ChromaWheel Color Wheels

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

ChromaWheel Displays

By default, each Chroma Wheel displays as a graphical outline that resembles the design of the Vectorscope monitor in the Video Input tool. Colors are oriented in the same manner as in the Vectorscope monitor, with red near the top. Axes indicate the offset in degrees from the 0° point, which corresponds with red.

You can display color backgrounds in the ChromaWheels that help you to understand the effect of an adjustment as you work. For more information, see “Customizing Color Correction Mode Settings” in the Help.

The Hue Offsets color wheels are designed to create a familiar environment for users by duplicating the general appearance of the Vectorscope monitor. They are not calibrated in the same way as in the Vectorscope monitor.

Each wheel 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. The following table shows the four pointers.

Color Wheel	Pointer
Shadows	
Midtones	
Highlights	
Master	

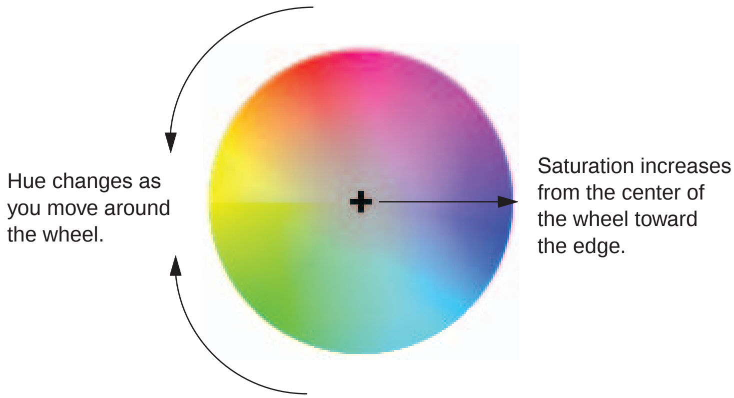
How ChromaWheels Work

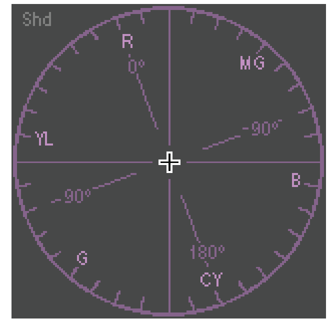
The ChromaWheel color wheel is a circular graph that represents hue and saturation values. Hue values are mapped around the circumference of the wheel, with colors in the same positions that they occupy on a vectorscope. Red is at the 0° point on the wheel, and cyan is at the 180° point.

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.





The graphical outline shows the degree values for measuring hue.

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When you use ChromaWheels 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 color wheel 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 Correction Type button and select a correction type.
   c. Click the HSL tab.

For more information on correction types, see "Working with Correction Types" in the Help.

2. Click the Hue Offsets subdividing tab in the first vertical group on the left side of the Color Correction tool.

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

   - Click one of the automatic color correction buttons, or use one of the Remove Color Cast buttons, to adjust one or more of the ChromaWheel color wheels automatically. For more information, see “Correcting Color Automatically in the Hue Offsets Tab” in the Help and “Using the Remove Color Cast Buttons” on page 189.
   - Drag the crosshair pointer on the appropriate ChromaWheel color wheel.

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

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 dragging the pointer.

   - Type values in the Hue and Amt text boxes for the appropriate ChromaWheel color wheel 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 degrees to 180 degrees where 0 degrees 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 color wheel 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.

You can also use the mouse scroll wheel to change values in the Color Correction tool. Click a slider or click in a value text box, then press the Ctrl key and use the scroll wheel to change the value in small increments, or press the Ctrl and Shift keys (or the Ctrl and Alt keys) and use the scroll wheel to change the value in increments of -10 or +10.

   - 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 191.

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

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

Examples of Hue Offsets Settings

The following illustrations help you to understand the Hue Offsets controls by showing the effect on an image of several simple adjustments made in the Master Hue Offsets ChromaWheel color wheel.

The Master wheel is used in these examples because it operates across the entire luminance range and alters the image in ways that are easy to see and understand. You have more precise control of corrections if you use the Shadows, Midtones, and Highlights wheels to make adjustments in specific luminance ranges.

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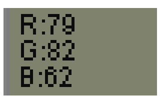
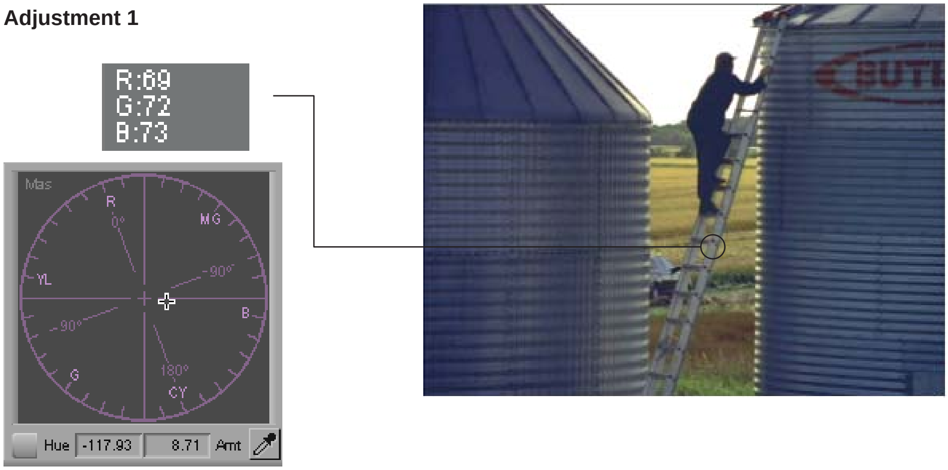
Original Image



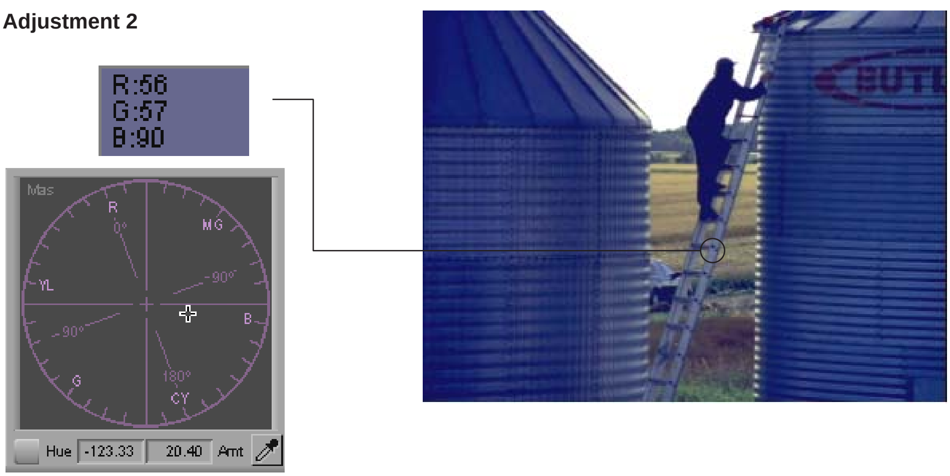
This original image has a yellow cast. The swatch to the left, which shows the sample RGB values for an area of the ladder, indicates that there is relatively less blue than red or green in the grays of the image. You might not need to change this coloring, but you might want to restore the metal objects in the image to a more neutral gray or even to change the look and mood of the image by creating a different cast. One way to do this easily is using the Hue Offsets ChromaWheel color wheels.

Adjustment 1



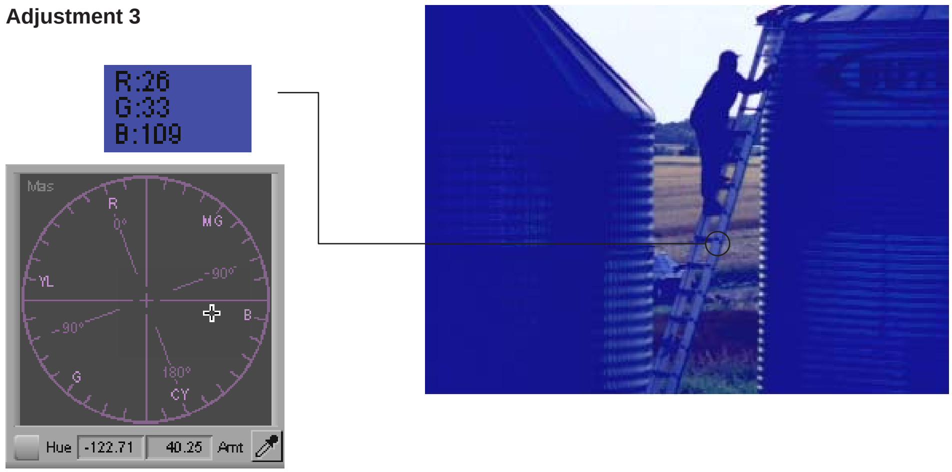
Adjustment 1 alters the original image by introducing just enough blue to make the grays in the image neutral. The RGB values in the ladder now show almost equal amounts of red, green, and blue. The yellow cast is corrected by moving the crosshair pointer in the ChromaWheel color wheel in the opposite direction from yellow.

Adjustment 2



Adjustment 2 increases the intensity of the blue that is being added to the original image. Metal objects in the image are now distinctly blue-gray, and the sample values from the ladder show more blue than red or green.

Adjustment 3



Adjustment 3 adds a large amount of blue to the original image. The metal objects now look very blue, and the grain elevators are so saturated in blue that they have lost a lot of detail. Though you might be unlikely to make such an extreme adjustment except as part of a deliberately unrealistic look, it demonstrates how much an image can be changed with a single adjustment of a Hue Offsets ChromaWheel color wheel.

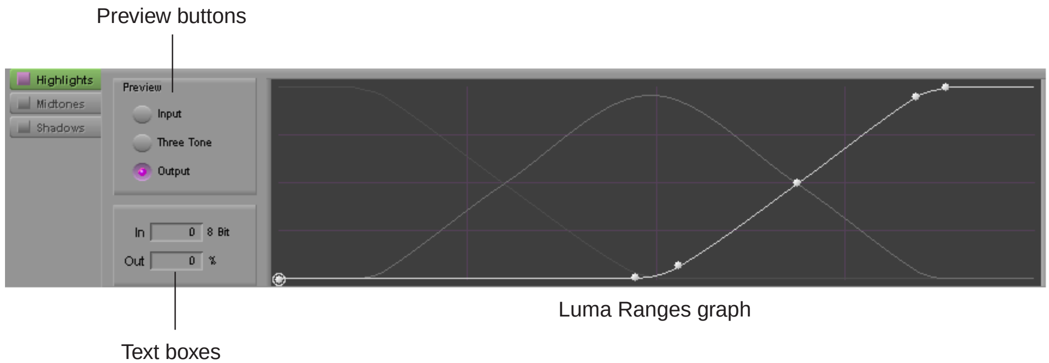
Understanding the Luma Ranges Tab

The Luma Ranges tab allows you to view and customize the luminance ranges that you are using to define the highlights, midtones, and shadows in other parts of the HSL group. You make these adjustments on a Luma Ranges graph.

You can view your images in three different ways while you are working in the Luma Ranges tab. You can view the uncorrected image, the image with all active corrections applied, or a three-tone preview that uses white, gray, and black to indicate the three luminance ranges.

You might use the Luma Ranges tab as a tool to adjust the three luminance ranges before you make other HSL adjustments. Alternatively, you might make HSL adjustments that affect the different ranges and then use the Luma Ranges tab to fine-tune the brightness ranges to which those adjustments apply. For example, you can make an adjustment that you like in the Highlights wheel of the Hue Offsets tab and then fine-tune the range of pixels to which that adjustment applies using the Luma Ranges tab.

The following illustration shows the Luma Ranges tab with the Highlights subdividing tab displayed.



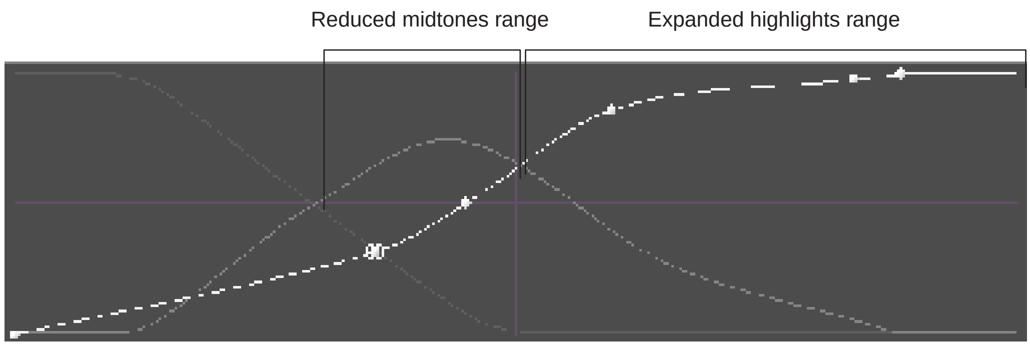
Understanding the Luma Ranges Graph

The Luma Ranges graph shows curves for each of the three luminance ranges: highlights, midtones, and shadows. You can always see all three curves, but you can make adjustments only to the curve that is active as defined by your subdividing tab.

The graph plots brightness values from 0 to 255 on the horizontal axis and percentage values on the vertical axis. The system defines a luminance range as the area in the graph where the curve for that range is highest in the graph. The following illustration shows this arrangement for the default curves.

When you adjust a curve, you move a control point on the curve up or down on the graph. This results in more or less of the curve being highest in the graph, which enlarges or reduces the luminance range for that curve.

For example, if you raise the highlights curve near the center of the graph and drop the midtones curve in the same area, you expand the highlights range toward the middle of the full luminance range and contract the midtones range into a smaller area. The following illustration shows this adjustment.



To fine-tune luma range adjustments, you should understand the role of all three curves in defining exactly how the system treats each level of brightness. At any point on the brightness scale (the horizontal axis of the graph), percentage values are plotted for all three ranges — shadows, midtones, and highlights. Though a luminance range is broadly defined by which curve is highest in the graph, each brightness level is affected more precisely by all three ranges in the relative percentage amounts shown on the graph.

For example, in the default Luma Ranges settings, brightness level 175 is defined as 50% highlight, 50% midtone, and 0% shadow. Brightness level 215 is defined as 95% highlight, 5% midtone, and 0% shadow. If you have made adjustments to the highlights luminance range elsewhere in the HSL tab, those adjustments are dominant in controlling pixels of brightness 215 but share control of pixels of brightness 175 equally with the midtones adjustments.

With some practice, you will find that you can control the relative impact of your adjustments in different luminance ranges very precisely.

Adjusting Luminance Ranges

To adjust luminance ranges:

1. If you have not already done so:

   a. Move the position indicator to the segment you want to correct.

   b. Click the Correction Type button and select a correction type.

   c. Click the HSL tab.

For more information on correction types, see "Working with Correction Types" in the Help.

2. Click the Luma Ranges tab in the first vertical group of subdividing tabs on the left side of the Color Correction tool.

3. Click one of the following tabs in the second vertical group of subdividing tabs on the left side of the Color Correction tool:

   - Highlights: Displays the Luma Ranges graph with the highlights curve available for editing
   - Midtones: Displays the Luma Ranges graph with the midtones curve available for editing
   - Shadows: Displays the Luma Ranges graph with the shadows curve available for editing

4. Select one of the following options to control how your image displays in the active monitor:

   - Input: Displays the uncorrected image in normal color
   - Three-tone: Displays the uncorrected image using white, gray, and black to represent the highlights, midtones, and shadows luminance ranges
   - Output: Displays the image in normal color with all active corrections applied

   You can switch back and forth freely between these settings as you work to assess your adjustments.

5. Adjust the active curve by adding and adjusting control points using the procedures in "Manipulating Luminance Range Curves" on page 215.

Manipulating Luminance Range Curves

To add a control point to a curve:

- Click the curve at the point where you want to move it.

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

To move a control point:

1. Click the control point to activate it.

   A circle appears around the control point.

2. Do one of the following:

   - Click the point on the graph, and drag it until the curve is in the position you want.
   - Type values in the In and Out text boxes to define the position of the point on 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.

You can also use the mouse scroll wheel to change values in the Color Correction tool. Click a slider or click in a value text box, then press the Ctrl key and use the scroll wheel to change the value in small increments, or press the Ctrl and Shift keys (or the Ctrl and Alt keys) and use the scroll wheel to change the value in increments of -10 or +10.

To delete a control point:

- Click the point to activate it, and then press the Delete key.

Examples of Three-Tone Previews

The following illustrations show sample three-tone previews for a typical video image and for a test monochrome gradient.

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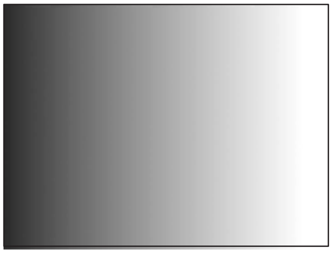
Monochrome gradient (Imported PICT graphic)

Video image



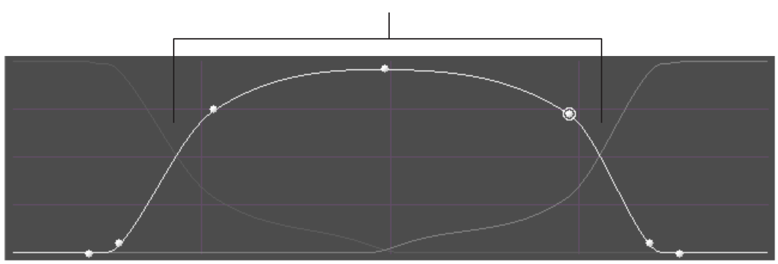
Original images

Three-tone preview using default luma range settings

Three-tone preview with expanded midtones range. The midtones range now includes more of areas such as the sign in the window and the drape beside it.

Expanded midtones range

Luma Ranges graph used to create the expanded midtones range shown in the images immediately above



The Channels Group

The Channels group provides controls that allow you to redefine each output color channel (red, green, blue) by blending different input color components in various proportions.

You can work with components from both the RGB (red, green, blue) and the YCbCr (luminance, red chroma, blue chroma) color spaces. Because you can blend up to four input components to create each output color channel, the Channels group offers very precise control over the final composition of each color channel.

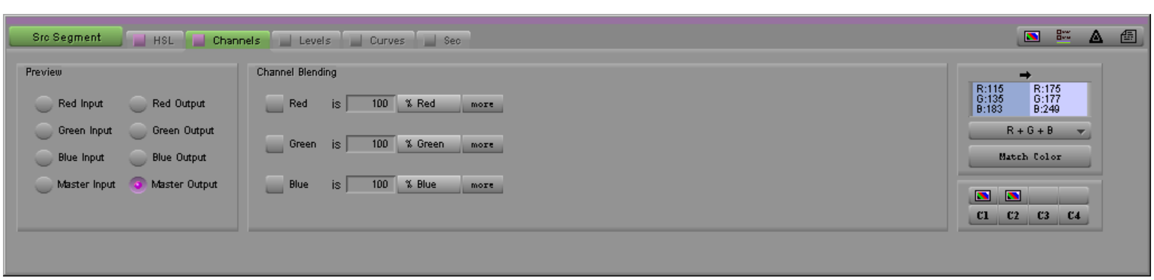
The Channels group also enables you to preview the individual color channels in monochrome. This is useful for checking the amount of contrast or noise in each channel.

The Channels group is particularly useful for identifying a color channel that is deficient in some way — one that is lacking in contrast or is noisy, for example — and repairing it by "borrowing" from another color channel. For some kinds of images, borrowing in this way is the only way to improve the appearance of the image significantly.

For example, you might preview the input channels for a segment and notice that, although the master input shows acceptable overall contrast, the green channel is clipped to white and has therefore lost contrast in the highlight range. It is not possible to "unclip" these green highlights by working in the existing green channel, since the brightness value of all the pixels in the highlight range is the same (or very nearly so). The best solution to this problem is to blend a percentage of one of the other channels into the green channel to reintroduce some contrast and detail. You might redefine the green channel as 80% green and 20% red to solve the problem.

As in other groups, you can use the Color Match control to set the blending controls automatically, based on selected input and output colors. For information on the Color Match control, see "Using the Color Match Control" on page 191.

The following illustration shows the Channels tab in its default configuration.



Making Corrections Using the Channels Tab

To make corrections using the Channels tab:

1. If you have not already done so:
   a. Move the position indicator to the segment you want to correct.
   b. Click the Correction Type button and select a correction type.
   c. Click the Channels tab.

For more information on correction types, see "Working with Correction Types" in the Help.

2. Preview the input image by selecting an input type in the Preview pane:
   - Red Input: Displays the uncorrected red channel in monochrome
   - Green Input: Displays the uncorrected green channel in monochrome
   - Blue Input: Displays the uncorrected blue channel in monochrome
   - Master Input: Displays the complete uncorrected image in color

   For more information on previewing options, see "Considerations When Working with Color Components" on page 220.
3. Adjust the blend for each channel in the Channel Blending pane.

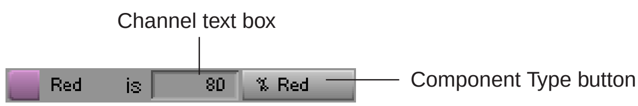
   For more information on using the Channel Blending pane, see "Using the Channel Blending Pane" on page 219.
4. Preview the output image by selecting an output type in the Preview pane:
   - Red Output: Displays the red channel in monochrome with the Channel Blending pane adjustments applied
   - Green Output: Displays the green channel in monochrome with the Channel Blending pane adjustments applied
   - Blue Output: Displays the blue channel in monochrome with the Channel Blending pane adjustments applied
   - Master Output: Displays the complete image in color with the Channel Blending pane adjustments applied
5. Repeat steps 2 through 4 as necessary until you are satisfied with the result.

   Remember that you can switch between Preview options freely at any time and that you can use the Enable buttons to turn each channel blending formula on and off or to reset it to its default values.

Using the Channel Blending Pane

The Channel Blending pane includes text boxes and buttons for each of the three RGB color channels. Use these controls in combination to blend components and to create a formula for the corrected color channel.

In its default configuration, the pane shows only one component for each channel. Each component is represented by a text box that defines the percentage of the component that is in the channel and a button that allows you to select the component type. You can add up to three more components for a total of four.



To select a component type:

- Click the Component Type button, and select a type from the menu.

  For information on the available options, see "Component Type Options in the Channels Tab" on page 220.

To adjust the amount of a component in the blend:

- Type a value in the text box for the component, and then press Enter (Windows) or Return (Macintosh). Values can range from –200% to 200%.

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.

You can also use the mouse scroll wheel to change values in the Color Correction tool. Click a slider or click in a value text box, then press the Ctrl key and use the scroll wheel to change the value in small increments, or press the Ctrl and Shift keys (or the Ctrl and Alt keys) and use the scroll wheel to change the value in increments of -10 or +10.

To add a new component to the formula for a channel:

- Click the "more" button to the right of the existing components.

  The "more" button changes to a plus (+) button, and a new set of component controls appears to the right of the button.

To remove components from the formula:

- Click the plus (+) button to the left of the components you want to remove.

  The system removes *all* components to the right of the plus (+) button you click.

Component Type Options in the Channels Tab

The following table describes the component type options available in the Channels tab of the Color Correction tool.

Option	Description
Red	The input red channel.
Green	The input green channel.
Blue	The input blue channel.
Luma	The luminance channel in the component video signal.
Cr	The red chroma channel in the component video signal.
Cb	The blue chroma channel in the component video signal.
Offset	A constant value that adjusts all the other values in the formula.
Invert	This option subtracts the component from the overall formula instead of adding it. Select one of the other options, and then select Invert to invert it. A minus sign (–) appears after the component name when it is inverted. This has the same effect as entering a negative value for a component: 20% Green – is the same as –20% Green.

Considerations When Working with Color Components

When you find that one of your color channels has a problem that you want to correct by blending, you need to look for another color component that can correct the problem while minimizing any unwanted changes. In general, you should look for a component that exhibits less of the specific problem you want to correct but that otherwise looks similar to the problem channel.

You do not have to restrict your component choices to the same color space (RGB or YCbCr). In fact, it is common practice when performing advanced color correction to borrow from a different color space. For example, if you have a green channel that is noisy in the highlight range, you might find that the Cb (blue chroma) component has less highlight noise but is otherwise similar in its brightness distribution to the green channel. Blending a percentage of Cb into the green channel reduces the noise without greatly disturbing other aspects of the channel.

You can preview the full range of color components available by temporarily redefining one of the existing channels. For example, if you want to see what the Cb component looks like in comparison to your problem green channel, you can redefine the red channel as 100% Cb. Then you can switch back and forth between the Red Input and Green Input previews to compare the two.

The total of the percentages you set for a channel does not need to be 100. The percentage values simply indicate relative proportions of one component as opposed to others.

Examples of Channel Blending Settings

The following illustrations show two representative Channel Blending settings for the red channel.

The following detailed example shows how an individual channel is altered by blending.

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The Blue Input monochrome preview shows that the blue channel lacks contrast. Blending 25% of the green channel information into the blue channel (as shown in the illustration of the controls) introduces somewhat more contrast into the blue channel.

The effect on the Master image in this case is not dramatic; this might or might not be desirable, depending on your project needs. A little extra detail has been obtained in the lower half of the image, but the color characteristics have changed so that the image is less intensely yellow. This probably improves the look of the sky; however, it reduces the strength of the yellow color in the sunflowers.

Blue Input preview

Blue Output preview

Master Input preview

Master Output preview

The Levels Group

The Levels group allows you to control the relative brightness or darkness of an image by defining the white point, gray point, and black point of video material.

You can do this for the master channel (red, green, and blue combined) or for each of the color channels. You can also control the white and black points only for the luminance range and for the composite signal to ensure your sequence is within legal limits. If you make adjustments in the master channel and in one or more of the other channels, the final output is the cumulative result of all the adjustments.

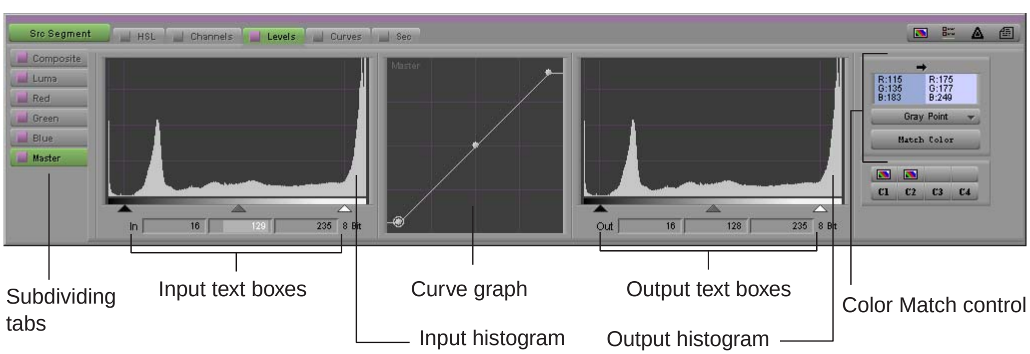
There are four ways to define the white, gray, and black points. You can type numerical values, adjust sliders on a histogram control, move control points on a ChromaCurve graph, or use the Color Match control to set points automatically, based on selected input and output colors. For information on the Color Match control, see “Using the Color Match Control” on page 191.

The main use of the Levels group is to rebalance the color or luma range. The group provides a great deal of control over the amount of contrast and detail visible in the video image, especially since you can make adjustments on the individual color channels. The Levels group is, therefore, a more refined and specialized version of the Gain, Gamma, and Setup controls in the HSL tab.

You might want to extend the range of contrast and detail in an image that lacks a full range (either in one color channel or across all the color channels), or you might want to deliberately reduce detail in part of the range (perhaps to expand another part of the range that is more important in the image). You might also want to adjust the gray point with respect to the black and white points in order to rebalance the midtones without significantly affecting the highlights and shadows.

It is important to understand the difference between a circumstance in which detail can be enhanced with the Levels group and one in which a blending adjustment in the Channels group is more useful. If a channel (for example, green) is clipped to white, then it does not contain enough information to contribute much detail; it must be repaired by borrowing contrast from another color component in the manner described in “The Channels Group” on page 217. If, however, the green channel contains an acceptable range of tones but they are shifted toward the highlight end of the brightness range, resetting the black point in the Levels group improves contrast and detail by spreading the available information over a bigger range.

The following illustration shows the Levels tab in its default configuration.



Understanding Input and Output Levels Adjustments

When you make an adjustment in the Levels tab, you are changing the relationship between input and output values for your image. You can make adjustments on both the input and the output side, and understanding the differences between input and output adjustments is important.

Examples of Black Point Input and Output Adjustments

A typical default setup for the Levels tab shows the following values on both the input and the output side:

Black Point	Gray Point	White Point
16	128	235

The black point and white point values represent normal, safe limits for video broadcast.

If you make an adjustment on the input side, you change the range of input values being mapped to the same range of output values. For example, if you move the black point up to 60, you instruct the system to map all values of 60 or less to the output value of 16. As a result, input values between 60 and 235 are now mapped to the full output range of 16 to 235 (176 input steps on the 8-bit scale are mapped to 220 output steps on the 8-bit scale). You have clipped some black values, but you have also spread the remaining input values over a greater range. Depending on the exact nature of the image, this will probably result in some degree of improvement in contrast and detail.

The input and output values for this adjustment are as follows:

	Black Point	Gray Point	White Point
Input	60	128	235
Output	16	128	235

The following illustrations show the effect of this adjustment for a monochrome gradient and a video image.

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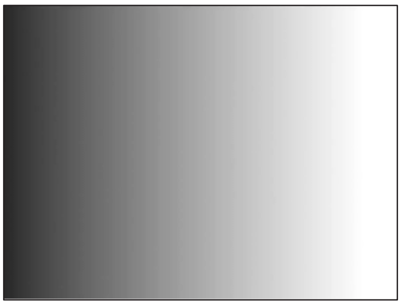
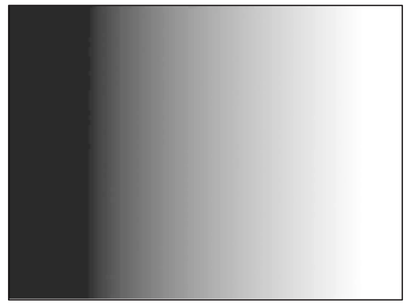


Unadjusted images

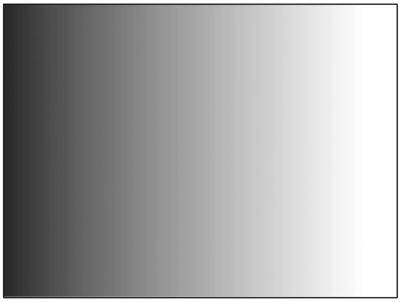


Adjusted images

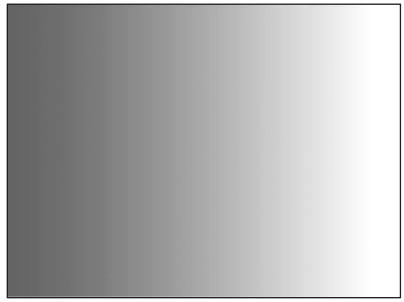
If you make an adjustment on the output side, you change the total range of output steps available. For example, if you leave the input points unchanged and change the output black point to 60, you are deliberately reducing the range of values in the image (220 input steps are mapped to only 176 output values). The input and output values for this adjustment are as follows:

	Black Point	Gray Point	White Point
Input	16	128	235
Output	60	128	235

The following illustrations show the effect of this adjustment for a monochrome gradient and a video image.



Unadjusted images



Adjusted images

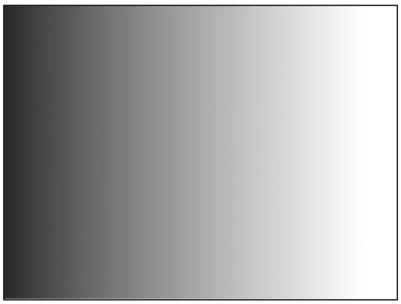
Examples of Gray Point Input and Output Adjustments

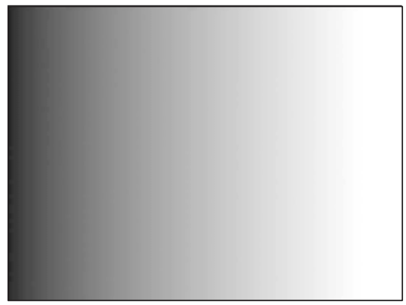
Gray point adjustments work in a similar way to black and white point adjustments except that output gray point changes will not change the total output range. If you change the input gray point to 100 while keeping all other values at their default setting, you are instructing the system to map input values from 16 to 100 to output values from 16 to 128, and input values from 100 to 235 to output values from 128 to 235. This brightens the image somewhat. The input and output values for this adjustment are as follows:

	Black Point	Gray Point	White Point
Input	16	100	235
Output	16	128	235

The following illustrations show the effect of this adjustment for a monochrome gradient and a video image. In the adjusted monochrome gradient, the mid-gray value has moved toward the left.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).





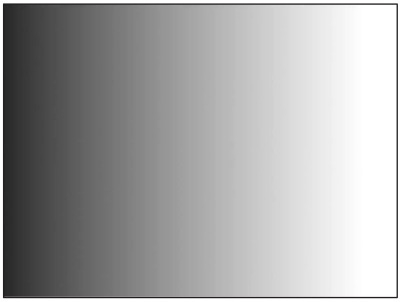
Unadjusted images

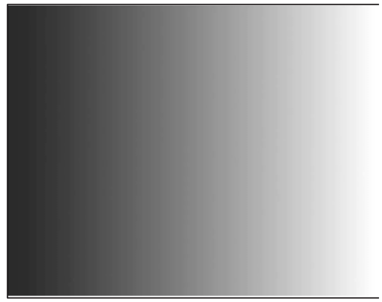
Adjusted images

If, however, you change the output gray point to 100, you are essentially performing the opposite correction. Input values from 16 to 128 are mapped to output values from 16 to 100. Input values from 128 to 235 are mapped to output values from 100 to 235. This has the effect of darkening the image somewhat. The input and output values for this adjustment are as follows:

	Black Point	Gray Point	White Point
Input	16	128	235
Output	16	100	235

The following illustrations show the effect of this adjustment for a monochrome gradient and a video image.





Unadjusted images

Adjusted images

Making Corrections Using the Levels Tab

To make corrections using the Levels tab:

1. If you have not already done so:
   a. Move the position indicator to the segment you want to correct.
   b. Click the Correction Type button and select a correction type.
   c. Click the Levels tab.

For more information on correction types, see “Working with Correction Types” in the Help.

2. Click the appropriate subdividing tab on the left side of the Color Correction tool.

   The subdividing tab selects the type of levels adjustment you want to make. The following options are available:

   - Composite: Allows you to adjust high and low points for the composite signal to ensure that your sequence remains within legal composite limits
   - Luma: Allows you to adjust levels based on luminance values only

Controls in the Composite and Luma tabs work slightly differently from those in the other Levels tabs. For more information on working with the Composite and Luma tabs, see “Working with the Composite and Luma Tabs in the Levels Tab” on page 234.

- Red: Allows you to adjust levels for the red channel only
- Green: Allows you to adjust levels for the green channel only
- Blue: Allows you to adjust levels for the blue channel only
- Master: Allows you to adjust levels for all three color channels

3. Make adjustments to the controls until you are satisfied with the result.

   For more information on the individual controls and how to use them, see “Understanding the Levels Tab Controls” on page 229.

Understanding the Levels Tab Controls

This topic provides detailed explanations of the different controls in the Levels tab.

The Levels controls are dynamically linked. When you make an adjustment to one of the controls, that adjustment is reflected in all other appropriate controls. For example, if you change the input black point value in the text box, the histogram slider and the control point for black on the ChromaCurve graph changes.

Understanding Histograms

A histogram is a graph of information about the color values of all the pixels in an image. Color values are plotted on the horizontal axis of the graph; the number of pixels is plotted on the vertical axis. For example, if an image contains 120 pixels of color value 30, then a bar 120 units high appears at the 30 point along the horizontal axis. A background grid indicates the quartile points on each axis to assist you when you are reading the graph and making adjustments.

Histograms provide an easily understood summary of the color range of an image. If an image is mostly dark, the bars of its histogram are concentrated at the low end. If an image contains only a small number of discrete color values, its histogram shows discrete spikes for each of those values. The following illustrations show several examples of histogram patterns.

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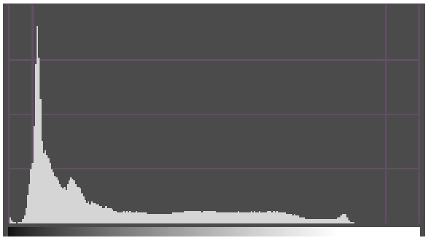
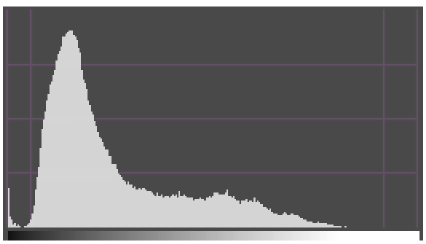
Example 1



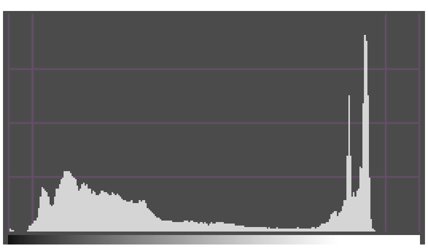
This image has large areas that are very dark and a relatively even distribution of values in the rest of the brightness range. The histogram shows a sharp spike at the very low end, a concentration of values in the lowest 25% of the range, and a relatively even distribution in the rest of the range.

Example 2



This image, like the last, has more dark values than light. But the distribution of values is less extreme, and this is reflected in the histogram, which shows a more rounded peak at the low end, fewer extremely low values, and relatively more midtone values.

Example 3

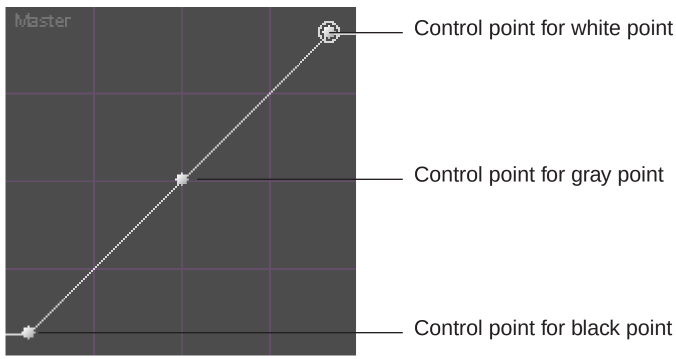


This image has very large highlight areas in the background and on the chicks. Most of the rest of the image is relatively, but not extremely, dark. The histogram shows sharp spikes at the high end, relative concentration in the low to middle range, and few values in the middle to high range.

Understanding ChromaCurve Graphs

A ChromaCurve graph shows the relationship of input values (on the horizontal axis) to output values (on the vertical axis). The graph in the Levels tab has three control points for manipulating black, gray, and white points. 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 Levels tab Curve graph.

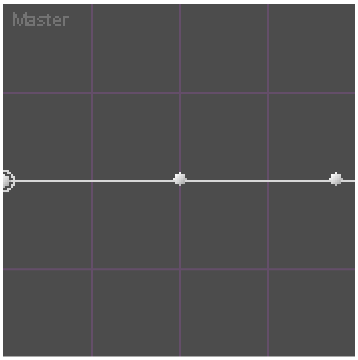


The default curve that displays in the graph (before any adjustments have been made) is therefore an ascending 45 degree straight line, since input and output values are the same across the entire range. (In the previous illustration, the line of the graph is horizontal for the extreme low and high values because of standard video limiting. All input values of 16 and below are mapped to an output value of 16; all input values of 235 and above are mapped to an output value of 235.)

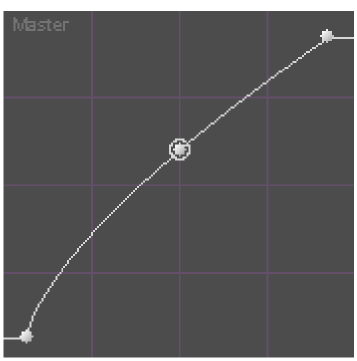
If you make an adjustment that moves part of the line below the 45 degree angle, you make the output values for that part of the image lower than the input values. If you make an adjustment that moves part of the line above the 45 degree angle, you make the output values for that part of the image higher 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. For example, if you move the control point for gray, the white point and black point remain in the same positions. Intermediate values along the curve are calculated based on the relative position of the new gray point with respect to the white and black points. The following illustration shows this behavior for a typical gray point adjustment.



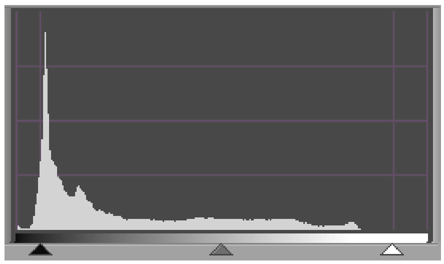
ChromaCurve graph for a typical gray point adjustment. Because of the exact position of the gray point, the curve is steeper near the black point and somewhat shallower near the white point. The adjustment therefore boosts values in the lower half somewhat more than in the upper half One benefit of this is that values near the white point receive some adjustment but are not clipped to white.

Using the Histogram Controls in the Levels Tab

To make adjustments to the histogram controls:

▶ Click the appropriate triangular slider below the histogram, and drag it to its new position.

The following illustration shows the Black Point, Gray Point, and White Point sliders.



For example, if you want to move the input black point toward gray, click the Black Point slider and move it to the right.

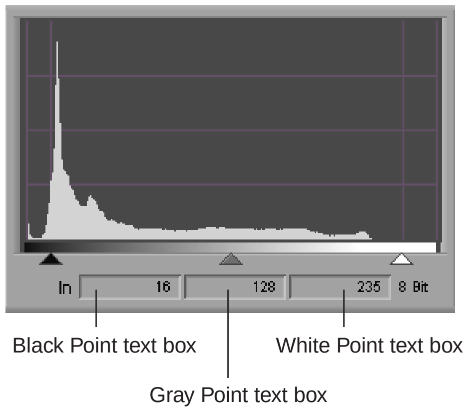
When you make an adjustment to the input controls, the input histogram does not update. The input histogram always shows the distribution of values for the uncorrected image. The appropriate text box, the ChromaCurve graph, and the output histogram do update.

Using the Text Boxes in the Levels Tab

To set black, white, and gray points for both input and output:

▶ Type a numerical value in the appropriate text box, and then press Enter (Windows) or Return (Macintosh).

The following illustration shows the input text boxes.



For example, if you are working with 8-bit values and you type `50` in the In Black Point text box, you set the black point to 50 on a scale from 0 to 255.

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.

You can also use the mouse scroll wheel to change values in the Color Correction tool. Click a slider or click in a value text box, then press the Ctrl key and use the scroll wheel to change the value in small increments, or press the Ctrl and Shift keys (or the Ctrl and Alt keys) and use the scroll wheel to change the value in increments of -10 or +10.

Using the ChromaCurve Graph in the Levels Tab

You adjust the ChromaCurve graph in the Levels tab by clicking one or more of the three control points and dragging it to a new position.

To adjust a control point:

- Click a control point, and drag it to a new position.

  When you click a control point, a circle appears around it to indicate that it is selected.

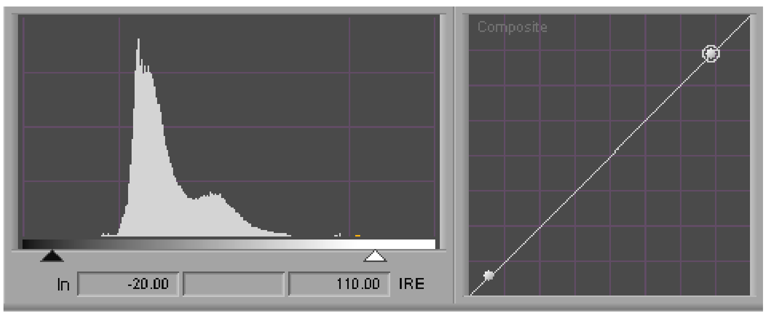
Working with the Composite and Luma Tabs in the Levels Tab

The Composite tab shows histograms that represent the levels in the composite image before and after correction. The Luma tab shows histograms that represent the luminance levels in the image before and after correction. They are useful for checking whether your color-corrected images are within the composite and luminance limits you need to meet and for adjusting levels to meet those limits, if necessary.

The Composite tab can display unit information in either IRE units or millivolts, depending on which option you select in the Correction Mode Settings dialog box. The Luma tab can display unit information in a broader range of unit types. For more information, see "Customizing Color Correction Mode Settings" on page 165.

You can make only black point and white point adjustments in the Composite and Luma tabs. By adjusting these two points, if necessary, you can bring any values that exceed your composite or luminance limits back into an acceptable range.

The following illustration shows the controls for the Composite histogram and Curve graph.



Black and white points only on histogram

Two control points in Curve graph

You can use the Composite and Luma tabs together with the Safe Color feature to ensure that your images remain within limits. If you set the Safe Colors feature to warn you when composite and luminance limits are exceeded, parts of the image that exceed the limit appear orange in the histograms and you can use these warnings to guide your adjustments. For more information on safe colors, see "Safe Color Basics" in the Help and the chapter "Safe Colors."

Examples of Levels Adjustments

The following illustrations show some common levels adjustments. In the first example, white, black, and gray points are all adjusted to create a small but significant change in the amount of contrast available in the image. In the second example, a gray point adjustment alone greatly increases the amount of detail that can be seen.

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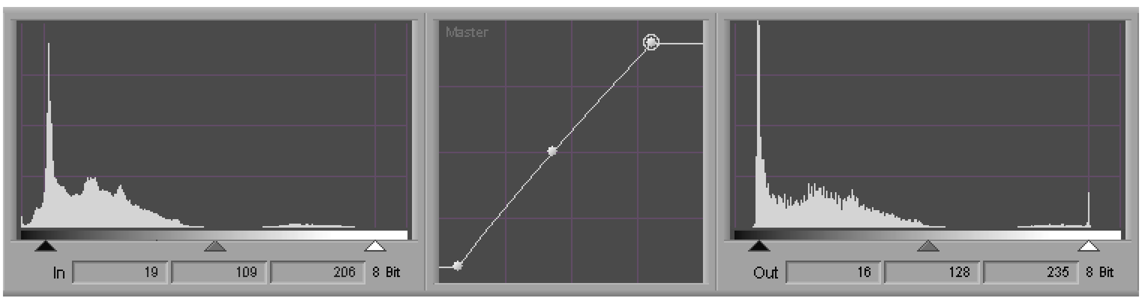
Example 1

Unadjusted image

Adjusted image

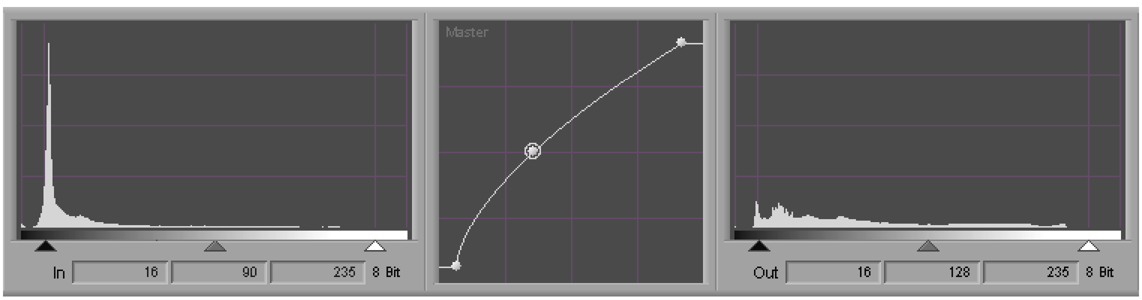


In this example, the intention is to enhance the contrast between the white building exterior and the black building interior toward which the car is driving. By changing the input black point to 19 and the input white point to 206, you increase the contrast range. These adjustments leave the entire image a little dark and lacking in detail, so a gray point adjustment is made to place more of the overall tonal range between gray and white. The final image shows strong contrast between the lightest and darkest areas and sharp highlights around the letters in the foreground.

Example 2

Unadjusted image

Adjusted image



In this example, the gray point adjustment substantially increases the proportion of the tonal range that lies between gray and white. As a result, detail is greatly enhanced in the image, revealing such details as the lettering on the wall at the extreme right.

The Curves Group

The Curves group allows you to control color by placing up to 16 control points on a ChromaCurve graph and then adjusting the points.

As in the Levels tab, you can control the master channel or any individual color channel.

The ChromaCurve graphs in the Curves tab are similar to those in the Levels tab, except that they allow you to add up to 16 control points. With 16 control points, you can control color with great precision in the Curves tab since you can make detailed adjustments to many different subdivisions of the brightness range.

By default, ChromaCurves in the Curves tab display as a graph line plotted through a set of control points. You can also choose to display color backgrounds in the Curves tab ChromaCurves that help you to understand the effect of an adjustment as you work. For more information, see “Customizing Color Correction Settings” in the Help.

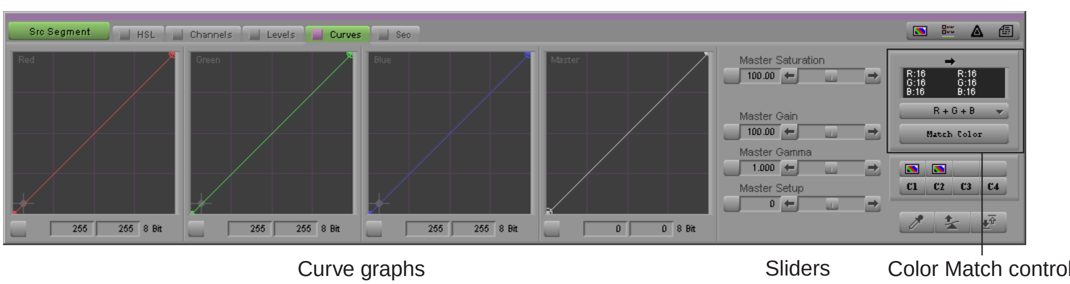
For more information on how ChromaCurve graphs operate, see “Understanding ChromaCurve Graphs” on page 231.

You can also type numerical input and output values in text boxes or use the Color Match control to automatically add control points 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 191 and “Curves and the Color Match Control” on page 241.

The Curves tab also contains four slider controls — Master Saturation, Master Gain, Master Gamma, and Master Setup. These sliders work in exactly the same way as the Saturation, Gain, Gamma, and Setup sliders in the HSL > Controls > Master tab, allowing you to make some HSL-type adjustments without having to leave the Curves tab. When you adjust any of these sliders, you enable the HSL > Controls > Master hierarchy of tabs. For more information on the function of these controls, see “Controls Tab Controls” on page 203.

Making Corrections Using the Curves Tab

The following illustration shows 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 Correction Type button and select a correction type.

   c. Click the Levels tab.

For more information on correction types, see “Working with Correction Types” in the Help.

2. Do one or more of the following:

   - Adjust the curves until you are satisfied with the results.

     For more information on adjusting curves, see "Adjusting Curves" on page 239.

   - Adjust the Master Saturation, Master Gain, Master Gamma, or Master Setup slider controls.

     For more information, see "Using the Sliders in the HSL Group" on page 202 and "Controls Tab Controls" on page 203.

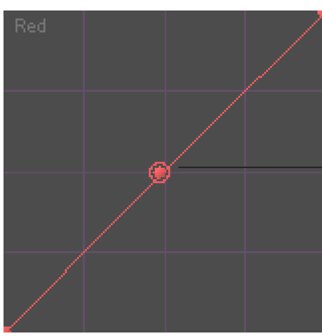
Adjusting Curves

Adjusting ChromaCurve graphs in the Curves tab is similar to adjusting the three-point ChromaCurve graph in the Levels tab. In the Curves tab, however, you can set up to 16 total control points on a ChromaCurve graph.

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.



New 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.

Active control point

Inactive control point

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

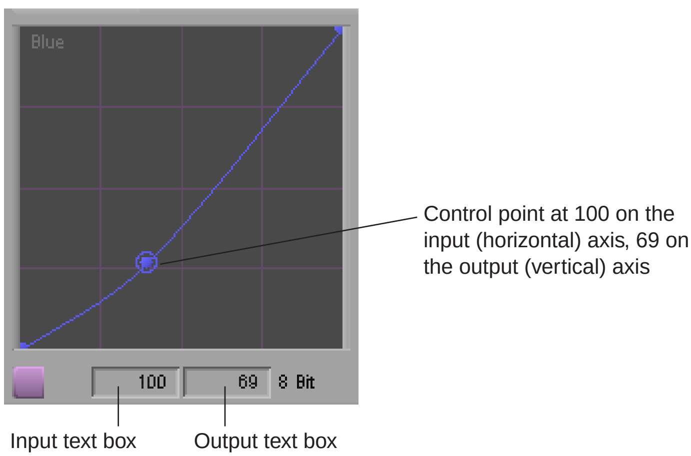
- Click the control point, and drag it to the location on the graph where you want to place the point.

  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 ChromaCurve 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.

You can also use the mouse scroll wheel to change values in the Color Correction tool. Click a slider or click in a value text box, then press the Ctrl key and use the scroll wheel to change the value in small increments, or press the Ctrl and Shift keys (or the Ctrl and Alt keys) and use the scroll wheel to change the value in increments of -10 or +10.



To delete a control point:

1. Click the control point to activate it.

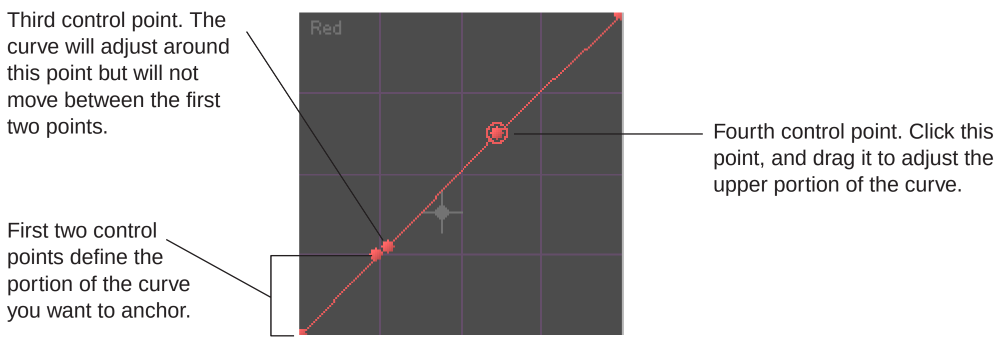
   A circle appears around the control point.

2. Make sure that the pointer is over the curve graph that contains the control point you want to delete.
3. Press the Delete key.

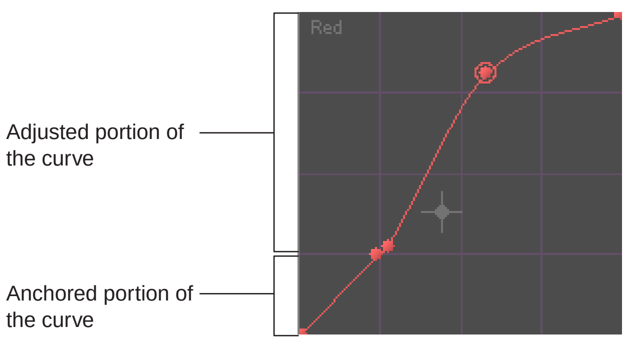
A curve is defined by at least two control points. If you have only two control points set in a curve graph, you cannot delete one.

To anchor a portion of the curve so that it does not move when you are making other adjustments:

1. Place two control points at either end of the portion of the curve you want to anchor.
2. Place a third control point very close to the point that separates the portion of the curve you want to anchor from the portion of the curve you want to adjust.
3. Place a fourth control point on the portion of the curve that you want to adjust.



When you drag the new control point to adjust the curve, the portion of the curve between the first two control points will not move.

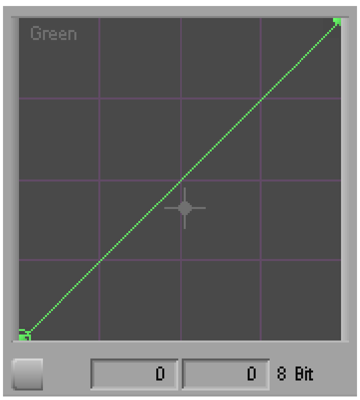


Curves and the Color Match Control

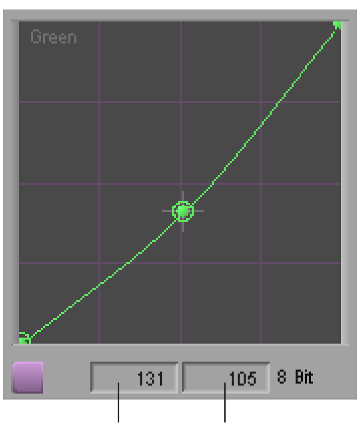
When you use the Color Match control in the Curves tab, a gray crosshair marker appears in each appropriate ChromaCurve graph to mark the intersection of the input value as defined by the input color swatch in the Color Match control and the output value as defined by the output color swatch in the Color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

When you click the Match Color button, the system adds new control points 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 points will appear 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 points will 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.



Input text box
Output text box

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 Curve 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 can learn how curves can be used to control color across different parts of the brightness range.

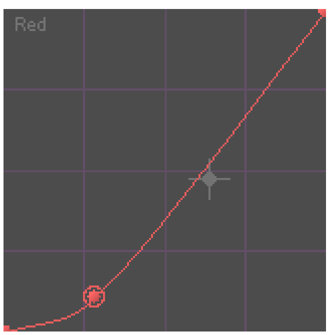
If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

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.

Uncorrected Image

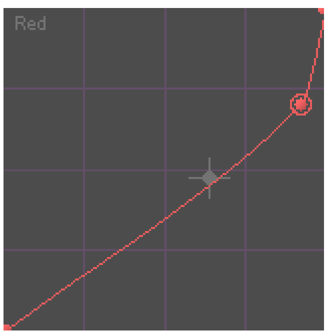
Adjustment 1



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

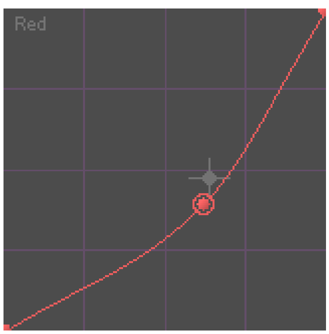
Adjustment 2



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

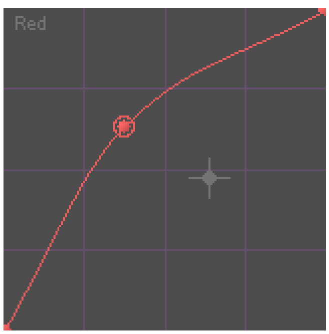
Adjustment 3



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

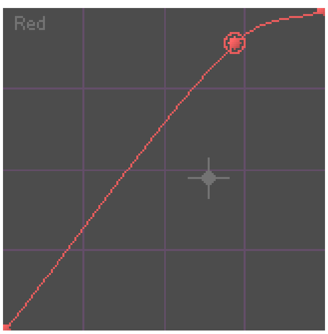
Adjustment 4



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

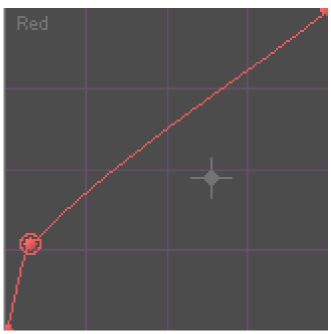
Adjustment 5



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.

The Secondary Group

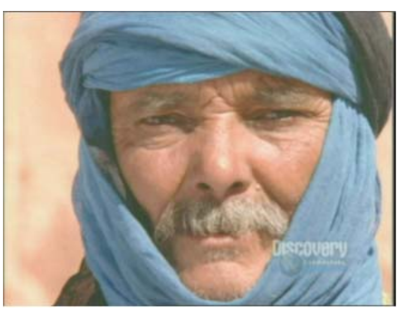
Secondary color correction allows you to make real-time adjustments to parts of an image defined by hue and saturation values. You can apply secondary adjustments, like other adjustments made in Color Correction mode, to a single segment or to multiple segments that you define by setting Source or Program relationships.

Secondary color correction works best when the range of colors that you want to change in an image is isolated in the area or object that you want to change and does not appear elsewhere in the image. For example, you can use secondary color correction to change the look of a sky as long as the blue tones of the sky are not present elsewhere in the image.

If you want to change the colors in part of an image without affecting any other part of the image in any way, you can use the Spot Color effect or certain modes in the Paint Effect to isolate part of the image using drawing tools, and then color correct that part only. For example, if you had a clip showing three red cars and you wanted just one of the cars to be a different color, you could use the Spot Color effect. For more information, see "Spot Color Correction" on page 321.

The following illustrations show a typical example of a secondary color correction. The original color of the turban is changed with virtually no alteration to the color characteristics of other parts of the image.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).



Before

After

Understanding Secondary Color Correction

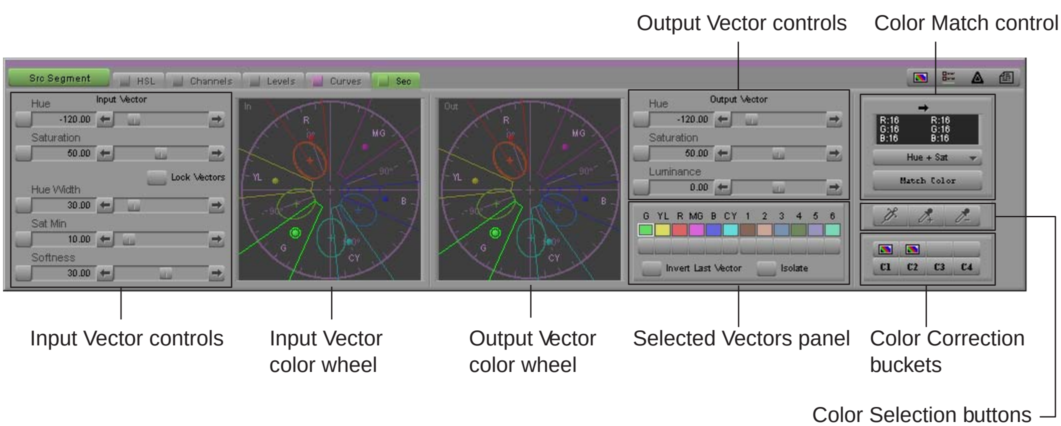
The Secondary group provides controls for making hue and saturation adjustments to as many as 12 distinct parts of the full color range in an image.

Secondary color correction is most useful for images in which the following two circumstances apply:

- You want to change the color characteristics of some parts of the image without altering the rest of the image in any way.
- The parts of the image that you want to change are characterized by hue and saturation values that are absent or nearly absent from the rest of the image.

For example, you might be correcting a shot of a person wearing a bright yellow scarf. After earlier stages of color correction, you are pleased with the image in general, but the scarf remains too bright. You can use secondary color correction to select the bright yellow of the scarf and then make an adjustment to alter the yellow color. The system applies that adjustment to only the bright yellow pixels in the image. As long as no other parts of the image are bright yellow, your correction changes the color of the scarf alone, preserving the rest of the image untouched.

The following illustration shows the Sec (Secondary) tab in its default configuration.



Secondary Color Correction Workflow

The workflow for secondary color correction differs slightly from that used in other color correction groups since you must make corrections in two distinct stages. In the first stage, you define the range of color in the image that you want to alter using the Input Vector controls, the Color Selection buttons, or the Color Match control. In the second stage, you change the hue and saturation values of the defined range of color using the Output Vector controls or the Color Match control.

The following procedure lists the main steps involved in making a secondary color correction and provides cross-references to detailed information on each step.

1. In Color Correction mode, verify that you have selected the track in which you want to make the correction.
2. Click the Sec (Secondary) tab.
3. Select a correction type to control the scope of the correction.

   For more information, see "Selecting Correction Types" on page 154.
4. Move the position indicator to the segment you want to correct.
5. Select a predefined color vector as a starting point for defining the color range you want to correct.

   For more information, see "Understanding Secondary Color Correction Vectors" on page 253 and "Selecting Vectors" on page 260.
6. Adjust the input values of the vector until it corresponds to the color range you want to correct.

   For more information, see "Adjusting Input Vector Values" on page 261.
7. (Option) As an alternative to steps 5 and 6, use the Color Selection buttons to select, enable, and adjust an input color vector based on colors that you sample from the image. For more information, see "Using the Color Selection Buttons" on page 266.
8. Correct the color range you have defined by adjusting the output values of the vector.

   For more information, see "Adjusting Output Vector Values" on page 270.

You can also use the Color Match control to quickly make a correction based on input and output color values that you select, and then fine-tune the correction using Input and Output Vector controls. For more information, see "Using the Color Match Control for Secondary Corrections" on page 271.

Understanding Secondary Color Correction Vectors

Secondary color correction is based on the concept of *color vectors*. A vector is a subset of the full color range in an image. When you work in the Secondary group, you select a predefined vector as a starting point, adjust the vector so that it represents the exact color range you want to correct, and then change the color characteristics of that vector.

Standard and Custom Vectors

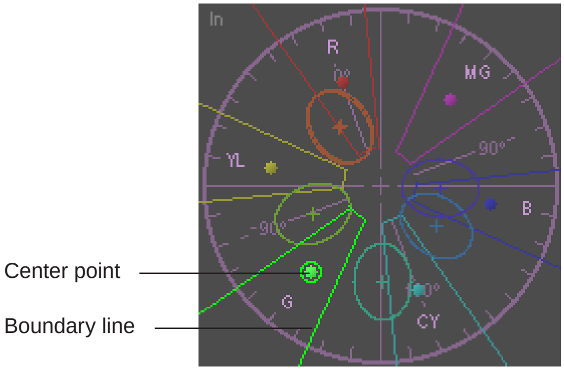
Your Avid editing application provides twelve predefined color vectors. The first six, known as *standard vectors*, represent the following major colors: Green, Yellow, Red, Magenta, Blue, Cyan. The remaining six, known as *custom vectors*, represent other, more narrowly defined colors that are useful starting points for common corrections (for example, blues that can be easily customized to define the sky color in an image).

Vector Display in Color Wheels

The Secondary tab displays vectors graphically in color wheels similar to those used in the Hue Offsets tab of the HSL group. In these displays, the full wheel represents the complete range of possible hue and saturation values, and each vector appears as a distinct area within the wheel. For more information on the color wheels and how they represent hue and saturation values, see "Understanding ChromaWheel Color Wheels" on page 205.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

The following illustration shows a color wheel that displays all the available color vectors.



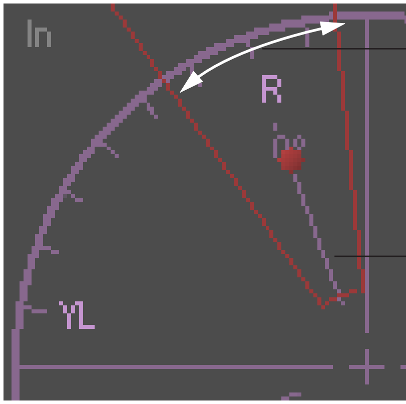
Each vector displays with a boundary line and a center point. The center point marks the base hue and saturation values for the vector, while the boundary lines indicate the range of hue and saturation values that the vector contains. Center points for standard vectors are filled circles; center points for custom vectors are crosshairs.

The hue range of a vector is represented by the arc of the wheel that it covers, and the saturation range of a vector is represented by the part of the wheel's radius that it covers.

The exact range of values included in a vector is also related to the shape of that vector. Standard vectors always appear as wedge shapes — they have no upper saturation limit, and their hue ranges are constant regardless of the saturation level. Custom vectors always appear as ellipses — their saturation ranges are fully adjustable, and their hue ranges scale with the saturation level.

The following illustrations show how to interpret the hue and saturation ranges of a vector from its color wheel display.

Hue Range Example Using Red Standard Vector

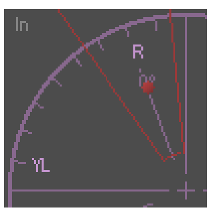


The vector extends for 30° of arc — 15° either side of pure red. A narrower arc limits the vector to a smaller range of reds. A wider arc expands the vector to include more yellow and magenta hues (see next illustration).

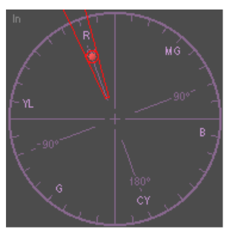
Zero degree line (location of pure red on the color wheel)

Examples of Varying Hue Ranges

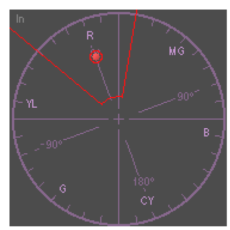
These three examples show three versions of a Red vector with different hue ranges (or widths). The top row shows the color wheel display for each version of the vector. The bottom row shows the color range defined by that vector with the rest of the color wheel shown as grayscale.



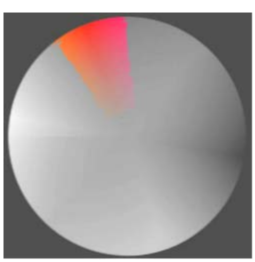
Hue width 30° (default)

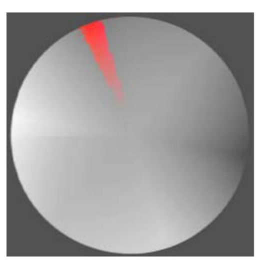


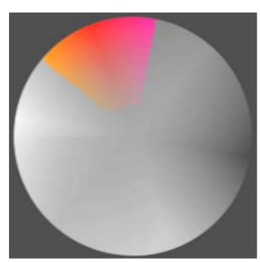
Hue width 10°



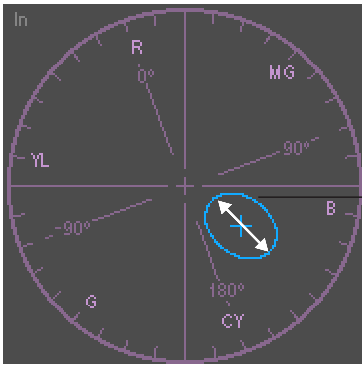
Hue width 60°







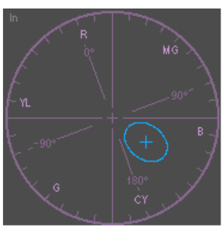
Saturation Range Example Using Custom Vector

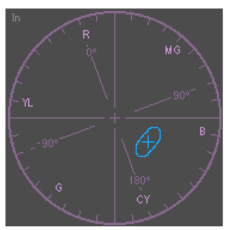


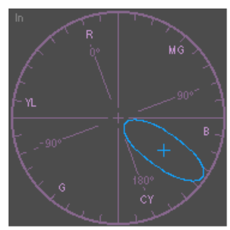
This custom vector (#3 in the Selected Vectors panel) has a default saturation value of 35 and a default saturation width of 40. Its saturation range therefore excludes very low saturation levels and a wide band of high saturation levels. Reducing the saturation width reduces the range of color intensity included in the vector even further. Increasing the saturation width expands the range of color intensity (see next illustration).

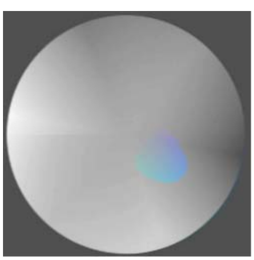
Examples of Varying Saturation Ranges

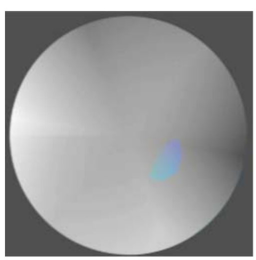
These three examples show three versions of a custom vector with different saturation ranges (or widths). The top row shows the color wheel display for each version of the vector. The bottom row shows the color range defined by that vector with the rest of the color wheel shown as grayscale.

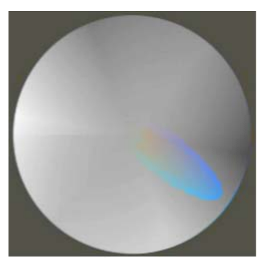

Saturation width 40 (default)


Saturation width 15


Saturation width 80







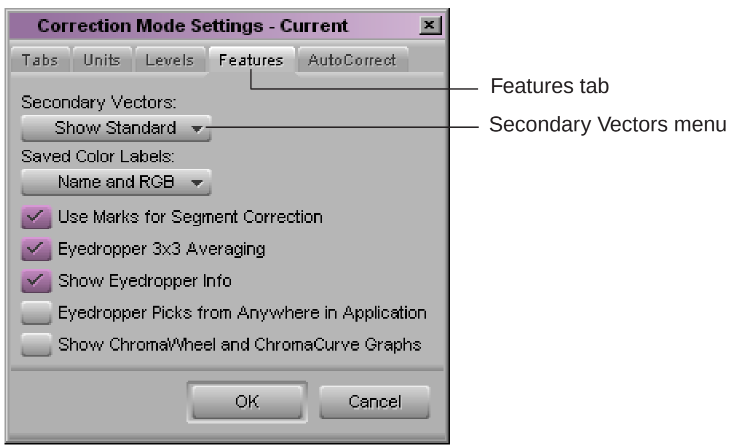
Customizing the Display of Secondary Color Correction Vectors

You can customize which vectors appear in the color wheels by setting options in the Features tab of the Correction Mode Settings dialog box.

To customize a vector display:

1. Open the Correction Mode Settings dialog box by doing one of the following:
   - In the Project window, click the Settings tab, and then double-click Correction in the Settings scroll list.
   -  In the Color Correction tool, click the Correction Mode Settings button.

   The Correction Mode Settings dialog box opens.
2. Click the Features tab.

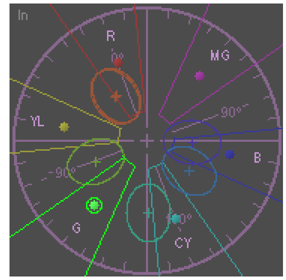
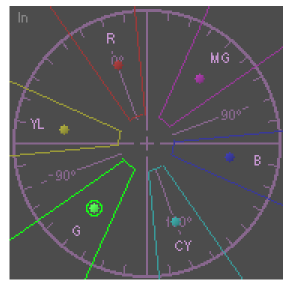
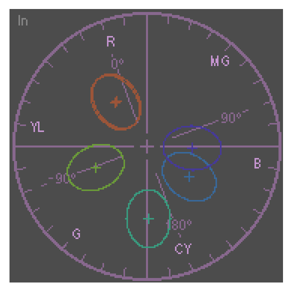
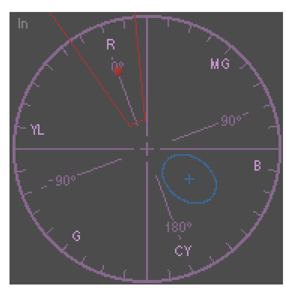


3. Click the Secondary Vectors menu, and then select an option.

   For detailed information on the available options, see "Options for Secondary Color Correction Vector Display" on page 257.
4. Click OK.

Options for Secondary Color Correction Vector Display

The following table describes available options in the Secondary Vectors menu in the Features tab of the Correction Mode Settings dialog box.

Option	Description	Display in Color Wheels
Show All	Shows all twelve vectors in the color wheels of the Secondary tab.	
Show Standard	Shows the six standard vectors (Green, Yellow, Red, Magenta, Blue, Cyan) in the color wheels of the Secondary tab. This setting also shows custom vectors that are enabled. This is the default setting.	
Show Custom	Shows the six custom (elliptical) vectors in the color wheels of the Secondary tab. This setting also shows standard vectors that are enabled.	
Show Enabled	Shows only those vectors that are currently enabled in the Selected Vectors panel. The illustration shows the Red standard vector and one custom vector.	

Understanding the Selected Vectors Panel

The Selected Vectors panel provides a central location in the Secondary group tab for controls that allow you to select or enable individual vectors.

In addition, the Selected Vectors panel includes the following check boxes:

- Invert Last Vector: Checking this box inverts the effect of the enabled vector furthest to the right in the Selected Vectors panel. When you invert a vector, you apply the adjustment to all parts of the image except those parts defined by the vector. For more information, see "Inverting a Vector" on page 273.
- Isolate: Checking this box isolates the selected vector in the image by displaying all other parts of the image as grayscale.

  You can use Isolate both as a preview feature and as an effect in its own right. While you are making a secondary color correction, you can select Isolate to see the extent of a vector more clearly. If you leave Isolate selected as part of a finished secondary color correction, you create a special secondary color correction that isolates one color range while displaying the rest of the image as grayscale. For more information, see "Isolating the Selected Vector" on page 269.

The following illustration shows the Selected Vectors panel with the Green vector selected.

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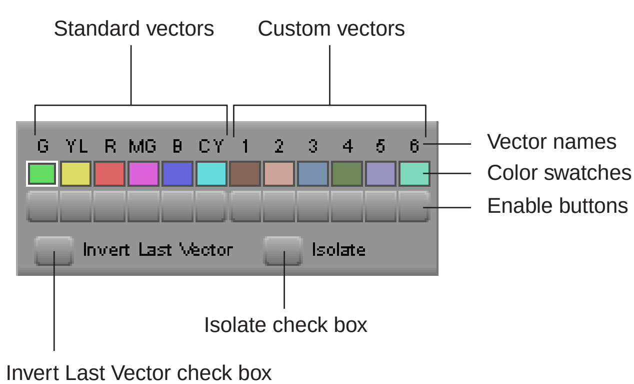
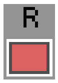
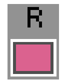


The color swatches for each vector in the Selected Vectors panel update in real time to provide a visual indication of the defined color range for the vector. The following illustrations show this behavior for the Red vector color swatch.



Default Red vector color swatch



Red vector color swatch after hue is adjusted to +20°

Selecting Vectors

You must select a vector to make an adjustment. Any adjustments that you make using controls in the Secondary tab are made to the currently selected vector.

To select a vector, do one of the following:

- Click the center point of the vector in the color wheel.
- Click the vector's color swatch in the Selected Vectors panel.

  For more information, see "Understanding the Selected Vectors Panel" on page 259.
- Use the syringe to define an input vector.

  The system automatically selects, enables, and adjusts the appropriate vector based on the colors you sample. For more information, see "Using the Color Selection Buttons" on page 266.

  A white box appears around the color swatch for the selected vector in the Selected Vectors panel, and the selected vector appears highlighted in the color wheels.

Enabling and Disabling Vectors

You can enable and disable vectors in any combination using Enable buttons. Enable buttons for vectors function in the same way as Enable buttons elsewhere in the Color Correction tool. For more information on Enable buttons, see "Working with the Enable Buttons" on page 162.

To enable or disable a vector, do one of the following:

- Click the vector's Enable button in the Selected Vectors panel.
- Use the syringe to define an input vector.

  The system automatically selects, enables, and adjusts the appropriate vector based on the colors you sample. For more information, see "Using the Color Selection Buttons" on page 266.

  Enable buttons are pink when the associated vector is enabled and gray when the associated vector is disabled.

Resetting Vectors

You can use a vector's Enable button to quickly reset the vector to its default values. For more information on Enable buttons, see "Working with the Enable Buttons" on page 162.

To reset a vector:

- Alt+click (Windows) or Option+click (Macintosh) the vector's Enable button in the Selected Vectors panel.

  The system resets the vector to its predefined values.

Adjusting Input Vector Values

Once you have selected a predefined vector as a starting point for a secondary correction, you adjust that vector so that it represents as accurately as possible the specific color range that you want to correct.

Secondary color correction allows you to make adjustments using several different kinds of controls. You can also use the Isolate check box to select a preview display that makes it easy to see what parts of an image are included in a vector.

To adjust an input vector:

1. Select the vector you want to adjust.

   For more information, see "Selecting Vectors" on page 260.

2. Adjust the vector by doing one or more of the following:

   - Manipulate the vector directly in the Input color wheel.

     For more information, see "Repositioning Vectors in the Color Wheel" on page 262.

   - Adjust the input sliders.

     For more information, see "Input Vector Sliders" on page 262.

   - Select colors from the image using the syringe and eyedroppers.

     For more information, see "Using the Color Selection Buttons" on page 266.

   You might want to click Lock Vectors at some stage in the adjustment process to prevent the output image from exhibiting premature color changes while you fine-tune your input vector. For more information, see "Locking Vectors While Adjusting an Input Vector" on page 263.

3. As you make your adjustments, use the Isolate feature to verify what parts of the image are currently defined by the vector. For more information, see "Isolating the Selected Vector" on page 269.

Repositioning Vectors in the Color Wheel

You can reposition a vector in the color wheel by dragging its center point. This changes the hue and saturation values of the vector.

To reposition a vector in a color wheel:

1. Move the pointer over the center point of the vector.

   The pointer changes to a hand.

2. Click the mouse button, and drag the center point of the vector to a new location in the color wheel.

   As you drag the center point around in the color wheel, the Hue and Saturation sliders update to show the current hue and saturation values, and the vector's color swatch updates in the Selected Vectors panel to show the currently selected color.

3. Release the mouse button when you are satisfied with the hue and saturation values.

Input Vector Sliders

You can change the values of a vector by adjusting the Input Vector sliders. These sliders work in exactly the same way as other sliders in the Color Correction tool, for example, those in the HSL group. For more information, see "Using the Sliders in the HSL Group" on page 202.

The following table describes the individual sliders available for input vectors.

Control	Description
Hue	Shifts the hue value for the center point of the vector around the color wheel. On the default Degree unit scale, 0 (the center point of the slider) represents red and –180 or 180 (the end points of the slider) represents cyan.
Saturation	Shifts the saturation value for the center point of the vector between the center and the outer edge of the color wheel. On the default Percent unit scale, 0 represents no saturation (the center of the wheel) and 100 represents full saturation (the outer edge of the wheel).
Hue Width	Sets the hue range of the vector. On the default Degree unit scale, values represent the number of degrees of arc that the vector covers on the color wheel, with the Hue value being the midpoint of the arc. For standard vectors, values range from 0 to 180; for custom vectors, values range from 0 to 100.

Control	Description
Saturation Minimum (standard vectors) Saturation Width (custom vectors)	For standard vectors, sets the minimum saturation value for the vector. Pixels in the image below the saturation minimum are not included in the vector even if their hue value is within the vector's hue width. For custom vectors, sets the saturation range of the vector. On the default Percent scale, values represent the saturation range as a percentage of the maximum saturation width. For example, a vector with Saturation Width 40 extends across 40% of the full saturation range. Pixels in the image outside this saturation range are not included in the vector even if their hue value is within the vector's hue width.
Softness	Sets a softness value for the vector. Values range from –255 to 255. Positive values blend the corrected color into areas of the image beyond the limits of the defined input vector. The higher the value, the further into adjacent color values the blend extends. Negative values blend the uncorrected color into parts of the area defined by the input vector. The higher the value, the more of the uncorrected color is retained in the input vector area. When Softness is set to 0, the correction has a hard edge at the limit of the defined input vector. The default Softness setting of 30 creates a softened edge without extending the corrected color significantly outside the defined input vector. For illustrations of the effect of various Softness settings, see "Examples of Softness Adjustments" on page 264.

Locking Vectors While Adjusting an Input Vector

You can lock the Hue and Saturation controls for Input and Output vectors together. When the vectors are locked, any changes you make to the Input Hue and Saturation values (either by adjusting the sliders or by dragging the vector in the vector wheel display) are matched by equivalent changes to the Output Hue and Saturation values.

To lock Input and Output Hue and Saturation controls together:

- Click Lock Vectors (below the Hue and Saturation sliders).

  If you lock the Input and Output vectors together while you are fine-tuning your Input vector (before you make an Output vector adjustment), you can avoid the impression that you are correcting your image prematurely (and inaccurately). The image that you see in the monitor does not show any false color changes while you are manipulating the Input vector. This is especially useful if you are demonstrating corrections for a client, who might be confused by seeing inaccurate color changes while you are setting up an input vector.

Workflow for a Secondary Color Correction Using Lock Vectors

A typical workflow for making a secondary color correction using Lock Vectors might include the following steps:

1. Define an initial color range for the Input vector, for example by using the Syringe.
2. Turn on Lock Vectors, and fine-tune the hue and saturation values for the Input vector, for example by dragging the Input Hue and Saturation sliders.

   Because the input and output vectors are locked together, these adjustments do not change the output colors in the monitor.
3. Turn off Lock Vectors, and adjust the Output vector until the color range you have defined changes to the finished color you want.
4. (Option) If you need to fine-tune the whole correction further but do not want to change the color shift that you have established from Input to Output values, turn on Lock Vectors and shift the vectors slightly by dragging in the vector wheel display.

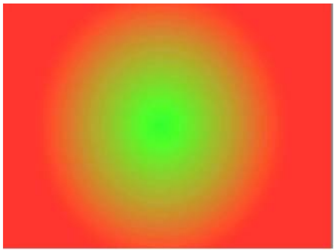
Examples of Softness Adjustments

Softness is an important control for fine-tuning the effect of a secondary correction on an image. You can control the appearance of the transitional areas between a corrected part of the image and the rest of the image. You can also quickly compensate for inaccuracies in the input vector definition by expanding or contracting the color range over which the correction has an effect.

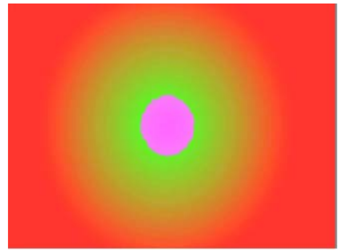
The following illustrations show the effect of a range of Softness adjustments on a test image.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

The original image is a radial gradient from green to red. The basic adjustment uses the default Green input vector and an output vector that shifts the Hue by 180 degrees on the color wheel. The effect of this adjustment is to change the strongly green area near the center of the image to magenta.

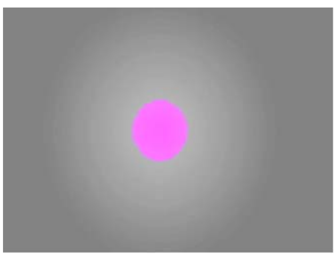


Original image

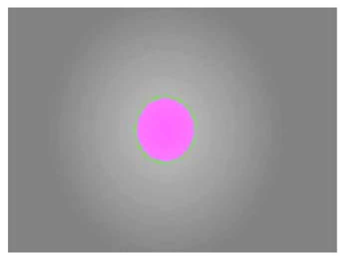


Adjusted image: Softness 0

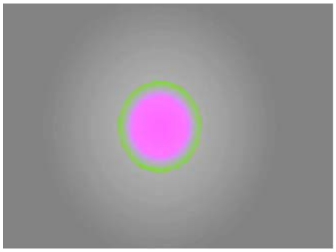
The following illustrations show the effect of a variety of Softness adjustments on the correction. The illustrations show the image as it appears with Preview Selected in the Secondary tab so that the extent of the adjustment is easy to see.



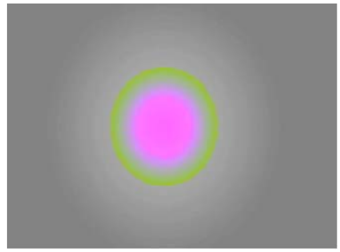
Softness 0 The correction is defined by a hard edge, and no blended color appears outside the area defined by the input vector.



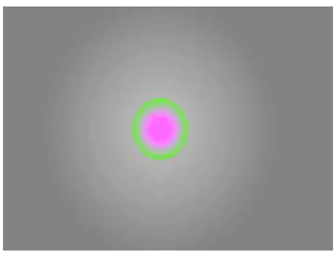
Softness +30 This is the default Softness setting. The correction color blends slightly into areas of the image with color values adjacent to the defined color range. The outside edge appears green because the uncorrected color is dominant in the blend at the edge of the area affected by the correction.



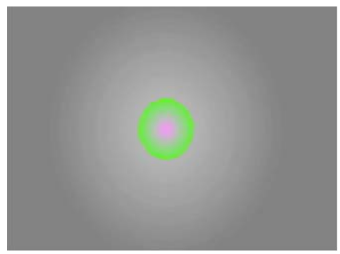
Softness +128 The correction now expands into more of the surrounding color, and the gradual blend from magenta back to green is more easily visible.



Softness +255 With Softness at its maximum positive value, the correction now affects an area substantially larger than the area defined when Softness is set to 0. However, the area that is 100% corrected color (magenta) remains the same.



Softness –128 When Softness values are negative, the blended area is within the limits of the original input vector. Only a small area in the center is now 100% magenta.



Softness –255 With Softness at its maximum negative value, almost all of the original input vector area is affected by a blend of uncorrected and corrected color.

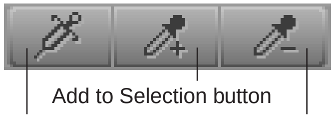
Using the Color Selection Buttons

You can use the Color Selection buttons to select, enable, and adjust a vector by sampling colors from an image. The system provides three distinct sampling tools that allow you to define an initial color vector and then fine-tune the vector by adding to or subtracting from the defined color range.

You can use the Color Selection buttons together with the Color Match control to quickly perform a complete secondary color correction. For more information, see “Using the Color Match Control for Secondary Corrections” on page 271.

You can also use the Color Selection buttons to refine the definition of an existing vector by sampling colors within or adjacent to that vector.

The following illustration shows the Color Selection buttons.



Defining a Vector with the Syringe

To define a vector using the syringe:

1. Click the Syringe button to highlight it.
2. Move the pointer over the image in the active monitor.

   The pointer changes to a syringe.
3. Move the tip of the syringe over the area of color you want to sample in the image.
4. Press and hold the mouse button, and drag the tip of the syringe over the area of color you want to sample.

   The system samples every color value that the tip of the syringe passes over. The input color swatch in the Color Match control updates as you drag the syringe to show the most recently sampled color.

Try to cover the area that you want to sample as fully as possible, but take care not to stray outside that area. Remember that you can make further refinements to the vector after completing the initial selection.

5. When you have finished sampling, release the mouse button.

   The system does the following:

   - Selects and enables the closest vector to the range of colors you have sampled.
   - Adjusts the Input Vector values for the vector so that it includes the full range of colors that you sampled with the syringe.
   - Sets the Output Vector values to match the Input Vector values.
   - Automatically selects the Isolate check box so that the vector you have defined is visible in the monitor. For more information, see "Isolating the Selected Vector" on page 269.
6. (Option) Refine the vector definition.

   For more information, see "Refining a Vector Definition with the Add to Selection and Subtract from Selection Buttons" on page 268.

The Syringe button remains selected until you explicitly turn it off by clicking it or by clicking one of the other Color Selection buttons. This means that you can perform repeated operations with the syringe without having to reactivate it for each operation.

Refining a Vector Definition with the Add to Selection and Subtract from Selection Buttons

You can refine the definition of a vector by adding or subtracting colors that you sample using the Add to Selection and Subtract from Selection buttons. You can use these buttons to refine any vector, regardless of how you originally defined the vector.

To refine a vector using the Add to Selection and Subtract from Selection buttons:

1. Select the vector that you want to refine.
2. Click the Add to Selection or Subtract from Selection button to highlight it.
3. Move the pointer over the image in the monitor.

   The pointer changes to an eyedropper.
4. Move the tip of the eyedropper over the color you want to add to or subtract from the vector, and then click the mouse button.

   The system updates the vector to include or exclude the color you have selected.

The Add to Selection or Subtract from Selection button remains selected until you explicitly deselect it by clicking it or by clicking one of the other Color Selection buttons. This means that you can perform repeated operations with the eyedropper without having to reselect it for each operation.

The Undo command works with eyedropper color selections. If you select too much color with the Add to Selection eyedropper or subtract too much with the Subtract from Selection eyedropper, select Edit > Undo or press Ctrl+Z (Windows) or Command+Z (Macintosh) to have the system delete the effect of that selection on the vector.

When the system calculates revised vector areas based on selections made with the Add to Selection and Subtract from Selection eyedroppers, it is constrained by the geometric limits of the vector (wedge-shape for standard vectors and ellipse for custom vectors). As a result, you might include or exclude more colors than you expect. In general, the Color Selection *buttons are excellent tools for quickly adjusting a vector to approximately the area you require. However, you might still need to fine-tune the vector using the sliders to achieve a precise match with the color range you want to correct.*

Isolating the Selected Vector

You can isolate the selected vector in an image. The system displays those parts of the image that fall within the selected vector in color, with the rest of the image in grayscale. This makes it easy to see which parts of an image are included in a selected vector while you are making corrections.

You can choose to use Isolate only as a preview feature that allows you to see the extent of vectors clearly. In this case, you must deselect Isolate when you have finished making the correction. Alternatively, you can use Isolate as a special Color Correction effect that isolates parts of an image in color while displaying the rest of the image in grayscale. In this case, you leave Isolate selected when you have finished making the correction.

To isolate the selected vector:

1. Make sure that the position indicator is in the segment that you want to isolate.
2. Click Isolate in the Selected Vectors panel of the Secondary tab.

   The active monitor changes to isolate the selected vector.
3. Make input and output adjustments to the vector until you are satisfied with the look of the correction.
4. Do one of the following:
   - To leave the areas of the image outside the vector grayscale, leave Isolate selected.
   - To return the image to a full-color display, click the Isolate check box to deselect it.

Isolate shows the effect of any output adjustment you have made to the vector. If you have made output adjustments and want to see a preview that shows only the input color range, disable the Output Vector Hue and Saturation sliders by clicking their Enable buttons.

The following illustration shows a typical image and its appearance when Isolate is selected. For more illustrated examples of the effect of isolating a vector, see "Examples of Inverted and Isolated Images" on page 121.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

Original image in full color.

Corrected image with Isolate selected. The preview shows the effect of an adjustment that changes the pale blue robe to match the green color of the shoes in the top left corner of the original image. Areas of the image not affected by the correction display as grayscale. The preview allows you to see which additional areas of the image are affected by the adjustment and confirm which areas are not — for example, the blue jacket in the bottom right.

Corrected image in full color. The correction has completely changed the color of the robe. A few other small areas of the image have also been changed by the correction, but most of the image retains its original color.

Adjusting Output Vector Values

Once you have an input vector defined correctly, the final step in the secondary color correction process is to adjust the output values for the vector to change the color characteristics.

Because you have already defined the extent of the vector using input adjustments, only hue, saturation and luminance values are adjustable for output. To change the color characteristics for that vector, you only need to define a new combination of hue, saturation, and luminance values.

You might make an output vector adjustment that causes the saturation levels in an image to exceed the RGB Gamut limits that you have set in the Safe Color Settings dialog box. Depending on the current settings in the Safe Color Settings dialog box, the system might ignore the excess value or display a warning. For more information, see *"Safe Colors" on page 325**.*

To adjust output vector values:

1. Select the vector you want to adjust.
2. Adjust the output vector values by doing one of the following:
   - Manipulate the vector directly in the Output color wheel. For more information, see "Repositioning Vectors in the Color Wheel" on page 262.
   - Adjust the output sliders.

   The Output Vector Hue and Saturation sliders are identical to their Input Vector equivalents. For more information, see "Input Vector Sliders" on page 262.

   The Output Vector Luminance slider changes the luminance value for the final color. Values for the Luminance slider range from –10 to +10, where –10 reduces the luminance by 10% of the full black-to-white luminance range, and +10 increases the luminance by 10% of the full black-to-white luminance range.

   As you adjust the output values, the active monitor updates to show the effect of the correction on your image. If Isolate is selected, the monitor shows the corrected areas of the image in color and the unaffected areas of the image as grayscale.
3. Do one of the following:
   - To have the areas of the image outside the vector continue to display as grayscale, make sure that Isolate is selected.
   - To have the image appear as a full-color display, make sure that Isolate is deselected.

Using the Color Match Control for Secondary Corrections

You can use the Color Match control to make secondary color corrections based on color values that you sample from images or select from the Windows Color dialog box or the Macintosh Color Picker. If necessary, you can make further refinements to the input and output vectors after the color match to achieve the precise correction that you want.

You can use the Color Match control together with the syringe to perform a secondary color correction based on a range of sampled color values. In most circumstances, this is the preferred method for achieving a good correction when the hue and saturation values of the area you want to correct are somewhat varied. This method also shows the selected vector before you complete the match, making it easier to verify that you have a well-defined input vector.

You can also use the Color Match control to make a secondary color correction with the same basic methods that you use to make Color Match corrections in the other Color Correction tabs. In this case, the system applies the match to a predefined range of colors centered on the single color value that you sample, and you cannot see the input vector until the color match is completed. Though generally less precise and less controllable than the first method, this technique might produce acceptable results quickly if you need to correct an area of uniform color.

To make a secondary color correction using the Color Match control and the syringe:

1. Select, enable, and define the input vector using the syringe.

   For more information, see “Defining a Vector with the Syringe” on page 267.

As part of the vector definition process, the system automatically selects Isolate.

2. Select the output color using the standard Color Match eyedropper.

   For more information, see “Making a Correction with the Color Match Control” on page 192.

3. Click the Match Type button, and select a Match Type to determine the exact nature of the match the system makes.

   For more information on the options available in the Secondary group, see “Match Type Options” on page 193.

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

   The system adjusts the output values for that vector, deselects Isolate, and displays the corrected image in the monitor that contains the current segment.

5. (Option) Make further adjustments to the vectors using the Input Vector and Output Vector sliders until you are satisfied with the correction.

To make a secondary color correction with the Color Match control only:

1. Select the input color using the standard Color Match eyedropper.

   For more information, see "Making a Correction with the Color Match Control" on page 192.

2. Select the output color using the standard Color Match eyedropper.
3. Click the Match Type button, and select a Match Type to determine the exact nature of the match the system makes.

   For more information on the match types available in the Secondary group, see "Match Type Options" on page 193.

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

   The system selects and enables a vector, adjusts the input and output values for that vector based on the sampled colors, and displays the corrected image in the monitor that contains the current segment.

5. (Option) Make further adjustments to the vectors using the Input Vector and Output Vector sliders until you are satisfied with the correction.

Inverting a Vector

You can invert a vector to apply a correction to every part of the image except for the area defined by the vector. The most common use of this technique is to isolate an object in its original color while altering the color of every other part of the image. For example, you might want to partially desaturate most of the image while retaining full color in the areas defined by the vector.

You can invert only one vector in each correction, and the vector that is inverted is always the enabled vector farthest to the right in the Selected Vectors panel. In the common case of using inversion to isolate one object in color, the vector that you invert is likely to be the only vector you need to adjust. If you do make adjustments to multiple vectors in a segment, make sure that the inversion applies to the vector you want by making that vector the enabled vector farthest to the right in the Selected Vectors panel.

To invert a vector:

1. Select the vector, and make input adjustments to it using standard methods.
2. Click Invert Last Vector in the Selected Vectors panel.

   The system inverts the vector, selecting all parts of the image not defined within the vector. If you are working with Isolate selected, the display updates to show the area defined by the vector as grayscale and the rest of the image in color.
3. Adjust the output hue and saturation values for the vector.
4. Make sure that the Isolate check box is selected or deselected as necessary to produce the final effect that you want. For more information, see "Isolating the Selected Vector" on page 269.

Examples of Inverted and Isolated Images

The following illustrations show the effects of Isolate and Invert Last Vector on a typical image. Using these two features alone or in combination, you can achieve a wide range of special Color Correction effects in which one area of the image stands out from the rest.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

Examples of Isolate and Invert Last Vector

Original Image

Image with Isolate selected. The selected vector displays in color.

Image with Isolate selected and a correction made to the selected vector.

Image with Invert Last Vector selected and a correction made to all parts of the image other than the selected vector.

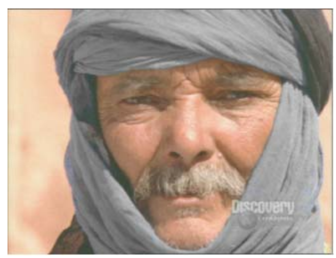


Image with both Isolate and Invert Last Vector selected. The selected vector displays as grayscale while the rest of the image displays in color.

Understanding How Multiple Vectors Interact

If you make corrections to more than one vector in the Secondary group, those corrections are applied cumulatively to the image when it plays back. The order of application moves from left to right across the Selected Vectors panel.

If the color ranges of vectors overlap, the final result in the image is the cumulative result of all the corrections for the overlapping vectors. For example, if you use the Green vector to change a green object in the image to yellow, and then adjust the Yellow vector so yellow objects become red, your original green object is red in the final image.

Working with the Waveform Monitors and the Vectorscope Monitor

The waveform and vectorscope commands 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.

Displaying a Waveform Monitor or Vectorscope Monitor

To display a Waveform monitor or a Vectorscope monitor:

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 select a waveform or vectorscope command.

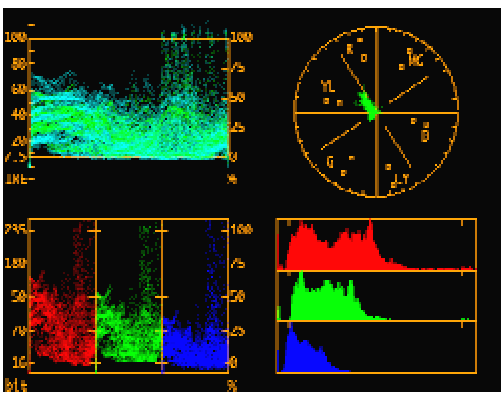
   The monitor displays the selected waveform or vectorscope information.

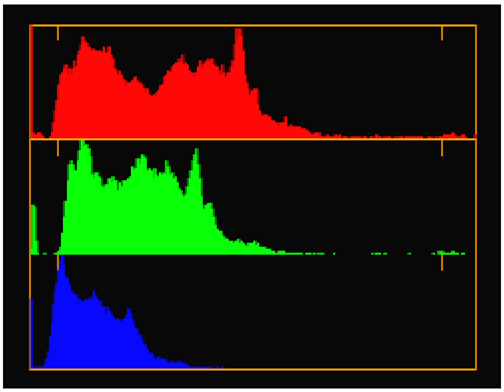
   For more information, see "Waveform and Vectorscope Commands" on page 277 and "Using the Waveform and Vectorscope Information" on page 284.

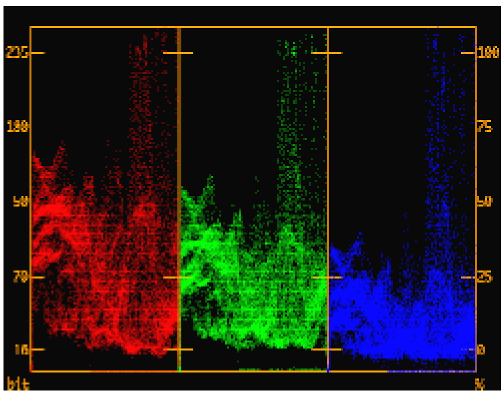
Waveform and Vectorscope Commands

The following table describes the waveform and vectorscope commands available in the Source menu for monitors in Color Correction mode.

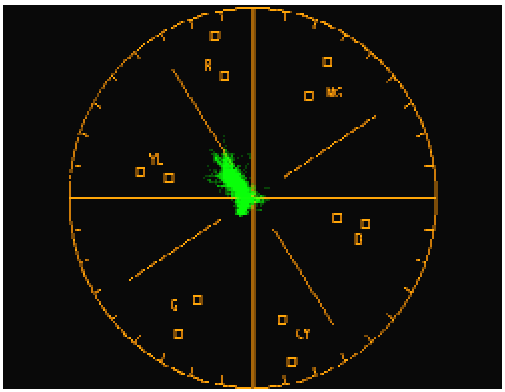
If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

<table>
<tr><th>Command</th><th>Description</th></tr>
<tr><td>Quad Display</td><td>Displays the following waveform and vectorscope information in a single monitor (clockwise from the top left corner):
• YC Waveform
• Vectorscope
• RGB Histogram
• RGB Parade

For information on each display, see its individual entry in this table.</td></tr>
</table>

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 Information" on page 284.

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 and Vectorscope Information” on page 331.  For information on using the RGB Parade display, see “Using the Waveform and Vectorscope Information” on page 284.

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 monitor, see "Using the Waveform and Vectorscope Information" on page 284.

Command	Description
Y Waveform	Displays a Waveform monitor with luma information. Luma is the brightness of an image without regard to color.

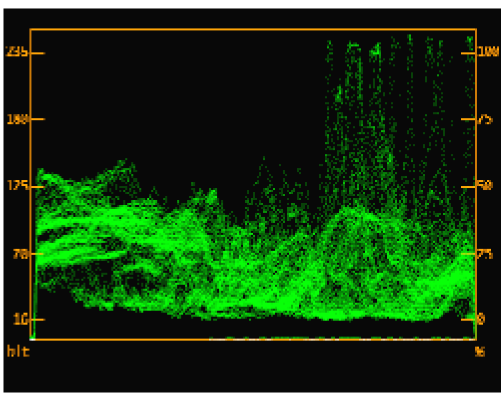
The scale on the left is a digital level scale using a 256-step (8-bit) range; 16 is the level for black, and 235 is the level for white.

The scale on the right shows the amount of white in the image as a percentage; 0% represents black, and 100% represents white.

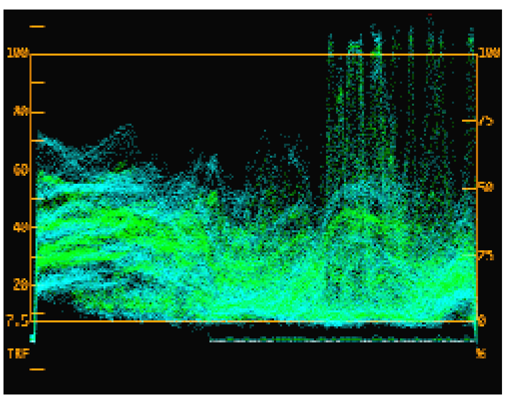
Parts of an image can have values outside the 0% to 100% range. The digital video standard allows for *headroom* and *footroom* so that you can correct a mistake in level in the postproduction process. The minimum is digital 0 or –8%, and the maximum is digital 255 or 108%.

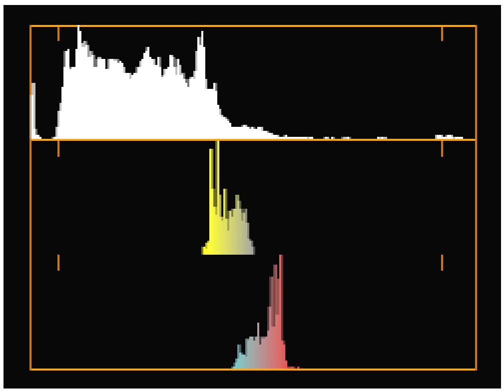
Some external software or hardware processing can clip a signal that is outside the 0% to 100% range.

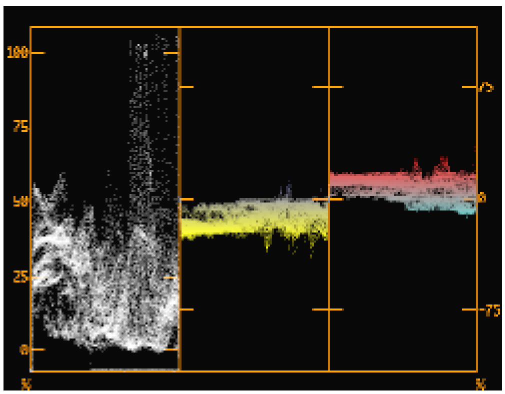
Y Waveform incorporates any safe color limits you have set. The system displays Luma values in white when the values fall outside the Luminance limits. For more information on color limits, see "Safe Color Limits with Waveform and Vectorscope Information" on page 331.



For information on using the Y Waveform display, see "Using the Waveform and Vectorscope Information" on page 284.

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 display 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 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 and Vectorscope Information” on page 331.  For information on using the YC Waveform display, see “Using the Waveform and Vectorscope Information” on page 284.

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 shows 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 Information" on page 284.

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 display. 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 Information" on page 284.

Using the Waveform and Vectorscope Information

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

- 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. For more information, see "Safe Color Limits with Waveform and Vectorscope Information" on page 331.
  - 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 lack contrast. If the images have too much contrast, with levels exceeding the 0% and 100% markings, the opposite is likely.

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

- Match scene brightness across a cut in the Y Waveform histogram.
- Put your flesh tones along a certain hue axis in the Vectorscope monitor.
- Watch the spread of the Y Waveform histogram to identify a good contrast range without clipping.
- Watch the top of the YC Waveform histogram 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.

You can also use the information in the Waveform and Vectorscope monitors to monitor safe color limits. For more information, see "Safe Color Limits with Waveform and Vectorscope Information" on page 331.

Waveform and vectorscope monitors show 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.

Using the Color Correction Effect

In addition to color corrections made using relationships, you can also apply color corrections using the Color Correction effect.

Some types of corrections can only be made using the Color Correction effect, and it is important to understand the situations that call for a Color Correction effect rather than a relationship color correction. For more information, see “When to Use the Color Correction Effect” on page 287.

You can apply the Color Correction effect in two different ways:

- You can apply it from the Color Correction tool by selecting CC Effect as the correction type, as described in “Applying a Color Correction Effect from the Color Correction Tool” on page 289.
- You can apply it from the Effect Palette, in the same way as any other effect. When you apply the Color Correction effect from the Effect Palette, your application makes the automatic color corrections set in the AutoCorrect tab of the Correction Mode Settings dialog box. (You can then make further color adjustments in the Color Correction tool if you need to do so.) For more information, see “Correcting Color Automatically Using the Color Correction Effect” in the Help.

Once you have applied a Color Correction effect, you can work with it in much the same way as any other effect. For example, you can save it as an effect template, or delete it using standard methods for deleting effects.

You can apply a relationship correcton and a color correction effect on the same segment. This results in two distinct corrections. The relationship correction is applied first, and its result is the input to the color correction effect.

This approach differs from applying two corrections by applying one on the Source side and another on the Program side. In this case, a single correction is made using the merged values from the Source and Program sides.

When to Use the Color Correction Effect

You need to use a Color Correction effect rather than a relationship color correction in the following situations:

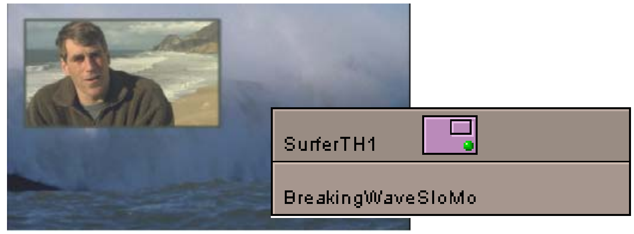
- When you want to apply multiple automatic corrections in a single operation.

  In this case, you must apply the Color Correction effect from the Effect Palette, as described in "Correcting Color Automatically Using the Color Correction Effect" in the Help.

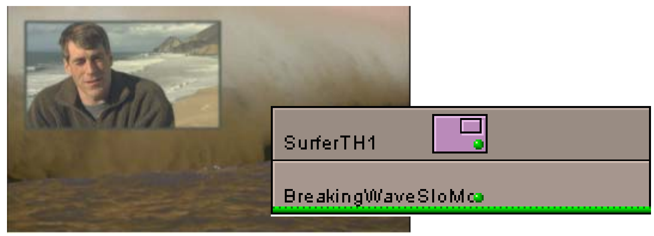
- When you want to apply a color correction in combination with certain other effects.

  For example, if you have two layers of video with a Picture-in-Picture applied to the top layer, you cannot color correct the entire video composite (foreground and background together) using a relationship correction. However, if you nest a Color Correction effect on top of the Picture-in-Picture, you can correct foreground and background at the same time. (This behavior is a result of the fact that relationship color corrections are processed before most other effects.) For more information, see "Understanding Relationship Color Corrections" on page 154.

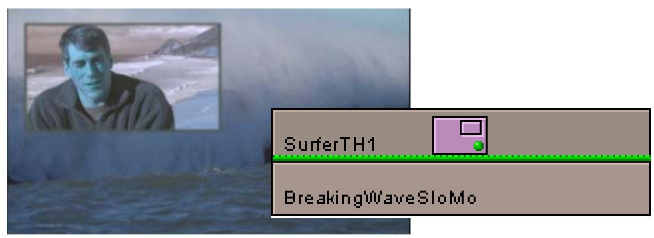
Original setup before color corrections



Relationship correction on bottom track — only bottom track has chroma inverted



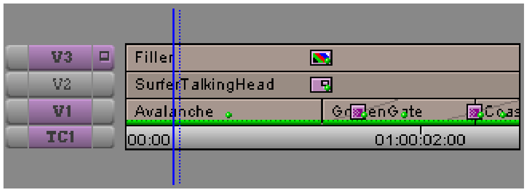
Relationship correction on top track — only top track has chroma inverted



Color Correction effect nested on top of Picture-in-Picture — entire composite has chroma inverted

- When you want to apply a color correction to filler.

  You cannot apply relationship color corrections to filler. A common example of the use of a color correction on filler is when you add a new video track above all other tracks and then add a Color Correction effect to that track. This provides a way to apply an overall color correction that affects every layer beneath it (for example, adding a little brightness to an entire sequence as a final color correction step). The Program Track relationship color correction, in contrast, affects the whole of any one track in a sequence.



Color Correction effect applied to filler
on top track, above multiple other tracks.

Applying a Color Correction Effect from the Color Correction Tool

You can apply a Color Correction effect in the Color Correction tool, and then make any combination of color correction adjustments that are available in the Color Correction tool.

When you apply a Color Correction effect from the Color Correction tool, your application does not apply the automatic corrections set in the AutoCorrect tab of the Correction Mode Settings dialog box.

To apply a Color Correction effect from the Color Correction tool:

1. If you have not already done so, move the position indicator to the segment you want to correct.
2. Click the Correction Type button and select CCEffect.
3. Make the color adjustments you want in one or more of the Color Correction tool's tabs.

   Once you make an adjustment, the Color Correction effect appears on the segment.

6 Managing Color-Corrected Sequences

The Color Correction tool includes menu commands that allow you to manage sequences once they have color correction applied to them. You can update a sequence to apply existing color corrections to newly added segments, merge different versions of a color-corrected sequence, convert color corrections in a sequence to segment-only relationships, and remove groups of corrections from a sequence.

You can control the extent of the changes for all these operations. You can also choose to make the changes on a new copy of the sequence so that the unchanged sequence is still available to you.

This chapter describes how to manage sequences with color corrections.

For information on how color-corrected sequences conform between Symphony and certain other Avid editing applications, see “Conforming Sequences with Color Correction” on page 40.

Updating Color-Corrected Sequences

The Update Correction command allows you to make color corrections to a sequence and then to edit additional material into the sequence without having to repeat much of your color correction work. When you return to Color Correction mode, you can instruct the Symphony system to apply existing color corrections to the new segments, based on their relationship to the existing material. The system updates any color corrections based on Source Tape, Clip Name, Master Clip, or Sub Clip relationships, or based on Program Track relationships.

For example, you are working with a sequence that contains several segments from the same source tape. When you first perform a Source color correction pass, you correct these segments simultaneously using the Source Tape relationship. Later, you edit new segments from the same source tape into the sequence. You can now go back into Color Correction mode and use the Update Correction command to apply the color correction from the original segments to the new segments automatically.

The following illustrations show the stages of this process for a simple sequence.

Before

Segment A corrected using
Source Tape relationship

Segment B corrected using
Source Segment relationship

After new edit

Segment C material is from the
same source tape as segment A.

After update

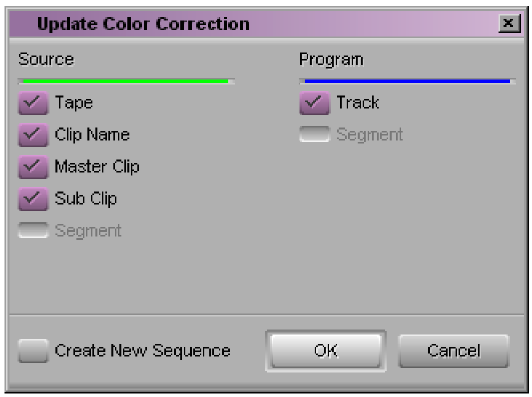
Color correction is applied to
segment C, based on its Source
Tape relationship with segment A.

To update a color-corrected sequence:

1. In Source/Record mode, edit new material into a previously color-corrected sequence.

2. Click the Color Correction Mode button at the bottom of the Timeline to enter Color Correction mode.
3. Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Color Correction tool, and select Update Correction.

   The Update Color Correction dialog box opens.



4. Select the Source and Program relationships you want the system to use when deciding which segments to update.

   By default, all available relationships are selected.

5. Select Create New Sequence if you want the system to create a new copy of the sequence and update that copy.

If you deselect Create New Sequence, the system updates the existing version of the sequence. Avid recommends that you create a new sequence when updating. You then retain the previous version as a backup. If you update an existing version of a sequence and want to return to the previous version, select Edit > Undo.

6. Click OK.

   The system updates the sequence and adds color correction to the appropriate new segments. If you have selected Create New Sequence, a new sequence appears in the bin with the title *[OldTitle].Copy 1.* You can rename the sequence to indicate more clearly that it is an updated version.

Understanding Color Correction Merging

Your workflow might make it useful to work with two versions of a sequence at the same time. For example, you might want an editor to work on one copy of a sequence while a colorist continues to make color adjustments on another copy. The Merge Correction command allows you to merge the two sequences to reflect the changes made on both copies.

Merge Correction merges any color corrections based on Source Tape, Clip Name, Master Clip, or Sub Clip relationships, or based on Program Track relationships, into the latest version of the edited sequence. For example, if the editor adds new segments from source tape 1, and a color correction exists for that source tape, the correction is applied to the new segments when the merge takes place. This is true whether the color correction was made before the editor began work or whether the color correction is made to the sequence while the editor is working with a copy of it.

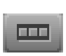
You can also control which of the two copies the system prefers if there is a conflict between the two copies when merging.

Merging Color-Corrected Sequences

The Merge Correction process begins with the creation of a new sequence, which is then copied. The two copies are worked on independently before being merged using the Merge Correction command. You can separate the two copies before you make any color corrections, or you can make initial corrections and then separate the two copies.

To work with two copies of a sequence and then merge the corrections:

1. Create a first version of your sequence.



2. (Option) Click the Color Correction Mode button at the bottom of the Timeline to enter Color Correction mode, and make initial color adjustments to the sequence.

3. Save the sequence, and then create one or two copies of the sequence.

   The way you handle copies of the sequence depends on the requirements of your workflow. You need only two versions of the sequence — the original and one copy. For example, the colorist might keep the original while the editor works on the copy. However, it might be safer to keep the original as a backup and to move forward in your workflow with two new copies.

Take care to name your copies clearly. For example, if you are creating two copies as well as keeping the original, you might use the extensions .Editor, .Colorist, *and* .Original *to distinguish the three versions.*

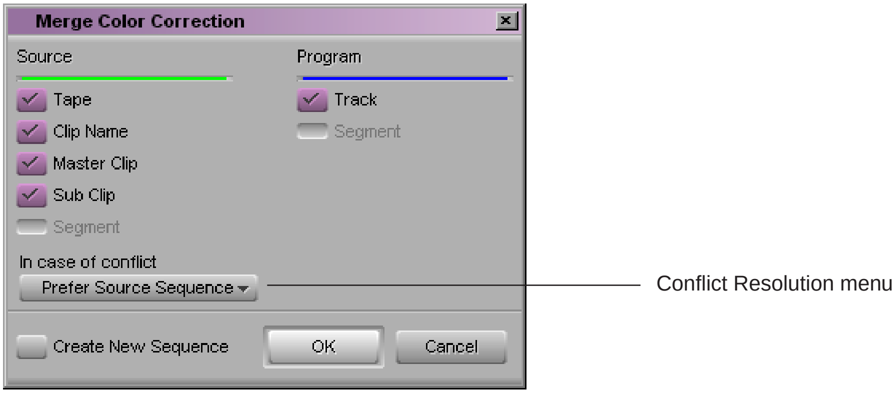
For more information on saving and copying a sequence, see "Basic Bin Procedures" in the Help.

4. Continue to work on the two copies independently.
5. When you are ready to merge the two copies, enter Source/Record mode, for example, by clicking the Source/Record button.
6. Load one copy of the sequence into the Source monitor and the other into the Record monitor.

   You can load a copy into either monitor. The only difference is that the system merges into the sequence in the Record monitor unless you instruct it to create a new sequence for the merge in step 11.
7. Click the Color Correction Mode button at the bottom of the Timeline to enter Color Correction mode.
8. Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Color Correction tool, and select Merge Correction.

The Merge Correction command appears dimmed in the Color Correction tool shortcut menu and cannot be selected until you load versions of a sequence in both the Source monitor and the Record monitor and enter Color Correction mode.

   The Merge Color Correction dialog box opens.



9. Select the Source and Program relationships you want the system to use when deciding which segments to update in the merging process.

   By default, all available relationships are selected.

10. Click the Conflict Resolution menu, and select an option to control how the system resolves conflicts between the two copies of the sequence:

Option	Description
Prefer Source Sequence	Resolves conflicts by preferring the information in the sequence you loaded into the Source monitor.
Prefer Record Sequence	Resolves conflicts by preferring the information in the sequence you loaded into the Record monitor.
Prefer Latest	Resolves conflicts by preferring the most recent information. This is the default setting.

11. Select Create New Sequence if you want the system to create a new copy of the sequence and merge into that copy.

    If you deselect this option, the system merges the two copies into the sequence that is currently in the Timeline. This is the sequence that you loaded into the Record monitor before entering Color Correction mode.

12. Click OK.

    The system merges the two existing sequences, based on the options you have selected. The merged sequence appears in the Timeline.

Color Correction Merging Example

The following example illustrates the capabilities of the Merge Color Correction command.

The original sequence for this example consists of seven segments that are derived from four different source tapes. For simplicity, the segments are edited together in exactly equal one-second lengths. The following illustration shows the original sequence before any color correction is performed.

1. Original sequence

The numbers on the segments indicate the source tape from which each segment comes.

The sequence now receives some initial color correction. Source Tape correction is applied to the material from source tapes 2 and 4. The following illustration shows the sequence after this initial color correction work.

2. Sequence after initial color correction

Segments from source tapes 2 and 4 have Source Tape corrections.

At this point in the workflow, a copy is made of the sequence and an editor continues to work on the copy. At the same time, further color corrections are made to the original version of the sequence.

The editor makes the following adjustments:

- The fifth segment is replaced by another clip from source tape 2.
- A new segment from source tape 4 is added near the end of the sequence.
- The second segment is trimmed to double its length.

3. Editor's copy of sequence after further editing

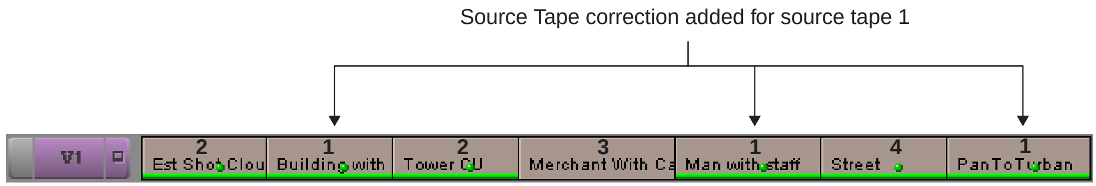
Lengthened segment after trimming

Replacement segment from source tape 2

New segment from source tape 4

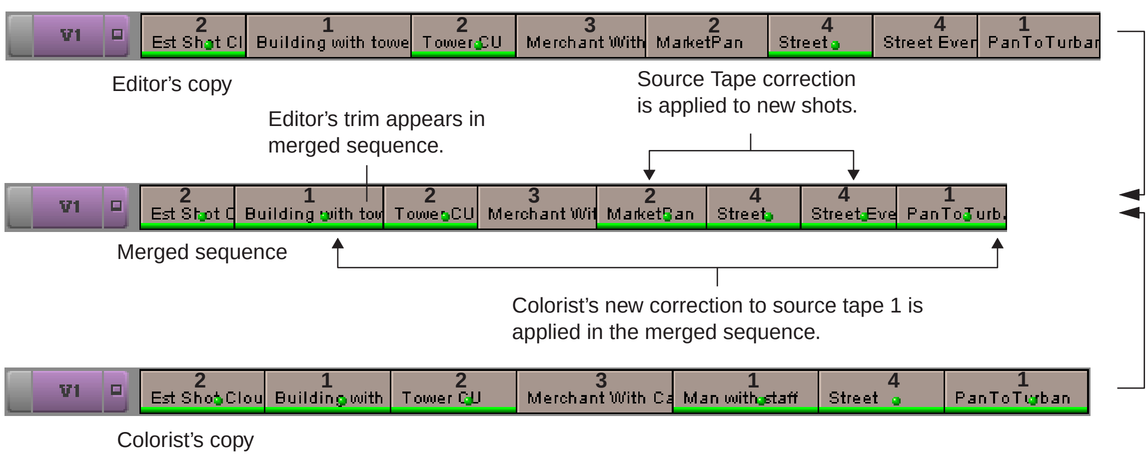
The colorist modifies his or her version of the sequence by adding Source Tape correction for source tape 1.

4. Colorist's copy of sequence after further correction



The editor's copy of the sequence is now out-of-date with respect to the colorist's corrections. It contains segments from source tapes 1, 2, and 4 that need to be updated to use the Source Tape corrections for those tapes. When the two sequences are merged, the editor's sequence is correctly updated.

5. Merge process



Flattening Color-Corrected Sequences

In some circumstances, you might want to convert a color-corrected sequence so that all the color corrections become segment-only relationships. This allows you to readjust the color correction in a single segment, even if it had previously been corrected as part of a broader relationship, without affecting any other segments. As with the other color correction sequence commands, you can define by relationship which groups of segments are converted to segment-only relationships.

The following illustrations show this process for a simple sequence.

Before flattening

Segments A and C are currently corrected using a Source Tape relationship. You cannot adjust the Source color correction for one segment without affecting the other.

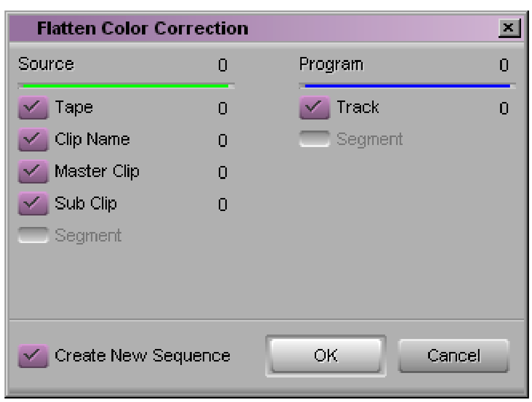
After flattening

All three segments are now governed by a segment-only relationship. You can adjust each of them independently without changing any other segment.

To flatten a color-corrected sequence:

1. Click the Color Correction Mode button at the bottom of the Timeline to enter Color Correction mode.
2. Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Color Correction tool, and select Flatten Correction.

   The Flatten Color Correction dialog box opens. The dialog box indicates the number of segments that are available for flattening in each relationship category.

3. Select the Source and Program relationships you want the system to use when deciding which segments to flatten.

   By default, all available relationships are selected.

4. Select Create New Sequence if you want the system to create a new copy of the sequence and flatten segments on that copy.

If you deselect Create New Sequence, the system flattens the existing version of the sequence. Avid recommends that you create a new sequence when flattening. You then retain the version that has not been flattened as a backup. If you flatten an existing version of a sequence and want to return to the previous version, select Edit > Undo.

5. Click OK.

   The system converts the segments you have selected to segment-only relationships. If you have selected Create New Sequence, a new sequence appears in the bin with the title *[OldTitle].Copy 1.* You can rename the sequence to indicate more clearly that it is a flattened version.

Removing Color Corrections

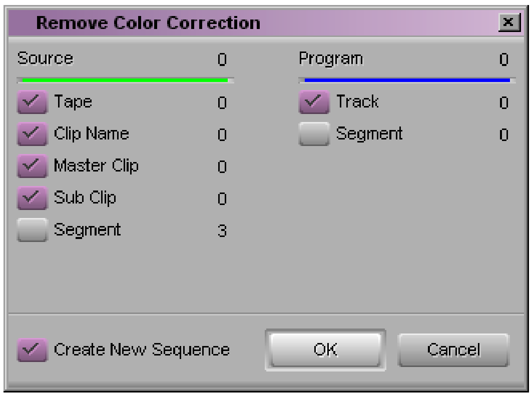
You can remove the color correction on a specific segment at any time by clicking the Remove Effect button in the Composer window while in Color Correction mode.

You can also remove groups of corrections with the same associated relationship using the Remove Correction command. This is useful for removing all corrections, or large numbers of corrections, at the same time.

To remove corrections using the Remove Correction command:

1. Click the Color Correction Mode button at the bottom of the Timeline to enter Color Correction mode.
2. Right-click (Windows) or Ctrl+Shift+click (Macintosh) in the Color Correction tool, and select Remove Correction.

   The Remove Color Correction dialog box opens. The dialog box indicates the number of segments in the sequence for each relationship category.

3. Select the Source and Program relationships you want the system to use as the criteria for removing segments.

   By default, all relationships are selected.

4. Select Create New Sequence if you want the system to create a new copy of the sequence and remove segments only from that copy.

If you deselect Create New Sequence, the system updates the existing version of the sequence. Avid recommends that you create a new sequence when removing groups of corrections. You then retain the previous version as a backup. If you remove corrections from the existing version of a sequence and want to return to the previous version, select Edit > Undo.

5. Click OK.

   The system removes color correction for all segments governed by the relationships you have selected. If you have selected Create New Sequence, a new sequence appears in the bin with the title *[OldTitle].Copy 1*. You can rename the sequence to indicate more clearly that it is a version from which some corrections have been removed.

7 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 two 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 the Color Correction tool, it might also be useful for anyone learning to work with the tool and its controls, even an experienced colorist.

This chapter contains the following main topics:

- Guiding Principles for Color Correction
- Examples of Color Correction Problems

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. The following topics use these two approaches to provide you with a set of guiding principles for color correction.

- Goals of Color Correction: Restoration and Adaptation
- Restoring the Original Look
- Adapting the Original Look
- Stages of Color Correction
- Correcting Tonal Range
- Neutralizing Color
- Achieving Shot-to-Shot Consistency
- Achieving a Final Look

Goals of Color Correction: Restoration and Adaptation

You can think of color correction as having two main goals:

- Restoring the original look of the scene
- 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 is 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 little tolerance for images that have unrealistic color values. 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 captured 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 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 306 and “Neutralizing Color” on page 307, 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.

You should generally try 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).

Remember that your Avid editing application is capable of two levels of color correction and that some kinds of adaptive adjustments, especially if they are to apply equally to every shot in a sequence, are best applied as Program relationships. However, if your correcting work involves only restoration and simple matching for consistency from shot to shot, it is probably better to do all your work as Source relationship corrections. This keeps your color corrections as a whole simpler and preserves the Program relationship option for any final adjustments that you might want to make.

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 lead to different emphases among these stages and might even make some unnecessary. Different working habits 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.

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 includes 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 Setup sliders in the HSL tab and the various controls in the Levels tab.

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 midgray, and how much is between midgray 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 controls for making gray point adjustments are the Gamma slider in the HSL group and the gray point controls in the Levels 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 midgray color. If you can correct each image so the card appears midgray 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 select 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 fact, this is exactly how you make corrections to remove color casts using the Remove Color Cast buttons. 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 using many different controls in the Color Correction tool. For example, you can use the Curves tab to adjust the proportions of each color. You can use the Hue and Saturation sliders in the Highlights, Midtones, and Shadows tabs of the HSL group. Or you can use the Hue Offsets color wheels, 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. Except when a color problem is extreme, you are usually more successful when neutralizing color if you make adjustments in individual colors or in specific brightness ranges rather than in the Master controls.

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.

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 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.

Depending on the requirements of your project, you might choose to make adjustments for shot-to-shot consistency as Source or as Program relationship corrections. If you have made a lot of earlier Source relationship adjustments and you know you do not need to make overall adjustments for a finished look, you might choose to move to Program relationships to make shot-to-shot corrections. If you expect to need Program relationships for significant finishing adjustments that apply across all the segments in your sequence, you should stay with Source relationships when making shot-to-shot adjustments.

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.

You usually make final corrections of this kind as Program relationship corrections by correcting entire program tracks 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.

Examples of Color Correction Problems

The following topics present examples of typical color correction problems.

- Example 1
- Example 2
- Example 3

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.

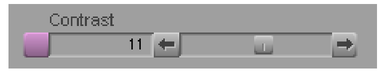
If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

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.

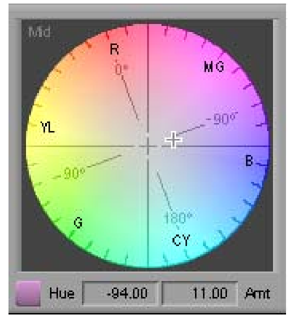
Step 1: Contrast Correction



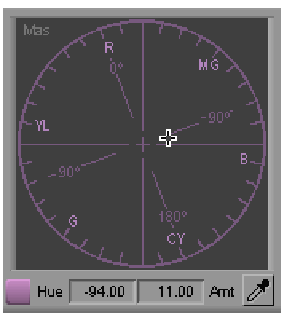
Split Screen: Uncorrected Image and Step 1 Correction

Step 1 of this correction is an adjustment to the Contrast slider in the Master 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



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 Master Hue Offsets ChromaWheel control in 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.

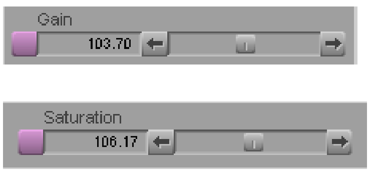
Alternative techniques: This example uses simple corrections that apply across the full luminance range. Another method for correcting this image would involve making individual adjustments in different ranges such as highlights and shadows. For an illustration of this approach, see "Example 2" on page 313. The contrast adjustments could be made using the Gain, Gamma, and Setup sliders as an alternative to the one adjustment on the Contrast slider. Another alternative for making the contrast adjustment would be to use the controls in the Levels tab.

Example 2

Uncorrected Image

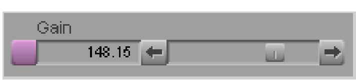
Analysis of original image: The highlight areas of this image (primarily the shirts) are not particularly bright, and the shadow areas (such as the underside of the cap brim) could be darker. Rebalancing white and black will improve contrast and sharpen the image throughout. Also, the image has a red 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 Master Controls Tab



Step 1 of this correction adjusts the Gain and Saturation sliders in the Master 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 Highlights Controls Tab

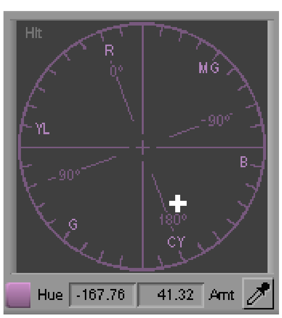


Step 2 makes a large adjustment to the Gain slider in the Highlights Controls tab. Gain is increased to 148.15. This brightens the highlight areas considerably and brings much more sharpness and contrast into the lighter areas of the cap and into the shirt in the lower right corner.

Step 3: Corrections in Shadows Controls Tab

Step 3 makes adjustments in the Shadows Controls tab. Saturation is reduced to 66.67 and Setup is reduced to –9. This makes the darkest areas of the image more nearly black and further contributes to the building of contrast in the image.

Step 4: Correction to Neutralize Color



Step 4 neutralizes the color cast in the highlights range by making a large adjustment in the Highlights color wheel. The adjustment values are Hue:–167.76, Amount:41.32. This removes the pink look in the shirts (most apparent by comparing the shirt in the background between Step 3 and Step 4). 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. A similar final result could probably be achieved in the Levels tab, but the adjustments there are made on individual color channels rather than on different overall luminance ranges.

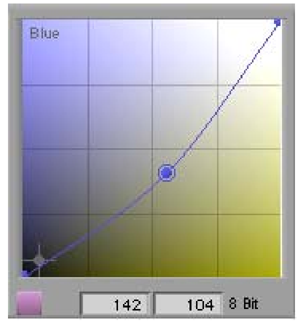
Example 3

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.

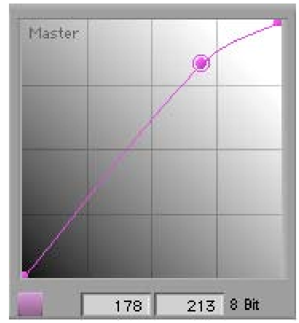
Step 1: Correction to Neutralize Color



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 curve correction could be made in the Hue Offsets tab, in the Blue Levels 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), or it could be made by adjusting white and gray points in the Levels tab.

8 Spot Color Correction

If your Avid editing application uses the advanced color correction interface, you can apply color adjustments to parts of images that you define by drawing. You can make these adjustments using the Spot Color Correction effect or using color adjustment modes in the Paint Effect. Both effects include the Color Match control for making automatic adjustments based on selected input and output colors.

Understanding the Spot Color Correction Effect

The Spot Color Correction effect allows you to make precise color adjustments to a part of an image that you define using the Intraframe drawing tools.

For example, you can outline a figure in a shot or isolate a single object and then adjust the color of that figure or object without affecting the color of the rest of the image. As with other Intraframe effects, you can use keyframes to adjust the effect over time.

Spot color correction is commonly used as a storytelling device that emphasizes part of an image by giving it distinct color characteristics. You can also make color corrections using spot color correction whenever you want a color adjustment to be restricted to part of the image only.

In many circumstances, you can correct the color in selected areas of an image more quickly and easily using the secondary color correction capabilities of the Color Correction tool. However, color corrections that define part of an image using drawing tools are sometimes the only way to isolate the exact area of an image that you need to correct. For more information on secondary color correction, see "The Secondary Group" on page 250.

The following illustrations show two basic examples of spot color correction. In the first example, the background of the shot is outlined with a drawing tool and then desaturated and lightened, leaving the car as the only part of the image in color. Additional shapes within the main outline of the car have been used to remove any color visible through the car's windows. In the second example, the straw bale on the left is outlined with a drawing tool and then enhanced with color adjustments to give it a stronger golden-yellow appearance.

If you are reading a black-and-white hardcopy version of this document, you will find it useful to view the color images in the online version of the document available from the Online Library for your Avid editing application (Help > Online Library).

You can also make color adjustments to Intraframe objects using various modes in the Paint Effect. However, you can apply only one kind of adjustment to a selected area using the Paint Effect. Using the Spot Color Correction effect, you can enable several kinds of color adjustments at the same time.

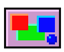
Making Corrections Using the Spot Color Correction Effect

To make corrections using the Spot Color Correction effect:

1. Select Tools > Effect Palette.

   The Effect Palette opens.

2. Click the Image category.



3. Click the Spot Color Correction Effect icon in the Effect Palette, and drag it to the segment you want to correct in the Timeline.

4. Click the Effect Mode button to enter Effect mode.

5. From the Effect Editor, select a drawing tool, such as the Polygon tool.

6. Use the drawing tool to define the area on the image that you want to correct.

   For more information on working with the Intraframe drawing tools, see “Intraframe Editing” in the Help.

7. Adjust parameters in the Effect Editor until you are satisfied with the look of your correction.

   For information on the parameters available, see “Image: Spot Color Correction” in the Help.

8. (Option) If necessary, repeat steps 3 through 6 to define and adjust additional areas for correction.

9. (Option) If necessary, use keyframes to adjust the corrected areas over time so that they follow movements in the footage.

   For more information on keyframing Intraframe objects, see “Intraframe Example:Animating a Matte Key Effect” in the Help.

10. Render the effect to play it back in real time.

Using Paint Effect Modes for Color Adjustment

Using some of the modes in the Paint Effect, you can adjust the color of a selected area that you have defined.

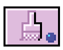
The main difference between color correction using the Paint Effect and color correction using the Spot Color Correction effect is that the Paint Effect can be used to apply only one kind of color adjustment. For example, you can adjust the luma range of a selected area by selecting the Luma Range mode of the Paint Effect, but you cannot then make an adjustment to the red color channel using the Color Gain mode. The Paint Effect can apply only one mode to an object.

To make a correction to an area in an image using a Paint Effect mode:

1. Select Tools > Effect Palette.

   The Effect Palette opens.

2. Click the Image category.



3. Click the Paint Effect icon in the Effect Palette, and drag it to the segment you want to correct in the Timeline.

4. Click the Effect Mode button to enter Effect mode.

5. From the Effect Editor, select a drawing tool, such as the Polygon tool.

6. Use the drawing tool to define the area on the image that you want to correct.

   For more information on working with the Intraframe drawing tools, see “Intraframe Editing” in the Help.

7. In the Mode parameter category, click the Fast Menu button, and select one of the following color adjustment modes:

   - Luma Adjust
   - Luma Range
   - Luma Clip
   - Chroma Adjust
   - Color Style
   - Color Gain
   - Color Match

8. Adjust the parameters in the Mode parameter category until you are satisfied with the look of your correction.

   For information on Paint Effect modes, see “Image: Paint Effect” in the Help.

9. (Option) If necessary, repeat steps 5 through 8 to define and adjust additional areas for correction.

10. (Option) If necessary, use keyframes to adjust the corrected areas over time so that they follow movements in the footage.

    For more information on keyframing Intraframe objects, see “Intraframe Example: Animating a Matte Key Effect” in the Help.

11. Render the effect to play it back in real time.

9 Safe Colors

Avid Color Correction allows you to set safe limits for the colors that display in your images — that is, limits beyond which the application issues a safe color warning. You can also limit colors to safe ranges by applying the Safe Color Limiter effect.

The following topics provide all information about the Safe Colors feature of your Avid editing application that is not covered in “Avid Color Correction: Basics” in the Help:

- Overview of Safe Color Limits
- Safe Color Settings Options
- Understanding the Graphical View of Safe Color Settings
- Understanding Safe Color Warnings
- Safe Color Limits with Waveform and Vectorscope Information
- Working with the Safe Color Limiter Effect

Overview of Safe Color Limits

Your Avid editing application allows you to set three different types of safe color limits. You can set limits for the composite signal range, the luminance range, and the RGB gamut. Your Avid editing application can issue safe color warnings when the color values in your video material fall outside these limits. Your Avid editing application can also use these limits as the default parameters for the Safe Color Limiter effect.

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 "Safe Color Settings Options" on page 326.

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.

Safe Color Settings Options

You set safe color limits and control how those limits are applied by selecting options in the Safe Color Settings dialog box. For information on how to open the Safe Color Settings dialog box and set limits and options, see "Managing Safe Color Warnings" in the Help.

The following table describes the available limit types, units of measurement, and types of action in the Safe Color Settings dialog box.

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 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.

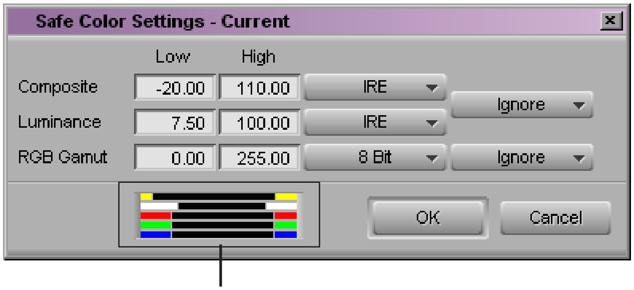
Option	Description
Composite	Sets safe color values for the composite video signal.
Luminance	Sets safe color values based on brightness.
RGB Gamut	Sets safe color values based on color range.

Option	Description
Units buttons	Define the units of measurement for the three types of safe color values. Click the Composite Units button and select either IRE or mVolts (millivolts). Click the Luminance and RGB Gamut buttons and select from the following options: • 8 Bit: Measures the adjustment on a scale from 0 to 255. • % (percent): Measures the adjustment on a percentage scale. Percentage values can be lower than 0 or higher than 100.. • IRE: Measures the adjustment in IRE units. • mVolts: Measures the adjustment in millivolts. *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.*
Actions buttons	Define how your Avid editing application implements the safe color settings. The top button controls both the Composite and the Luminance limit types; the bottom button controls the RGB Gamut limit type. Click an Actions button and select from the following options: Ignore — Your application does not limit based on these settings. This is the default setting. Warn — Your application provides warnings when these limits are exceeded. For more information on safe color warnings, see "Understanding Safe Color Warnings" on page 329.

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.

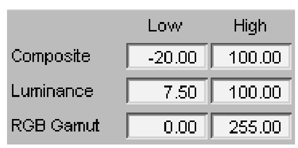


The graph shows colored bars that represent the current low and high levels for each limit type. The colors are the same as those used to display safe color warnings in the monitors. It also displays gray vertical lines that represent the default high and low levels for each limit type.

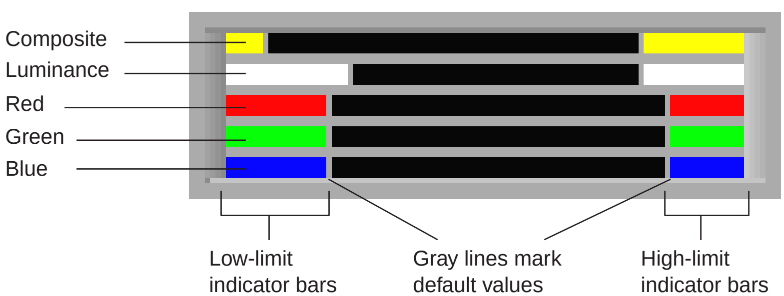
The following illustrations present two graphs in detail — the first showing default levels and the second showing adjusted levels — and explain how to interpret the graphs.

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.



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 you select the Warn option for one or more of the types of safe limit, your Avid editing application displays warnings when material exceeds the limits you have set. You select the Warn option using the Actions button as described in “Managing Safe Color Warnings” in the Help.

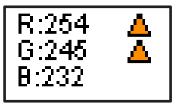
Warnings appear in the monitors for all limit types — Composite, Luminance, and RGB Gamut. (Warning indicators do not appear unless color levels exceed at least one of the limits currently set to Warn.) For more information, see “Safe Color Warnings in the Monitor Window” in the Help.

Warnings appear in the Color Match control for RGB Gamut limits only.

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.

Safe Color Warnings in the Color Match Control

If you select the Warn option for the RGB Gamut limit type, your Avid editing application 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 subdividing tab of the HSL group and the Curves group.

You can also use the Safe Color Limiter effect to achieve safe color values automatically. For more information, see "Working with the Safe Color Limiter Effect" on page 333.

To bring luminance within safe limits:

1. Click the Controls subdividing tab in the HSL group.

   The Controls tab opens.

2. Click the Enable button for the HSL group and the Controls subdividing 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. Your Avid editing application 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. Your Avid editing application adjusts RGB values above 235 down to 235.

To bring composite levels within safe limits:

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

   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 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.” A program with illegal levels 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 editing 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 does 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 you meet particular standards, use a legalizer such as the Safe Color Limiter effect or a third-party AVX™ plug-in.

These instruments do not measure analog outputs. If your Avid editing 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. The following table 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.

Display	Component	Value	Display Color
Y Waveform	Luma	Legal	Green
		Illegal	White

Display	Component	Value	Display Color
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

Working with the Safe Color Limiter Effect

In addition to the safe color warning system, you can also limit colors to safe ranges by applying the Safe Color Limiter effect. The Safe Color Limiter effect modifies color and luminance values in video material to bring the material within the safe color limits you define. If you use the Safe Color Limiter effect, you do not have to make manual adjustments in the Color Correction tool to ensure that video is within limits.

Understanding the Safe Color Limiter Effect

The Safe Color Limiter effect has effect parameters that control high and low color limits for luminance, composite signal, and red, green, and blue color gamut. It also allows you to change the units with which these limits are measured. These parameters parallel the options available in the Safe Color settings.

When you first apply a Safe Color Limiter effect, its parameters default to the current limits in the Safe Color settings. In the simplest situation, therefore, you can set limits in the Safe Color settings that meet your needs (for example, luminance or composite signal standards set by a broadcaster), and then apply the Safe Color Limiter effect to the video material you need to limit. Without any further adjustment, the effect modifies the color and luminance values of any pixels in the video material that exceed your limits, ensuring that the video meets the required standards. For more information on safe color limit values and possible reasons for using them, see "Overview of Safe Color Limits" on page 325.

When you want to make adjustments to the safe color limits that a Safe Color Limiter effect is using, you do so using parameter controls in the Effect Editor. You can also view an analysis of the image in the Source monitor that makes it easy to see exactly which pixel areas in an image are outside the limits set for the effect. For more information, see "Using the Safe Color Limiter Analysis Display" on page 335.

The following information provides important additional details on how the Safe Color Limiter effect operates:

- The Safe Color Limiter automatically takes variations in broadcast formats into account, for example the differences between PAL and NTSC material, and the difference in the setup offset between NTSC and NTSC-J.
- Because the primary purpose of safe color limiting is to ensure that video is acceptable for SD broadcast, all limiting by the Safe Color Limiter effect is performed in the 601 color space. When you are working with HD material in the 709 color space, the Safe Color Limiter converts the material to the 601 color space to apply limiting, and then converts back to the 709 color space. For more information on SD and HD color spaces, see "Video Color Space for HD" in the Help.
- Like many other Avid effects, the Safe Color Limiter effect supports both 8-bit and 16-bit processing. For more information, see "Using 16-bit Processing Support for Rendered Effects" in the Help.

Applying the Safe Color Limiter Effect

The Safe Color Limiter effect is a segment effect available from the Image category of the Effect Palette. A common scenario for applying the Safe Color Limiter effect is to apply it to filler on the top track in the Timeline so that the effect acts on the entire duration of the sequence. Depending on your needs, you might also want to apply a Safe Color Limiter effect to a single segment in a sequence, or to multiple selected segments.

To apply the Safe Color Limiter effect:

1. Set the default safe color limits you want the Safe Color Limiter effect to use.

   For more information, see "Modifying Settings" in the Help and "Safe Color Settings Options" on page 326.

2. (Option) If you want to apply the effect across the entire duration of the sequence, add a new video track in the Timeline, for example, by selecting Clip > New Video Track.

3. Do one of the following:

   - If you are applying the Safe Color Limiter effect to the entire duration of the sequence, drag the effect from the Image category of the Effect Palette, and drop it on the empty top video track.

     The top video track shows filler material with the Safe Color Limiter effect applied to it, and all of the video material in the sequence is limited according to the limit values you set in step 1.

   - Apply the effect to one or more segments using standard methods, as described in "Applying Effects From the Effect Palette" in the Help.

     The video in the segment or segments to which you applied the effect is limited according to the limit values you set in step 1.

   By default, when the Effect Editor is open, the effect changes the display in the Source monitor to an analysis mode that highlights pixels in the image that fall outside the current safe color limits. For more information on using and understanding this display, see "Using the Safe Color Limiter Analysis Display" on page 335.

4. If necessary, enter Effect mode and adjust effect parameters in the Effect Editor.

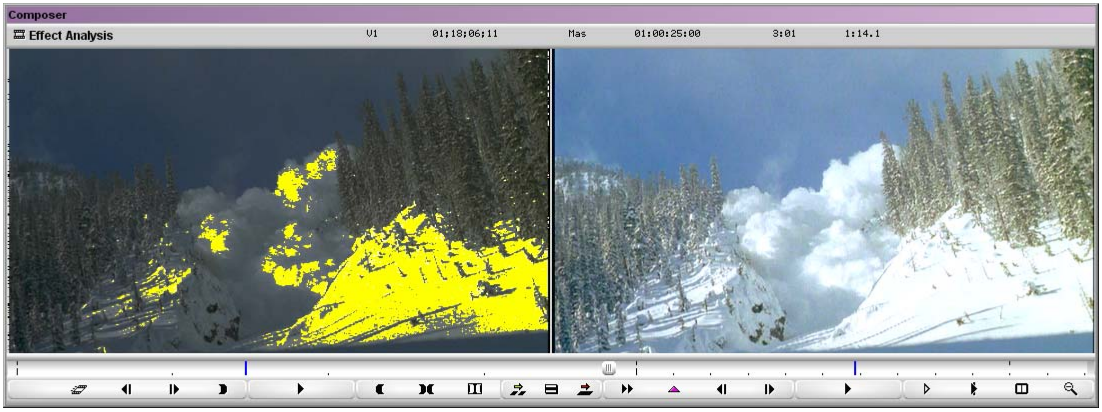
   For more information, see Adjusting Effects in the Help and "Adjusting the Safe Color Limiter Effect" on page 335.

Adjusting the Safe Color Limiter Effect

You adjust a Safe Color Limiter effect by changing effect parameter values in the Effect Editor. You can adjust the low or high limit values for each limit type (composite, luminance, or RGB gamut). You can select the units used to measure the limit values. You can also turn the effect analysis display on or off. For reference information on all the Safe Color Limiter effect parameters, see "Image: Safe Color Limiter" in the Help.

Using the Safe Color Limiter Analysis Display

An effect analysis display appears by default in the Source monitor when you apply a Safe Color Limiter effect. The following illustration shows a typical display.



The effect analysis display has two layers. The background layer is a copy of the image that has luminance reduced to allow the foreground information to stand out clearly. The foreground layer highlights those pixels in the image whose color values fall outside the limits currently being used by the effect — that is, pixels that are being modified by the effect.

The color scheme used for the highlighting is the same as that used for the safe color warning indicators that can appear in the monitors in Color Correction mode:

- Yellow: Indicates pixels that fall outside composite limits.
- White: Indicates pixels that fall outside luminance limits.
- Red: Indicates pixels that fall outside RGB gamut limits for red.
- Green: Indicates pixels that fall outside RGB gamut limits for green.
- Blue: Indicates pixels that fall outside RGB gamut limits for blue.

In the illustration above, the pixels highlighted in yellow have color values that fall outside the composite limits currently being used by the effect.

When you adjust the limit parameters in the Effect Editor, the analysis display updates. For example, if you adjust a limit parameter so that it permits a larger range of values, fewer pixels are highlighted in the analysis display.

If a pixel in the image falls outside current limits for multiple limit types, the analysis display uses the color for only one of the types to highlight the pixel. As a result, for example, you might adjust the RGB gamut limits so that a pixel no longer has a blue highlight and find that the display highlights the pixel using yellow because that pixel is still being limited by the composite limits.

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