Audio/Video User's Guide for the Silicon Graphics 320™ and Silicon Graphics 540™ Visual Workstations

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About This Guide

The *Audio/Video User's Guide for the Silicon Graphics 320™ and Silicon Graphics 540™ Visual Workstations* describes how to use the audio and video features of the Silicon Graphics Visual workstations. This guide contains the following chapters:

- Chapter 1, "Getting Started"
- Chapter 2, "Recording and Playing Audio"
- Chapter 3, "Capturing and Playing Video with VidCap and Video for Windows"
- Chapter 4, "Capturing and Playing Video with HackTV and QuickTime"
- Chapter 5, "Silicon Graphics Video Compression Techniques"
- Appendix A, "NTSC and PAL"

Intended Audience

This guide is intended for both novice and experienced video editors. This broad range includes people involved in video editing, composition, and animation, Web designers, game developers, or those in similar endeavors who require high-quality, full-motion video and audio editing. Readers of this guide should thoroughly understand digital video editing techniques and be familiar with video editing application software.

This document refers to the English-language editions of Video for Windows and QuickTime.

Additional Information

For additional sources of information, consult the following documents:

- *Silicon Graphics 320 Visual Workstation Owner's Guide*
- *Silicon Graphics 540 Visual Workstation Owner's Guide*
- *Digital Media Programming Guide for Windows NT*
- *Silicon Graphics SD1100™ Serial Digital Video Interface Board Owner's Guide*
- *Silicon Graphics MJ1100™ M-JPEG Compression Card Owner's Guide*
- *Silicon Graphics DA1100™ Digital Audio Card Owner's Guide*

Contacting Customer Support

Support contact information can be found in the Owner's Guides or on your system (go to Start > Silicon Graphics > Support).

Chapter 1

Getting Started

This chapter explains the multimedia features of the Silicon Graphics 320 and Silicon Graphics 540 workstations and how to use them to capture video and audio from an external source.

This chapter discusses the following topics:

Hardware Overview

The Silicon Graphics 320 and Silicon Graphics 540 workstations are high-performance multimedia workstations. They come with built-in software and a complete set of audio and video back-panel connectors to allow you to capture high-quality video and audio from a variety of sources. Designed to run with Microsoft Windows NT, both workstations present professional digital video editors with the ease of use and convenience of the Windows NT operating environment.

The Silicon Graphics 320 workstation supports up to two Pentium II or Pentium III processors, while the Silicon Graphics 540 workstation supports up to four Pentium III processors.

In addition to the features offered in the basic versions of the workstations, Silicon Graphics offers the following options to boost performance:

- The Silicon Graphics DA1100 Digital Audio Card—multichannel digital audio capability and audio/video synchronization board
- The Silicon Graphics MJ1100 MJPEG Compression Card—dual-channel M-JPEG compression board
- The Silicon Graphics SD1100 Serial Digital Video Interface Board—digital video capture and external synchronization board
- The Silicon Graphics DS1100 Disk Array—disk array that enables full-motion video capture and playback of compressed and uncompressed material with high-capacity storage
- The Silicon Graphics 1600SW Flat Panel Monitor—a thin-profile high-performance display

More information about these options is found later in this guide.

Silicon Graphics 320 Visual Workstation

The Silicon Graphics 320 workstation provides the following multimedia features:

- CD-quality stereo line-level audio input and output (two RCA jacks)
- Composite video input and output (two RCA jacks)
- S-Video input and output (two S-Video jacks)
- Speaker/Headphone output (mini jack)
- Microphone input (mini jack)
- Hardware support for audio and video synchronization

You can install the following options in the Silicon Graphics 320 workstation:

- Silicon Graphics DA1100 Digital Audio Card
- Silicon Graphics MJ1100 M-JPEG Compression Card
- Two types of 64-bit PCI Hard Disk Controller Cards to control the Silicon Graphics DS1100 Disk Array:
  - SCSI
  - Fibre Channel

Figure 1-1 shows the back of the Silicon Graphics 320 workstation.

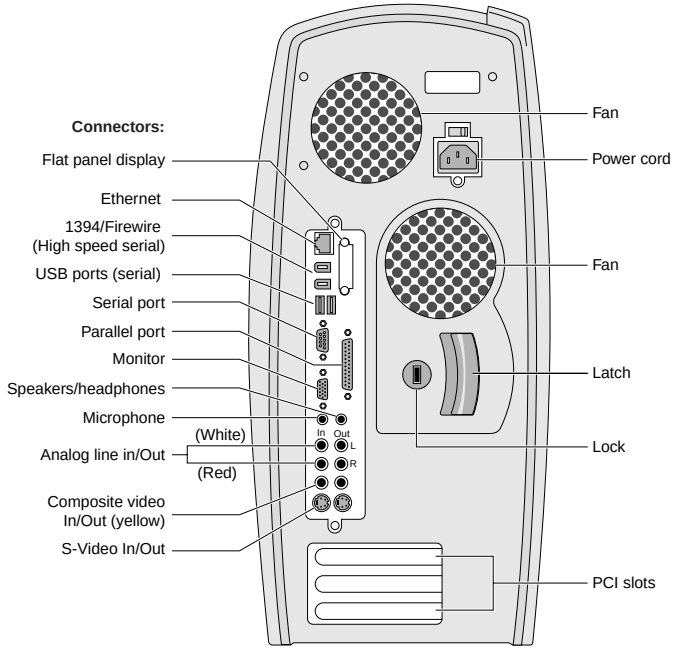

Figure 1-1 Back View of Silicon Graphics 320 Workstation

Silicon Graphics 540 Visual Workstation

In addition to the multimedia features provided by the Silicon Graphics 320 workstation, the Silicon Graphics 540 workstation offers compatibility with the Silicon Graphics SD1100 Serial Digital Video Interface Board, and additional PCI expansion slots, as shown in Figure 1-2, which shows the back of the Silicon Graphics 540 workstation.

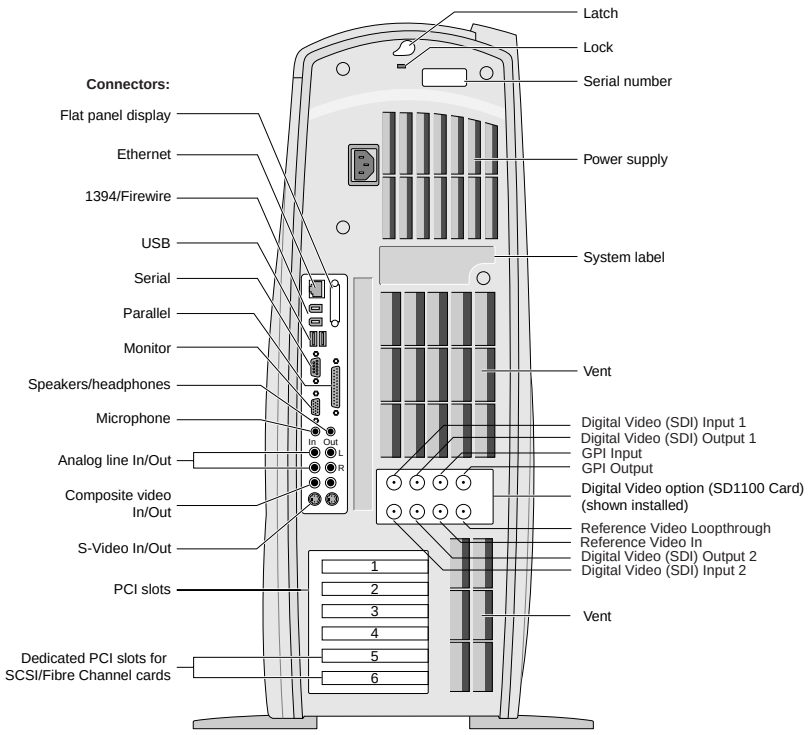

Figure 1-2 Back View of Silicon Graphics 540 Workstation

Software Overview

This section explains the software environment, tools, and panels the workstations use to capture video.

Software Environments

The workstations include full support for the following digital media software environments:

- Microsoft Windows Multimedia, including Video for Windows
- Apple QuickTime for Windows

Windows Multimedia

The Windows Multimedia environment includes the following tools and graphical panels:

- VidCap32 video capture tool[1]
- Sound Selection panel
- Media Player panel
- Windows Volume and Recording panels
- Silicon Graphics Video for Windows Capture Settings panel

Apple QuickTime

The Apple QuickTime environment includes the following tools and panels:

- HackTV video capture tool[1] (downloadable from Apple's website)
- Sound Control Panel for control of compression, source, and sampling
- Video Control Panel for control of compression, source, and imaging
- Windows Volume and Recording panels

1 Other third-party applications may also be used for capturing and editing video.

Silicon Graphics Control Panels

In addition to Windows and QuickTime, Silicon Graphics provides the following control panels, which are accessible from the Silicon Graphics System Tray icon or from the System Control Panels folder:

- Silicon Graphics Audio Control Panel
- Silicon Graphics Video Control Panel

The software environment is explained in detail in Chapters 2 and 3.

In addition to the software included with the workstations, sophisticated third-party software may be purchased that allows you to capture and edit video and audio. These third-party applications are based on either Microsoft Video for Windows or Apple QuickTime. Some third-party tools support only one or the other and some support both. Because Apple QuickTime offers somewhat better performance, Silicon Graphics recommends that you use multimedia software based on QuickTime where possible.

The software can be considered to exist at three levels or layers:

- Application Control Panels and Dialog Boxes
- Developer API (application program interface) Layer
- Driver Layer

Figure 1-3 shows the general software environment for Windows Multimedia.

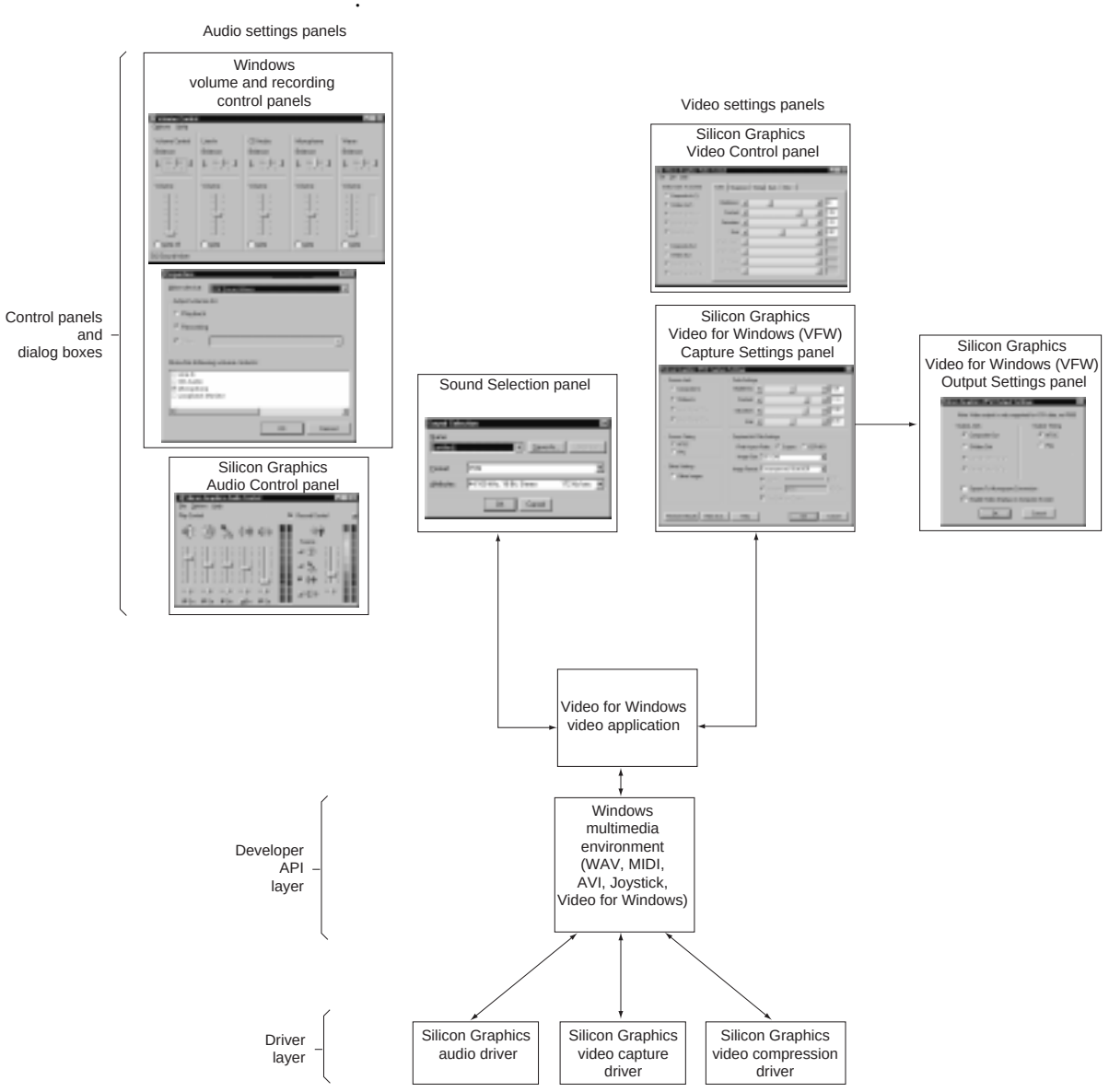

Figure 1-3 Windows Multimedia Software Environment

Some of the panels shown in Figure 1-3 are brought up by the VidCap application (or other third-party applications), and others are brought up from the Windows System Tray or from the Windows Control Panel. Each panel

has its own submenus and dialog boxes, which are explained in subsequent sections of this guide.

Figure 1-4 shows the general software environment for Apple QuickTime.

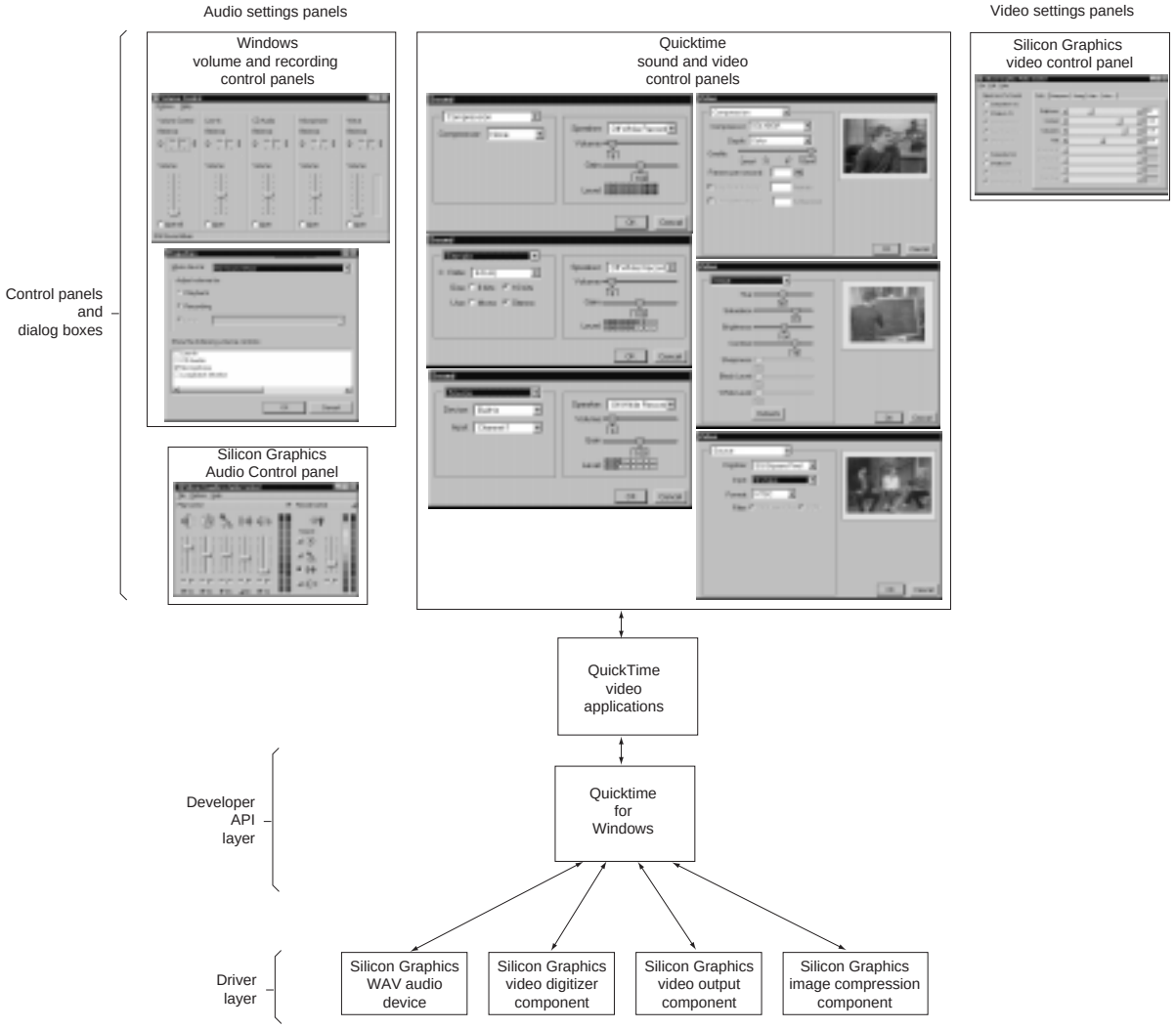

Figure 1-4 Apple QuickTime Software Environment

A Simple Video Capture Example

This section explains how to hook up your NT workstation to an external video source, capture video using both the Windows VidCap and QuickTime HackTV applications, and play it back.

Making the Connections

In this example, the workstation is connected to a television and to an external VCR that plays back a video source tape. The connections are made as shown in Figure 1-5.

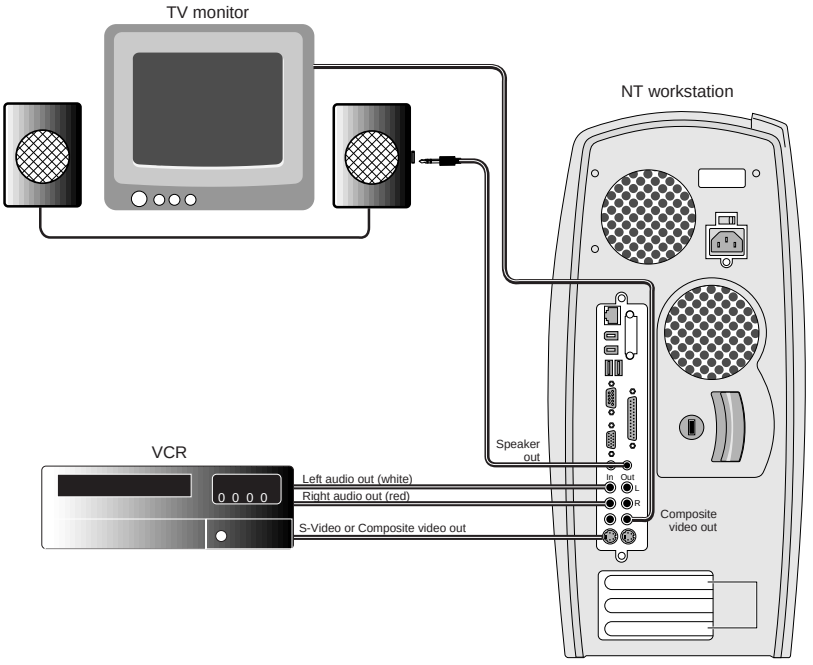

Figure 1-5 Connections to an External Video Source

Note: This connection configuration assumes that your VCR has an S-Video output. If it does not, connect its composite video output to the NT workstation's composite video input.

Capturing Video Using VidCap

In this example, you capture a 2-second video clip to hard disk using the VidCap application. The following sections illustrate the steps to follow to perform the capture.

Start the Application

1. Bring up the VidCap application by double-clicking the VidCap32.exe icon, located at *C:\WINNT\SYSTEM32*.

   The **VidCap** main screen appears, as shown in Figure 1-6.

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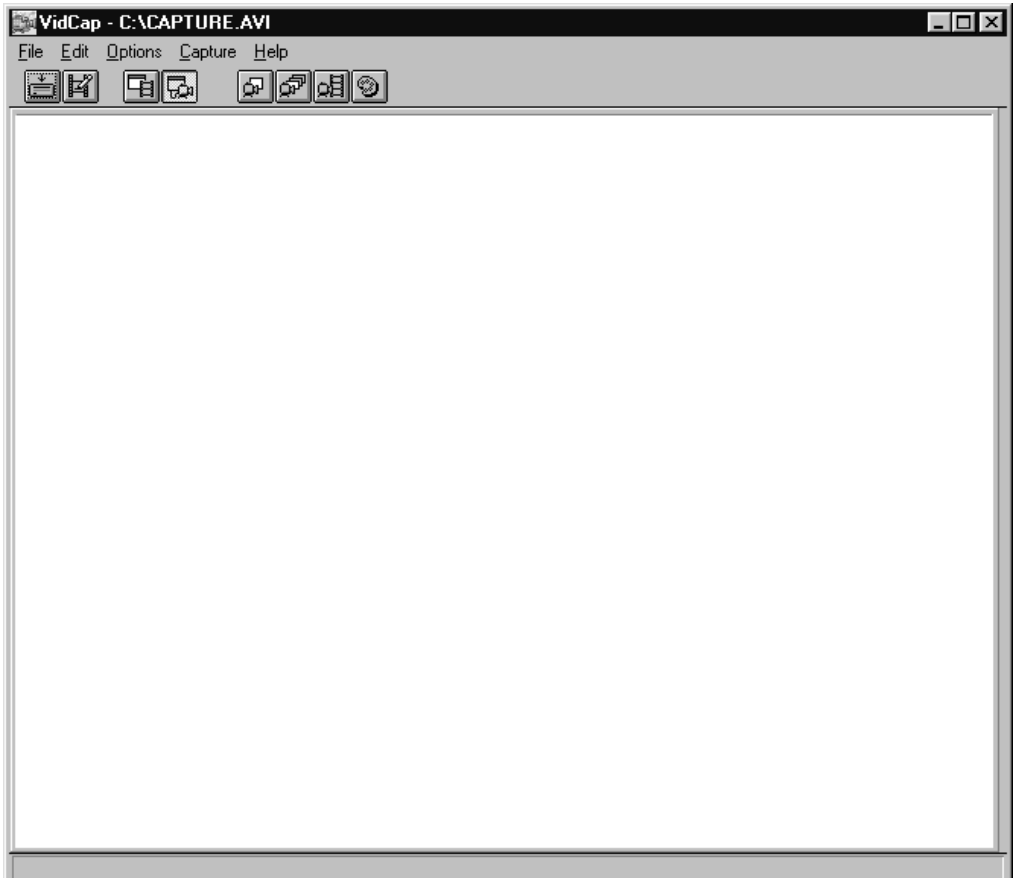

Figure 1-6 VidCap Main Screen

Choose the Audio Format

1. From the **VidCap** main menu bar, choose **Options** > **Audio Format**.

   The **Sound Selection** window appears, as shown in Figure 1-7. To capture audio along with the video, you must specify the audio quality, format, and attributes in this window.

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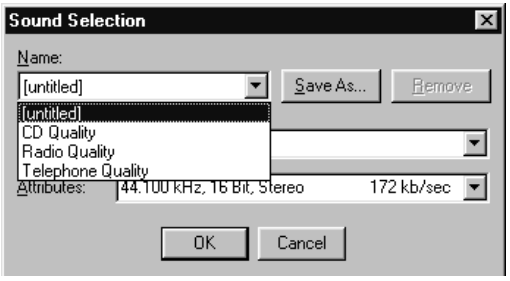

Figure 1-7 Sound Selection Window

2. Choose **CD Quality** in the **Name** box.
3. Choose **PCM** in the **Format** box.
4. Choose **44.100 kHz**, **16-bit**, **Stereo**, **172 Kb/s** in the **Attributes** box.

Choose the Video Format

1. From the **VidCap** main menu bar, choose **Options** > **Video Format**.

   The **Silicon Graphics VFW Capture Settings** screen appears, as shown in Figure 1-8.

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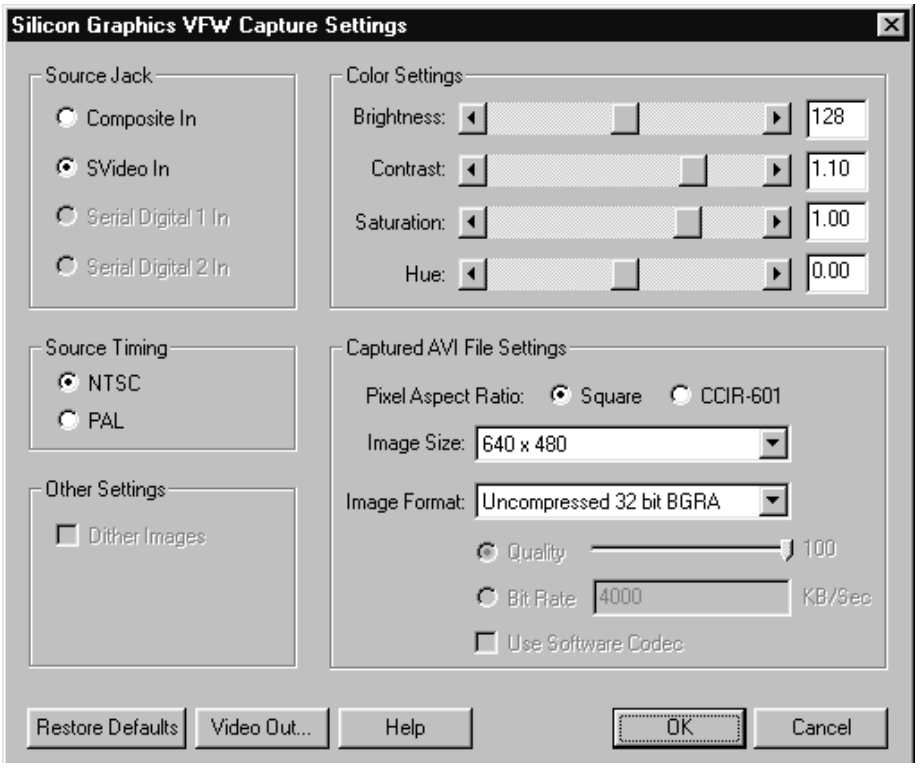

Figure 1-8 Silicon Graphics VFW Capture Settings Screen

2. In the **Silicon Graphics VFW Capture Settings** screen, make the following selections:

   – Source Jack: **S-Video** (or **Composite In**, depending on your VCR video output to the workstation)

   – Source Timing: **NTSC**[1]

---

1 NTSC is the format for North America. The format may change for foreign countries. See Appendix A.

– Color Settings: leave the default settings as is

– Captured AVI File Settings:

Pixel Aspect Ratio: Square

Image Size: **320 x 240**

Image Format: **Uncompressed 32-bit BGRA** or **16-bit Uncompressed UYVY**.

3. Click **Video Out...** on the **Silicon Graphics VFW Capture Settings** screen.

The **Silicon Graphics VFW Output Settings** window appears, as shown in Figure 1-9.

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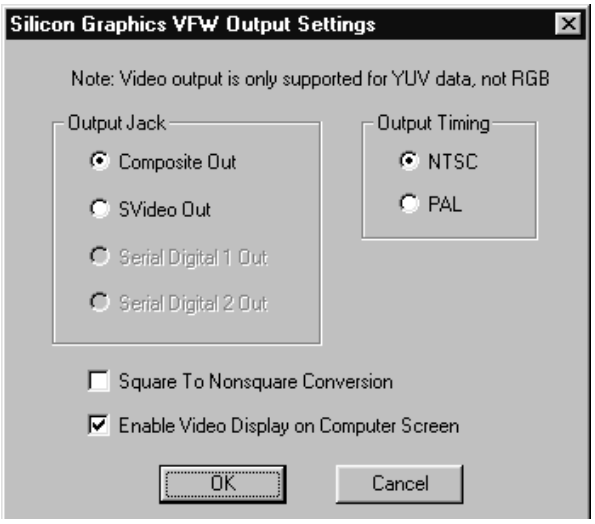

Figure 1-9 Silicon Graphics VFW Output Settings Screen

4. In this screen, make the following selections:

   - Output Jack: **Composite Out**

   - Output Timing: **NTSC**[1]

   - Enable Video Display on Computer Screen: checked

5. From the **VidCap** main menu bar, choose **Options** > **Overlay** and click **OK**.

At this point, you should see motion video on the computer monitor. Video does not actually appear on the TV monitor except during the time video is actually being captured.

Create a Media File

1. From the **VidCap** main menu bar, choose **File** > **Allocate File Space**.

   The **Set File Size** window appears, as shown in Figure 1-10.

.

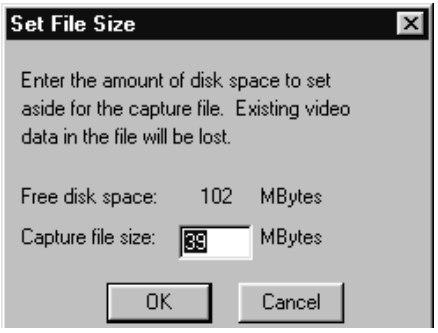

Figure 1-10 Set File Size Window

2. In the window, enter **39** megabytes for the capture file size. This should be more than sufficient to hold two seconds of full motion, uncompressed video.

   Note: This step may take a very long time for large file sizes. It is acceptable to skip this step.

---

1 NTSC is the format for North America. The format may change for foreign countries. See Appendix A.

Set the Audio Record Level

1. From the Windows System Tray (located on the Taskbar), click the Silicon Graphics icon and choose **Audio Control Panel**

   The **Silicon Graphics Audio Control** panel appears, as shown in Figure 1-11.

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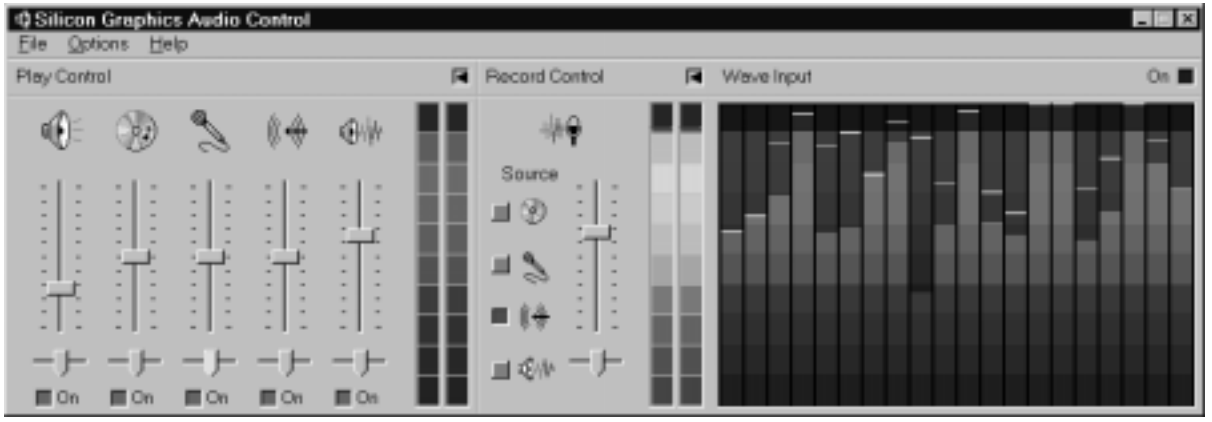

Figure 1-11 Silicon Graphics Audio Control Panel

There are three areas on the panel: **Play Control**, **Record Control**, and **Wave Input**. The **Record Control** section lets you choose the recording source and adjust the record level. The **Play Control** section lets you monitor and adjust the audio level of various audio sources through the speakers and does not affect the recording level. The **Wave Input** section presents a dynamic visual picture of the sound input.

2. Set up the **Record Control** section of the panel as follows:

   – If the **Wave Input** panel is not displayed, click the small right arrow in the upper right of the **Record Control** panel to display it.

   – Click the **Line In** check box so that audio is recorded from the audio line inputs from the VCR. If the **Wave Input** panel does not display vertical bars, choose **Options** > **Solid Meters**. The vertical bars in the **Wave Input** panel should reflect the sound activity.

   – Adjust the record slider so that the audio levels indicated in the two vertical bars in the **Record Panel** are as high as possible without clipping (red region).

– Close the **Wave Input** panel before you actually start recording.

3. Set up the **Play Control** section of the panel as follows:
   – Click the **On** button below the **Line In** icon . This allows you to monitor the sound coming in from the VCR or other video source.
   – Set the **Line In** and **Wave** volume sliders for an acceptable listening level.

Begin Capturing Video

1. From the **VidCap** main menu bar, choose **Capture** > **Video**.

   The **Capture Video Sequence** window appears, as shown in Figure 1-12.

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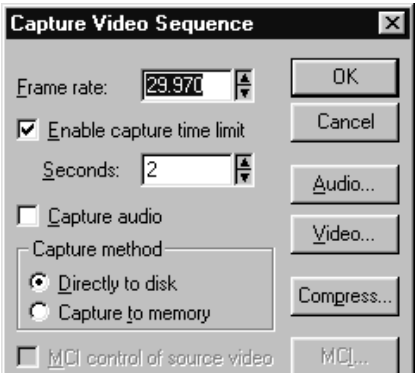

Figure 1-12 Capture Video Sequence Window

2. Set up the window as follows:
   - Frame rate: **29.970**[1] for NTSC or **25** for PAL
   - Enable Capture Time Limit: **checked**
   - Seconds: **2**
   - Capture Audio: **checked**
   - Capture Method: **Directly to disk**

1 Although the 29.97 number might seem unusual, it corresponds to the proper frame rate for NTSC.

3. If you are using tape in the VCR as a video source to capture, start the tape.
4. Click **OK**

   You see and hear video at the television monitor for two seconds. When the two seconds elapses, the television screen goes blank. The following video file is now present on the hard disk:

   C:\CAPTURE.AVI

Playing Back the VidCap Video

To play back the captured video, double-click the CAPTURE.AVI file. The Windows Media Player opens and the captured video begins playing, as shown in Figure 1-13.

Figure 1-13 Windows Media Player Window

Use the controls in the window to start, stop, and pause the displayed video.

Capturing Video Using HackTV and QuickTime

In this example, you capture a short video clip to hard disk using the HackTV application. HackTV can be downloaded from Apple Computer's Web site and uses QuickTime to capture and play back video. Follow these steps to perform the capture:

Start the Application

1. Bring up the HackTV application by double-clicking the HackTV executable file.

   The **HackTV** main menu appears, along with real-time video playing in the **Monitor** window, as shown in Figure 1-14.

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Figure 1-14 HackTV Main Menu and Monitor Window

Choose the Video Format

1. From the HackTV **Monitor** menu, choose **Video Settings**. The QuickTime **Video Compression** window, shown in Figure 1-15, appears.

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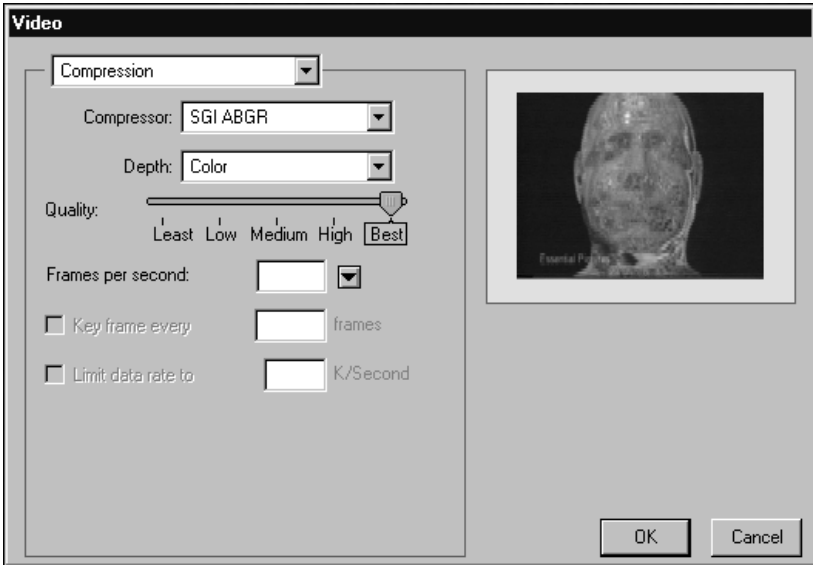

Figure 1-15 Video Settings Compression Window

2. Choose **Compression** in the main drop-down box at the top of the window, and set up the options in the window as follows:
   - Compressor: **SGI ABGR**
   - Depth: **Color**
   - Quality: **Best**
   - Frames per Second: **Best**

3. Choose **Source** in the main drop-down box. The window changes, as shown in Figure 1-16.

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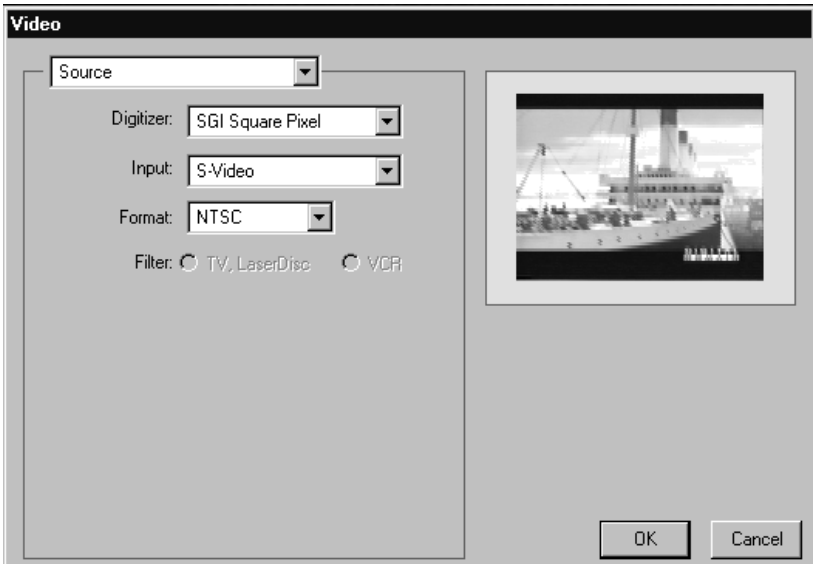

Figure 1-16 Video Settings Source Window

4. Set the options in the window as follows:

   - Digitizer: **SGI Square Pixel**

   - Input: **S-Video**

   - Format: **NTSC**

5. Choose **Image** in the main drop-down box. The window changes, as shown in Figure 1-17.

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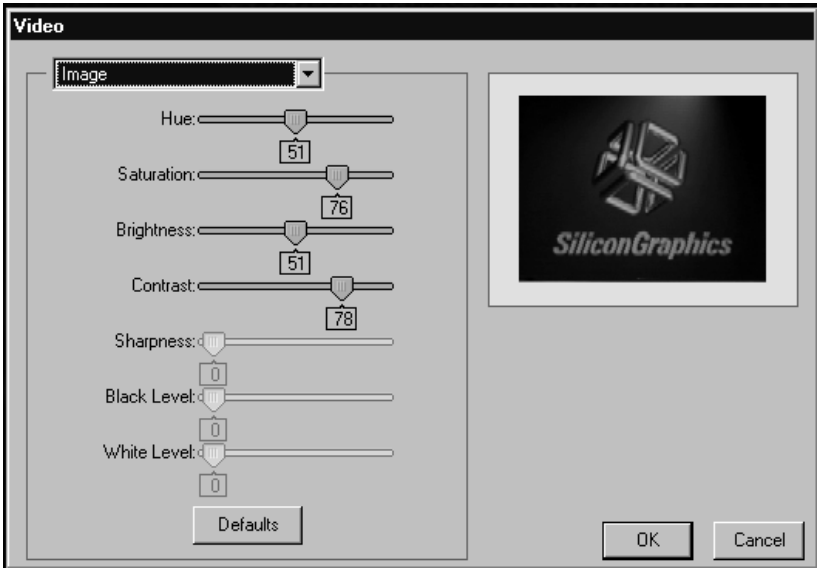

Figure 1-17 Video Settings Image Window

6. Use the default settings, as shown in Figure 1-17.
7. Click **OK**.

Choose the Audio Format

1. From the HackTV **Monitor** menu, choose **Sound Settings**. The QuickTime **Sound Compression** window, shown in Figure 1-18, appears.

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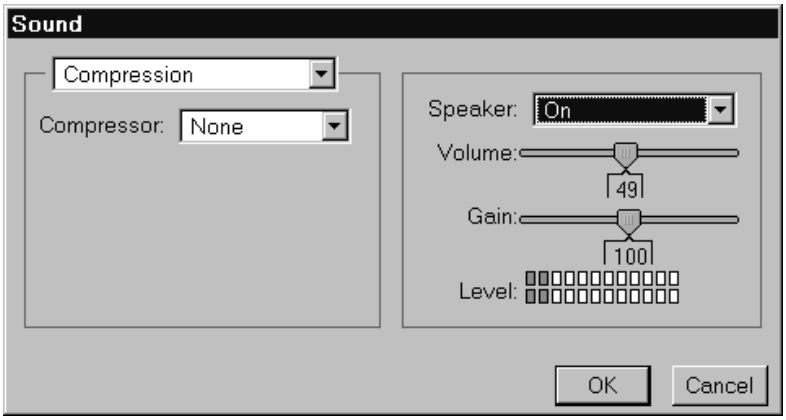

Figure 1-18 Sound Settings Compression Window

2. Choose **Compression** in the main drop-down box at the top of the window and set up the options in the window as follows:
   - Compressor: **None**
   - Speaker: **On**
   - Volume: **mid-range**
   - Gain: **mid-range**

3. Choose **Source** in the main drop-down box. The window changes, as shown in Figure 1-19.

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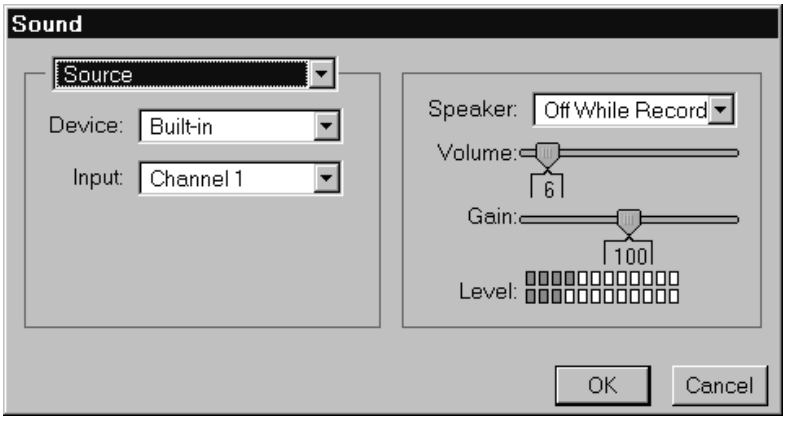

Figure 1-19 Sound Settings Source Window

4. Set the options in the window as follows:
   - Device: **Built-in**
   - Input: **Channel 1**
   - Speaker: **Off While Recording**
   - Volume: **mid-range**
   - Gain: **mid-range**

5. Choose **Sample** in the main drop-down box. The window changes, as shown in Figure 1-20.

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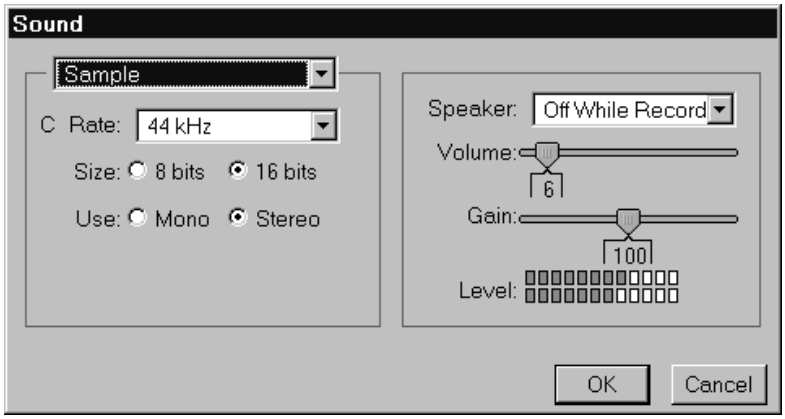

Figure 1-20 Sound Settings Sample Window

6. Set the options in the window as follows:

   - Rate: **44 kHz**

   - Size: **16 bits**

   - Use: **Stereo**

   - Speaker: **Off While Recording**

   - Volume: **mid-range**

   - Gain: **mid-range**

7. Click **OK**.

Begin Capturing Video

1. To begin capturing video, go to the HackTV main menu and choose **Monitor** > **Record**. The window shown in Figure 1-21 appears and allows you to specify a filename for the video you are about to capture. Because QuickTime normally uses a *.MOV* extension for its movie files, simply type *Test.mov* as the filename.

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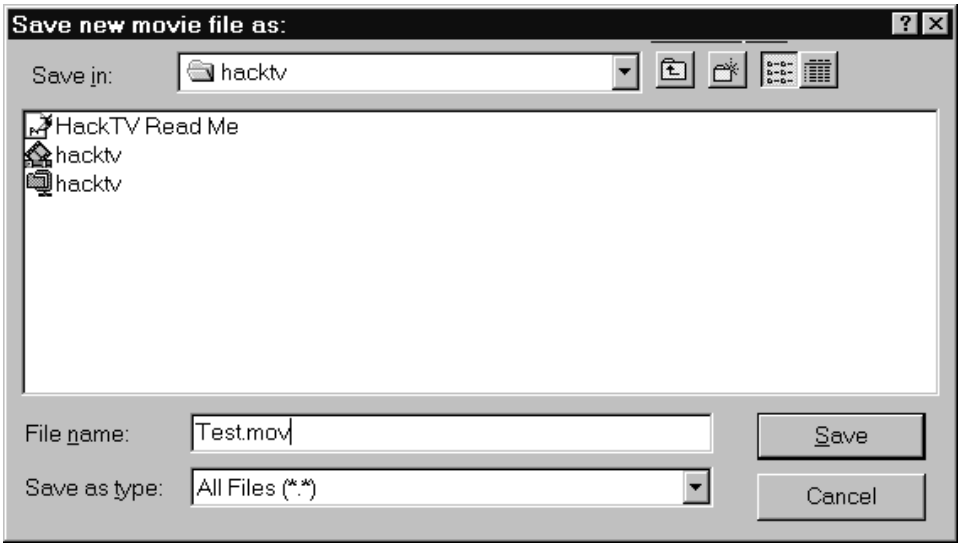

Figure 1-21 Filename Prompt Window

2. If you are using tape in the VCR as a video source to capture, start the tape.
3. Click **Save**.

   At this point, video is being captured to the hard disk. To stop capturing video, left-click the mouse. The prompt shown in Figure 1-22 appears when you click the mouse.

Figure 1-22 End-of-Recording Prompt

4. Click **OK**.

Playing Back the Video

To play back the video you just captured, follow these steps:

1. Double-click the *Test.mov* file. The window shown in Figure 1-23 appears.

.

Figure 1-23 QuickTime Playback Window

2. From the **File** menu, choose **Present Movie**. The prompt shown in Figure 1-24 appears.

Figure 1-24 Present Movie Prompt Window

3. Set the options in the window as follows:

   - Movie Size: **Normal**

   - Mode: **Normal**

4. Click **Play**.

   The movie plays to completion. You may use the controls at the bottom of the window to start, stop, and pause the displayed video.

Chapter 2

Recording and Playing Audio

This chapter explains how to set up the Silicon Graphics 320 and Silicon Graphics 540 workstation hardware and software to record and play back audio.

This chapter discusses the following topics:

Audio Inputs for Recording and Playback

Audio is provided to the workstations from the following sources:

- Microphone input jack (mini-jack on rear panel)
- Built-in CD player (internally connected)
- Line In (stereo RCA jacks on rear panel)
- Wave audio (directly from the CPU when playing a sound file)

Audio is played back from the workstations to the following destinations:

- Line Out (stereo RCA jacks on rear panel)
- Speaker Out (mini jack on rear panel)

Audio System Architecture

Figure 2-1 shows the overall architecture of the audio recording and playback system in the workstations.

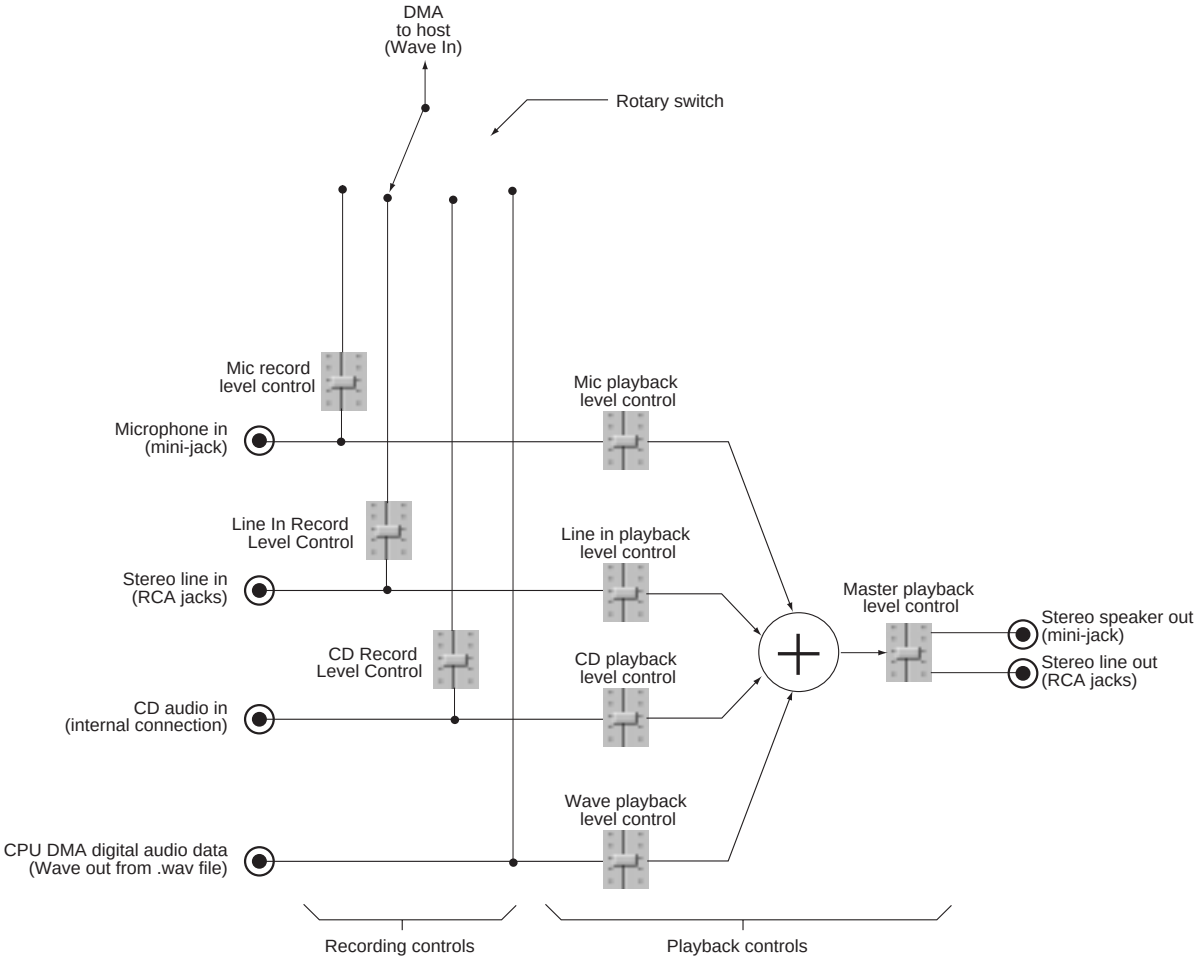

Figure 2-1 Audio System Architecture

As shown in Figure 2-1, each audio input has separate record and playback level controls. The only exception is that the digital audio from the CPU (a .wav file) does not have a record control.

Although Figure 2-1 shows separate record controls for each audio input, in actuality, only one audio input can be recorded at a time. The selected input's record level is set by a single slider (see Figure 1-11 on page page 16). The top of Figure 2-1 shows a rotary switch, which is intended to convey that only one of the inputs can be recorded by the CPU. The audio is typically recorded to memory, and can later be saved to disk as a *.wav* file.

There are individual playback controls for each audio source, including for a .wav file from disk. Each control can be manipulated to give the proper playback level for its channel. Audio from all of the sources is summed together, then controlled by a master playback control, indicated in Figure 2-1 on page page 31 and by the master playback icon  in Figure 1-11 on page 16. Finally, the audio output is sent to the Speaker and Line Out connectors on the workstation back panel.

Windows Multimedia Audio Settings Panels

This section describes the audio settings available under the Windows Multimedia software environment, located on the following panels:

- Volume Control Panel
- Properties Panel for Playback Control
- Properties Panel for Record Control
- Recording Control Panel
- Advanced Controls for Microphone Panel
- Sound Selection Panel

Volume Control Panel

The Windows **Volume Control** panel, shown in Figure 2-2, controls playback volume. You can display it by double-clicking the small speaker icon in the System Tray (located in the taskbar). You enable the small speaker icon by activating the **Show Volume Control on the Taskbar** check box in the **Microsoft Multimedia Properties** panel (**Start** > **Settings** > **Control Panel** > **Multimedia** > **Audio Tab**).

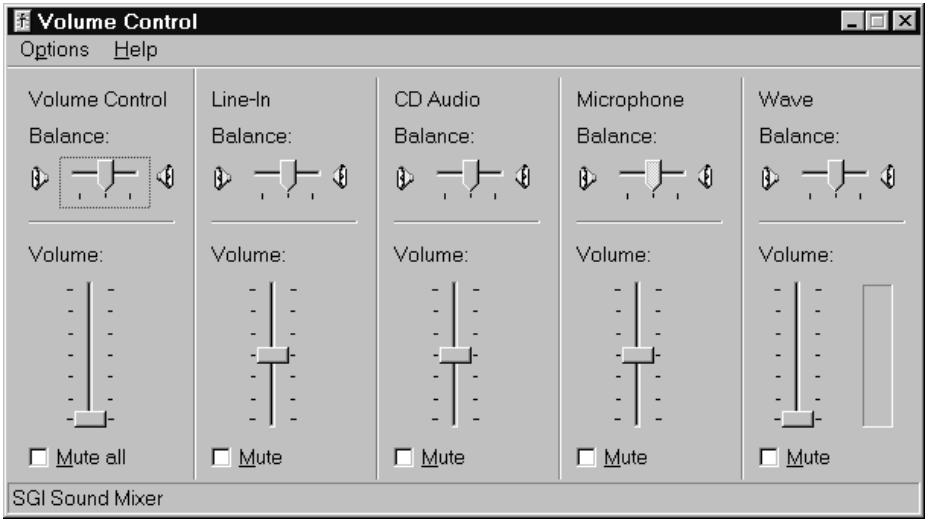

Figure 2-2 Windows Volume Control Panel

The settings in the Microsoft Windows **Volume Control** panel reflect those in the Silicon Graphics **Audio Control** panel, providing you with an alternate means of controlling playback and recording levels. The set of controls that your system uses depends on which controls you most recently set. If you bring up the Microsoft **Volume Control** panel while you have the Silicon Graphics **Audio Control** panel running, you can see how they interact as you change the settings on each.

In the panel, there are balance, volume, and mute controls for each audio input, as well as an overall master control at the extreme left side of the panel.

Properties Panel for Playback Control

At the bottom left of the **Volume Control** panel, it says **SGI Sound Mixer**, which refers to the device selected in the **Mixer Device** drop down box in the **Properties** panel. The **Mixer Device** is what is used to blend the audio from various sources. The **Properties** panel, shown in Figure 2-3, is available under **Options** > **Properties** on the Windows **Volume Control** panel.

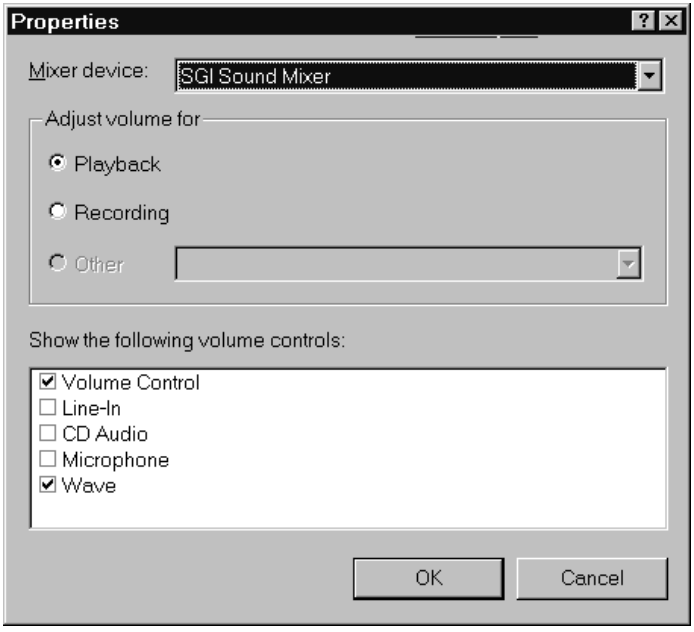

Figure 2-3 Properties Panel for Playback Control

In this panel, if you activate the **Playback** radio button, you can check one or more of the devices listed in the lower area of the panel for which controls on the **Volume Control** panel will be available. If a box is not checked, controls for the corresponding sound source are not displayed on the **Volume Control** panel (Figure 2-2).

Properties Panel for Record Control

You can display the **Properties** panel that controls audio recording by choosing **Options** > **Properties** on the Windows **Volume Control** panel. You must also activate the **Recording** radio button, as shown in Figure 2-4.

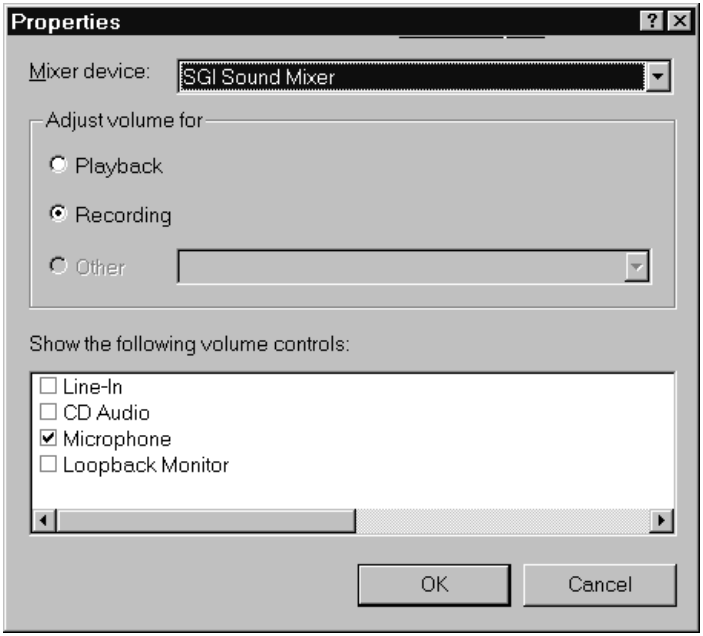

Figure 2-4 Properties Panel for Record Control

As shown, you can check the sound source from which you wish to record. When you click **OK**, the Windows **Recording Control** panel is brought up, as shown in Figure 2-5.

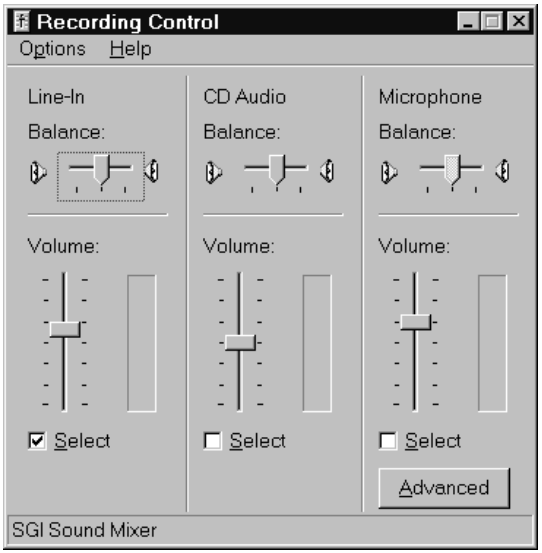

Figure 2-5 Recording Control Panel

This panel allows you to set up the balance and record levels for the devices you have selected.

When you click the **Advanced** button, the **Advanced Controls for Microphone** panel appears, shown in Figure 2-6.

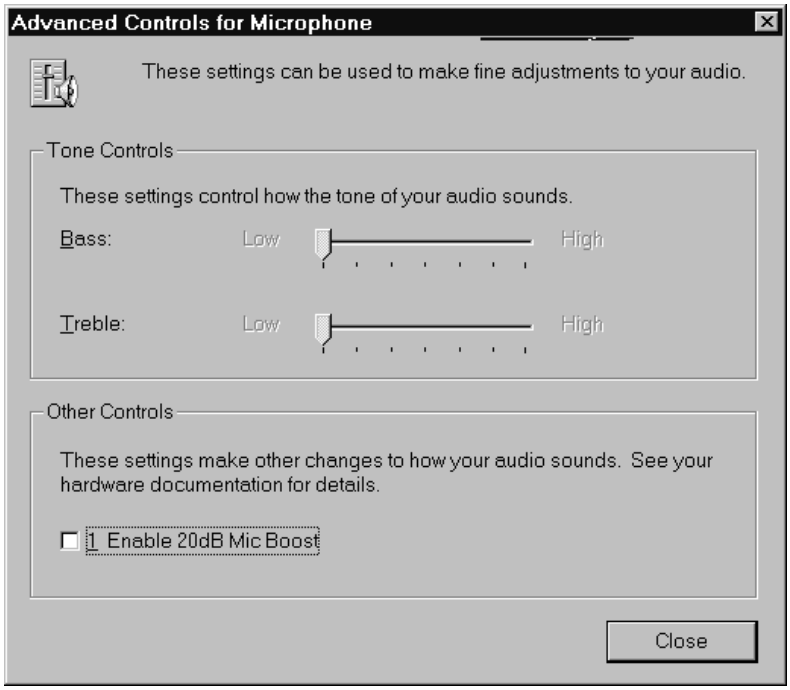

Figure 2-6 Advanced Controls for Microphone

Use the **Tone Controls** section of the panel to adjust the bass and treble for the microphone.

Note: The Silicon Graphics audio driver does not support the tone controls. As a result, they are deactivated (gray).

Activate the **Enable 20dB Mic Boost check box** in the **Other Controls** section of the panel to increase the microphone sensitivity.

Sound Selection Panel

The **Sound Selection** panel is shown in Figure 2-7.

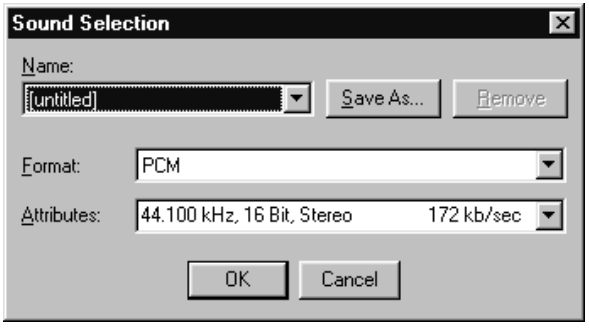

Figure 2-7 Sound Selection Panel

You can display the **Sound Selection** panel by selecting **Options** > **Audio Format...** in the VidCap application. Use this panel to set up the wave device in the **Name** drop-down box and determine the quality of the sound to be recorded.

Name Drop-Down Box

Under the **Name** drop-down box, you must choose the desired sound quality. The choices are:

- **CD Quality**
- **Telephone Quality**
- **Radio Quality**

Choose the audio quality that corresponds to the target medium.

Format Drop-Down Box

Under the **Format** drop-down box, the only available choice is **PCM** (pulse code modulation).

Attributes Drop-Down Box

Under the **Attributes** drop-down box, the following sampling rate choices are available, along with their corresponding data rates:

- **44.100 kHz, 16 bit, Stereo, 172 Kb/sec**
- **48.000 kHz, 8 bit, Mono, 46 Kb/sec**
- **48.000 kHz, 8 bit, Stereo, 93 Kb/sec**
- **48.000 kHz, 16 bit, Mono, 93 Kb/sec**
- **48.000 kHz, 16 bit, Mono, 187 Kb/sec**

In general, the following sampling rate guidelines apply for digital audio sound recording quality:

- Telephone—8 kHz
- Radio—16 kHz
- Compact Disk (CD)—44.1 kHz
- Digital Audio Tape (DAT)—48 kHz

The sampling rate you choose determines the rate at which the workstation analog to digital converters (ADCs) sample and digitize the incoming analog audio.

The sampling rates are based on fulfilling the Nyquist criterion, which requires sampling at twice the maximum analog frequency. The maximum frequency varies according to the medium transmitting the audio. The bandwidth of telephone audio is limited to about 4 kHz, so the telephone quality sampling rate is 8 kHz. However, CD and DAT audio are high quality and have sampling rates above 40 kHz. These rates approach the frequency limit of human hearing, which is around 20 kHz.

The 44.1 kHz rate seems a little odd—you might wonder why a simple rate of 40 kHz was not adopted. The main reason for this is that in the early days of digital audio research, the necessary bandwidth of about 1 Mbps per audio channel was difficult to store. Disk drives had the bandwidth but not the capacity for long recording time, so attention turned to video recorders, which were adapted to store audio samples by creating a pseudo-video waveform that conveyed binary as black and white levels.

The sampling rate of such a system is constrained to relate simply to the field rate and field structure of the television standard used, so that an integer number of samples can be stored on each usable TV line in the field. Such a recording can be made on a monochrome recorder, according to the NTSC and PAL standards: 525 lines at 60 Hz and 625 lines at 50 Hz. It is possible to find a frequency that is a common multiple of the two and is also suitable for use as a sampling rate that is twice the maximum analog frequency.

The allowable sampling rates in a pseudo-video system can be deduced by multiplying the field rate by the number of active lines in a field (blanking lines cannot be used) and again by the number of samples in a line. By careful choice of parameters it is possible to use either 525/60 or 625/50 video with a sampling rate of 44.1KHz.

In 60 Hz video, there are 35 blanked lines, leaving 490 lines per frame or 245 lines per field, so the sampling rate is given by:

60 X 245 X 3 = 44.1 kHz

In 50 Hz video, there are 37 lines of blanking, leaving 588 active lines per frame, or 294 per field, so the same sampling rate is given by:

50 X 294 X 3 = 44.1 kHz.

The sampling rate of 44.1 kHz came to be used for compact disc audio. Even though a CD player has no video circuitry, the equipment used to make CD masters is video-based and determines the sampling rate.

Digital audio tape tapes (DATs) use a sampling rate of 48 kHz. It has been claimed that their sampling rate differs from that of CDs to make digital copying from one to the other more difficult. The rate of 48 kHz is, in principle, better because it is a multiple of the other standard sampling rates, namely 8 kHz and 16 kHz for telephone-quality audio. Sampling rate conversion is simplified if rates are integer multiples of each other.

Choose the sampling rate most appropriate for the equipment used in your recording environment. You may use the Save As... button to save the Sound Selection panel choices to a file that will appear in the Name drop-down box.

QuickTime Audio Settings Panels

This section describes the audio settings available under the Apple QuickTime Multimedia software environment, which are:

- Sound Compression Panel
- Sound Sample Control Panel
- Sound Source Control Panel

Sound Compression Panel

The QuickTime **Sound Compression** panel is shown in Figure 2-8.

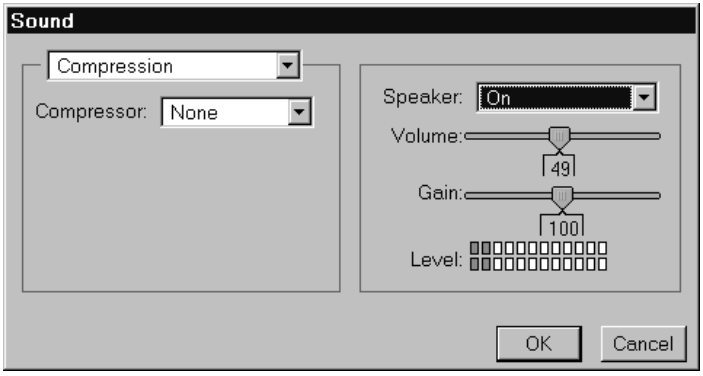

Figure 2-8 Sound Compression Panel

You can display this panel under the HackTV application by selecting **Monitor** > **Sound Settings**, then selecting **Compression** in the drop-down box of the **Sound** panel. This panel allows you to set the audio compression algorithm, control the speaker operation, and adjust the recording audio volume and gain.

Compression

The compression algorithms available are the following:

- **MACE 3:1**
- **MACE 6:1**
- **Qualcomm Pure**
- **ALaw 2:1**
- **32-bit Floating Point**
- **64-bit Floating Point**
- **IMA 4:1**
- **24-bit Integer**
- **32-bit Integer**
- **µLaw 2:1**

More information about these QuickTime compression options can be found on the Apple Web site at www.apple.com/quicktime.

Speaker Operation

The **Speaker** drop-down box allows you to control the speakers with the following choices:

- **Off**—mutes the workstation speaker output
- **On**—enables the workstation speaker output
- **Off While Recording**—mutes the workstation speaker output while recording is in process. This is useful in eliminating feedback when you are recording from a microphone.

Volume and Gain Controls

Two sliders, **Volume** and **Gain**, allow you to control the recording level.

Sound Sample Control Panel

The QuickTime **Sound Sample** panel is shown in Figure 2-9.

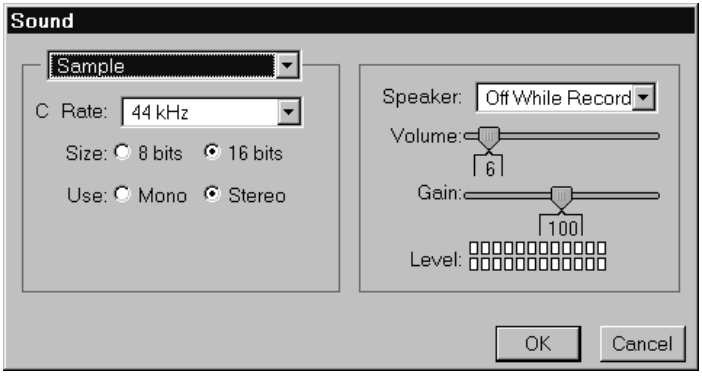

Figure 2-9 Sound Sample Panel

You can display this panel under the HackTV application by selecting **Monitor** > **Sound Settings**, then selecting **Sample** in the drop-down box of the **Sound** panel.

Sample Rate

Use the **C-Rate** drop-down box to set up the audio sampling rate. The available rates are:

- **11 kHz**
- **22 kHz**
- **44 kHz**

The audio sampling rate choice determines the rate at which the workstation analog to digital converters (ADCs) sample and digitize the incoming analog audio. The higher the rate, the higher the sound quality.

Size

Use the **Size** buttons to choose the bit size of the samples.

Use

Use the **Use** buttons to choose mono or stereo audio.

Sound Source Control Panel

The QuickTime **Sound Source** panel is shown in Figure 2-10.

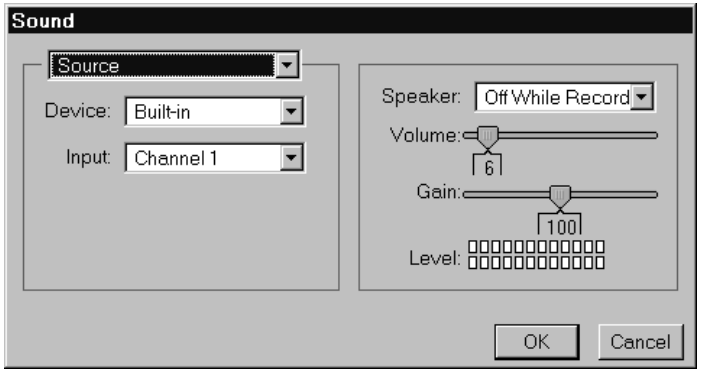

Figure 2-10 Sound Sample Panel

You can display this panel under the HackTV application by selecting **Monitor** > **Sound Settings**, then selecting **Source** in the drop-down box of the **Sound** panel.

This panel allows you to set up the source for audio recording. The **Built-in** device is the integrated audio support available with the workstations. As you add more support for audio, such as the Silicon Graphics DA1100 Digital Audio Card, the **Device** and **Input** windows reflect more choices.

Silicon Graphics Audio Control Panels

This section describes the audio programs available from the Silicon Graphics System Tray icon, which are:

- Audio Control Panel
- Digital Audio Control Panel (Silicon Graphics DA1100 Digital Audio card installed)
- Digital Audio Meter Panel (Silicon Graphics DA1100 Digital Audio card installed)

Audio Control Panel

The Silicon Graphics **Audio Control** panel is shown in Figure 2-11.

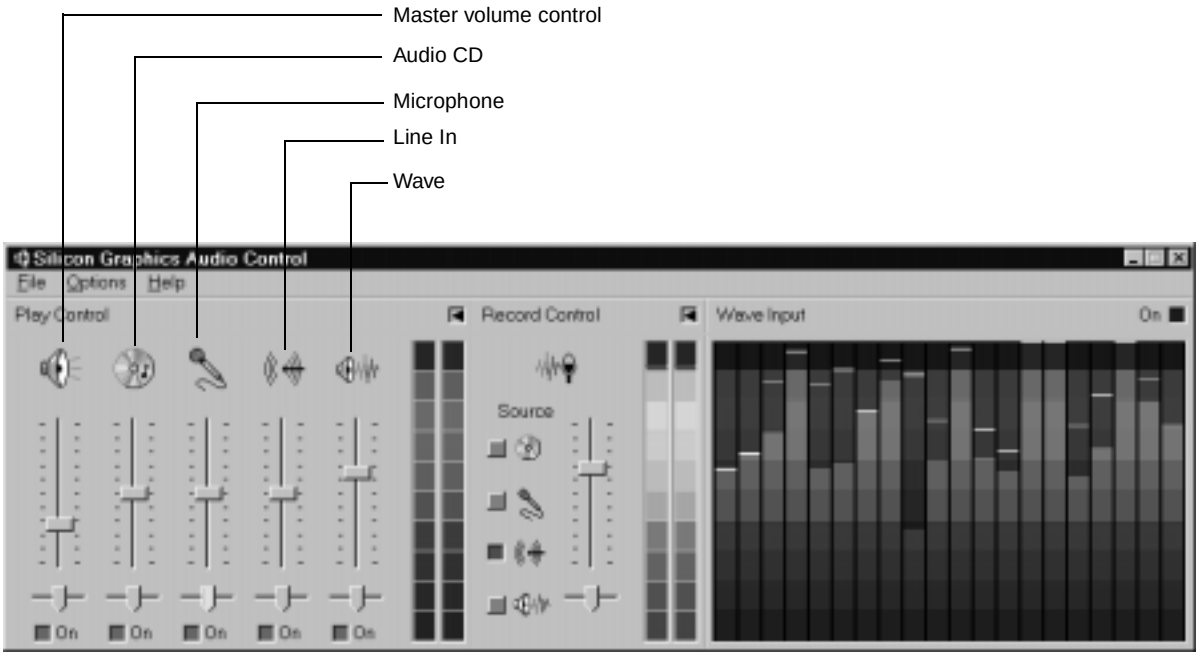

Figure 2-11 Silicon Graphics Audio Control Panel

The basic functions of this panel were explained in "Capturing Video Using VidCap" on page 11. More detailed functions are explained in this section.

The Silicon Graphics **Audio Control** panel, shown in Figure 2-11, provides you with a set of mixer controls that governs audio input and output volume and that selects the input line. The controls set volume levels from the different sources, allowing you to "mix" sounds together.

The **Volume Control** panel has three sections:

- Play Control
- Record Control
- Wave Input.

The **Play Control** section contains the line-enable checkboxes, volume controls, and balance controls for each input line that can be mixed into the audio output, as well as the master volume control. The **Record Control** section contains the recording-enable check boxes, gain control, and balance control for each line. The **Wave Input** displays a graphic representation of the frequency content of the input in either two or three dimensions.

You adjust the volume for playback or recording by raising or lowering the vertical sliders under or next to the icons that represent the lines. You adjust the right-left balance of the audio by moving the horizontal sliders under the volume controls.

Note: The **Audio Control** panel preserves the settings you choose for the various source options unless you change the settings with another audio control mechanism, such as the Windows **Volume Control** panel.

The **Audio Control** panel also shows right and left stereo audio levels through use of dynamic display meters in the **Play Control** and **Record Control** sections.

Playback Functions

To mute or enable listening to a line, click the **On** box below the slider bars for the line. Each input can be independently controlled. Change the listening volume or left-right balance with the associated slider controls.

Record Functions

In the **Record Control** section, you can choose CD, microphone, and line sources, and you can record a currently playing *.wav* file. Only one line can be selected at a time for recording by clicking the button to the left of the line icon next to the slider bar. Use the volume and balance sliders to adjust the record settings. Adjust the record slider so that the audio levels indicated in the **Record Control** panel are as high as possible without clipping (red region). Be sure to close the **Wave Input** panel before you actually start recording— otherwise the wave input remains unavailable and recording does not take place.

Note: The **Record Control** panel does not actually record audio. You must use a multimedia application such as HackTV for QuickTime or VidCap for Windows.

File Pulldown Menu

Use the **File** pulldown menu to exit the audio control panel. You can also enter **Ctrl+Q** to exit.

When you exit the Silicon Graphics **Audio Control** Panel, your system saves the audio settings you selected. These settings stay in effect until you change them using either the Silicon Graphics **Audio Control** Panel or other audio control software, such as Microsoft Windows audio controls.

Options Pulldown Menu

Use the **Options** pulldown menu to control the display of the Silicon Graphics **Audio Control** panel **Wave Input**. Below is a list of the menu choices available in the **Options** pulldown menu and a brief description of how to use them.

- **Show Wave Input** (Ctrl+S)—displays the dynamic frequency content of the audio input.
- **Show Record Controls** (Ctrl+R)—enlarges or diminishes the display of the control panel to show or hide the recording controls.
- **Freeze Graphics** (Ctrl+G)—use this option to stop the motion of the level meters and the wave input display.

- **Enable 20dB Mic Boost**—use this option to increase microphone sensitivity.
- **Solid Meters** (Ctrl+M)—use this option to change the display of the double vertical audio input and output level meters (to the right of the play and record sections). When you enable this option, the bars change to solid bands of different colors.
- **Log Amplitude** (Ctrl+A)—changes the sensitivity of the spectral display.
- **3D Spectrum** (Ctrl+D)—changes the spectral display from a series of vertical colored bars (2D) to a moving color display (3D).
- **3D Options—**changes the manner in which the 3D spectrum displays. For example, you can make the 3D spectrum draw vertical lines (Draw Lines), draw a series of dots (Draw Points), or display a series of triangles (Draw Triangles). The following list details the 3D options:
  - **Reverse View** (Ctrl+V)—flips the Wave Input display 180 degrees.
  - **Draw Mesh** (Ctrl+H)—shows the wave input as a web of colored lines.
  - **Draw Time Lines** (Ctrl+L)—displays the wave input as a sequence occurring over a period of time. The lines run from the front to back of the display. This display resembles the mesh display, but without the horizontal lines.
  - **Draw Frequency Lines** (Ctrl+U)—displays the wave input as a series of lines that run from left to right in the display. Each line represents the frequency content of a time-slice of the signal.
  - **Draw Points** (Ctrl+P)—shows Wave Input display as a series of dots instead of lines.
  - **Draw Triangles** (Ctrl+T)—displays the wave input as solid colors.
  - **Log Frequency** (Ctrl+F)—shows more detail at the lower frequencies and less detail at the higher frequencies.
  - **Audio/Video Sync**—choosing this option brings up the screen shown in Figure 2-12. Use this screen to choose the video signal source that will be used to synchronize audio.

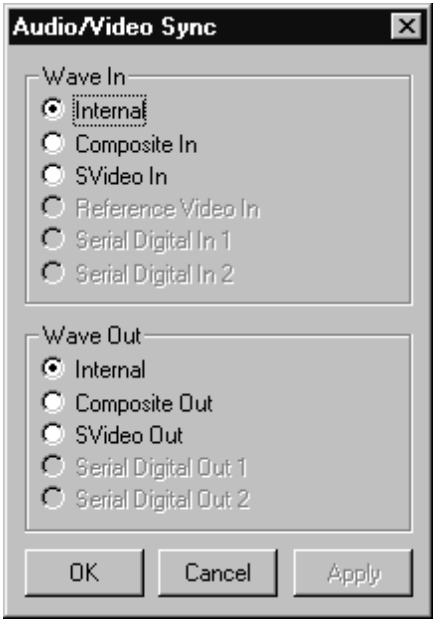

Figure 2-12 Audio/Video Sync Panel

A check mark appears next to each of the enabled options on the **Options** pulldown menu.

Digital Audio Control Panel (Silicon Graphics DA1100 Digital Audio Card Installed)

When the Silicon Graphics DA1100 Digital Audio Card is installed, you can bring up the **Silicon Graphics Digital Audio Control** panel by clicking the Silicon Graphics icon in the Windows System Tray and selecting **Digital Audio Control Panel**. The panel is shown in Figure 2-13.

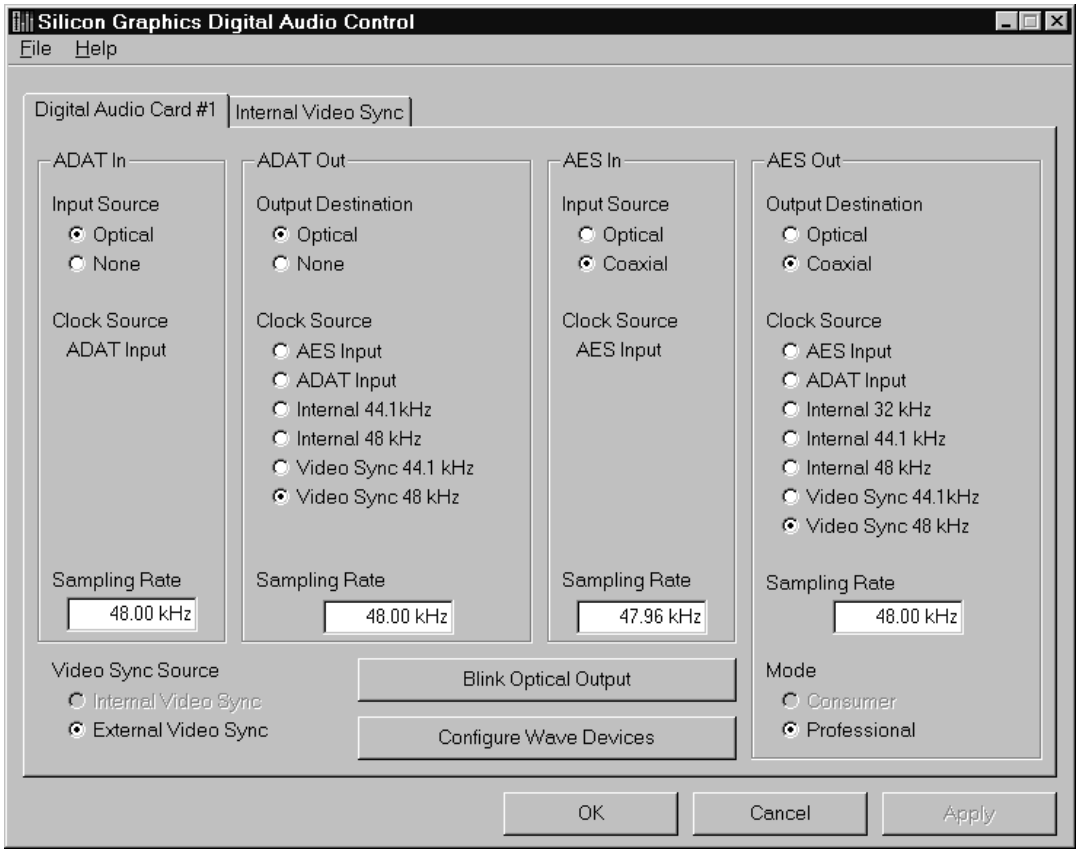

Figure 2-13 Silicon Graphics Digital Audio Control Panel

For a detailed explanation of this panel see the *Silicon Graphics DA1100 Digital Audio Card Owner's Guide.*

Digital Audio Meter Panel (Silicon Graphics DA1100 Digital Audio Card Installed)

When the Silicon Graphics DA1100 Digital Audio Card is installed, you can bring up the **Silicon Graphics Digital Audio Meters** panel by clicking on the Silicon Graphics icon in the Windows System Tray and selecting **Digital Audio Meter Panel**. The panel is shown in Figure 2-14.

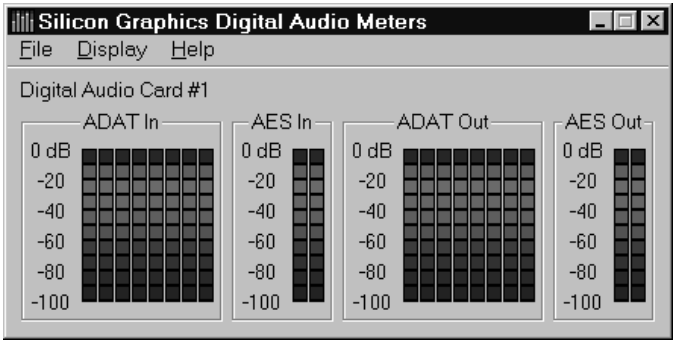

Figure 2-14 Silicon Graphics Digital Audio Meter Panel

For a detailed explanation of this panel see the *Silicon Graphics DA1100 Digital Audio Card Owner's Guide.*

Software Synthesizer and MIDI Support

This section explains how to use the Yamaha S-YXG50 software wave table synthesizer software and MIDI Player with the Silicon Graphics 320 and Silicon Graphics 540 workstations. The Yamaha software synthesizer and the Yamaha MIDI player application are separate entities. The software synthesizer is a driver that provides a system service to other applications; the MIDI player is an application that plays MIDI files through the software synthesizer driver.

The S-YXG50 software wavetable synthesizer software supports up to 128 simultaneous voices at 44 kHz and supports Yamaha XG MIDI format, the most popular MIDI format in the music industry.

The Yamaha S-YXG50 Software Synthesizer allows you to play back MIDI song files on your computer without using a hardware tone generator. Its high fidelity sounds, which match the sounds from an authentic tone generator, are based on and realized by highly advanced MMX technology. The S-YXG50 synthesizer lets your workstation act as a potential music synthesizer.

Because the hardware audio codec on the workstation does not come with MIDI synthesis capability, the Yamaha software wave table synthesizer is bundled with the system.

Features

The Yamaha Software Synthesizer S-YXG50 software wave table features are as follows:

- Professional sound quality (44-kHz sampling rate).
- YAMAHA XG format compatible, with a variety of controllable effects.
- Simultaneous playback of wave and MIDI data.
- Driver application for Windows that is not dependent on specific CODEC hardware.
- Performance can be matched to a wide range of applications (44 kHz/22 kHz/11 kHz sample rate switching).
- Designed specifically for use with MMX technology.
- DirectSound support.

Software Synthesizer

Figure 2-15 shows the main synthesizer settings panel.

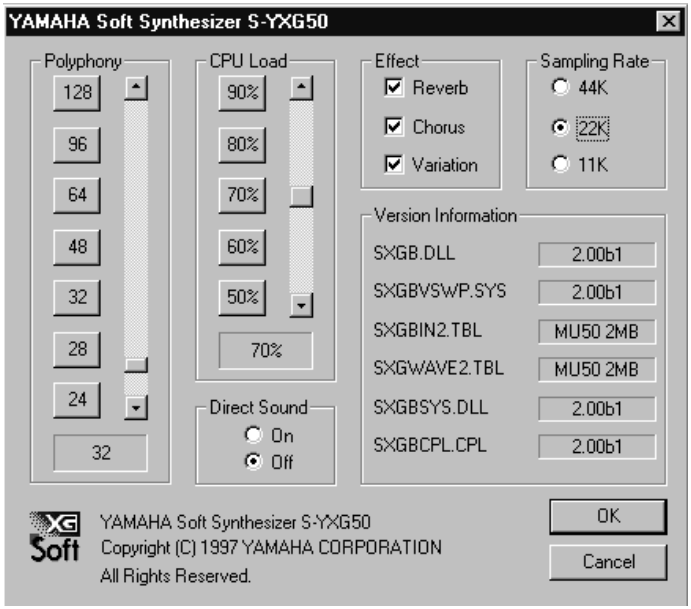

Figure 2-15 Software Synthesizer Panel

This panel may be used to set the number of voices (polyphony), allowable CPU load, special sound effects, sampling rate, and DirectSound (for DirectSound-compatible games). The panel is fully described in the help files that come with the Yamaha software.

MIDI Player

Figure 2-16 shows the MIDI player panel.

Figure 2-16 MIDI Player Panel

The Yamaha MIDI player can be used as an alternative to the Windows Media Player for playing MIDI files. The panel is fully described in the help files that come with the Yamaha software.

Configuration

Silicon Graphics provides a scheme in which the software synthesizer shares the hardware codec audio output with a wave output device. This is essential for providing simultaneous sound from both game and MIDI outputs. There are two ways to share the codec and wave output device:

- Use DirectSound
- Use the Yamaha Special Wave Device

DirectSound

If you are running an application that is DirectSound compatible (many Windows games are), Microsoft's DirectSound layer allows the Yamaha software synthesizer to share the audio output hardware with one or more wave audio outputs from the application.

You must manually configure the Yamaha synthesizer for DirectSound operation—but then non-DirectSound applications can no longer produce sound. By default, the Yamaha Software Synthesizer is not configured for

DirectSound operation when you first operate the Silicon Graphics 320 or Silicon Graphics 540 workstation.

Yamaha Special Wave Device

Yamaha provides a special Wave Output device for their synthesizer that shows up in the Windows NT Multimedia Properties Audio tab (under Playback Devices). If you select this as the default Playback device instead of the SGI Sound device, then Yamaha’s driver intercepts Wave Output from an application and redirects it through their driver so that the synthesizer output can be mixed in along with the Wave Output samples.

This net effect is equivalent to that provided by a PC sound card: one MIDI file and one Wave file can be played at the same time, and the sounds from the two are mixed together in hardware. This is the default configuration of the Yamaha synthesizer “out of the box.” However, Yamaha's “interceptor” driver seems to degrade latencies for Wave audio playback, so it is not the output device of choice for video editing and layback to tape, for example.

Recommendations

You may want to use either of the two configurations just explained, depending on what application is running. Also, the system may need to be restarted between configuration changes.

Yamaha's on line documentation and help files include some explanation about where to configure DirectSound versus Wave Out operation. See the Yamaha documentation included in the help files for all the control panel settings (numbers of voices, sample rate, and so forth).

Chapter 3

Capturing and Playing Video with VidCap and Video for Windows

This chapter explains the details of the various panels and dialog boxes encountered when capturing and playing back video using the VidCap application and Video for Windows. The basic process of capturing video was explained in Chapter 1, “Getting Started.”

This chapter discusses the following topics:

Video for Windows Capture Settings

The capture settings are available under the main VidCap window. To bring up this window, double-click the VidCap32.exe icon, located at C:\WINNT\SYSTEM32. The main **VidCap** screen appears, as shown in Figure 3-1.

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Figure 3-1 VidCap Main Screen

Under the **Options** menu of the **VidCap** main screen, there are three choices dealing with video: **Video Format**, **Video Source**, and **Video Display**. Each choice takes you to the **Silicon Graphics VFW Capture Settings** screen, shown in Figure 3-2.

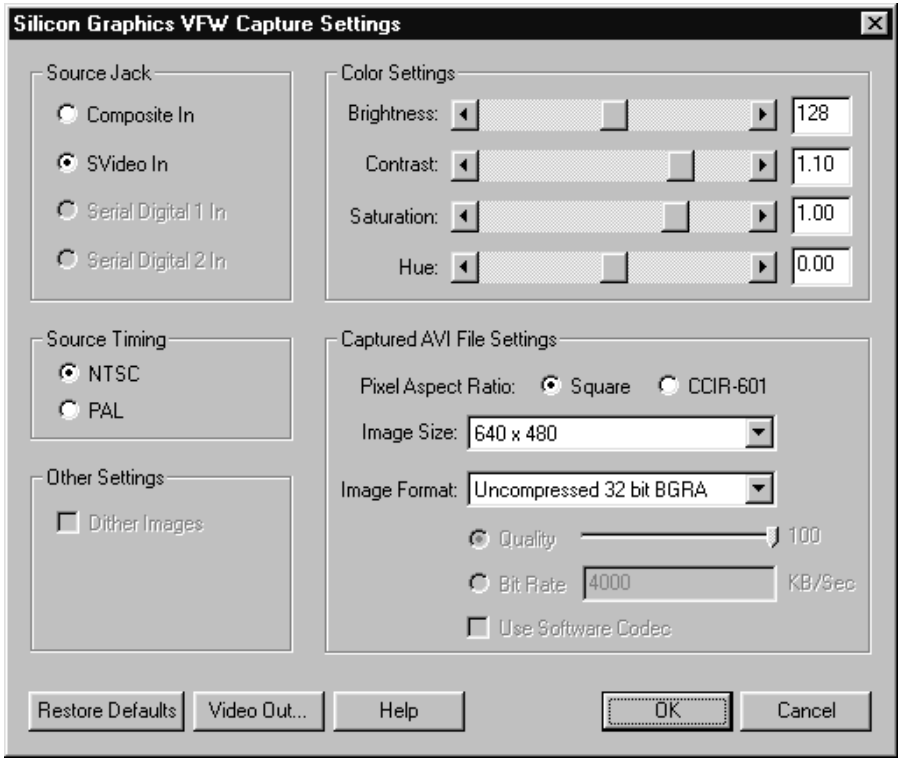

Figure 3-2 Silicon Graphics VFW Capture Settings Screen

The **Silicon Graphics VFW Capture Settings** panel lets you configure several settings before capturing video. As shown in the figure, the screen is divided into several sections and contains several buttons. Each is explained in the following subsections.

Source Jack

The **Source Jack** section of the panel lets you set up video capture for a particular video input jack. You can adjust the settings in all of the other sections of the panel, click **OK**, and those settings are applied to and remembered for that jack. The available jacks are:

- Composite In
- S-Video In
- Serial Digital 1 In (the Silicon Graphics SD1100 Serial Digital Video Interface Board[1] #1 must be installed)
- Serial Digital 2 In (the Silicon Graphics SD1100 Serial Digital Video Interface Board[1] #2 must be installed)

Source Timing

You must set up the buttons in the **Source Timing** section to match the video timing standard of the video you wish to capture on a particular jack. The two choices are:

- NTSC (the video standard used in North America)
- PAL (the video standard used most everywhere else)

Other Settings

Clicking the **Dither Images** check box applies dithering to the captured image. This check box is active only for capturing in the 16-bit RGB format.

Dithering is an image display technique that is useful for overcoming limited display resources. The word dither refers to a random or semi-random perturbation of the pixel values. Two applications of dithering are particularly useful:

1 The board is only available on the 540 workstation.

- Low quantization display. When images are reduced to just a few bits, only a limited number of gray levels are used in the display of the image. If the scene is smoothly shaded, then the image display generates distinct boundaries around the edges of image regions, degrading the quality of the image. To eliminate this effect, dithering adds random noise (with a small range of values) to the original signal to mask the limited color range. The result is a smoother image captured to disk.
- Limited color display. When fewer colors are able to be displayed (for example, 256) than are present in the input image (for example, 24-bit color), then dithering causes patterns of adjacent pixels to simulate the appearance of the unrepresented colors.

Color Settings

The **Color Settings** sliders interact with the sliders found on the **Color** tab of the **Silicon Graphics Video Control** screen (see Figure 3-7). When you move a slider on one of the screens, the corresponding slider moves on the other screen. Although you can visually detect changes as you move the sliders, it is best to use test equipment to monitor the S-Video or composite output as you make adjustments to make certain that the colors are properly adjusted. In monitoring and controlling picture quality two pieces of equipment are essential. The first is the waveform monitor, which graphically displays and measures the brightness or luminance level of the video. The second is the vectorscope, which measures the color (chroma) information. Although these are generally separate instruments, in some cases both can be displayed on a single TV monitor or computer editing screen.

The numeric values in the boxes to the right of each slider are relative numbers only, and can serve as reference numbers you may want to record for later restoration of particular color setting configurations.

There are four **Color Settings** sliders in the **Silicon Graphics VFW Windows Settings** panel:

- **Brightness**—changes the brightness of the video.
- **Contrast**—changes the ratio of luminance (brightness) between the lightest and darkest elements of a video scene. Contrast ratio is a major determinant of perceived picture quality and sharpness.

- **Saturation**—changes the degree of colorfulness, from neutral gray through pastel to saturated colors.
- **Hue**—changes the color perception denoted by blue, green, red, yellow, and so on.

Note: You cannot adjust color settings for digital video input sources. The **Color Settings** sliders are grayed out if you have one or more Silicon Graphics SD1100 Serial Digital Video Interface Boards installed and activate the **Serial Digital 1 In** or **Serial Digital 2 In** radio button on the **Silicon Graphics VFW Windows Settings** panel.

Captured AVI File Settings

The **Captured AVI (Audio Video Interleave) File Settings** section lets you control pixel size, image size, and video compression.

Pixel Aspect Ratio

Picture aspect ratio is the width of the picture divided by the height. There are two choices available for pixel aspect ratio:

- **Square**—used for video on computer monitors
- **CCIR601**—used for high-end video production and display on video monitors

Pixel aspect ratio is defined as the pixel height divided by its width. For example, in Figure 3-3, the pixel represented on the left is square, with a pixel aspect ratio of 1.0; the one on the right is non-square, with a pixel aspect ratio of 1.125.

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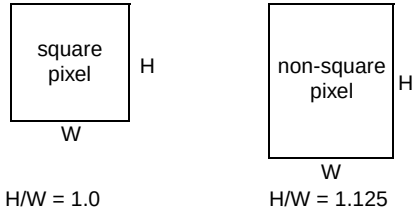

Figure 3-3 Pixel Aspect Ratio

The choice of square or CCIR601 (non-square) for the pixel aspect ratio depends on the source providing the video and how the video will be displayed.

Video sampling and digitizing inside the workstations always produces CCIR601 non-square pixels from analog video input. If you activate the Square radio button, the workstation performs additional processing in hardware to convert from square to CCIR601 pixel format.

All digital video sources, such as the Silicon Graphics DV100 Serial Digital Video Card, supply video in non-square pixel format. When you use a digital video source, there is no need to sample the video and create pixels—the video is already in digital form and the pixel content is defined to be non-square according to the CCIR601 standard. However, you can still convert the pixels to square format by activating the Square radio button.

If you choose to capture video from one of the analog inputs (composite or S-Video), the hardware in the workstation uses an ADC to digitize the video and additional hardware processing creates non-square pixels. Square pixels are produced from the non-square pixels if you check the Square radio button.

In general, graphics rendering and display devices typically generate and accept only square pixels, but video I/O devices can typically generate and accept either square or non-square formats. It is preferable to use and retain a non-square format for an application whose purpose is to produce video, while it is preferable for an application whose ultimate intent is producing computer graphics to use and retain a square format. Whether a conversion is necessary or optimal depends on the original image source, the final destination, and, to a certain extent, the hardware path transporting the signal.

A diagram showing the timing associated with CCIR601 digital video is shown in Figure 3-4.

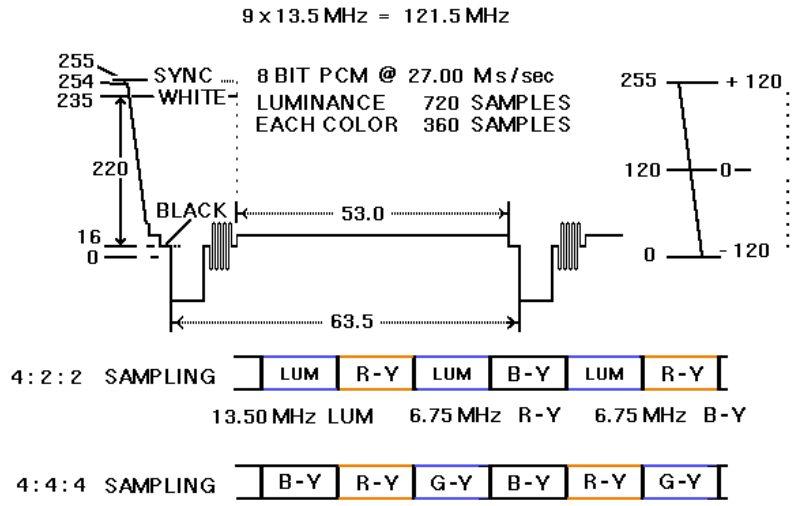

Figure 3-4 CCIR601 Timing

The CCIR standard applies to both NTSC and PAL video. In NTSC, two vertical fields are completed 30 times per second (every 33.33 ms), with each scan filling one-half of the 525 vertical lines. So it takes 16.67 ms to complete each field. The horizontal scan time is calculated by the following equation:

Horizontal scan time = 16.67 ms/(525 lines/2) = 63.5 µs. Of the 63.5 µs, 53 µs are actually used for video data. The CCIR601 standard specifies that analog video be sampled at 27 MHz, with each sample being 8-bit PCM. At a sampling rate of 27 MHz, 1440 samples fit into the 53 µs period. With CCIR601 4:2:2 sampling (see Figure 3-4), there are 720 luminance (Y) samples, 360 red color difference (R-Y) samples, and 360 blue color difference (B-Y) samples, for a total of 1440 samples per line.

Image Size

The **Image Size** drop-down box lets you choose different image sizes for both square pixels and CCIR601 pixels. To keep the image resolution constant, the picture size must be reduced when there are fewer pixels in the picture. The image size that you choose affects the bit rate, as shown in Table 3-1.

Table 3-1 shows a list of common frame sizes, pixel formats, and associated data rates.

Table 3-1 Common Video Parameters

Frame Size	Video Standard	Pixel Format	Data Rate (MB/sec)
640 x 480	NTSC	2YUV	18.1
720 x 486	NTSC	2YUV	20.6
720 x 576	PAL	2YUV	20.4
768 x 576	PAL	2YUV	22.2
640 x 480	NTSC	RGBA	36.1
720 x 486	NTSC	RGBA	41.1
720 x 576	PAL	RGBA	40.6
768 x 576	PAL	RGBA	43.3

The data rate numbers in the table include video frame capture as well as two-channel 44.1 kHz CD-quality audio.

When you activate the **Square Pixel Aspect Ratio** button, the following image sizes appear in the drop-down box:

- 640 x 480
- 320 x 240
- 160 x 120
- 80 x 60

All of these choices have the same picture aspect ratio, 1.333.

When you activate the **CCIR601 Pixel Aspect Ratio** button, the following image sizes appear in the drop-down box:

- 720 x 480
- 360 x 240
- 180 x 120
- 88 x 60

Because the pixels are non-square, these choices, too, have a picture aspect ratio of 1.33.

When using an image size of 640 x 480 made up of square pixels, the picture aspect ratio is 640/480 = 1.333. Now, if you keep the same ratio, and create a picture with CCIR601 sampling (for example, 720 x 480), you have 720 pixels in the same horizontal width that formerly held 640 pixels, so the pixels have a shorter horizontal length, but have the same vertical length, since the number of lines (480) is the same in both cases. Therefore, the pixels become non-square. See Figure 3-5.

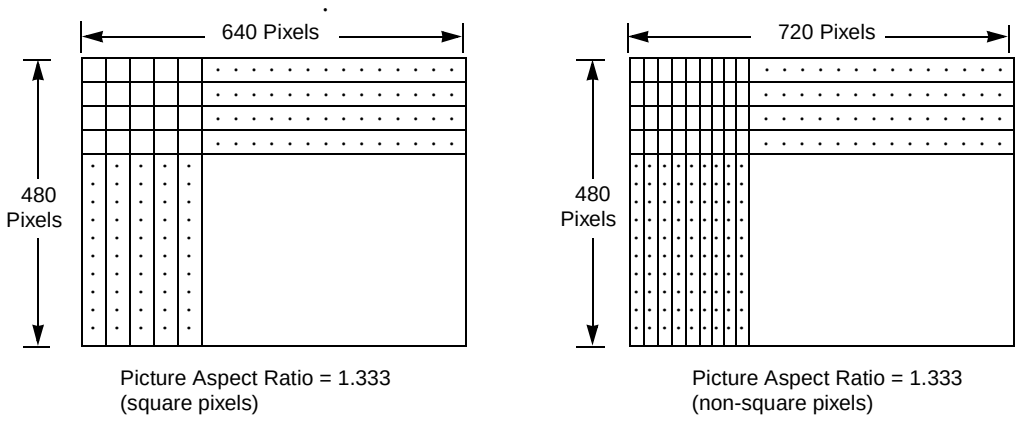

Figure 3-5 1.333 Picture Aspect Ratio with Square and CCIR601 Pixels

Image Format

The **Image Format** drop-down box and the associated buttons (**Quality**, **Bit Rate**, and **Use Software Codec**) deal with video compression. This topic is fully covered in Chapter 5, “Silicon Graphics Video Compression Techniques.”

Restore Defaults Button

The **Restore Defaults** button allows you to restore the default settings in the **Silicon Graphics VFW Windows Settings** panel. The button is especially helpful in restoring the color settings, which can easily be misadjusted when you change the sliders without monitoring the results with professional test equipment.

Video Out Button

The **Video Out** button allows you to configure the video out of the workstation on the analog or digital video connectors. When you click **Video Out**, the screen shown in Figure 3-6 appears.

.

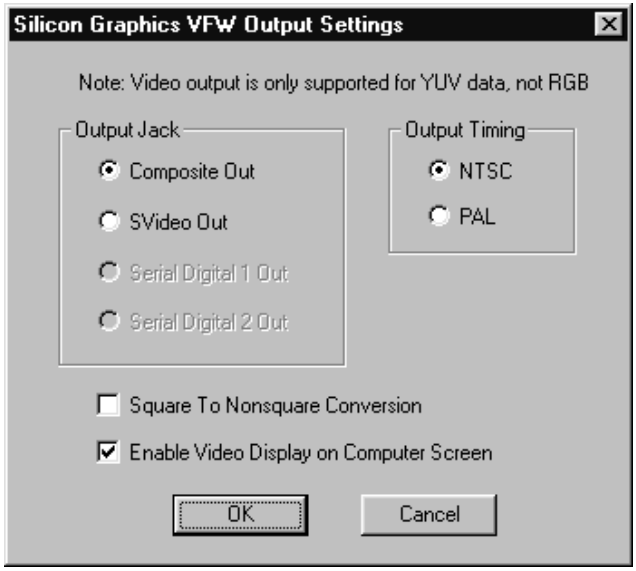

Figure 3-6 Silicon Graphics VFW Output Settings Screen

Output Jack

The **Output Jack** radio buttons let you choose one video connector for output video.

Note: Unless you have one or more Silicon Graphics DV100 Serial Digital Video Cards plugged in, the **SerialDigital 1 Out** and **SerialDigital 2 Out** radio buttons are grayed out.

Output Timing

The output video is selectable between **NTSC** and **PAL**. The NTSC standard specifies 525 lines per frame, with two fields per frame of 262.5 lines each.

Each field refreshes at a rate of 29.97 Hz. The NTSC standard specifies 625 lines per frame, with two fields per frame of 312.5 lines each. Each field refreshes at a rate of 25 Hz.

Activating an **Output Timing** button does not mean that the workstation converts input video from one timing to the other (for example, NTSC to PAL). Rather, you should match the **Source Timing** buttons in the **Silicon Graphics VFW Windows Settings** panel to those of the **Output Timing** section in the **Silicon Graphics VFW Output Settings** panel. To output an already captured video file, you should first determine the video standard (NTSC or PAL) of the file, then choose the corresponding **Output Timing** button in the **Silicon Graphics VFW Output Settings** panel.

Square to Non-Square Conversion

If you have captured analog video with the **Square** button activated on the **Silicon Graphics VFW Windows Settings** panel, and you need to output the video to a device that requires non-square pixels, you must activate the **Square to Nonsquare Conversion** check box. With this check box active, an NTSC image will become larger (from 640 to 720), and a PAL image become smaller (from 768 to 720).

Enable Video Display on Computer Screen

Checking this box allows video to be displayed on the computer monitor. This may not take effect until you restart the computer.

Silicon Graphics Video Control Screen

To bring up the **Silicon Graphics Video Control** screen, click on the Silicon Graphics icon in the System Tray and choose **Video Control Panel**. The panel appears, as shown in Figure 3-7.

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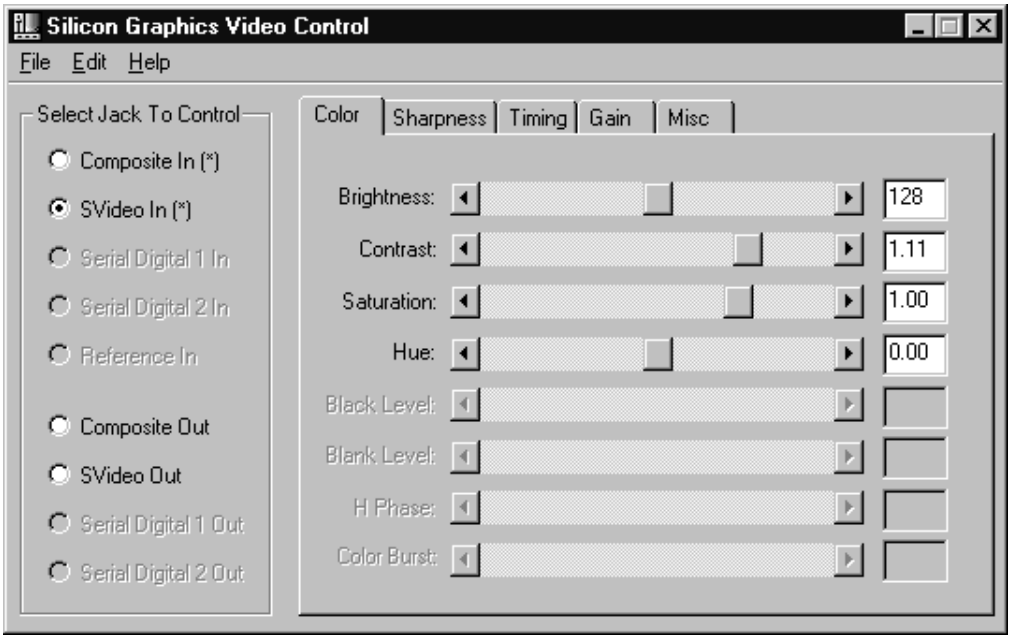

Figure 3-7 Silicon Graphics Video Control Screen

As shown in the figure, the panel has these sections:

- **Select Jack to Control**
- Tabs (**Color**, **Sharpness**, **Timing, Gain**, and **Misc**)

In addition to these controls, these choices under the **File** menu are discussed here:

- **Restore Default Settings for This Jack**
- **Graphics Display Framelock**

The other choices under the **File** menu and the **Edit** and **Help** menus are self-evident, and not discussed here.

Select Jack to Control

The top five radio buttons in the Select jack to Control section correlate to the input jacks, and the bottom four correlate to the output jacks. When you choose a particular input or output jack (only one may be chosen at a time), you can use the **Color**, **Sharpness**, **Timing**, **Gain**, and **Misc** tabs to configure that jack. The settings available on the tab panels often depend on which jack has been activated. Some of the settings may be grayed out, depending on whether you selected an input jack or output jack. The settings you choose are saved for the selected jack and remain in effect until you change them. It is not necessary to have a video cable plugged into a jack to configure its settings.

IComposite In

The **Composite In** radio button, when activated, allows you to configure the settings for the Composite video input. An asterisk beside the **Composite In** radio button indicates that there is an active video signal at the jack.

S-Video In

The **S-Video In** radio button, when activated, allows you to configure the settings for the S-Video input. An asterisk beside the **S-Video In** radio button indicates that there is an active video signal at the jack.

Serial Digital In (1, 2)

These jacks are grayed out unless you have the corresponding Silicon Graphics DV100 Serial Digital Video Card plugged into the Silicon Graphics 540 workstation. If a Digital Video Card is plugged in, an asterisk beside the name of the card indicates that there is an active signal at the jack. When the buttons are enabled, checking them allows you to configure the settings for the corresponding digital video input.

Reference In

The **Reference In** radio button is grayed out unless a Silicon Graphics SD1100 Serial Digital Video Interface Board is installed. When this radio button is activated, you may connect a “house sync” clock synchronization

signal to the Serial Digital Interface Board “Ref Vid In” jack. The signal on the jack synchronizes output signals from the Silicon Graphics 540 workstation. Studio houses typically have a single synchronization signal to which all the equipment is slaved.

Composite Out

The **Composite Out** radio button, when activated, allows you to configure the settings for the Composite video output.

S-Video Out

The **S-Video Out** radio button, when activated, allows you to configure the settings for the S-Video output.

Serial Digital Out (1,2)

These jacks are grayed out unless you have the corresponding Silicon Graphics DV100 Serial Digital Video Card plugged into the Silicon Graphics 540 workstation. When the buttons are enabled, checking them allows you to configure the settings for the corresponding digital video output.

Color Tab

When the **Color** tab is selected, the sliders that are available depend on the jack selected. When an input jack is selected, the **Brightness**, **Contrast**, **Saturation**, and **Hue** sliders are available, as shown in Figure 3-8.

.

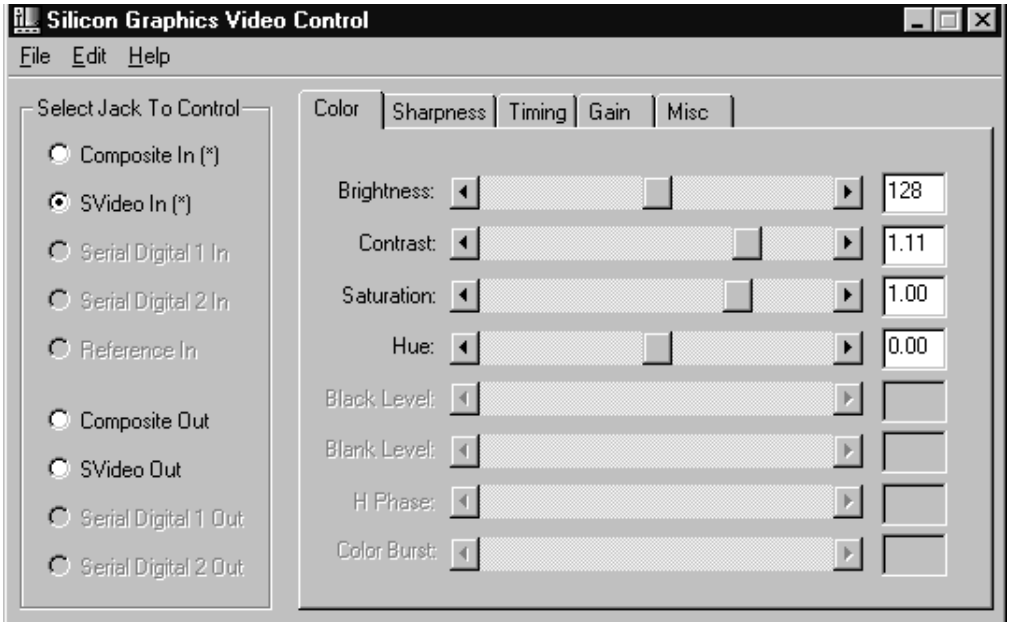

Figure 3-8 Color Tab for Input Jacks

When an output jack is selected, the **Black Level**, **Blank Level**, **H Phase**, and **Color Burst** sliders are available, as shown in Figure 3-9.

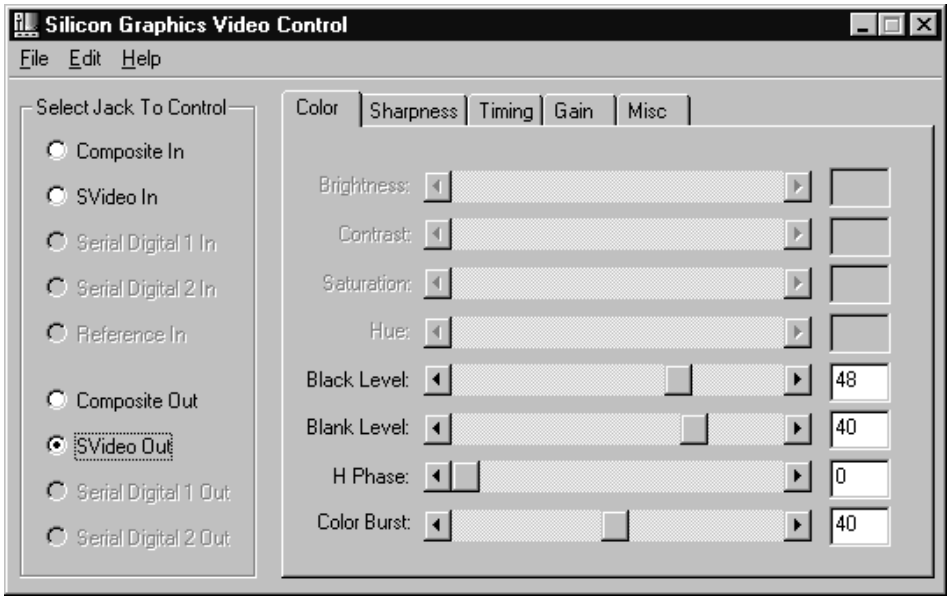

Figure 3-9 Color Tab for Output Jacks

It is highly recommended that you use professional test equipment when changing the sliders on the **Color** tab. The reason is that it is difficult to see subtle changes in the color settings with the naked eye, and the perceived color depends to a large extent on the quality and calibration of the display mechanism (TV or computer monitor).

Brightness, Contrast, Saturation, and Hue Sliders (input jacks)

- **Brightness**—changes the brightness of the video.
- **Contrast**—changes the ratio of luminance (brightness) between the lightest and darkest elements of a video scene. Contrast ratio is a major determinant of perceived picture quality and sharpness.
- **Saturation**—changes the degree of colorfulness, from neutral gray through pastel to saturated colors.
- **Hue**—changes the color perception denoted by blue, green, red, yellow, and so on.

Black Level, Blank Level, H Phase, Color Burst Sliders (output jacks)

- **Black Level**—adjusts the offset of the red, blue, and green elements presented on the display. The black level is related to bias, which sets the reference level for a color scale. Figure 3-4 shows the typical timing diagram for a horizontal scan line. The blackest portion of the picture is represented by the amplitude of the black level. If the black level is too low, the picture has compressed blacks. The resulting video is too dark, without any detail in the dark areas, and a gray scale reproduces with a loss of separation between the darkest divisions of the scale. On the other hand, if the black level is too high, the video looks overexposed or washed out. The ideal setting for the black level results in a uniform distribution of colors with no clipping at the white level and no merging of the blacker levels of the picture.
- **Blank Level**—in the timing for the horizontal scan line, at the beginning of the line, the amplitude below the black level contains important timing signals referred to as sync, which is short for synchronizing pulses. These are the high-speed timing pulses that keep all video equipment “in lock step” during the process of scanning lines, fields, and frames. These pulses dictate the precise point that the electronic beam starts and stops while scanning each line, field, and frame. In fact, without these pulses, electronic chaos would instantly break out between pieces of video equipment. A single source of sync from an electronic device called a sync generator supplies a common timing pulse for all equipment that must work in unity within a production system or facility. If the sync timing extends too long, the black level of the video is pushed too high (graying out the picture); if the sync timing is too short, the black level cuts into the sync and the picture rolls and breaks up. The blanking signal (sometimes called pedestal or set-up) occurs just before the color burst and needs to be kept at the proper level to maintain proper blacks and to ensure that strange diagonal lines do not appear in your video.
- **H Phase**—adjusts the phase of the encoded color subcarrier (including burst) relative to horizontal sync. It can be adjusted in steps of 360/256 (1.406) degrees.
- **Color Burst**—adjusts the amplitude of the color burst signal, which indicates whether video equipment is generating a basic color timing signal. It consists of 8 to 11 cycles of 3.58 MHz color subcarrier and occurs during the horizontal pulse just after the blanking signal and just before the actual color content of the signal (the area known as the “back porch”).

Sharpness Tab

You must choose an input jack before the controls are active in the **Sharpness** tab. If you choose an output jack, the controls are grayed out. The **Sharpness** tab panel is shown in Figure 3-10.

.

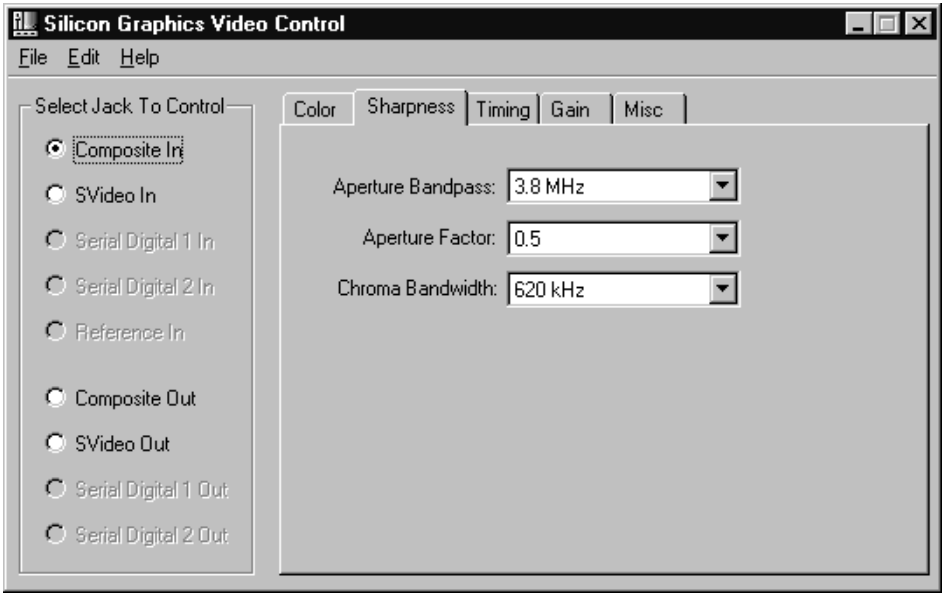

Figure 3-10 Sharpness Tab (Input Jacks Only)

Aperture Bandpass

You can peak the higher frequencies of the luminance signal by running the signal through a bandpass filter. The filtered signal is weighted by an **Aperture Factor** (see next section) and added to the original unfiltered signal, boosting the frequencies passed by the filter. The **Aperture Bandpass** control selects the center frequency of the bandpass filter.

The choices for **Aperture Bandpass** are **4.1 MHz**, **3.8 MHz**, **2.6 MHz**, or **2.9 MHz**. Each choice represents a different center frequency. Changing this selection affects only the luminance portion of the picture. When you look at TV broadcast information with a spectrum analyzer, you see that there are

packets of information every 15 kHz. Luminance (the black and white part of the picture) starts at 15 kHz, with the next packet is at 30 kHz, and so on. Chrominance (color) information also occurs every 15 kHz, but is interleaved, starting at 7.5 kHz. To deinterleave the luminance and chrominance information, a comb filter is normally implemented. A comb filter acts every 15 kHz to extract the packets. All packets are contained within a 4.2 MHz band for a single channel. Because the Silicon Graphics workstations do not implement a comb filter, they implement a filter that rolls off the luminance before the chrominance information is encountered. The aperture corrector in the workstation hardware makes the picture look better by selectively boosting a certain range of frequencies based on a center frequency (the Aperture Bandwidth). Essentially, it is a sharpness mechanism. The Aperture Bandpass filter is a corrector that is adjustable so you can pick the center frequency you are going to affect.

Aperture Factor

The **Aperture Factor** allows you to determine the amplitude contribution of the frequencies you have chosen with the **Aperture Bandpass** control. The choices are:

- **0.0**—no contribution
- **0.25**—1/4 contribution
- **0.5**—1/2 contribution
- **1.0**—full contribution

Chroma Bandwidth

The choices for **Chroma Bandwidth** are **620 kHz**, **800 kHz**, **920 kHz**, and **1000 kHz**. The numbers represent the bandwidth of the chrominance difference signals. The color difference signals are low-pass filtered to achieve the selected bandwidth.

Timing Tab

On the **Timing** tab, the controls that are available depend on the jack selected. When an input jack is selected, the **Signal Present**, **Jack Timing**, and **Color Standard Detect** controls are available, as shown in Figure 3-11.

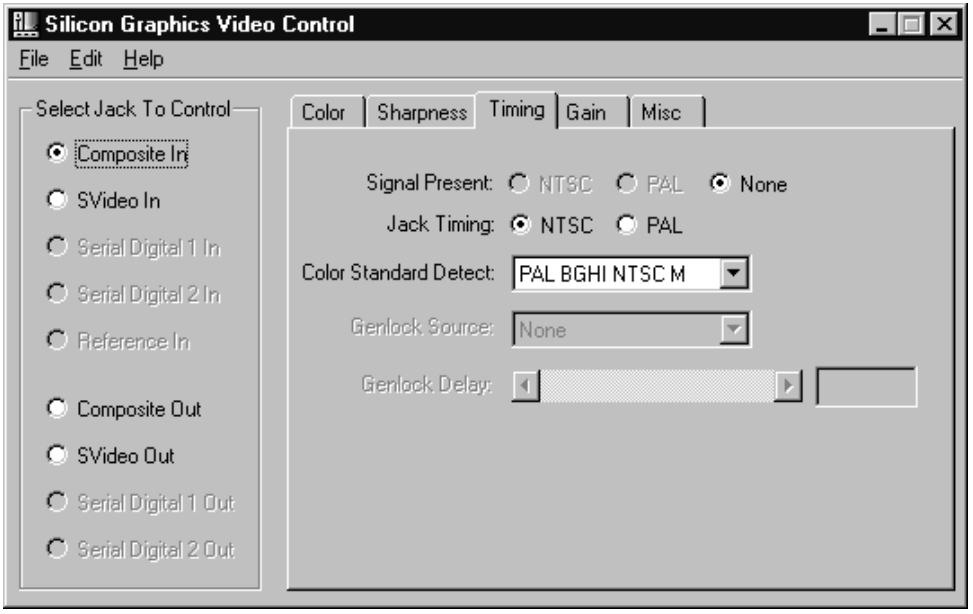

Figure 3-11 Timing Tab for Input Jacks

When an output jack is selected, the **Jack Timing**, **Genlock Source**, and **Genlock Delay** controls are available, as shown in Figure 3-12.

.

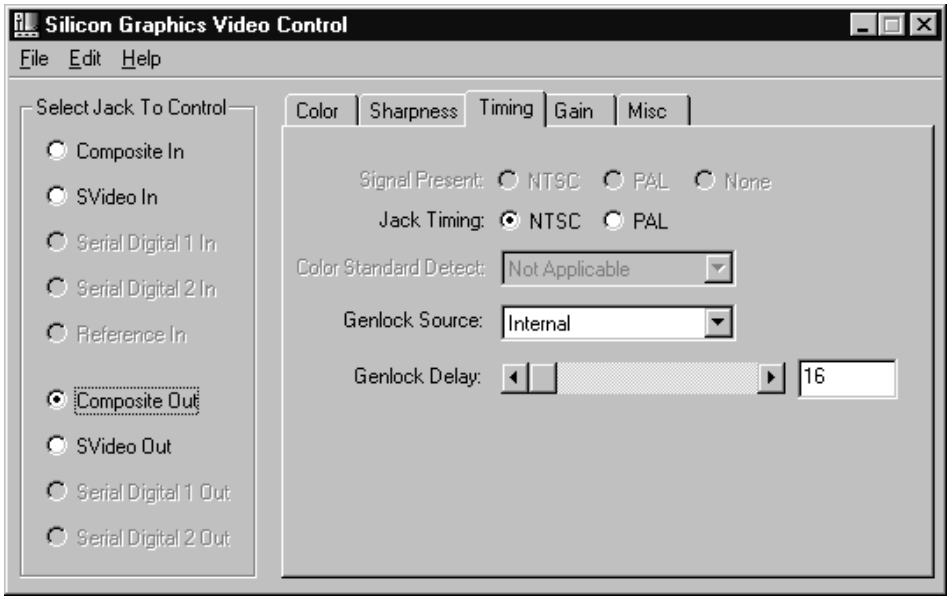

Figure 3-12 Timing Tab for Output Jacks

Signal Present

The **Signal Present** buttons are active only when you choose an input jack. They indicate what type of signal, if any, is present at the jack.

Jack Timing

When you have selected an input jack, activate the **Jack Timing** button that matches the timing of the input signal on that jack.

When you have selected an output jack, activate the **Jack Timing** button that corresponds to the timing you wish to output on that jack.

Color Standard Detect

The **Color Standard Detect** drop-down box is active only when an analog input jack is selected. It is grayed out if you choose the Serial Digital 1 In or Serial Digital 2 In jacks.

The choices are **Not Applicable**, **PAL BGHI NTSC M** (the default standard), **NTSC 443 PAL 443**, **PAL N NTSC 443**, and **NTSC N PAL M**. The 443 in the nomenclature refers to the 4.43 MHz color subcarrier frequency. You should choose the color standard that nest matches the video at the input source jack.

See Appendix A for more information about the NTSC and PAL standards.

Genlock Source

The **Genlock Source** drop-down box is available only when you choose an output jack. The Genlock device allows the output video to be synchronized to a common frequency source. The choices for the **Genlock Source** are as follows:

- **None**—audio and video are not synchronized.
- **Internal**—the video output generates its own clock, which is not locked to any video signal.
- **Composite In**—the video synchronization signal is derived from the composite video in signal.
- **S-Video In**—the video synchronization signal is derived from the composite S-Video In signal.

Genlock Delay

The **Genlock Delay** slider is available only when you choose an output jack. It allows you to control the timing delay between the genlock source and video output timing, which allows you to achieve genlock with other devices in an editing suite. When you switch from one device to another, unless you have all the sources genlocked and synchronized, you might see a black bar in the middle of the screen or bad color.

The units of Genlock Delay are in units of CCIR clock cycles. When adjusting genlock, it is highly recommended that you use external test

equipment to line up the genlock delays from various pieces of equipment. There is typically one sync generator for an editing suite, but often each individual piece of equipment must be individually adjusted.

Gain Tab

On the **Gain** tab, the controls and sliders that are available depend on the jack selected. When an input jack is selected, the **Automatic Gain Control (AGC)**, **Gain Hold**, **AGC Updates Every**, **YC Gain**, **C Gain**, and **Gain Hysteresis** controls and sliders are available, as shown in Figure 3-13.

.

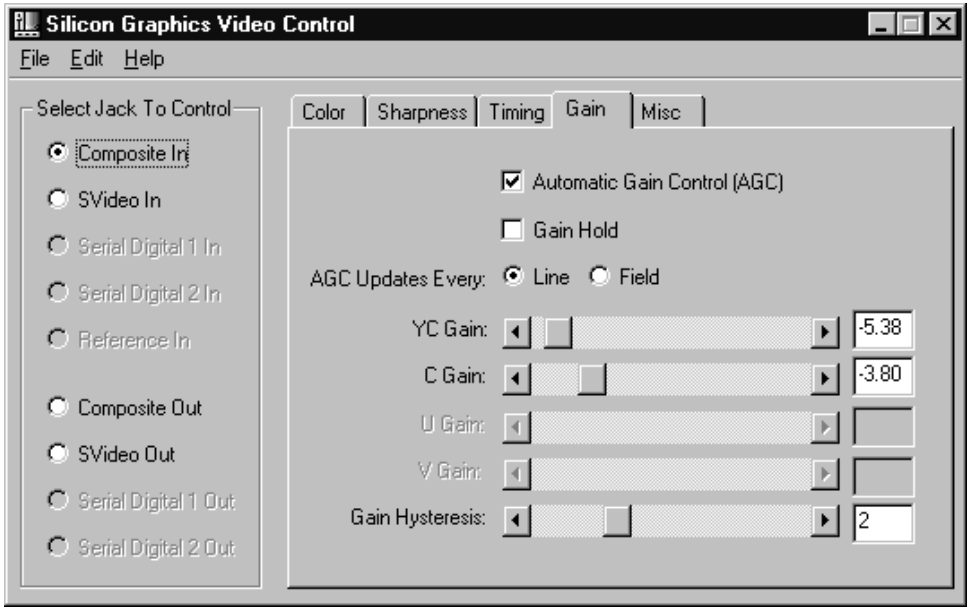

Figure 3-13 Gain Tab for Input Jacks

When an output jack is selected, the **U Gain** and **V Gain** sliders are available, as shown in Figure 3-13

.

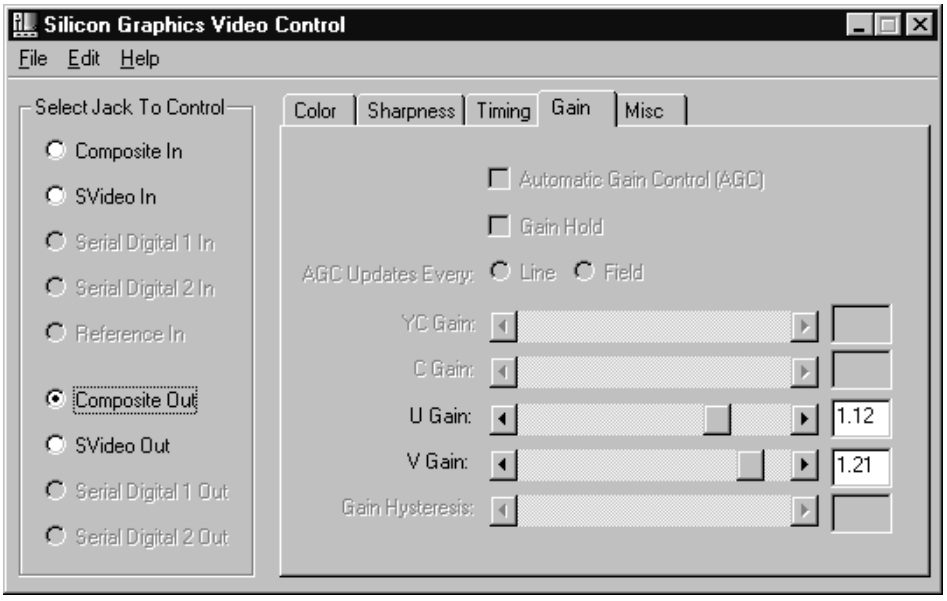

Figure 3-14 Gain Tab for Output Jacks

Automatic Gain Control AGC Check Box

The **Automatic Gain Hold (AGC)** check box is available only when you choose an input jack. When this box is checked, the workstation automatically compensates for level fluctuations in the input signal. Under normal circumstances, the box should always be checked.

Gain Hold Check Box

The **Gain Hold** check box is available only when an input jack is selected. When you check it, the level of the signal attempts to remain constant as the picture content changes. If you want to freeze the gain, you can check the **Gain Hold** check box on-the-fly when you have a gain level you want to maintain. When the **Gain Hold** check box is checked, it overrides the **AGC** check box.

AGC Updates Every Line/Field Radio Buttons

This check box is available only when an input jack is selected. It specifies how often the AGC circuitry should look at and try to regulate the gain. If the Line radio button is activated, the AGC circuit reevaluates the gain every horizontal line. If the Field button is chosen, the gain is reevaluated every field (262.5 lines for NTSC, for example). The look of the picture changes with these two selections. When you choose **Field**, the gain is averaged over the entire field before a decision is made to change the gain, so that high-contrast elements within a frame maintain their respective gains. If you choose **Line**, and you have a picture with high vertical contrast situations, the AGC can regulate the gain every line. In this situation, the contrast ratio is small, because the gain changes as soon as the picture gets darker or lighter on a line-by-line basis, compared with doing a weighting over the whole field. An empirical process is probably the best way to evaluate the selection of AGC updates every field or line.

Color Gain Sliders

It is highly recommended that you use professional test equipment to properly adjust the color gains. If the sliders are accidentally misadjusted, choose **File** > **Restore Default Settings** to restore the slider settings for a particular jack. The output and input sliders are completely independent. However, when making adjustments, adjust the output first with a test signal (use the **Output Test Colorbars** check box in the **Misc** tab), then adjust the input sliders. Use test equipment to calibrate color saturation, brightness, and so forth. The following Color Gain sliders are available:

- **YC Gain**—applies to input jacks only, and is adjustable only when the **AGC** check box has not been activated. The **YC Gain** slider adjusts both the Y and C gain of the composite video input, because Y and C are combined onto the same signal (one wire). When adjusting S-Video gain, this slider applies only to the Y portion of the S-Video signal.
- **C Gain**—applies to input jacks only, and is adjustable only when the **AGC** check box has not been activated. The **C Gain** slider adjusts the C portion of the gain of the S-Video input. The Y portion of the gain is adjusted with the **YC Gain** slider.
- **U Gain**—applies to output jacks only. The **U Gain** value affects the U color difference level.
- **V Gain**—applies to output jacks only. The **V Gain** value affects the V color difference level.

The boxes to the right of the **Color Gain** sliders are in units of dB. They change as you adjust the sliders, or you may type into them directly.

Gain Hysteresis Slider

The **Gain Hysteresis** slider applies only when an input jack is selected. The numbers in the boxes are relative numbers only. The actual gain must change by the **Gain Hysteresis** amount for the AGC circuitry to reevaluate the gain. A large **Gain Hysteresis** number results in slower AGC adjustments. A small number results in faster adjustments.

Misc Tab

On the **Misc** tab, the controls that are available depend on the jack selected. When an input jack is selected, the **Vert Noise Reduction**, **Analog Process**, **Luma Delay**, **TV/VTR**, **Limit White Peak**, and **Fast Color Time** controls are available, as shown in Figure 3-15.

.

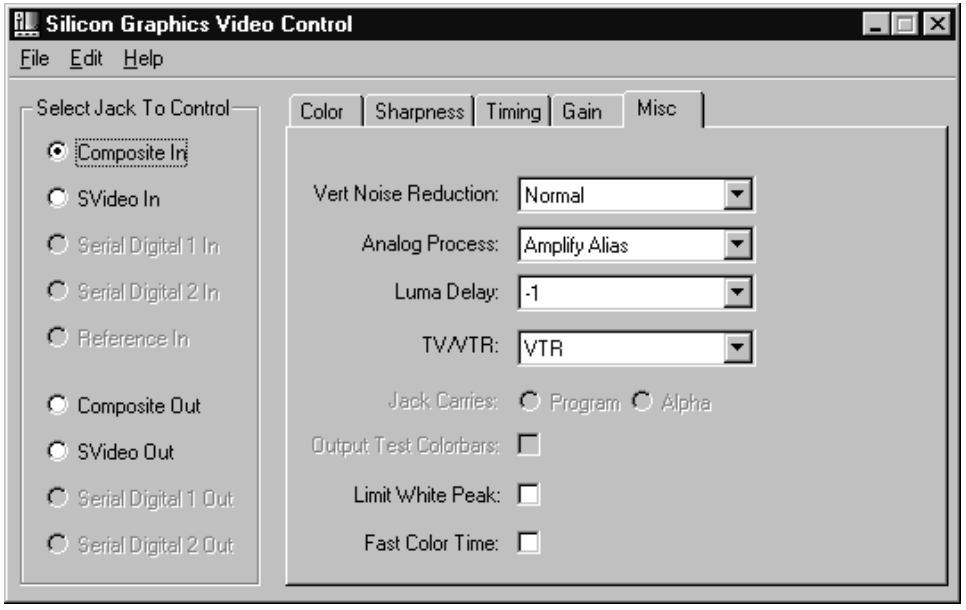

Figure 3-15 Misc Tab for Input Jacks

When an output jack is selected, the **Jack Carries** and **Output Test Colorbars** controls are available, as shown in Figure 3-16.

.

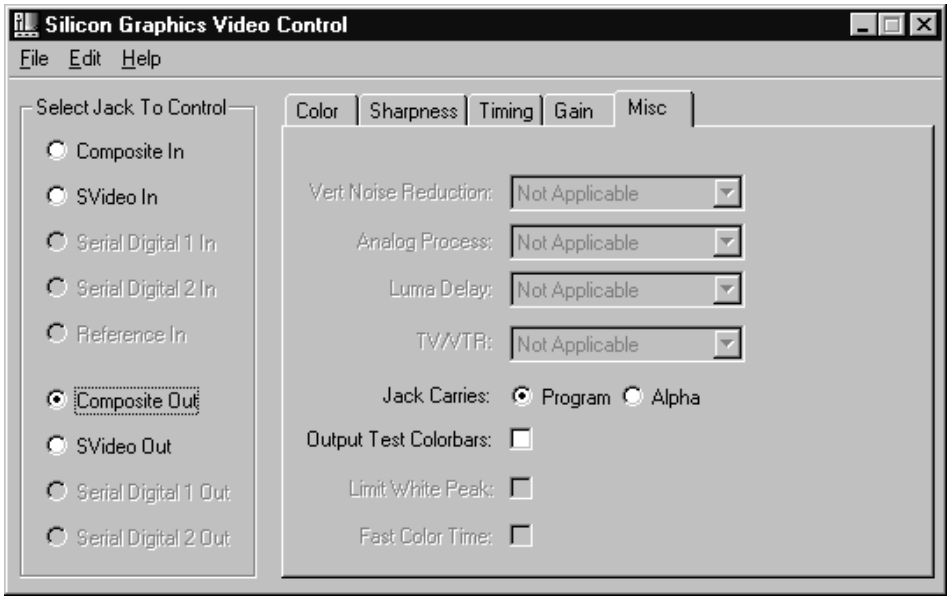

Figure 3-16 Misc Tab for Output Jacks

Vertical Noise Reduction

The **Vert Noise Reduction** drop-down box is available only when an input jack is selected. The purpose of this control is to determine how the video input responds to vertical noise in the video signal. Excessive noise can make the picture roll or not lock up. The choices are:

- **Normal**
- **Search**
- **Free Run**
- **Bypass**

In all cases, choose **Normal** for Vertical Noise Reduction.

Analog Process

The **Analog Process** drop-down box is available only when an input jack is selected. Before A to D conversion, the analog signal can be amplified and antialias filtered. The choices for Analog Process are:

- **Not Applicable**—no action
- **Bypass**—no action
- **Amplify**—amplify only
- **Amplify Alias**—amplify and perform antialias filtering

Luma Delay

The **Luma Delay** drop-down box is available only when an input jack is selected. The filters in the workstation hardware separate the Luma and Chroma video components (see “Aperture Bandpass” on page 75). The purpose of this control is to line up the Luma and Chroma components before the signal is processed by the ADC converter. It is highly recommended that you use professional test equipment to align the components. The **Luma Delay** choices, which are in units of 2 x CCIR video clock cycles, are:

- **Not Applicable**
- **-4**
- **-3**
- **-2**
- **-1**
- **0**
- **1**
- **2**
- **3**

TV/VTR

The **TV/VTR** drop-down box is available only when an input jack is selected. The purpose of this control is to compensate for VTR timing jitter resulting from the slight variations inherent in an electromechanical systems. If you choose TV, you are assuming a stable input source. If you use a VTR as a

video input source, and do not choose VTR mode, the resulting picture is unstable.

Jack Carries Program/Alpha

The **Jack Carries** controls are available only when an output jack is selected. These controls allow you to output program video on one output jack and Alpha video on another. Many computer graphics images have RGB and A components. RGB is the program video and A is the Alpha video. Computer graphics video can often be configured as RGBA8 (8 bits of RGB and 8 bits of Alpha), or RGB5_A1 (5 bits of RGB and 1 bit of Alpha).

The Alpha component of the video determines the opaqueness of a portion of the video. The higher the Alpha number, the more opaque the video; the lower the number, the more transparent the video. Before RGB can be output to a monitor, it is converted to YUV or YCrCb, and the Alpha is stripped off. With the workstation, you can preserve the Alpha portion of the video by sending it out on a separate jack from the color video, thus preserving all of the video components. The Alpha portion of the video signal becomes the luminance (Y) component of a video signal and, when presented on a monitor, carries no color information. In the case of 8-bit Alpha, the Y component represents 256 shades of gray; for 1-bit Alpha, it represents either white or black.

Use the **Jack Carries** buttons to determine the jack that carries YUV and the jack that carries Alpha.

Output Test Colorbars

The **Output Test Colorbars** check box is available only when an output jack is selected. When this box is checked, the familiar colorbar test pattern is available on the selected output jack.

Limit White Peak

The **Limit White Peak** check box is available only when an input jack is selected. The purpose of this control is to allow you to limit the input level of a bad signal.

Fast Color Time

The **Fast Color Time** check box is available only when an input jack is selected. If the button is activated, a fast time constant is in effect; if the button is not activated, a normal time constant is in effect. Always leave the check box deactivated.

File Menu

The **Silicon Graphics Video Control** screen has two items under the **File** pulldown menu:

- **Restore Default Settings for This Jack**
- **Graphics Display Framelock**

  Note: The third item, **Exit**, closes the screen.

The **File** pulldown menu is shown in Figure 3-17.

.

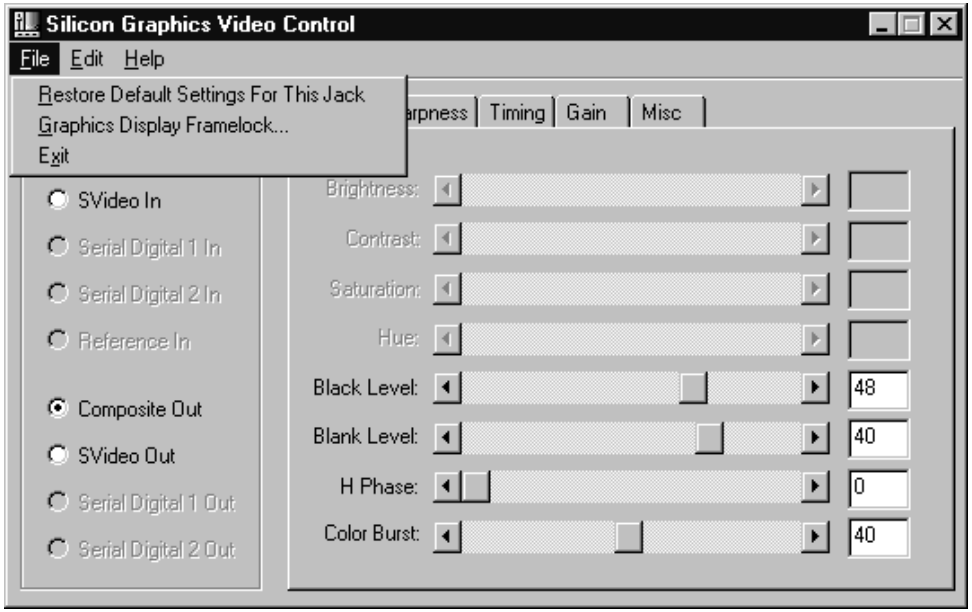

Figure 3-17 File Pulldown Menu

Restore Default Settings for This Jack

When you choose this menu item, the default settings for the currently selected input or output jack are restored. This is a quick and easy way to get the settings back to a normal condition if you misadjust them.

Graphics Display Framelock

When you choose **File** > **Graphics Display Framelock**, the screen shown in Figure 3-18 appears.

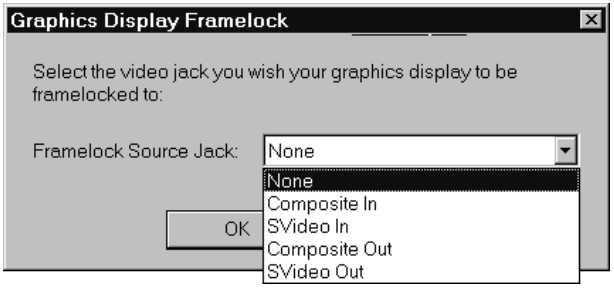

Figure 3-18 Graphics Display Framelock

Genlock for your graphics display can come from an input or output video signal, which can be chosen using the **Graphics Display Framelock** panel. The video outputs can derive their timing from a video input, and vice versa. You cannot adjust genlock in real time—you have to restart the software program every time you want to adjust the genlock source.

Chapter 4

Capturing and Playing Video with HackTV and QuickTime

This chapter explains the details of the various panels and dialog boxes encountered when capturing and playing back video using the HackTV application and QuickTime.

This chapter discusses the following topics:

This chapter goes into some detail explaining the panels and dialog boxes used when capturing video using HackTV and QuickTime. The basic process of capturing video was explained in Chapter 1, "Getting Started."

The two main screens that are notable are:

- HackTV Menu Bar
- Monitor Window

HackTV Menu Bar and Monitor Window

To bring up the HackTV application, double-click the HackTV executable file. If you do not have the HackTV application, you can download it from Apple's Web site.

The HackTV menu bar appears, along with real-time video playing in the **Monitor** window, as shown in Figure 4-1. If video does not appear in the **Monitor** window, double-check the connections as explained in "A Simple Video Capture Example" on page 10.

.

Figure 4-1 HackTV Main Menu and Monitor Window

Video Compression Settings

To configure the video compression settings for QuickTime, choose **Video Settings...** from the HackTV **Monitor** menu. The **Video** screen appears with the topmost drop-down box indicating **Compression**, as shown in Figure 4-2. If the top drop-down box does not display **Compression**, click on the box and choose **Compression**.

.

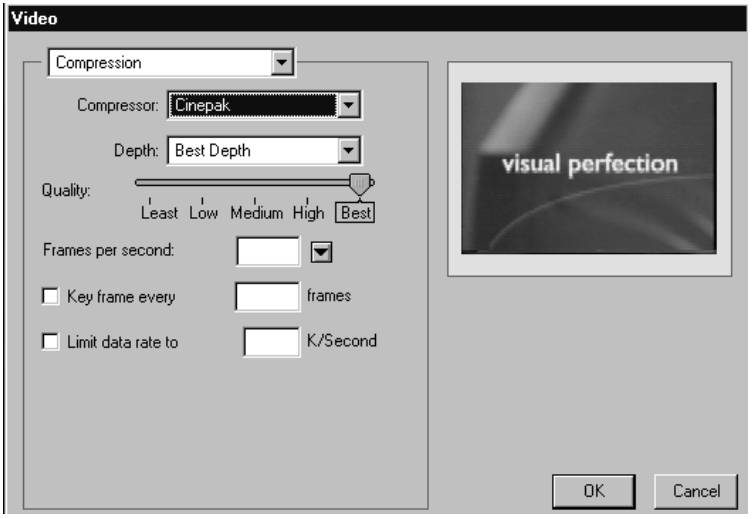

Figure 4-2 HackTV Video Compression Window

This screen allows you to choose a video compression algorithm by using the **Compressor** drop-down box, the color depth by using the **Depth** drop-down box, and the quality and frame rate by using the other controls.

The topic of video compression is rather extensive, and is covered separately (as are the options on this screen) in Chapter 5, “Silicon Graphics Video Compression Techniques.”

Video Image Settings

To configure the video image settings for QuickTime, click the main selection drop-down box at the top of the **Video** window and choose **Image**, as illustrated in Figure 4-3.

.

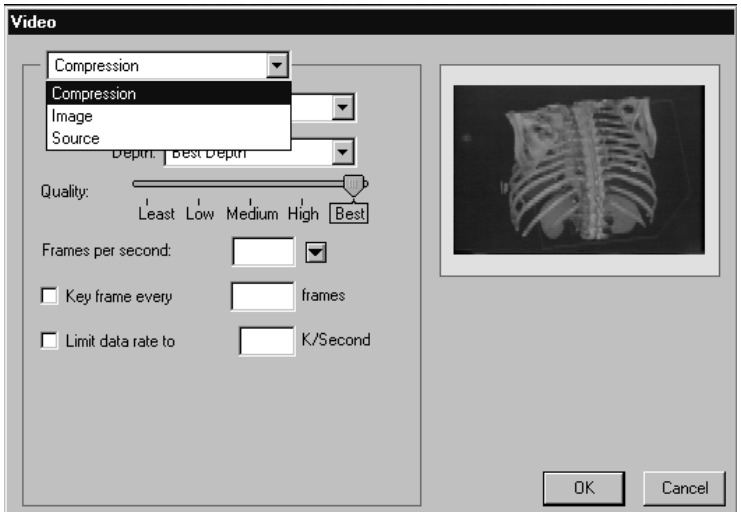

Figure 4-3 HackTV Video Main Selection Drop-Down Box

The **Video** screen changes to show selections related to video image configuration, as shown in Figure 4-4.

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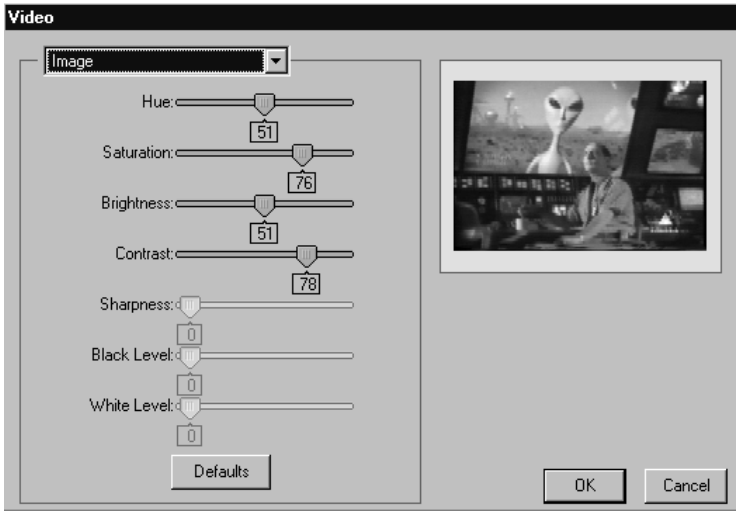

Figure 4-4 HackTV Video Image Screen

The **Sharpness**, **Black Level**, and **White Level** sliders are grayed out because they are not supported by the Silicon Graphics software.

The Silicon Graphics **Video Control** panel, explained earlier (see “Silicon Graphics Video Control Screen” on page 69) allows many more controls to be adjusted than those available on the QuickTime **Video** panel. Explanations for the settings on this screen are listed there also.

Video Source Settings

To configure the video source settings for QuickTime, click the main selection drop-down box at the top of the Video window and choose **Source**. The **Video Source** screen appears, as shown in Figure 4-5.

.

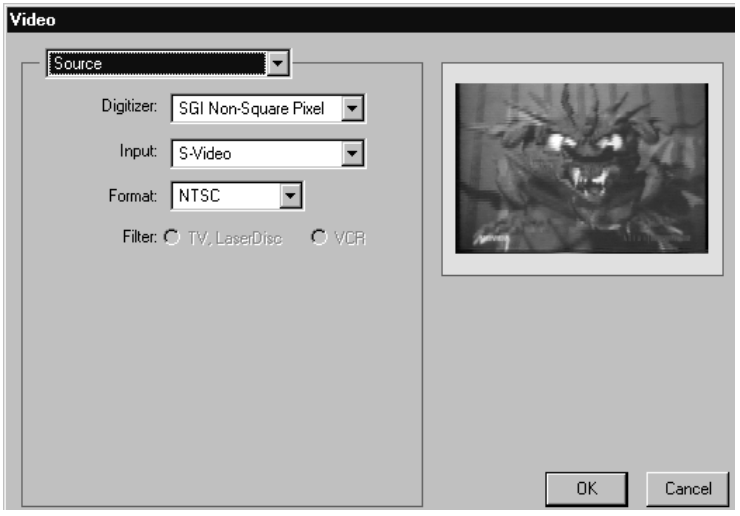

Figure 4-5 HackTV Video Source Screen.

Digitizer

The **Digitizer** drop-down box allows you to choose either **Non-Square** or **Square** pixels. Refer to “Pixel Aspect Ratio” on page 62 for more details regarding square and non-square pixels.

Input

The **Input** drop-down box allows you to choose the **S-Video** input jack or the **Composite** input jack as video input sources.

Format

The **Format** drop-down box allows you to choose one of three video timing formats:

- **NTSC**
- **PAL**
- **SECAM**

Filter

The **Filter** radio buttons allow you to choose either **TV**, **LaserDisc** or **VCR**. The purpose of this control is to compensate for VCR timing jitter resulting from the slight variations inherent in an electromechanical systems. If you choose **TV** or **LaserDisc**, you are assuming a stable input source. If you use a VCR as a video input source, and do not choose **VCR** mode, the resulting picture is unstable.

Silicon Graphics Video Output Settings

To configure the Silicon Graphics video output settings for QuickTime, double-click the sgiqtvout.exe icon, at *C:\WINNT\system32\sgiqtvout.exe*. The screen shown in Figure 4-6 appears.

.

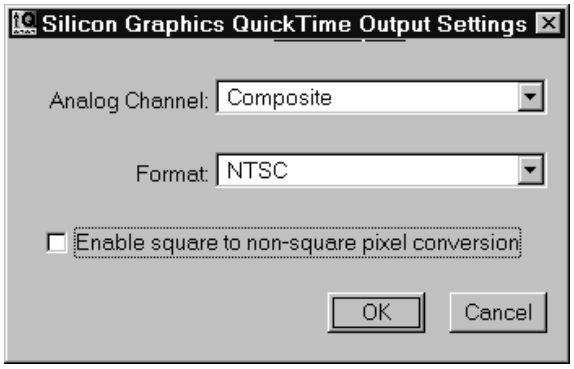

Figure 4-6 Silicon Graphics QuickTime Output Settings

This panel configures the video sent out to an external monitor or other video equipment.

Analog Channel

Use the **Analog Channel** drop-down box to choose one of the following video output jacks:

- **Composite**
- **S-Video**

Format

Use the **Format** drop-down box to choose one of the following video output timing standards:

- **NTSC**
- **PAL**

Enable Square to Non-Square Pixel Conversion

Activate this check box if you want to output video to a digital device that requires non-square pixels. If you have captured analog video with the Silicon Graphics Square selection on the Source drop-down box in the QuickTime Video window (see “Video Source Settings” on page 94), and you need to output the video to a device that requires rectangular pixels, you must activate this check box to enable square to non-square pixel conversion.

Audio Compression Settings

To configure the audio compression settings for QuickTime, choose **Audio Settings...** from the HackTV **Monitor** menu. The **Sound** screen appears with the topmost drop-down box indicating **Compression**, as shown in Figure 4-7. If the box does not contain **Compression**, click on the box and choose **Compression**.

.

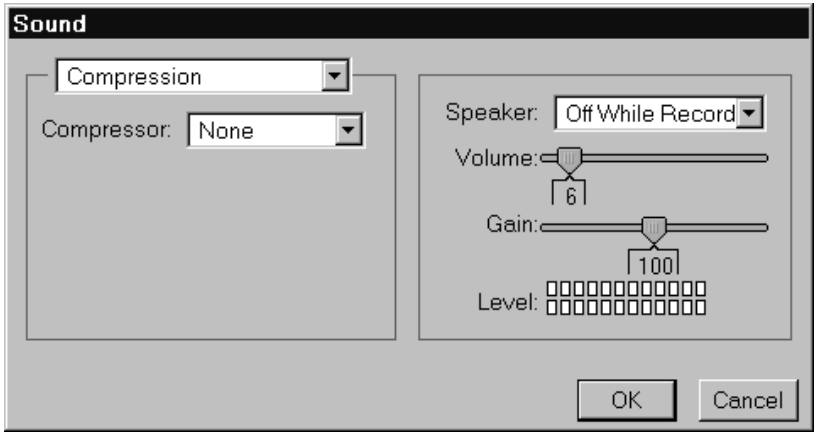

Figure 4-7 HackTV Sound Compression Screen

Compressor

When you click the **Compressor** drop-down box, several choices are presented. However, because none of the audio compressors available in the **Compressor** drop-down box are supplied by Silicon Graphics, they are not explained here. To get information about the compressors from various companies, contact the respective company directly, or look on the Apple Web site for QuickTime (www.apple.com/quicktime).

Speaker

Clicking the **Speaker** drop-down box yields the following choices:

- **Off**—mutes the speakers
- **On**—turns on the volume to the speakers
- **Off While Recording**—mutes the speakers while recording a video clip

Volume/Gain

The **Volume** and **Gain** sliders affect the record audio levels.

Level Meter

The **Level** meter reflects the playback volume.

Audio Sample Settings

To configure the audio sample settings for QuickTime, click the main selection drop-down box at the top of the **Sound** window and choose **Sample**, as illustrated in Figure 4-8.

.

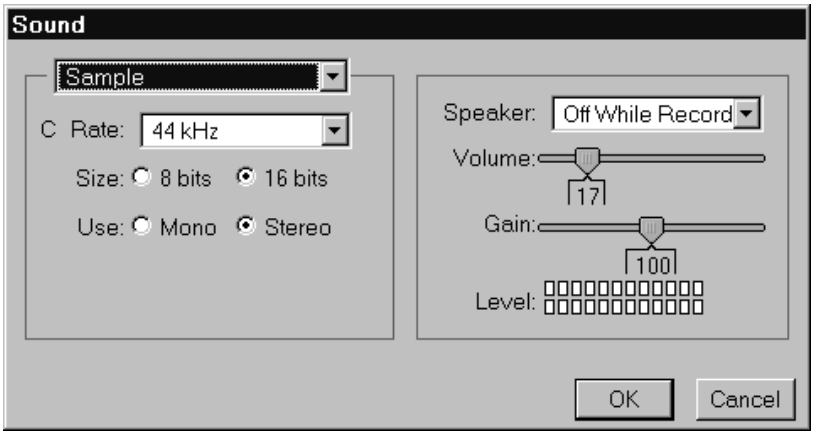

Figure 4-8 HackTV Sound Sample Screen

C Rate (Clock Rate)

The **C Rate** drop-down box allows you to configure the following audio sampling rates:

- **44 kHz**—provides CD-quality audio
- **22 kHz**—provides medium quality audio
- **11 kHz**—provides low-quality audio

You must decide on the audio quality desired based on your application and the amount of memory and disk space you want to allocate.

Size

The two **Size** radio buttons, 8 bits and 16 bits, determine how accurately each sample reflects the original analog audio. 16-bit sampling provides higher-quality audio than 8-bit sampling, but takes up more storage space.

Use

The two **Use** radio buttons, **Mono** and **Stereo**, allow you to monitor two input audio jacks and merge them into one audio stream (Mono), or to keep them separated (Stereo).

Audio Source Settings

To configure the audio source settings for QuickTime, click the main selection drop-down box at the top of the **Sound** window and choose **Source**, as illustrated in Figure 4-9.

.

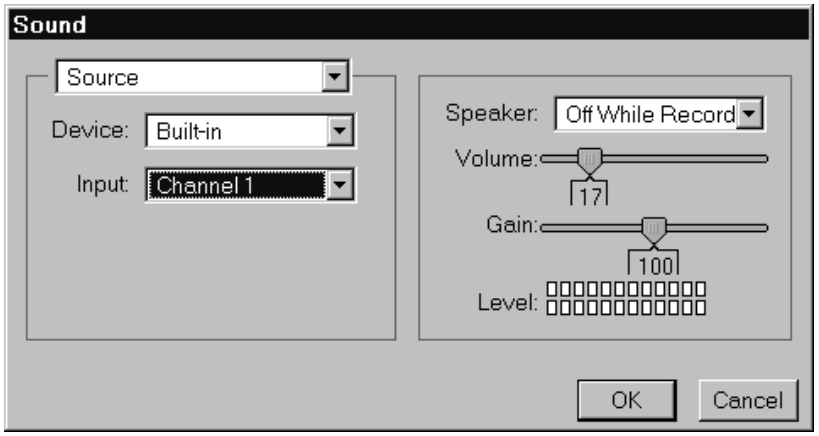

Figure 4-9 HackTV Sound Source Screen

This panel allows you to set up the source for audio recording. The **Built-in** device is the integrated audio support available with the workstations. As you add more support for audio, such as the Silicon Graphics DA1100 Digital Audio Card, the **Device** and **Input** windows reflect more choices.

The Silicon Graphics **Audio Control** panel, explained earlier (see “Silicon Graphics Audio Control Panels” on page 45) allows additional controls to be adjusted. For more information about the audio settings on the right side of the screen, see “QuickTime Audio Settings Panels” on page 41.

Chapter 5

Silicon Graphics Video Compression Techniques

This chapter explains the details of how to use the various video compression panels and dialog boxes when capturing video with the Silicon Graphics 320 and Silicon Graphics 540 workstations. Video compression is necessary to keep file sizes small and bit rates low while retaining good video quality.

This chapter discusses the following topics:

Compression with Video for Windows

When you use Video for Windows, two areas cover compression:

- Silicon Graphics VFW Capture Settings window
- Video Compression window

Silicon Graphics VFW Capture Settings Window

When using Video for Windows, you can configure video compression with the **Silicon Graphics VFW Capture Settings** window, shown in Figure 5-1. You bring up the window by using the **Options** menu of the **VidCap** main screen to choose **Video Format**, **Video Source**, or **Video Display**. Each choice takes you to the **Silicon Graphics VFW Capture Settings** screen. Only the compression aspects provided by this screen are discussed in this chapter; see Chapter 3, “Capturing and Playing Video with VidCap and Video for Windows” for more information on the other areas of the screen.

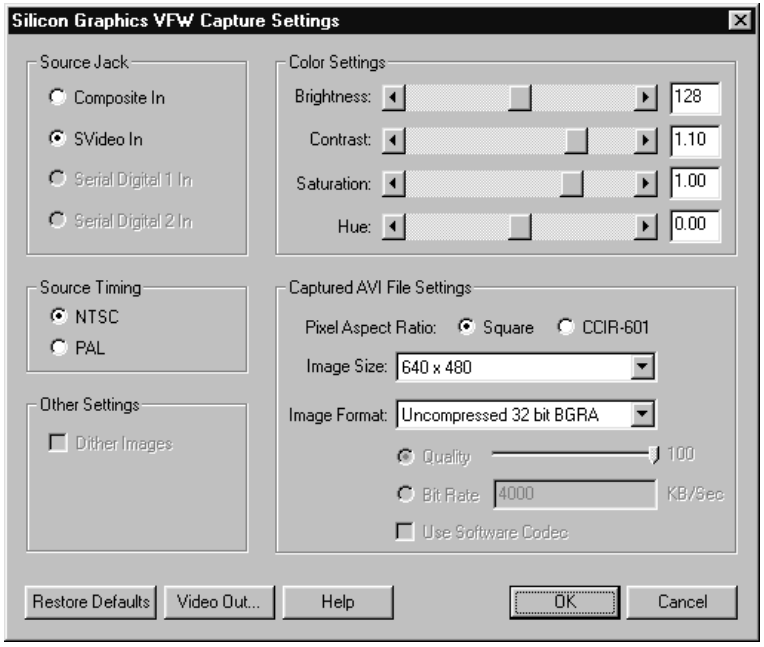

Figure 5-1 Silicon Graphics VFW Capture Settings Window

The Captured AVI File Settings area of this screen allows you to configure video compression with the following controls:

- **Image Format** drop-down box
- **Quality** radio button and slider
- **Bit Rate** radio button and drop-down box
- Use Software Codec check box

Image Format Drop-Down Box

When you click the **Image Format** drop-down box, the following choices are presented:

- **Uncompressed 32-bit BGRA**—a 32-bit uncompressed video format with 8-bit blue (B), green (G), red (R), and alpha (A) components in each pixel. Use this format to capture video that includes alpha[1], or opacity, information. This format also allows you to capture the full pixel component, with no subsampling, similar to the UYVY format. If you want to work in the RGB color space, use the uncompressed 32-bit BGRA format.
- **Uncompressed 16-bit BGR**—an uncompressed video format with 5-bit blue (B), green (G), and (R) components in each pixel. There is no alpha component as in BGRA (the extra bit is ignored).
- **Uncompressed 16-bit UYVY**—an uncompressed 4:2:2 format in which the first pixel contains an 8-bit U and an 8-bit Y1 component, with the next pixel containing an 8-bit V and an 8-bit Y2 component. This format is recommended by Silicon Graphics.
- **Uncompressed 8-bit Grayscale**—an uncompressed video format in which each pixel carries only luma (Y) information, with 8 bits (256 shades) of gray.
- **Motion JPEG (MJPEG)**—this format is a popular compression algorithm for video capture editing because it separately captures each field in a video frame, which allows you to cut between arbitrary images when editing. Other algorithms that do interframe coding, such as MPEG, do not lend themselves to video editing, because each frame

1 For more information about alpha, see “Jack Carries Program/Alpha” on page 86.

may or may not carry full video content. The advantage of MJPEG over all varieties of MPEG is the fact that MJPEG does not disturb the individual fields in the video. The MPEG compression technique exploits the redundancy in moving pictures by generating P frames and B frames. These are virtual pictures, which do not exist as real video frames, so any attempt to use them as a reference for editing is likely to generate unpredictable results. MJPEG is ideal for video editing because it allows editing on a frame-by-frame basis.

- **Photo JPEG**—compared to MJPEG, Photo JPEG provides good compression ratios, but has less quality because it compresses a frame at a time instead of a field at a time. So, if there is motion from one field to the next, video compressed with Photo JPEG has some blurring. Photo JPEG uses the same compression techniques as MJPEG.
- **Baseline**—available if the Compression card is present. This is the lossy JPEG compression baseline standard.
- **Lossless**—available if the Compression card is present. This is the lossless JPEG compression standard, which achieves around 25% compression.

The available compressors (see “Video Compression Using Options > Compression...,” on page 108) depend on the image format you choose. If you choose Motion JPEG, for example, there are no compressors that understand how to compress video that is already compressed, so the only option available is No Recompression. More details are given in the section titled “Video Compression Using Options > Compression....”

Quality Radio Button and Slider

The **Quality** radio button and slider are available for versions of JPEG (Photo JPEG or MJPEG), whether available with software or accelerated with the Silicon Graphics MJ1100 M-JPEG Compression card.

Clicking the **Quality** button causes the compressor to adjust the compression ratio such that the quality of the picture remains constant. The slider, which is adjustable between 0 and 100, indicates the level of quality you want to maintain, with 100 being the highest quality. A quality level of 100 results in a compression ratio of approximately 2:1.

These controls allow you to make adjustments to the amount of detail in an image, and allow the bit rate to increase or decrease to maintain the quality level indicated by the slider.

Bit Rate Controls

The **Bit Rate** radio button and box are grayed out until an MJPEG Compression card is plugged in. Clicking the **Bit Rate** radio button causes the compression algorithm to maintain a constant bit rate for capturing video. Use the box to specify the bit rate in kbps. This technique allows you to fill up the disk at a known rate regardless of the video content. However, unless you set a sufficiently high bit rate, the video quality may suffer when capturing fast action, high-content video.

The constant bit rate technique works well for creating an edit decision list, where high-quality video is not important, and all you need is enough content to see and recognize the captured video.

Use Software Codec Check Box

This check box is grayed out until an MJPEG Compression card is plugged in. When the card is present, the Silicon Graphics MJPEG and Silicon Graphics JPEG image formats use the Compression card for all the images supported by the board, but the board only supports images that are multiples of 8 in each dimension (such as 160 x 120 or 720 x 480). An exception is image heights of 243 or 486 (the NTSC heights for fields or frames, respectively).

If you check the box, software compressors are used instead of hardware compression on the card.

Video Compression Using Options > Compression...

Another way of configuring video compression is to choose **Options** > **Compression...** in the **VidCap** main window. When you do this, the **Video Compression** screen appears, as shown in Figure 5-2.

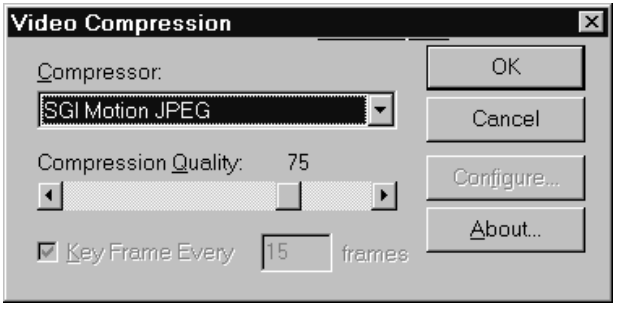

Figure 5-2 Video Compression Screen

Compressor

When you click the **Compressor** drop-down box, the available compressors are shown, as illustrated in Figure 5-3.

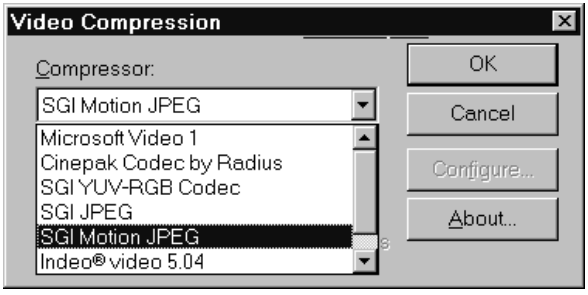

Figure 5-3 Compressors

When you configure video compression using the **Video Compression** window, the workstation video digitizer captures video to a memory buffer in an uncompressed pixel format. The contents of the memory buffer then go from the video capture driver to the video compression driver you have selected from those among the list in Figure 5-3. To see another view of the

available compressors, go to **Start** > **Settings** > **Control Panel** and double-click on **Multimedia**. The **Multimedia Properties** window appears. Choose the **Advanced** tab and click **Video Compression Codecs**. See Figure 5-4.

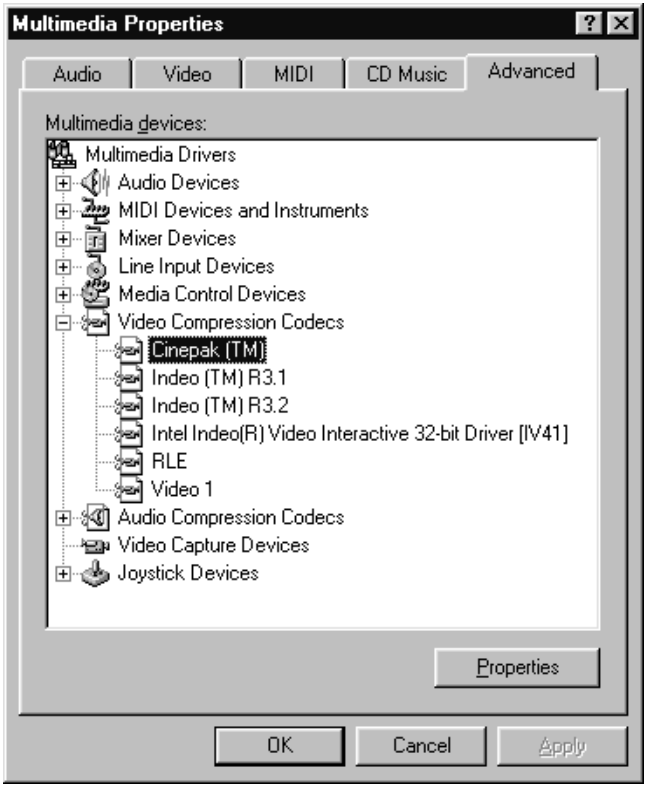

Figure 5-4 Available Video Compression Codecs

The list (either in the **Video Compressor** window or in the **Multimedia Properties** window) shows all of the compressors that are available with the particular format selected with the **Image Format** drop-down box in the **Silicon Graphics VFW Capture Settings** window (see Figure 5-1).

Of the software compressors in the list shown in Figure 5-3, the Silicon Graphics compressors are:

- **SGI YUV-RGB Codec**—this codec accepts 16-bit BGR or 32-bit BGRA video format, and sends it to a software color conversion compression driver that converts the video format into to 4:2:2 YUV format. This same codec also plays back video to an RGB color monitor (see "Video Playback Using Media Player" on page 119).
- **SGI JPEG**—compared to MJPEG, SGI JPEG provides good compression ratios, but has less quality because it compresses a frame at a time instead of a field at a time. So, if there is motion from one field to the next, video compressed with SGI JPEG has some blurring. SGI JPEG uses the same compression techniques as MJPEG.
- **SGI Motion JPEG (MJPEG)**—this format is a popular compression algorithm for video capture editing because it separately captures each field in a video frame, which allows you to cut between arbitrary images when editing. Other algorithms that do interframe coding, such as MPEG, do not lend themselves to video editing, because each frame may or may not carry full video content. The advantage of MJPEG over all varieties of MPEG is the fact that MJPEG does not disturb the individual fields in the video. The MPEG compression technique exploits the redundancy in moving pictures by generating P frames and B frames. These are virtual pictures, which do not exist as real video frames, so any attempt to use them as a reference for editing is likely to generate unpredictable results. MJPEG is ideal for video editing because it allows editing on a frame-by-frame basis. SGI Motion JPEG is compatible with the Open DML MJPEG standard.

For information on the other compressors, contact the company that provides the respective compressor.

Compression Quality

The **Compression Quality** slider is grayed out unless you are using a codec that actually compresses video. The **Compression Quality** slider adjusts the software compressor to maintain a constant picture quality. As picture content changes, the software adjusts its coefficients and adjusts the bit rate up and down to maintain the quality level indicated by the slider, from least to best. Use this slider control when you are more concerned about quality than the amount of disk space taken up with a video clip. The best quality setting can cause frame or field dropouts.

Key Frame Check Box

For the Silicon Graphics compressors, the **Key Frame** check box is available for compressors that do interframe coding. A key frame is a video frame that contains full video content, and is used in MPEG-2 as a reference for other frames containing video difference information. If the software compressor you have chosen does differencing between frames (for example, MPEG-2, Indio, and Cinepak), check the **Key Frame** check box and enter a number for how often you want a key frame to occur (a rule of thumb is one key frame every 30 frames).

The **Key Frame** box is grayed out for the SGI JPEG compressor because every frame is a key frame.

Configure Button

For the Silicon Graphics compressors, the **Configure** button is grayed out unless a compression card is plugged in. If a card is plugged in and you click **Configure** with a Silicon Graphics compressor in the **Compressor** drop-down box, the **Configure Encoder** screen shown in Figure 5-5 appears.

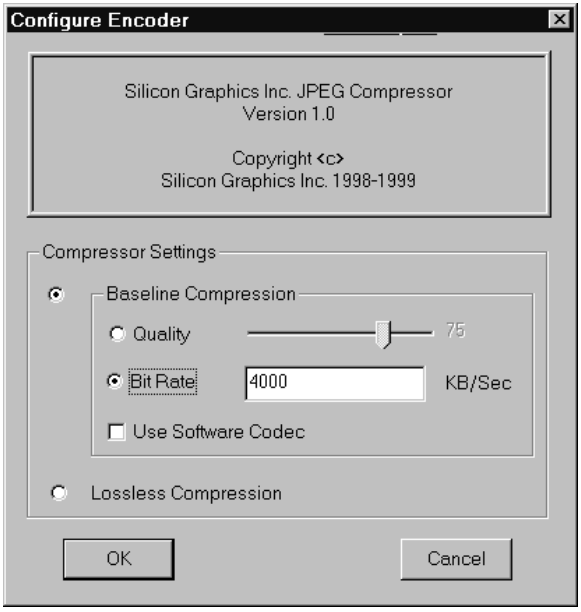

Figure 5-5 Silicon Graphics Encoder Screen

The screen shown in Figure 5-5 has two sets of controls:

- **Baseline Compressor**
  - **Quality** radio button and slider—check the button and use the slider to configure the quality of the video capture. The bit rate then is allowed to increase or decrease to maintain the quality you choose.
  - **Bit Rate** radio button—check this button to maintain a constant bit rate for the video capture.
  - **Use Software Codec** check box—activating this check box causes software compressors to be used instead of hardware compression on the compression card.
- **Lossless Compression** radio button—check this button to allow lossless compression as defined by the JPEG standard.

Compression with QuickTime

When using HackTV with QuickTime, you can configure video compression with the Video window. Bring up the window by choosing **Video Settings...** from the HackTV **Monitor** menu. The **Video** screen appears with the topmost drop-down box indicating **Compression**, as shown in Figure 5-6. If the top drop-down box does not display **Compression**, click on the box and choose **Compression**.

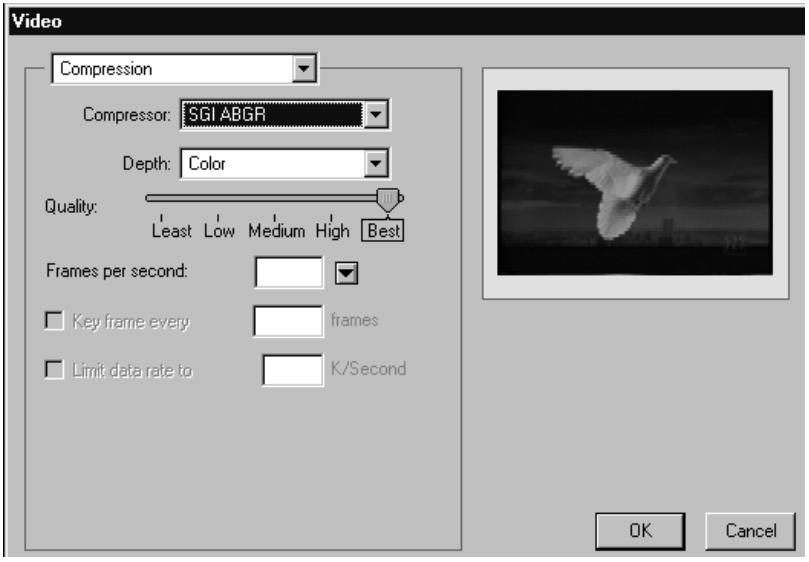

Figure 5-6 HackTV Video Compression Window

Compressor Drop-Down Box

The **Compressor** drop-down box allows you to choose a software compression algorithm. Figure 5-7 shows an example of the list of available choices.

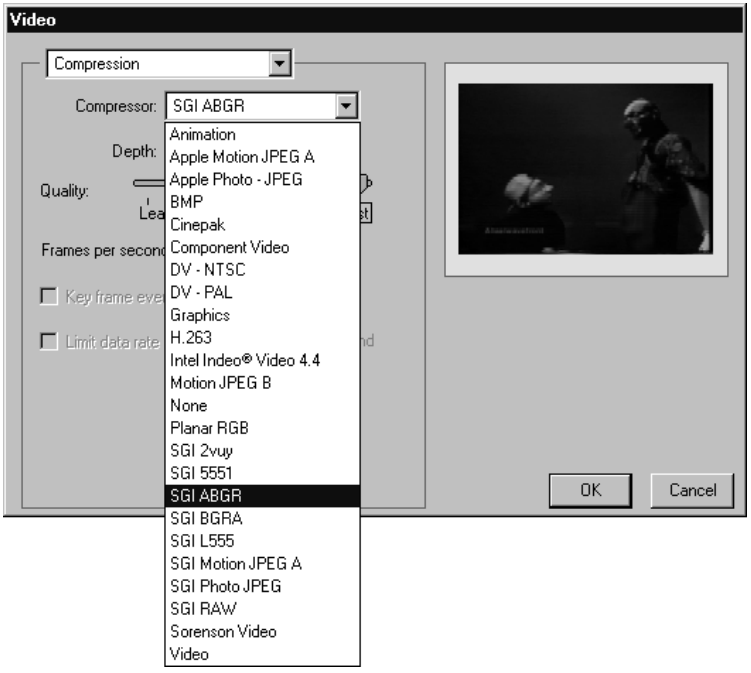

Figure 5-7 Software Compressor Choices

The list reflects all of the compressors that are registered with QuickTime. QuickTime provides a video digitizer and an Image Compression Manager (ICM) to convert from one format to another. Silicon Graphics has moved some of the QuickTime library components for video compression and conversion from the ICM into hardware, thus achieving greater efficiency and acceleration in some cases.

Silicon Graphics provides decompressors for the **DV-NTSC** and **DV-PAL** compressors shown in the list. These decompressors are decompress DV-NTSC or DV-PAL compressed video in real time.

Of the software compressors on the list shown in Figure 5-7, Silicon Graphics provides eight of them:

- **SGI 2vuy**—an uncompressed 4:2:2 format in which the first pixel contains an 8-bit U and an 8-bit Y1 component, with the next pixel containing an 8-bit V and an 8-bit Y2 component. This is the preferred format.
- **SGI 5551**—a 16-bit RGBA format, in which the pixels contain 5-bit red (R), green (G), and blue (B) components, plus a 1-bit alpha (A) component. Use this compressor for RGB formats on a Silicon Graphics workstation.
- **SGI ABGR**—a 32-bit format, in which the pixels contain 8-bit alpha (A), blue (B), green (G), and red (R) components. Use this compressor for compatibility with the Apple Macintosh platform. Use this compressor also for RGB formats on a Silicon Graphics workstation.
- **SGI BGRA**—a 32-bit format, in which the pixels contain 8-bit blue (B), green (G), red (R), and alpha (A) components. Use this format when the target system is another Windows platform (not a Silicon Graphics workstation).
- **SGI L555**—a 16-bit ARGB format, in which the pixels contain a 1-bit alpha (A) component, and 5-bit red (R), green (G), and blue (B) components. The L indicates little-endian bit ordering. Use this format when the target system is another Windows platform (not a Silicon Graphics workstation).
- **SGI Motion JPEGA**[1]—a format compatible with the Apple M-JPEGA standard, but with better performance. The file created with this compressor is compatible and playable on standard Apple codecs running under the Windows and Apple operating systems.
- **SGI Photo JPEG**[1]—a format compatible with the Apple QuickTime Photo JPEG standard.
- **SGI RAW**—the Silicon Graphics version of Apple's ARGB format, only faster. Use for Macintosh-based system compatibility.

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1 On a dual-processor system that implements the Silicon Graphics DS110 Disk Array, the SGI JPEG codecs provide real-time 30 fps capture and a quality factor of up to 90% (9:1 compression). The quality factor reflects how much detail, and therefore how many bits, are used to make up the video image.

For information on the operation of the other compressors, contact the respective company responsible for the compressor.

Depth Drop-Down Box

The **Depth** drop-down box shown in Figure 5-8 lets you choose the color depth and is compressor-dependent.

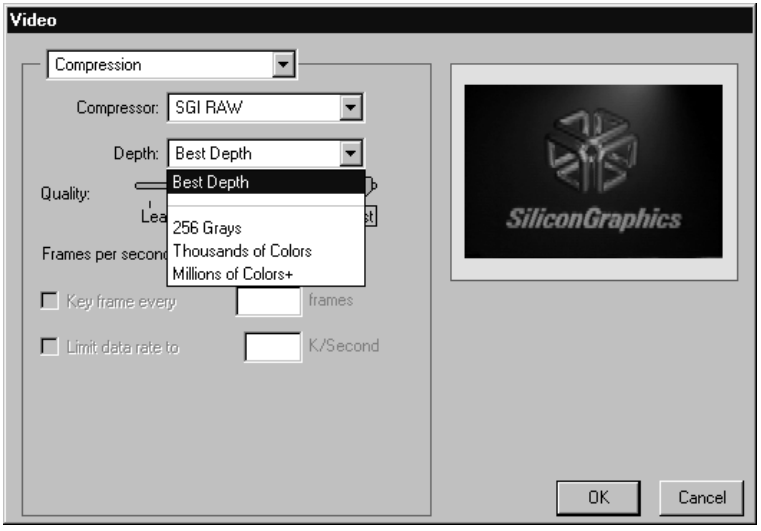

Figure 5-8 Color Depth Choices

If you have selected SGI RAW, the available choices are:

- **256**
- **Thousands**
- **Millions**

Choose **256** (Y component only), **Thousands** (16-bit 1555 big endian), or **Millions** (23-bit ARGB) of colors.

Quality Slider

The **Quality** slider causes the software compressor to adjust the compression such that the quality of the picture remains constant. The slider, which is adjustable between **Least** and **Best**, indicates the level of quality you want to maintain. As picture content changes, the software adjusts its coefficients and adjusts the bit rate up and down to maintain the quality level indicated by the slider. Use this slider control when you are more concerned about quality than the amount of disk space taken up with a video clip.

Frames Per Second Drop-Down Box

Figure 5-9 shows the choices that are available when you click the **Frames per second** drop-down box.

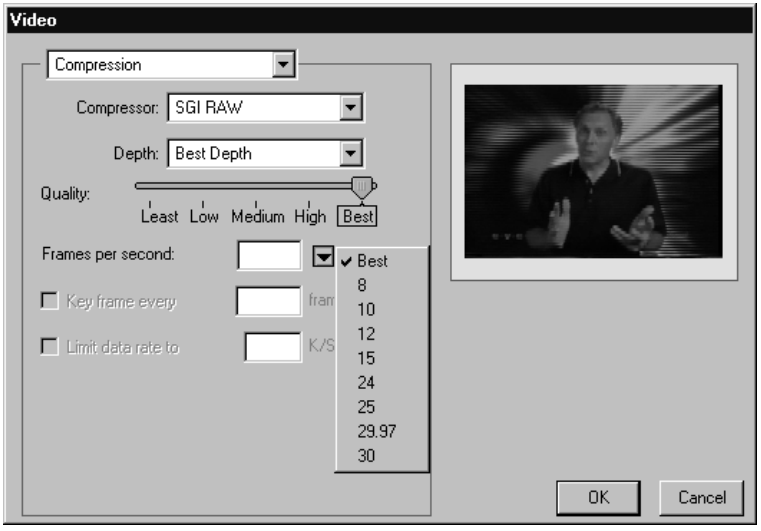

Figure 5-9 Frames per Second Choices

The choices are:

- **30**—the nominal NTSC rate
- **29.97**—the standard NTSC rate

- **25**—the PAL rate
- **24**— the film rate
- **15**, **12**, **10**, and **8**—these rates are normally used for web authoring

Key Frame Check Box

For the Silicon Graphics compressors, the **Key Frame** check box is available for compressors that do interframe coding. A key frame is a video frame that contains full video content, and is used in MPEG-2 as a reference for other frames containing video difference information. If the software compressor you have chosen does differencing between frames (for example, MPEG-2, Indio, Sorenson, and Cinepak), check the **Key Frame** check box and enter a number for how often you want a key frame to occur (a rule of thumb is one key frame every 30 frames).

The **Key Frame** box is grayed out for the SGI codecs because every frame is a key frame. This is typical of uncompressed MJPEG and DV formats that do not apply intraframe compression techniques.

If your target is the Web, CD-ROM, or DVD-ROM, you may want to capture using one of the compression codecs, such as Sorenson, to allow you to directly distribute captured material.

Limit Data Rate Check Box

Clicking the **Limit Data Rate** check box causes the software compressor to maintain a constant bit rate for capturing video. Use the box to the side to specify the bit rate in Kbps. This technique allows you to fill up the disk at a known rate regardless of the video content. However, unless you set a sufficiently high bit rate, the video quality may suffer for fast action video content.

The constant bit rate technique works well for making up an edit decision list, where high-quality video is not important, and all you need is enough content to see and recognize the captured video.

Video Playback Using Media Player

Captured video files can be played back using Media Player. To bring up Media Player, go to the taskbar on your workstation and choose **Start** > **Programs** > **Accessories** > **Multimedia** > **Media Player**.

If you capture video in RGB format, the SGI YUV-RGB recompressor allows you to change the format from RGB to YUV for display on an external video monitor.

Because the YUV format is not supported by Video for Windows, if you capture video in 16-bit YUV, the SGI YUV-RGB recompressor converts from YUV to RGB so that the video can be displayed on the computer screen.

If you play a file captured in the YUV format, it is automatically routed to the SGI YUV-RGB codec. The codec converts from YUV to RGB and sends the RGB video to the computer screen. In parallel, it sends YUV video to an externally attached video monitor.

Appendix A

NTSC and PAL

This appendix contains overviews of the NTSC and PAL standards, as well as tables listing the countries in which the NTSC and PAL standards are used. The information in these tables is subject to change and is presented here as reference only.

NTSC Standard Use by Nation

The National Television System Committee (NTSC) did most of the work developing a color transmission standard in the United States. This standard, approved by the Federal Communications Commission in 1953, was compatible with the then-current 525-line, 60 fields per second, 2:1 interlaced monochrome standard. Because of the audio subcarrier at 4.5 MHz, the color transmission was required to occupy the same bandwidth as the monochrome video signal, 0–4.2 MHz.

There are several variations of the NTSC standard, including the non-interlaced NTSC, which uses 262 lines and 30 frames per second. This standard is commonly used in video games and onscreen displays. However, the technical broadcast video standard is (M) NTSC. The M refers to the monochrome standard for line and field rates (525/59.94), an audio carrier frequency 4.5 MHz above the video carrier frequency, a video bandwidth of 4.2 MHz, and an RF channel bandwidth of 6 MHz.

The (M) NTSC standard is used for both VHF and UHF video transmission. The (M) NTSC standard is in use in the countries listed in Table A-1. A (V) after a country's name indicates that country supports only VHF.

Antigua	Aruba	Bahamas (V)
Barbados (V)	Belize (V)	Bermuda (V)
Bolivia	Burma (V)	Canada
Chile	Colombia	Costa Rica
Cuba	Çuracao	Dominican Republic
Ecuador	El Salvador (V)	Guam (V)
Guatemala	Honduras	Jamaica
Japan	Mexico	Montserrat (V)
Mynamar (V)	Nicaragua	Panama
Peru	Philippines	Puerto Rico
St. Christopher and St. Nevis (V)	Samoa (V)	South Korea
Suriname (V)	Taiwan	Trinidad/Tobago
USA	Venezuela	Virgin Islands (V)

Table A-1 NTSC Standard Use by Nation

PAL Standard Use by Nation

Europe did not implement a television standard until 1967, when Germany and the United Kingdom began broadcasting slightly different variants of the Phase Alternation Line (PAL) system. This system uses a color transmission standard compatible with the 625-line, 50 field per second, 2:1 monochrome standard.

As with the NTSC standard, there are several variants of the PAL standard, depending on the video bandwidth and placement of the audio subcarrier. The PAL composite video signal has a bandwidth of 4.2, 5.0, 5.5, or 6.0 MHz,

depending on which variant of the standard is used. The variants of the PAL standard are B, D, G, H, I, or Combination PAL, with the variant being listed in parentheses, such as (I) PAL. A noninterlaced PAL, most commonly used in video games and on-screen displays, uses 312 lines per frame.

If you need greater detail about the specifications of the PAL standard, refer to the International Telecommunications Union documentation.

The (I) PAL standard is used for both VHF and UHF transmission. The following countries use the (I) PAL standard. Countries that use the standard only for UHF transmission are followed by (U).

Angola	Botswana	Gambia
Guinea-Bissau	Hong Kong (U)	Ireland
Lesotho	Malawi	Namibia
Nigeria (U)	South Africa	Tanzania
United Kingdom	Zanzibar	

Table A-2 (I) PAL Standard Use by Nation

The (B) PAL standard is used for VHF transmission except in special cases. The following countries use the (B) PAL standard. Countries that use the standard also for UHF transmission are followed by (U).

Albania	Algeria	Australia (U)
Austria	Bahrain	Bangladesh
Belgium	Bosnia-Herzegovina	Brunei Darussalam
Cambodia	Cameroon	Croatia
Cyprus	Denmark	Egypt
Ethiopia	Equatorial Guinea	Finland
Germany	Ghana (U)	Gibraltar
Greenland	Iceland	India
Indonesia	Israel	Italy

Table A-3 (B) PAL Standard Use by Nation

Jordan	Kenya	Kuwait
Liberia	Libya	Luxembourg
Malaysia	Maldives	Malta
Nepal	Netherlands	New Zealand
Nigeria	Norway	Oman
Pakistan	Papua New Guinea	Portugal
Qatar	Sao Tomé and Principe	Saudi Arabia
Seychelles	Sierra Leone	Singapore
Slovenia	Somali	Spain
Sri Lanka	Sudan	Swaziland
Syria	Thailand	Tunisia
Turkey	Uganda	United Arab Emirates
Yemen		

Table A-3 (B) PAL Standard Use by Nation

The (N) PAL standard is used for both VHF and UHF transmission. The following countries use the (N) PAL standard. Countries that use the standard only for VHF transmission are followed by (V).

Argentina	Paraguay	Uruguay (V)

Table A-4 (N) PAL Standard Use by Nation

The (G) PAL standard is used for UHF transmission except in special cases. The following countries use the (G) PAL standard. Countries that also use the standard for VHF transmission are followed by (V).

Albania	Algeria	Austria
Bahrain	Bosnia/Herzegovina	Cambodia
Cameroon	Croatia	Cyprus

Table A-5 (G) PAL Standard Use by Nation

Denmark	Egypt	Ethiopia
Equatorial Guinea	Finland	Germany
Gibraltar	Greenland	Iceland
Israel	Italy	Jordan
Kenya	Kuwait	Liberia
Libya	Luxembourg	Malaysia
Monaco	Mozambique (V)	Netherlands
New Zealand	Norway	Oman
Pakistan	Papua New Guinea	Portugal
Qatar	Romania	Sierra Leone
Singapore	Slovenia	Somalia
Spain	Sri Lanka	Sudan
Swaziland	Sweden	Switzerland
Syria	Thailand	Tunisia
Turkey	United Arab Emirates	Yemen
Zambia (V)	Zimbabwe (V)	

Table A-5 (G) PAL Standard Use by Nation

The (D) PAL standard is used for both VHF and UHF transmission. The following countries use the (D) PAL standard. Countries that use the standard only for VHF transmission are followed by (V).

China	North Korea (V)	Romania (V)

Table A-6 (D) PAL Standard Use by Nation

The (H) PAL standard is used for UHF transmission in Belgium.

Glossary

ADAT Optical interface

The ADAT Optical interface provides a unidirectional point-to-point conversion of 8 tracks of 24-bit digital audio, with subcodes, at professional sampling rates, on a single consumer-grade optical fiber. A typical use is for data connection between multiple ADAT tape decks, for bouncing tracks between the decks.

black level

In the active video portion of the video waveform, the voltage level that defines black.

blank level

The signal level at the beginning and end of the horizontal and vertical blanking intervals, typically representing zero output (0 IRE).

brightness

The intensity of the video level relative to the display.

CCIR-601

The digital interface standard developed by the CCIR (Comité Consultatif International de Radiodiffusion, or International Radio Consultative Committee). It is based on component color encoding, in which the luminance and chrominance (color difference) sampling frequencies are related in the ratio 4:2:2: four samples of luminance (spread across four pixels), two samples of CR color difference, and two samples of CB color difference. The standard, also referred to as 4:2:2, sets parameters for both 525-line (NTSC) and 625-line (PAL) systems.

chroma (also chrominance)

In an image reproduction system, a separate signal that contains the color information. Black, white, and all shades of gray have no chrominance and contain only the luminance (brightness) portion of the signal. However, all colors have both chrominance and luminance.

Chrominance is derived from the I and Q signals in the NTSC television system and the U and V signals in the PAL television system. *See also* luma.

color burst

The segment of the horizontal blanking portion of the video signal that is used as a reference for decoding color information in the active video part of the signal. The color burst is required for synchronizing the phase of 3.58 MHz oscillator in the television receiver for correct hues in the chrominance signal.

In composite video, the image color is determined by the phase relationship of the color subcarrier to the color burst. The color burst sync is 8 to 11 cycles of 3.58 MHz color subcarrier transmitted on the back porch of every horizontal pulse. The hue of the color sync phase is yellow-green.

Also called “burst” and “burst flag.”

contrast

The difference between the darkest blacks and the whitest whites in the video signal. The greater the difference, the higher the contrast.

gain

The intensity of the video or audio signal. In audio, gain is normally associated with volume. In video, gain is the amount of a specific color signal, or amount of a combination of color signals.

gain hysteresis

The lag between adjusting a gain control and when the adjustment takes effect.

genlock

Synchronizing with another video signal serving as a master timing source. The master timing source can be a composite video signal, a video signal with no active video (only sync information), or, for video studio, a device called house sync.

hue

The designation of a color in the spectrum, such as cyan, blue, or magenta.

Sometimes called tint on NTSC television receivers. The varying phase angles in the 3.58 MHz (NTSC) or 4.43 MHz (PAL) C signal indicate the different hues in the picture information.

luma (also luminance)

The perceived brightness of a surface. Typically refers to a weighted average of red, green, and blue color values that gives the perceived brightness of the combination. For video systems, luminance is the video signal that describes the amount of light in each pixel. *See also* chrominance.

NTSC

A color television standard or timing format encoding all of the color, brightness, and synchronizing information in one signal. Used in North America, most of South America, and most of the Far East, this standard is named after the National Television Systems Committee, the standardizing body that created this system in the U.S. in 1953. NTSC uses a total of 525 horizontal lines per frame, with two fields per frame of 262.5 lines each. Each field refreshes at 60 Hz (actually 59.94 Hz).

pixel aspect ratio

The ratio of the width to the height of an image. For example, the standard aspect ratio for television is 4:3. Maintaining the original aspect ratio of an image prevents it from being distorted.

PAL

A color television standard or timing format developed in West Germany and used by most other countries in Europe, including the United Kingdom but excluding France, as well as Australia and parts of the Far East. PAL uses a total of 625 horizontal lines per frame, with two fields per frame of 312.5 lines per frame. Each field refreshes at 50 Hz. PAL encodes color differently from NTSC. PAL stands for Phase Alternation Line or Phase Alternated by Line. This system attempts to correct some of the color inaccuracies in NTSC. *See also* NTSC.

saturation

Color intensity; zero saturation is white (no color) and maximum saturation is the deepest or most intense color possible for that hue. Saturation does not mean brightness. In signal terms, saturation is determined by the ratio of luminance level to chrominance amplitude. *See also* hue.

sharpness

The clarity of the video signal, a combination of color, brightness, and intensity. Sharpness differs from focus.

S-Video

Video format in which the Y (luminance) and C (chrominance) portions of the signal are kept separate. Also known as YC.

YCbYCr

The color space in 4:2:2 digital component video that allows compatibility among various television signal standards where Y is luma, Cb and Cr are color difference signals that are scaled and offset versions of (Y,B'-Y) and (R'-Y) signals.

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