47

VIDEO CAPTURE CARDS

CHAPTER AT A GLANCE

Of all the expansion devices that have become available for PCs over the last decade, *video capture* boards (Figure 47-1) are certainly some of the most exciting. The ability to record sound and video on a PC has been an important element in the push toward desktop multimedia PCs. The captured data can be edited, enhanced, and incorporated into any manner of computerized presentation. Such potential makes the video capture board ideal for applications in areas ranging from real estate to business to medicine—even Internet-based video conferencing. This chapter introduces you to basic video recorder concepts, outlines a typical installation process, and shows you how to deal with a wide range of problems that can accompany the hardware.

FIGURE 47-1 A typical PC video capture board (Intel Corporation)

Understanding Video Capture Boards

The first step in dealing with video capture problems is to understand the overall processes that make the board work in the first place. Figure 47-2 illustrates a multi-function video board that doubles as a capture board, a VGA video adapter, and a "video output" system (to drive things such as a TV monitor or VCR).

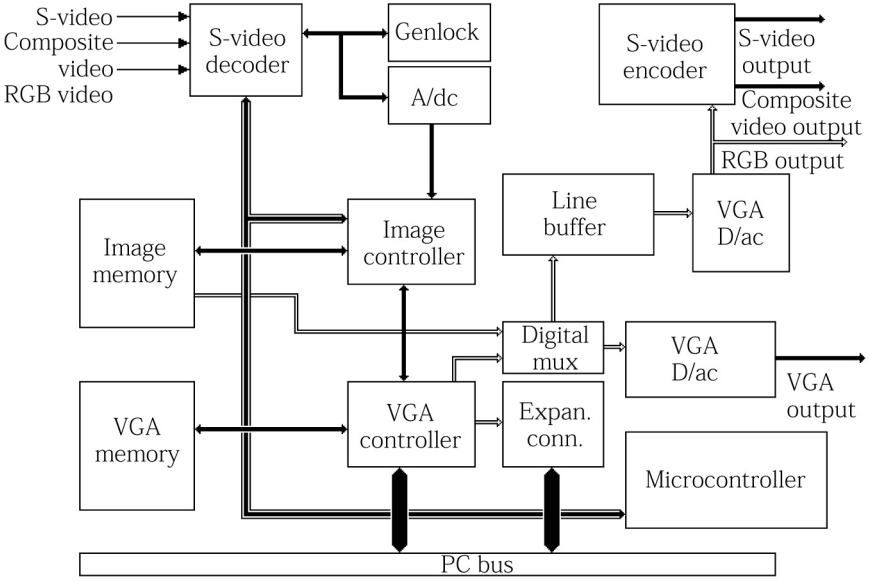

FIGURE 47-2 Block diagram of an integrated video capture/VGA board

The capture board plugs right into any available ISA slot. Keep in mind that the card shown in Figure 47-2 is only one type of video capture product. Most of the newest video capture-type products use the PCI bus for high-performance data transfer, and a few multi-function cards (cards that integrate the video adapter, graphics accelerator, PC-TV, MPEG decoder, and so on) will use the AGP slot.

HOW A CAPTURE BOARD WORKS

The heart of the board is a *microcontroller*, which directly operates the *video decoder* and *image controller* chip(s). Video signals entering the decoder are converted to analog RGB (red, green, and blue) data. The *genlock* circuit is a high-frequency clock source that is phase-locked to the horizontal sync signal of the video source. The ADC (analog-to-digital converter) circuits use the genlock signal as a basis for digitizing the video (not all video capture products offer a genlock feature). The image controller (which can be set to operate in several different color modes, such as 15-bit, 16-bit, and 24-bit modes) directs the transfer of digitized image data into *image memory*. Image memory can then be read from a second data bus directly to a *digital multiplexer*. The multiplexer selects data from either the image memory or the *VGA controller* to be passed on to the *VGA DAC* (digital-to-analog converter), where data is converted into analog form to drive the monitor. Thus, you can see the digitized video image on the monitor while it is being recorded.

The capture board also contains a standard VGA subsystem that provides a VGA video adapter for the PC on the same board. The VGA controller IC manages the video adapter operations and stores graphics information in the *VGA memory*. The VGA controller can be addressed directly from the expansion bus. When the capture circuit is idle, the VGA controller passes data from the VGA memory on to the data multiplexer, where it is converted to analog RGB monitor signals. Not all video capture devices include an on-board video adapter—many only capture video, using the existing video adapter for "preview" and "playback."

The capture board in Figure 47-2 offers an added bonus—a video drive subsystem. Video data is passed through a line buffer. The line buffer (also dubbed a "scan converter") converts the data to NTSC data rates, then passes the data on to a stand-alone VGA DAC. The analog RGB signals are sent to an output port, as well as processed through an S-video encoder, which provides an independent video source. This system is ideal for observing the VGA image on a TV or recording it to a VCR. Figure 47-3 shows you the typical connector arrangement for such a multi-function capture board. As a technician, you should realize that only a few video capture boards provide built-in VGA adapter support or an independent video output.

THE CAPTURE PROCESS

Now that you have some insight into how a basic video capture board works, you can understand how the video capture process works in the PC as a whole. Figure 47-4 shows you a "roadmap" of audio and video data through the PC. As with all capture systems, the process begins with a *video source*. In today's PCs, the source can be virtually any video device, such as a camcorder, VCR, or laserdisc/DVD player. Video signals are sent to the capture board, while sound is sent to the PC's sound board.

The video capture board digitizes the video signal. Some boards—such as Intel's Smart Video Recorder (or "SVR") family—will process and compress the video data "on-the-fly" (also known as *hardware-based compression*). Data is then stored in system RAM. Audio is digitized by the sound board, and that audio data is also placed in system RAM. With software tools like Microsoft *Video for Windows*, sound and video data are synchronized together, then stored on the hard drive in a standard file format, such as Audio-Video Interleave (or AVI). While data is being moved to the hard drive, additional data

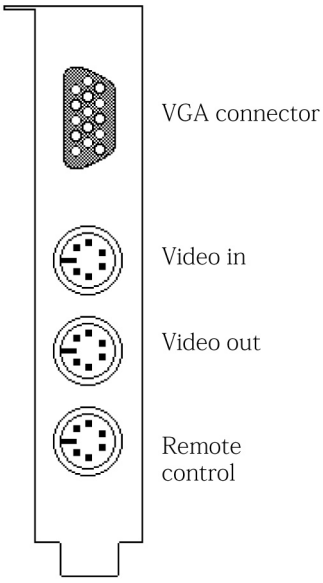

FIGURE 47-3 Typical video capture board connections

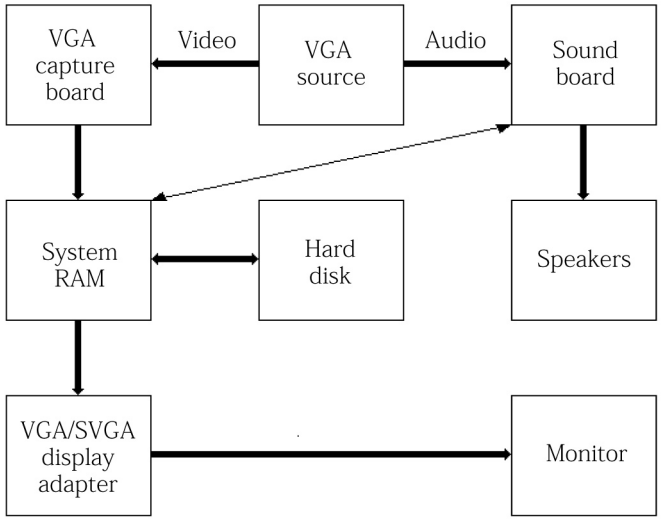

FIGURE 47-4 The audio/video capture and playback "map"

compression techniques (or *software-based compression*) can be applied to reduce the overall resulting file size.

During the playback process, files are read from the hard drive and expanded (if necessary, with software decompression techniques) into system RAM. Sound and video data are separated. Video data is sent to the display adapter and on to the monitor. Sound data is sent to the sound board, where it is processed and passed to the speakers. Thus, sound and video can be repeated as required or used in conjunction with other computer packages (such as presentation packages).

THE ROLE OF A CODEC

Video capture produces a *tremendous* amount of data. Just consider a single 320x200 frame, which is made up of 64000 pixels (320x200). If you are using a color depth of 65536 colors, each pixel would need 16 bits (2 bytes), or 128KB per frame. If you are trying to capture ten complete frames per second, more than 1.28MB per second will have to be channeled into system RAM. As you might imagine, it would not take more than a few seconds to use up all the available RAM in a PC. However, much of the video data captured in each frame is repetitive—it can be compressed before storing data in RAM or on the hard drive, then decompressed during playback. As a result, the actual data stored in the system can be much less than it would be otherwise.

The *Compressor/Decompressor* (or *CODEC*) is responsible for reducing this data load. A well-designed CODEC can reduce this data overhead without measurably reducing the quality of an image. CODEC functions can be implemented in hardware as a digital signal processor or in software as a driver. Today, there are four major CODEC techniques: Cinepack, Indeo, Video 1, and RLE. Cinepack is perhaps the best CODEC, offering very good compression for fast action sequences (where data changes rapidly) with little loss of image quality. However, Cinepack compression is a very slow process—not really

appropriate for "on-the-fly" compression. Intel's Indeo video is much faster than Cinepack, but it is not well-suited for quickly changing data such as that found in fast action sequences. Video 1 and RLE are generally used only for slow animation or palletized video.

INTEL INDEO VIDEO

Indeo video is Intel's digital video capture, compression, and decompression software. The technology revolves around a software-based CODEC (a driver) that compresses digital video data for storage, and decompresses it for playback on a multimedia PC. In order for a computer to play files compressed with Indeo video, the Indeo video CODEC must be installed on the computer, using the setup program provided by Intel. You can check for the presence of Indeo video drivers using the following steps:

1. Click Start, select Settings, and then open the Control Panel.
2. Double-click on Multimedia.
3. Select the Advanced tab.
4. Double-click on "Video Compression Codecs" (Figure 47-5).
5. Double-click on the Indeo video drivers you see listed.
6. Click Settings. An "About" box appears containing the version number.

If there no Indeo video drivers are listed, they are not installed.

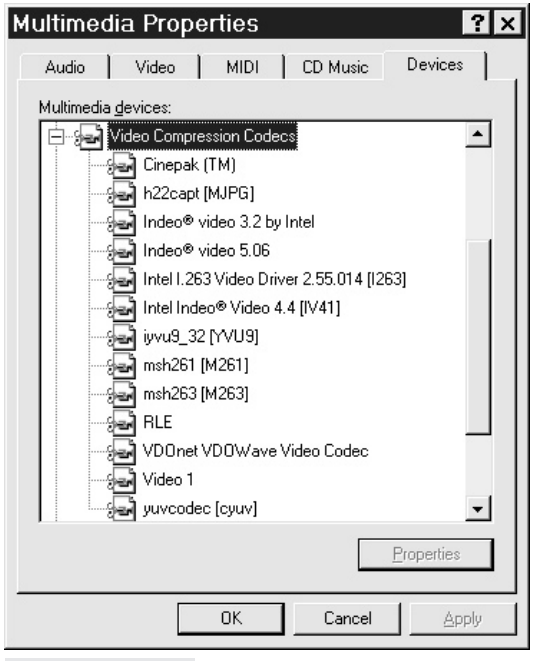

FIGURE 47-5 Checking for Video Compression Codecs under the Multimedia icon

Installing a Video Capture Card

Today's video capture devices are typically PnP devices that are designed for automatic detection and resource assignments. Still, most capture problems *start* when the card is first installed in the system—usually problems are due to inadequate or incorrect installation of the hardware and software. This part of the chapter offers an overview of the installation process, so that you can check for missing steps.

Always use proper static precautions (such as an antistatic wrist strap) when working inside a system with sensitive devices—such as the video capture card.

HARDWARE INSTALLATION

Following are the hardware-related steps to be followed when installing a new video capture card:

1. Shut down Windows 98/SE, and then turn off and unplug the computer.
2. Unbolt the outer case, and then remove the housing and set it (and the screws) aside in a safe place.
3. Remove the old video adapter (if necessary). If your video capture card integrates the features of a video adapter and/or graphics accelerator, you may need to disconnect your monitor and remove the existing video adapter from the system first. If the video adapter is integrated onto the motherboard, you'll need to disable the video adapter through a jumper or the system's CMOS Setup. If the video capture card will exist alongside the current video adapter, you can skip this step.
4. Locate a slot for the video capture card. Many capture card devices will require a PCI slot, though some "integrated" video capture cards (those including the video adapter, MPEG-2 decoder, and so on) may need an AGP slot. Find an available slot that's appropriate for your capture card. Remove the cover for the slot you intend to use (if it's not already removed), and save the screw for the mounting bracket.
5. Insert the video capture card. Push the card in firmly and evenly until it's fully seated in the slot. Replace the screw to secure the bracket of your capture card to the computer's chassis.
6. Make your signal connections. You'll need to connect your external devices to the video capture card. Here are just a few of the connections you may need to make (your capture card may have more or fewer connections depending on its particular features):
   - **Monitor** If your video capture card is taking the place of your existing video adapter, double-check that the monitor cable is also secure at the monitor end.
   - **Video Input** This is the primary video input (usually through an S-video or RCA jack), which allows you to display and capture video from a VCR, camcorder signals, or ordinary TV video signals.
   - **Audio Line Output (LineOut)** Of course you'll want to hear the captured audio through your system's speakers, so connect this output to your sound card's LineIn connection (if necessary). Your capture card package will usually provide a short patch cable for this purpose.
   - **Audio Line Input (LineIn)** This is sound input: where you should connect the sound source from a VCR or video camera.
   - **TV Output** If your capture card provides an output that will drive an external TV (dubbed a "scan converter" feature), you can connect the remote TV to this jack. Remember that if your remote TV has a TV/video switch, be sure that it's set to the *video* position. Similarly, you can attach this output to a VCR, but you'll need to set the VCR's tuner/line switch to the *line* position.

The ability to handle TV input and output signals often allows you to record TV shows or prerecorded video tapes through your capture device. Keep in mind that the unauthorized recording or use of broadcast television programming, videotape, or other copyrighted material may violate copyright laws. In most cases, you cannot record from a copy-protected video source.

SOFTWARE INSTALLATION

Now that the physical hardware for your video capture card has been installed, it's time to install the capture drivers and application software that you'll need in order to identify the device under Windows 98/SE, view and record your video signals, and edit the captured video to an AVI or MPG file. Leave the computer's housing off for now, but reconnect the AC cord to the computer and prepare to start the system again.

Always refer to the README file on the video capture card's driver disc to obtain the very latest feature descriptions and software installation guidelines for your particular card.

In virtually all cases, the video capture system will require a recent version of *DirectX*. You should download and install the very latest version of DirectX before proceeding with the software installation. You may need to install DirectX in order to utilize all the features of your video capture device.

- *Reboot the computer*. Turn on your computer and allow Windows 98 to boot normally. In virtually all cases, Windows 98 will detect the video capture card automatically at start time. Windows usually reports finding a "PCI adapter" (even if you're using an AGP card).
- *Install the display drivers (if necessary).* If your capture card is now serving as the video adapter, you should install the display drivers now, and then reconfigure the Display settings for a suitable resolution and color depth.
- *Install the video capture drivers.* After the computer restarts, you should insert the driver/software CD in the drive. Chances are that an AUTORUN.INF file will launch the driver installation automatically. Follow the on-screen instructions to install the video capture driver files, and then restart your computer so that your changes can take effect. Doing this will probably add one or more entries for your capture card to the "Sound, video, and game controllers" portion of your Device Manager. Leave the CD in the drive.
- *Expect system tests*. Once you reboot the system, there may be one or more performance tests that will evaluate the performance of your hard drive and system—any results will generally be used to limit your video capture settings. You may need to reboot the system again.
- *Test your setup.* Now it's time to see that your hardware is working properly. If your installation CD offers a "diagnostic" mode, check to see that all of your connections are secure, and verify that the video capture card hardware is responding. For example, you may be able to attach a video camera and see the picture in a "capture overlay" window. You may need to reboot the computer before proceeding.
- *Install the applications.* One of the final steps is to install the related application software that supports your video capture card (the capture and editing software tools). Select each utility that you want to install, and then follow the on-screen instructions to load and test each utility.

VIDCAP DRIVER NOTES

The heart of your video capture software is the video capture (VIDCAP) driver. This is the interface through which you'll select a video source, video format, capture window size, capture data rates, and

other attributes. A typical VIDCAP driver will offer three setting areas: the video source, the video format, and overlay/preview settings.

Video Source

This window is where you'll select the source of the video signal to be captured (Figure 47-6). The *Video channel* area typically allows for S-video, Composite video, and TV tuner video (cable or antenna). The dialog in Figure 47-6 even allows you to select the channel that you want to capture from. The *Standard* area lets you select the video format that you'll be capturing. You can choose NTSC, PAL, or SECAM, depending on your region of the world. If your capture card provides a "scan converter" to support a remote television output, you can select the "Output to TV" check box to enable this feature.

Video Format

The video format dialog allows you to define the color characteristics of your captured video. The RGB mode allows you to select a basic "uncompressed" AVI video format in 8-bit color (256 shades of gray), 16-bit color (*high-color* mode), or 24-bit color (*true-color* mode). If you select MPEG or MJPEG as the video format, you'll compress the captured video into an MPG file. You can configure many of the capture characteristics in the MJPEG Settings dialog (Figure 47-7). "MJPEG dimensions" allows you to select the size (resolution) of the capture frames: full size, half size, CIF, and QIF. The smaller your capture window, the less data will be generated (and less storage space needed). When you're recording in MJPEG format, you can select the amount of compression to be applied in the "MJPEG quality" area. Since MPEG formats use *lossy* compression techniques, "lower" quality will result in faster capture rates, but poorer image integrity. The dialog of Figure 47-7 also illustrates the "required" and "available" hard drive data transfer rates, so that you'll be able to keep your video capture selections within the capabilities of your storage system.

Overlay and Preview Modes

The video capture program that you're using may give you a choice of *overlay* or *preview* modes. When the MJPEG video format is selected, overlay and preview settings have no effect. If an RGB video format is selected, overlay and preview settings affect how video is viewed or captured:

- In the overlay mode, the video signal appears in its capture windows in real time because the video signal is not being processed through the VIDCAP algorithm. This feature is handy because you don't spend vital processing time viewing the image as if you were capturing it.

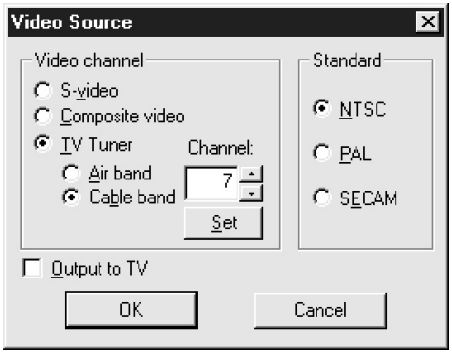

FIGURE 47-6 Configuring the source characteristics for video capture

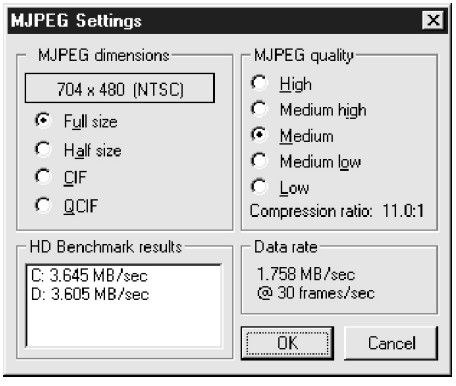

FIGURE 47-7 Configuring the capture MJPEG settings

- In the preview mode, the video signal is processed as if it were being captured. You may notice a low frame rate in the video window (the video may appear "jerky"). This mode is a somewhat more accurate representation of how the video capture system will handle the capture after the process starts.

Making the Most of Video Capture

Even under the best of circumstances, video capture presents a serious challenge to system processing. The challenge of video capture is to record an image of adequate quality at a window size large enough to be meaningful, while maintaining a frame rate high enough to reproduce smooth motion. High quality video capture requires a careful balance of processing power with window size, frame rate, and original image quality. This part of the chapter outlines some issues to consider when capturing video.

IMAGE WINDOW SIZE

It takes a finite amount of time to put a pixel on the screen—the more pixels that must be generated, the more time is required. Since larger playback windows contain more pixels, it takes more time to "draw" each playback frame. This in turn reduces the frame rate. Larger playback windows also result in larger video files. Faster machines can support larger playback windows for any given frame rate. There are typically three playback window sizes:

- 320x240 is considered ideal for many multimedia applications, but it is limited to slower frame rates (unless you're using a reasonably FAST computer).
- 240x180 is regarded as a good intermediate window size across a range of frame rates.
- 160x120 is the smallest commonly used video window size, but it allows the fastest frame rates.

IMAGE FRAME RATE

Frame rate has a highly significant influence on playback quality. Faster frame rates provide smoother images (especially for moving images or action shots), but they are processor-intensive and generate more data. Smaller playback windows can usually sustain a higher frame rate, and vice versa. Faster machines can support faster frame rates for any given playback window size. The most common frame rates are listed below:

- **5–10fps** Used for low data-rate applications like video conferencing or Internet video.
- **15fps** Considered satisfactory for most multimedia presentation applications.
- **24fps** The frame rate at which motion pictures are projected in theaters.
- **25fps** PAL (Europe) broadcast television frame rate.
- **30fps** NTSC (USA, Japan) broadcast television frame rate.

VIDEO SOURCE QUALITY

The most important factor affecting the quality of your final video capture file is the quality of the *original* source video. Compression cannot recreate detail that wasn't present in the original image, but it *can* take

artifacts present in the original video (such as static) and potentially make them worse. So it is important that the best video source possible be used to create compressed video files.

Compression algorithms (such as Cinepak or Indeo video) analyze the digitized video input stream searching for redundant or predictable data patterns that can be compressed and reconstructed later. The CODEC compressor interprets noise or artifacts digitized from the analog source as *nonredundant*, unpredictable data and therefore wastes valuable CPU time and file space attempting to accurately compress and store these deficiencies. That's why the quality of the original source video is so critical to the quality of the resulting compressed digital video file. Video artifacts can also look worse after compression than they did originally.

Capture your source video using a high-quality video tape format. The best source video uses S-Video, rather than composite formats. S-Video signals carry separate signals for *luminance* (brightness) and *chrominance* (color)—resulting in higher bandwidth and an improved signal-to-noise ratio. Composite video sources modulate the luminance and chrominance together on one signal, which lowers both the bandwidth and the signal-to-noise ratio. Composite video signals are also subject to video artifacts, such as color bleeding. The available formats are outlined below (in order of image quality):

- **D1 and Digital Betacam** D1 and Digital Betacam actually store video information digitally (rather like an audio CD). Both formats are broadcast quality but expensive, even for a professional's budget.
- **D2** D2 is the digital composite cousin of D1 and is similar to D1 in both quality and expense.
- **Betacam SP** Betacam SP is the most widely used analog recording format for video creation and post-production. Its high quality makes it an ideal choice for professional and semiprofessional multimedia authoring.
- **1" Type C, ¾" U-Matic** 1" and ¾" literally refer to the width of the recording tape used in each format. 1" is an open reel-to-reel format, and ¾" is a cartridge format. Both are older professional studio formats. Both produce better results than consumer formats, but they have been almost entirely supplanted by the newer and better Betacam SP format.
- **Videodisc/DVD** Despite being a composite format, videodisc (also known as *laserdisc*) still provides good overall quality. Some videodisc players provide S-Video outputs, though the original signal is still composite, and low-cost electronics can sometimes make these S-Video outputs worse than the composite. For our purposes, the DVD video output is about the same quality as a videodisc.
- **Hi-8, Super-VHS** Hi-8 and S-VHS are consumer formats, so they're inexpensive and easily available. Both produce good results for desktop and consumer use.
- **VHS** VHS is the familiar home consumer format. Its composite signal and low-end recording and playback mechanisms make it the lowest in quality of any available format, and it is not suitable for commercial multimedia.

COLOR

As with lighting, selecting colors and arranging color in a scene can effect the overall quality of your video source. Use the points below to optimize your use of color:

- *Avoid saturated colors in the scene* Video with highly saturated colors (especially red) can bleed or appear blocky—particularly when viewed on 8-bit (256-color) displays.
- *Avoid adjacent areas of high contrast* For example, a white shirt with black stripes is a poor choice. Sudden changes in brightness levels can emphasize color bleeding and create edges that are more difficult to compress.

- *Avoid extremely thin horizontal or vertical lines* Areas of fine detail are not always particularly visible after compression, especially when displayed in a small video playback window. Extremely fine lines or patterns (such as those that are one pixel wide) can distort the source video image. Such distortion looks bad and makes the image extremely difficult to compress successfully.

LIGHTING

If you've ever snapped a photo, you've probably been concerned with lighting. Lighting is just as important with video and can effect the overall image quality used during the capture. The following points offer some lighting tips to produce the clearest images and minimize the noise often produced in poor lighting environments:

- *Use ample light* Adequate lighting is vital for creating high-quality video. Most consumer video cameras generate noise in low light. Random noise in an image decreases the redundant information and leads to poor compressed video quality and larger image files.
- *Avoid fluorescent light* The "color temperature" of fluorescent light makes videos look blue-green. If you're in an office, shoot near windows to use the natural light. Place the camera between the windows and the subject (don't use the windows as a background, as doing this would place your subject in a shadow).
- *Use natural light wherever possible* The best light occurs outside on a cloudy or overcast day, because the light is evenly diffused. Direct sunlight can create areas of deep shadow where video noise can be prominent.
- *Use a reflector to bounce light onto your subject* Reflectors produce more even lighting and can also reduce areas of deep shadow.

CAMERA TECHNIQUES

The way in which you use the camera to record original video will also have a profound impact on the way in which the CODEC can compress the video during capture. The following tips can help you get the most compression potential from your camera techniques:

- *Use a tripod* Even the best hand-held video camera moves, and this movement is always noticed by the viewer. Also, because a camera on a tripod is steadier, more information is redundant between frames—yielding better compression.
- *Use close-ups* Remember that your video will probably be played within a relatively small window on a computer monitor. Close-ups work well to emphasize your visual message in this medium and reduce the small detail that may be lost during compression anyway.
- *Don't overuse pans and zooms* Pans and zooms limit how much can be compressed because nearly every pixel can change between frames. Rather than zooming, break the action up into two static shots (one close-up and one long shot). Use other techniques to create visual excitement. For example, instead of centering your subject in the frame, create a more dynamic shot by placing the subject to one side of center and directing your attention to the other side of the frame.
- *Use auto-focus wisely* The auto-focus feature of most modern video cameras works well for most medium and wide shots, but don't use it in close-ups where the subject is moving, or when zooming in on a subject. The entire image gets blurry for a moment, then sharp as the camera attempts to stay focused on the object in the center of the frame. The result is distracting and limits the effectiveness of

compression because every pixel changes as the camera refocuses. Instead, lock your camera on non-auto focus, zoom in tight on the subject, and then manually focus and zoom back out to frame the shot *before* you shoot.

Troubleshooting Video Capture Boards

Like most other expansion devices, video capture products generally make use of highly integrated, proprietary chips. As a result, it can be extremely difficult to troubleshoot the capture board to the component level. Fortunately, there are a large number of capture problems that can be tracked to installation, setup/configuration, or operational errors. When diagnostics can isolate problems to the capture board itself, it is a simple matter to replace the capture board outright.

HARDWARE CONFLICTS—VIDEO CAPTURE DEVICES

Hardware conflicts are much more prevalent in today's systems than in systems of only a few years ago. Sound boards, MPEG decoder cards, modems, drive controllers, network interface cards (NICs), and video capture boards all contribute to the congestion that fills up a system and demands its available resources. Most devices require an interrupt (IRQ), one or more I/O address settings, an occasional direct memory access (DMA) channel, and possibly some small amount of memory for a BIOS (firmware). Unfortunately, those resources are scarce in most PCs, and you must be aware of what resources are available and what is being used before adding new devices to your system. When configuring a system from scratch, it is a simple matter to make a written record of each device setting. But with so many new upgrade options, keeping a written list up-to-date can be a difficult effort. The use of Plug-and-Play also makes "presetting" a device's resources difficult. As a technician servicing and upgrading customer's systems, you will rarely have the luxury to perform such a thorough analysis. Your most effective course is to analyze the free resources available through the Device Manager before starting your installation.

All CPUs operate linearly—that is, they tackle only one task at a time. When a device such as the keyboard needs the CPU to perform important work that cannot wait for free CPU time, an interrupt signal is generated that forces the CPU to put aside whatever it was doing and respond to the interrupt immediately. When the device requesting the interrupt has been taken care of, the CPU can return to whatever it was doing until the next interrupt comes along. The problem is that only *one* device can use any one interrupt. If two or more devices try to use the same interrupt at the same time, one of those conflicting devices will not operate properly. In mild cases, this condition may appear simply as system hesitation. In serious cases, IRQ conflicts can crash your system. When you find that more than one device is using an interrupt, you must place one of those conflicting devices on an unused IRQ. IRQs can usually be changed by altering a jumper or DIP switch on the expansion board or through the device's Properties dialog under Windows 95/98. You can recognize the effects of IRQ conflicts between a video capture board and other devices in your system from the following symptoms:

- Video frames are dropped during video capture or playback.
- The video capture or playback process is slow or jumpy.
- The system or VIDCAP software hesitates or hangs up (crashes) completely.
- The display or data file generated during capture is corrupt.
- Audio is not captured or played back properly (if at all).

An I/O address works a bit differently. Most devices require one or more addresses to exchange data and instructions between its "registers" and the system. This I/O address works in conjunction with an IRQ, although an IRQ can be changed without changing the I/O address. All devices must use a unique I/O address. Otherwise, one device may try writing data while another device tries to read data, and the operation of both devices will be affected. I/O conflicts may also result in system crashes. As with IRQs, it is important that each device be assigned to its own unique I/O address. If more than one address is needed, there can be *no* overlap of addresses at all. When more than one device attempts to use the same address, you must move one of the devices to an unused area. I/O settings can usually be changed by altering hardware jumpers or DIP switch settings on the expansion board or through the device's Properties dialog under Windows 95/98. You can recognize the effects of I/O conflicts between a video capture board and other devices in your system from the following symptoms:

- The video capture board installation program or device driver refuses to recognize the presence of the capture card (or to initialize the capture card).
- Microsoft *Video for Windows* (or other capture application) can't initialize the capture device.
- The video capture board works erratically or fails to respond at all.

Removing/Disabling Older Video Capture Devices

Video capture devices can be very sensitive to the presence of other video capture devices or older drivers. Before you install a new video capture device, make it a point to remove the old video capture device (if it's still in the system) and remove all of the drivers and applet software that supported the older capture device. It's normally a simple matter to remove an older video capture card and uninstall its corresponding software, but getting rid of those older CODECs can be tricky unless you know where to look. Start by removing the old video capture device through the Device Manager:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the System icon.
3. Select the Device Manager tab.
4. Click on the plus (+) sign to the left of "Sound, video and game controllers."
5. Click on the older capture driver that you want to remove, and then press the Remove button.
6. Reboot your system.

When the system reboots, verify that the CODEC(s) have been removed:

1. Click Start, highlight Settings, and then click Control Panel.
2. Double-click the Multimedia icon.
3. Select the far-right tab (in Windows 95 it's called Advanced, and in Windows 98 it's called Devices).
4. Click on the plus (+) sign to the left of Video Capture Devices.
5. Click on the device that you want to remove, and then click the Remove button. If the system won't let you remove the CODEC, it's probably still listed in the Device Manager and should be removed there first.

6 If the CODEC is related to other elements of your graphics card or TV tuner (and you *cannot* remove the CODEC), you can select the device by clicking on it, and then clicking on the Properties button. Select "Do not use this capture device," then click the Apply button. You will have to restart Windows for this change to take effect.

B&W Errors

If you notice that the color source image in your preview/overlay window is in black and white, and any captured clips are played back in black and white, there may be a setup or configuration issue that you need to correct. These problems are usually fixed by adjusting Video Source settings. Use either Adobe Premiere or the VIDCAP to bring up the Video Source settings screen. Check the following points:

- *4.43MHz color carrier (or some other unusual color model) has been selected.* Remove the check in the 4.43MHz color carrier checkbox by clicking on it.
- *The Saturation setting is set to zero (or nearly zero).* Click on the Default button: brightness, contrast, sharpness, brightness, and hue will be reset to their default values.
- *The video input Standard setting is set to PAL, rather than to NTSC.* At the top of the Video Source dialog (in the box marked "Standard"), set this to NTSC.
- *If you're using S-video cables for input/output, they may be damaged.* Try replacing the S-video cable(s).

Audio/Video Sync Issues

When you capture audio and video simultaneously, it's important that the audio and video components of the capture remain properly synchronized. Otherwise, sounds and voices will not mesh, and the capture won't playback correctly. This part of the chapter provides some tips that may help you correct A/V synchronization issues.

Synchronization is sometimes a problem on captured clips that have yet to be made into a movie. In such cases, the capture rate is usually too high for the hard drive to play back the file. The solution is to lower the capture rate and recapture again. If frames are being dropped during the capture process, continue to lower the data rate and recapture until no frames are dropped. If the problems still occur after lowering the capture rate substantially, check and correct the "setting suggestions," as shown below. If the problems occur on clips that have been compiled (for instance, a completed MPEG file), the problem could be caused by numerous issues, such as:

- The computer's hardware and/or operating system settings are incorrect.
- The capture settings are incorrect.
- The MPEG file settings are incorrect.
- The original clips have dropped frames from the capture.

SETTING SUGGESTIONS

Here are some suggestions for setting up your audio and video systems:

- Check the version of your video capture driver and upgrade to the current driver if necessary.

- If you're using Adobe to develop your video, upgrade older versions of Adobe to the current versions: for Windows 95, use version 4.2 or later.
- Make sure that the drivers for your sound card, video adapter, and hard drive controller are all up-to-date. Under Windows 95, there are settings for disabling the software cache for your hard drive:
  1. Open the Control Panel, double-click the System icon,
  2. Select the Performance tab and click File System.
  3. Set the read-ahead cache to "None." Go from there to Troubleshooting and put a check in the "Disable write-behind caching" checkbox.
  4. Open the Control Panel, double-click the System icon, and select the Device Manager tab. Check for exclamation marks or question mark on any devices. If there are problems, reconfigure or reinstall the offending device(s).
- Review the CONFIG.SYS and AUTOEXEC.BAT files, and disable any TSRs or old 16-bit drivers.
- Turn off any background applications to open as much conventional memory as possible:
  - Turn off the wallpaper.
  - Turn off the screen saver.
  - Disable any real mode drivers.
  - Disable MS Plus "System Agent."
  - Disable any virus checker.
  - Delete any unnecessary fonts.
- Change the resolution of the display adapter—reduce it to 800x600x16.
- Disable the video acceleration on your display adapter.
- Make sure that the computer is not connected to a network (if it is, log out).
- Make sure that the hard drive that is receiving the captured video is set to 32-bit mode. Hooking up a device that only uses 16-bit drivers will cause all devices on the chain to work in 16-bit mode.
- Defrag the capture drive.
- Run ScanDisk on the capture drive.
- Make sure that compression software (such as. DriveSpace) is not being used.
- Make sure that the hard drive you're capturing video to is a high-performance drive (such as a UDMA/66 or WideSCSI-2).
- Try a second HDD for the video capture.
- Make sure that there is an adequate amount of RAM in the system. If you're editing a lot of clips and transitions, plan on at least 64MB.

TROUBLESHOOTING TIPS

Although video capture and playback devices can sometimes be daunting, there is a series of fairly "standard" troubleshooting policies that can help you track down potential problem areas quickly:

- *Use the latest drivers.* Video capture, MPEG, and CODEC devices depend on drivers. Buggy or outdated drivers can easily result in errors and poor performance.

- *Run in the 8-bit (256-color) graphics mode.* Running in any "lower" mode will result in extremely poor image quality. If you have sufficient video memory and PC processing power, you should run in the 16-bit (or high-color) video mode.
- *Use care in the installation of drivers—especially with capture drivers that depend on DirectDraw and ActiveX resources under Windows 95/98.* You may need to update or reinstall these resources (DirectX, for example) after the capture device is installed.
- *Be sure to use a strong and clean signal for recording.* Your capture is only as good as the original signal.
- *Be sure to use good-quality cabling.* Poor cabling and connectors can easily degrade even strong video signals. Check that all of your video/audio cables are secure.
- *When using MPEG and capture devices, use moderate video resolutions and refresh rates.* These devices normally "downshift" higher refresh rates during play, and the flicker can be quite noticeable at high resolutions.
- *Don't shift video modes while MPEG or capture devices are in use.* The change in the video drivers can crash the computer.
- *Disable power management features such as APM when using video capture, MPEG, and playback devices.* The computer can crash if the system shuts down into suspend mode while these devices are in operation.
- *PCI video devices often depend on the correct configuration of a PCI bus slot. Check the slot's configuration under your CMOS Setup.* In some cases, you may need to move the PCI video capture card to a higher priority slot (usually closet to the AGP slot).

INSTALLATION SYMPTOMS

SYMPTOM 47-1 When you connect a camcorder, your capture software crashes with a "fatal exception" error In virtually all cases, the incorrect drivers have been installed on the system. Try reinstalling the capture software and supporting files such as. DirectX) from the manufacturer's CD, or download any patches or updates from the manufacturer's web site. During your reinstallation, make sure that you are installing drivers and files for the correct video capture hardware model.

SYMPTOM 47-2 When launching your video capture software, an error indicates that the capture hardware is not found In most cases, you *must* run video capture software with the hardware that it was designed/optimized for. If you try to run the software with other ("foreign") hardware, the software will usually respond with an error. If you previously had installed some other video capture controller in your system, it's most likely that some files relating to this device are still on your hard drive, and these may be conflicting with the current video capture device. If you had (or still have) another video capture device in the system, please disable it in Device Manager:

1. Click Start, select Settings, click Control Panel, and then double-click the System icon.
2. Click the Device Manager tab.
3. Locate the "old" video capture device (usually located under "Sound, video and game controllers").
4. Double-click the old device reference. On the General tab under Windows 98, put a check in the box marked "Disable in this hardware Profile." Reboot your computer.

You should also verify that the correct (current) video capture device is listed in the Device Manager and that it is running without conflicts. If the problem persists, try *Removing* the video capture device from the Device Manager and allow Windows to redetect and reinstall the drivers for it on the next boot.

SYMPTOM 47-3 When launching the video editing software, you receive an error such as: "Cannot initialize audio playback" This message usually indicates that the audio subsystem (your sound card) is already in use by another application. Make sure that your CD player (or any other application that uses the sound card) is not running. Press CTRL+ALT+DELETE simultaneously to open the Close Program window. Click on any individual applications listed in the Close Program window that may be tying up your sound card, and select End Task. Always be sure to leave Explorer and Systray running. Also check your Device Manager to verify that the sound device is running properly. If you notice any yellow exclamation marks or red *X*s, you may need to troubleshoot a sound hardware conflict or remove and reinstall the sound device.

SYMPTOM 47-4 You cannot launch your video capture software by double-clicking on its icon In virtually all cases, you must reboot the system after installing the video capture drivers and software. If you have just installed the software but have not rebooted the system, try that now. If you find that certain applications conflict with the video capture device, you may also need to reboot the system so that any such conflicts may be cleared. If the problem persists, try reinstalling the video capture software.

SYMPTOM 47-5 Windows keeps detecting a previously installed capture device instead of your current one If you had a different capture card previously installed and the computer keeps trying to load these drivers, and then some of the files for the *old* card are still on the system. If you have uninstalled the previous hardware and software, more than likely some .INF files (or some other file) were never removed, and the old device is still being identified. To get around this problem, identify and delete any old .INF files associated with the old video capture device.

SYMPTOM 47-6 The video capture WDM driver doesn't work under Windows 98 Capture programs using the *Video for Windows* 1.1 (VFW) interface cannot directly communicate with analog video capture devices that use the *Windows Driver Model* (WDM) video capture interfaces in Windows 98. These analog capture devices may include PCI adapters with video decoder chips that use WDM drivers. This problem occurs because the VFW/WDM mapper files included with Windows 98 do *not* allow WDM-based analog capture devices to be used with the VFW 1.1 interface. You can download a patch file from the Microsoft that should correct this problem. This patch should have the following file attributes (or later):

```
VFWWDM.DRV 4.10.2043 8/10/98 9:35pm 15,344 bytes
VFWWDM.DLL 4.10.2043 8/10/98 9:38pm 56,832 bytes
KSWDMCAP.AX 4.10.2043 8/10/98 9:29pm 51,712 bytes
```

This problem was corrected in Windows 98 Second Edition.

SYMPTOM 47-7 There are problems installing the S-Video cable Most video capture boards are designed to accept composite audio/video signals from either a single RCA connector or an S-Video connector. Unfortunately, the S-Video connector is not keyed to prevent incorrect insertion. An incorrectly installed connector will generally result in signals not reaching the capture board. It is possible to install the S-Video cable rotated 90 degrees from where it should be. Make sure that the arrow on the cable matches the marking on the capture board.

SYMPTOM 47-8 Even though a valid video source is available, you see vertical multicolored lines appearing in the capture application window This problem is particular to capture boards when the board itself is loose or installed improperly or the signal cabling is not secure. Check the capture board to see that it is fully inserted in the expansion slot. If there are any modules or sub-boards attached to the capture board, see that they are secure and inserted properly. Also check any connectors and cables to be sure that they are all installed correctly.

SYMPTOM 47-9 Even though a valid video source is available, you see nothing but black in the capture application window There are several possible reasons for this symptom. First, check the video signal being fed to the capture board. If there is no signal, the video capture window (the *Video for Windows* VIDCAP window) will be dark. You can test the video signal by disconnecting the video cable from the capture board and connecting it to a stand-alone monitor, such as a TV set. Damaged or defective video cables and connectors should be replaced. If you are using a camcorder as a real-time video source, make sure that the camera is turned on, that the lens cover is off, and that you have selected the correct video source (composite or S-Video, for example). Also check that the capture board is inserted in the system properly and completely. Any sub-modules should be attached securely to the main expansion board.

Finally, there may be an IRQ conflict between your video capture board and another device in your system. If you attempt to capture a video file while the capture window is dark *and* receive an error such as "Wave input device not responding," there is almost certainly an IRQ problem. Run a diagnostic such as Microsoft's MSD (or use a hardware tool such as AllMicro's *Discovery Card*) to identify unused IRQs, and then set the video capture board to use an available IRQ. In some cases, you must run an installation routine for the capture board when changing settings. If problems persist, the capture board may have failed.

SYMPTOM 47-10 During installation, you see the error "Unable to locate an available interrupt" This type of symptom occurs with an IRQ conflict or when a device driver or TSR interferes with the installation. Make sure that the capture board is configured to use an available IRQ (9, 10, 11, or 12, for example). You may have to use a diagnostic (such as Microsoft's MSD or the Device Manager) to locate available interrupts. Try booting the system from a clean DOS disk to prevent any TSRs or device drivers from interfering with installation.

Unfortunately, if there is a conflict during installation, there will also probably be conflicts during actual use. So, if you suspect a TSR or device driver conflict, you will have to disable TSRs and device drivers one-by-one until the conflict disappears, and then work with the offending TSR or device driver configuration to eliminate the conflict. Under Windows 95/98, you can adjust device resources through the video capture card's Properties dialog.

SYMPTOM 47-11 You cannot initialize the capture board because of a lack of available IRQs On some systems, the capture board fails to initialize when launching the capture application. This problem is usually due to the lack of an available interrupt request (IRQ) for the capture board to use. To check the IRQs on your system:

1. Go to the Windows 95/98 desktop.
2. Right-click the My Computer icon and select Properties.
3. Click the Device Manager tab.
4. Double-click on Computer to display all IRQ resources.

You see each of your system's interrupts and which devices are using them. If all IRQs are already assigned to other devices, you'll need to free an IRQ for the video capture board. You can usually free an IRQ by removing a device no longer in use or disabling the IRQ on a feature not being used (for example, if you're not using the MIDI port of a sound board, disable it to free the IRQ).

SYMPTOM 47-12 When starting the capture utility, you see the error "Unable to initialize a capture device" This is an error message produced by the capture utility (for instance, the *Video for Windows* VIDCAP utility) when the capture board cannot be located. For most capture boards, there is probably an IRQ conflict with one or more devices in the system—a conflict can occur easily when new devices are added to the system *after* the capture board has been installed. Use a diagnostic (such as Microsoft's MSD or the Device Manager) to locate unused IRQs. If new equipment has been added, change the new equipment to relieve the conflict. If the error manifested itself when the capture board was installed, change the board's IRQ to an available setting.

If interrupts check out properly, make sure the capture board is inserted properly and completely into the motherboard. If there are any modules or sub-boards attached to the capture board, see that they are inserted and secured properly. You may also have installed the capture software in the wrong order. Some boards require that DOS software be installed first, and then Windows software drivers must be installed. If this process is reversed, the capture board's Windows drivers may not install properly. Try reinstalling the capture software. If software is correct, try another capture board.

CAPTURE SYMPTOMS

SYMPTOM 47-13 Your capture halts with a message that the audio data rate has changed This is often an issue with "digital video" captures. Many digital video camcorders allow video to be stored in either 12-bit or 16-bit mode (32KHz and 48KHz, respectively), so this message is generally produced by digital video capture software when it detects that the bit rate of your audio source has changed during the capture. To avoid this error, you should keep the same audio bit rate setting on your digital video camcorder at all times. If you have tapes that contain different bit rates, you capture each of those footage segments separately.

SYMPTOM 47-14 You only capture up to 18 minutes when capturing in a "full quality" mode This is normally an issue with the video capture software. Some software packages place a 4GB limit on a captured file's size. A "full quality" file has a maximum length of about 18.5 minutes (18.5 minutes is 1110 seconds at a data rate of 3.6MB/sec—this works out to approximately 4GB). The "preview quality" mode can capture much longer files, since it captures at a low data rates (normally a few hundred KB/sec—less than a tenth of the "full quality" data rate). To work around this issue, keep your captures relatively short. You can always edit them together in the video editing software.

SYMPTOM 47-15 When capturing, you get an error such as "Cannot capture—the data rate on C: is less than the required rate" Many video capture packages (especially for "digital video") require that the hard drive receiving the captured video be able to sustain some minimum data transfer rate for instance, 4000 Kbytes/sec). This data rate is necessary in order to transfer the video from the signal source to the hard drive *without* any loss of data. Any lost data will show up as dropped frames, and video with dropped frames plays back with a visible "stutter," making the captured footage unusable. Captured video that is "jerky" or "stutters" in this fashion and can be corrected only by recapturing the video until no frames are dropped.

Low data rates and data loss can be influenced by many factors (see the *Audio/Video Sync Issues* section above). If your hard drives cannot support the minimum requires data rate, you may not have UDMA support enabled for the drive(s). Check if UDMA support is enabled on your hard drives:

1. Open your Device Manager and double-click on Disk Drives.
2. Double-click on the device GENERIC IDE TYPE *xx* (*xx* is some 2 digit number, usually 01, 02, and so forth).
3. Click on the Settings tab.
4. In the section marked Options, select the DMA check box. If you do *not* have a check box called "DMA," then you probably do not have the UDMA driver loaded or your hard drives do not support UDMA (or both).
5. You'll get a message stating that you may want to contact your hard drive vendor to ensure that the setting is supported. Click OK.
6. You'll be prompted to reboot your system. Click OK.
7. When the system reboots, recheck to see that DMA support is enabled and run any video capture benchmarking utility again to detect the performance of your hard drive(s). If the drive(s) indicate an adequate data rate, try your capture again.

SYMPTOM 47-16 You receive the error "Unable to capture video, the video source is not stable" In most cases, you've selected the incorrect video source format. Verify that you have the correct video standard (NTSC, PAL, or SECAM) selected for your capture device.

SYMPTOM 47-17 You're getting a "copy protection" error when you try to capture video If you've been playing a DVD video—and it has copy protection—the copy protection may not be disabled when the DVD video stops playing. So, after you play a copy-protected DVD video, you may not be able to record any video with a video recorder connected to your capture card. To disable this "accidental" copy protection, restart your computer. You may want to check for a patch to update your DVD video player so that it will properly disable the copy protection when you shut it down.

SYMPTOM 47-18 You find 0 frames captured, 1 frame captured, or line playback is frozen on the first frame This is almost always an IRQ issue. The IRQ assigned to the capture card is probably assigned as "edge trigger" instead of "level trigger." Go to your CMOS Setup, select your PnP configuration menu, look for "IRQ activated by," and make sure that this is set to "level."

SYMPTOM 47-19 The PC capture window is displaying only part of the video clip In virtually all cases, you have not selected the correct video standard (for instance, PAL instead of NTSC). Go to the Properties dialog for your capture software, select the Video tab, and then select the correct video standard to match your video source.

SYMPTOM 47-20 Colors appear washed out or bleeding This can occur while viewing the video image before capture *or* during the actual playback of an image file. If the problem is manifesting itself before capture, begin by checking the signal quality from your video source, such as a VCR or video camera. A loose or damaged cable or a poor-quality video source can result in signal degradation at the video capture board.

If the video signal and connections are intact (and the signal looks good on a monitor, such as a TV set), the problem may be in the Windows video driver being used. Better color depth in the video driver will result in better color quality in the video capture. In virtually all cases, a 16-color video driver (generic VGA) is totally inappropriate for video capture applications—a 256-color driver is considered to be the minimum. If you're already using a 256-color video driver, try an upgrade to a 32K, 64K, or 16M color driver. You may have to contact the manufacturer of the particular video board to obtain an advanced video driver for Windows 95/98.

SYMPTOM 47-21 The video signal appears to be weak or washed out even though the video signal source is acceptable This is typical when a composite video signal output is being sent to the video capture board as well as to a stand-alone monitor through a Y-connector. Composite output signals are usually power balanced for *one* connection load *only*. When the load on a composite output is not balanced properly, the video signal at your capture board will not contain enough power (signal degradation will occur). Try connecting the video signal *directly* to the video capture board.

SYMPTOM 47-22 You get a "Vertical Sync" error when trying to capture Chances are that you've got an IRQ conflict. Check the IRQ assigned to the video card's PCI slot in the Device Manager under Windows 95/98. If the PCI slot that the video card is in is being used by another device, you will need to reassign the PCI slot for the video board a different IRQ. This can be done through your system's CMOS Setup. If *no* IRQ is being assigned to the PCI slot the video card is in, *that* can also be a problem. Once again, you can assign an IRQ to the PCI slot through the CMOS Setup. There could also be an IRQ conflict with the video capture driver. To check this, look in the Control Panel under Multimedia. Click on the Advanced tab and then look under Video Capture Drivers. There you'll see an entry such as "Diamond Multimedia Capture Driver." Double-click on it and then click on the Settings option. There you can change the IRQ of the capture driver. Try a free IRQ, or free an IRQ.

SYMPTOM 47-23 Up to 50 percent of small frames are being dropped (large frames appear to capture properly) This symptom may occur in systems using fast 32-bit SCSI adapter boards and is almost always due to the effects of double-buffering in the SMARTDRV.EXE utility. If possible, try to disable SmartDrive in the CONFIG.SYS file. If SmartDrive cannot be disabled (usually because it would have adverse side-effects on other devices that rely on SmartDrive's caching), try capturing video at a larger frame size, such as 320x240, *before* capturing at a small frame size. Doing this lets SmartDrive adjust to the data needs of the larger frame size, so subsequent captures at a smaller frame size should work correctly until the system is rebooted. An updated video capture driver may also provide better performance.

SYMPTOM 47-24 When capturing video, the corresponding screen image appears broken-up or jerky If the image being previewed on the screen prior to capture looks smooth and the captured video looks smooth when played back, you should suspect that the customer's hardware platform is not quite fast enough to update the screen while capturing. This is not necessarily a problem, since many video capture applications (for instance, *Video for Windows*) is designed to sacrifice screen updates for the sake of smooth captures. If you need a smooth display during capture, start by relieving any unnecessary processing loads from the system:

1. Close other Windows 95/98 applications running in the background.
2. Close any DOS applications running through a window.

3. Make sure the Windows disk cache is set to at least 2MB (4MB if possible).
4. Set audio capture specifications to 8-bit, mono, 11kHz sample frequency for the lowest audio processing overhead.

SYMPTOM 47-25 The video capture board is working, but captures are occurring very slowly In most cases, very slow recording performance is the result of an IRQ conflict between the capture board and another device on the system. Evaluate the components in your system or run a diagnostic (such as Microsoft's MSD or the Device Manager) to locate and identify any unused interrupts in your system. If you are faced with a *jumper-only* capture board, set the jumper(s) to use a free valid IRQ. If your capture board requires a software setup, run its setup utility and choose another valid interrupt (such as 9, 10, 11, or 15).

SYMPTOM 47-26 You find that you cannot use the Super Compressor option in Video for Windows This is not an actual user problem. The Super Compressor is an off-line compression utility that compresses and stores video files captured at 320x240, 15 frames per second (fps) at the same data rate as CD-ROM (150KB/sec). *Video for Windows* version 1.0 does not support the Super Compressor function when used with Indeo 3.0 device drivers. Only the Quick Compressor in the VIDEDIT utility is available. Later versions of *Video for Windows* make use of this function, and you should upgrade your version of *Video for Windows* at your earliest convenience.

SYMPTOM 47-27 You can't capture more than one frame of motion video This is a problem reported with the Intel SVR III. While trying to capture video, the capture process stops after one frame, but the capture application acts as if it is still capturing and you must click Stop to exit. The YUV9 video format always seems to exhibit this problem. The RGB24 video format seems to work at lower window sizes. There are no problems capturing still images or sequences of still images. This problem appears to be related to an improper or incomplete installation of Windows 95 Direct Draw drivers. You can download and install the latest DirectX drivers from Microsoft's website at **http://www.microsoft.com/directx/default.asp**.

SYMPTOM 47-28 The color video being captured is shown as black and white There are two possible causes for this. First, the capture window (that is, the *Video for Windows* VIDCAP utility) is set to receive a Composite video source, but the video signal is being fed to the capture board through its S-Video cable. Check the configuration settings under your video capture options. Make sure that the correct input type (Composite or S-Video) is selected in the video capture utility.

Another possible source of problems is a bad connection. Check that the video signal is indeed color and that a good cable is securely attached to the capture board. Try a different video source. Next, check that the capture board is inserted properly and completely in the expansion slot. If there are any modules or sub-boards attached to the capture board, see that they are secured correctly. If problems persist, try another capture board.

SYMPTOM 47-29 The video image shown in the VIDCAP capture window appears torn or bent at the top This symptom is typical of signals being supplied by VCRs (or camcorders used as VCRs) and is almost always the result of a weak video synchronization signal from the signal source. The problem can often be rectified by using a different (stronger) signal source (another camcorder or VCR). If you are using a VCR signal source, make sure that the *Video for Windows* VCR box is checked.

Use the S-Video signal source if possible, since S-Video signals are less prone to noise and losses than are composite signals. Also make sure that the video cable feeding your capture board is not lying parallel to power cables, since the power cable can induce unwanted noise into the video signal. Try placing the video capture board in another expansion slot as far as possible from the system power supply and other expansion boards, since electrical signals generated by other boards may cause interference with the video data. As a sanity check, make sure that any modules or sub-boards for the video capture device are attached properly.

SYMPTOM 47-30 **When capturing video, you get this error: "No frames captured. Confirm that vertical sync interrupts are configured and enabled"** There are some known issues with the Intel SVR III, but these may also effect other capture devices:

- The Adaptec 1542B & 1542C 16-Bit ISA SCSI controllers were tested with the SVR III using IRQ 11 and I/O address 330h. When the SVR III was also set to IRQ 11, the VIDCAP utility in *Video for Windows* returned blank video (no frames were captured) and then returned the error message. Reconfigure the system devices to avoid IRQ conflicts.
- The Media Vision Pro Audio Spectrum 16, a 16-bit sound board, was tested with the SVR III using IRQ 5, IRQ 15, and I/O addresses 220h and 388h. When the SVR III and the Pro Audio Spectrum 16 were both set to IRQ 11, the SVR III software detected a conflict, and *Video for Windows* returned the error message. Reconfigure the system devices to avoid IRQ conflicts.
- This fault can also be caused by a Diamond VLB Speedstar Pro Video board using IRQ 2 by default. Disable the use of IRQ 2 on the Diamond Video Board.
- SiS FI2 P54C motherboards using an Award BIOS also have been known to suffer this problem. You'll need to go into BIOS and tweak the chipset configuration. Change the "ISA BUS Clk Frequency" entry from "PCI Clk divided by 3" to "PCI Clk divided by 4.Note that this changes numerous settings in the chipset configuration: SRAM, Read Pulse, SRAM Burst, Refresh, all of which go to slower value.

SYMPTOM 47-31 **You see artifacts when capturing video at high data rates** When capturing at high data rates (such as when using 640 x 480 resolutions and 30 fps frame rates), occasional problems have been noted on some PCs—most notably with Intel SVR III or Pro capture products. *Artifacts*, which resemble black horizontal lines, may appear in your preview or capture window. Try repeating the capture (best if the problem occurs only infrequently). If the artifacts occur too frequently for you to recapture, you're probably trying to capture at too high a data rate for your computer's PCI bus to handle. Reduce PCI bus traffic by lowering the data rate of the video you're capturing:

- Use a lower frame rate.
- Use a lower window resolution.
- If you're using RGB24 as the Video Format, try using YUV9 instead.
- Use more compression (a lower-quality setting).
- Turn off the preview mode.

If you continue to find horizontal black lines in both preview and captured video (even at 320x240 resolution) when using the YUV9 Video Format, your computer's PCI chipset may be programmed to disable a feature called "host memory write posting." When enabled, this feature allows your PCI chipset to

write to memory at its maximum speed. When write-posting is disabled, your PCI bus performance can be significantly reduced. Write-posting is enabled in different ways on different systems. Some computers may permit this feature to be controlled through the CMOS Setup, while other computers may require a BIOS upgrade from the system manufacturer.

SYMPTOM 47-32 You see artifacts when capturing video using certain PCI graphics cards The method used by some graphics cards and their drivers to utilize the PCI bus can sometimes cause horizontal line artifacts. For example, Intel has verified a problem using the Number Nine 9FX Motion 771 graphics card (which uses the S3 Vision968 graphics chipset) together with the SVR III. The problems seem to occur when the display color depth is 16-bit or 32-bit and when "preview" is on during the capture process. This symptom also seems to occur in files captured at 320x240 resolution at 15 fps using either the YUV9 or RGB24 video format. Try setting the graphics display to 8-bit (256-color) mode (this has no effect on the quality of the captured video—only the previewed video). You might also try disabling "preview" during the capture process.

SYMPTOM 47-33 Systems with SiS 5596 or 5511 PCI chipsets lock up when using a video capture device This is a known issue with the Video Logic Captivator PCI board. SiS has identified the problem, and a fix is available through a BIOS update. Contact the system maker or motherboard manufacturer for a BIOS update.

SYMPTOM 47-34 Systems lock up when running video capture devices on PCs with Phoenix BIOS Some PCs are known to lock up with the Video Logic Captivator PCI card installed (affected products include members of the DEC Venturis family). This problem has been traced to the Phoenix v.1.6 BIOS. All PCs using Phoenix v.1.6 BIOS should be upgraded to Phoenix BIOS v.1.9 or later.

SYMPTOM 47-35 You cannot use the capture device on a system with a SiS PCI chipset This is a known problem with the Intel SVR III, and it is due to a driver compatibility issue. The SVR III driver 1.2 will cause the system to lock up when launching the capture utility. You can determine the current driver version by opening the README.TXT file on the SVR III CD-ROM. Download and install the version 1.3 driver or later (SVR3-14.EXE from Intel at **www.intel.com**). You can find out which PCI chipset is in your system by checking the PCI chipset in the Device Manager:

1. Click Start, Settings, and Control Panel.
2. Double-click the System icon.
3. Go to the Device Manager tab.
4. Click the plus sign (+) in front of System Devices and look for a reference to the "PCI to ISA bridge," as in Figure 47-8.

SYMPTOM 47-36 You cannot use the capture device on a system with an S3 chipset-based video card If your system uses an Award BIOS version 4.51pg, Windows 95 Release 2 (OSR2), and an S3 968 based video graphics card, you may experience system lockups when trying to launch your capture program. This is a known problem that has been seen with the Intel SVR III and the Diamond Stealth 64 as well as with the Number Nine Motion 771. This problem arises from a memory address conflict between the Intel SVR III and the S3-based video graphics card. According to Intel, it appears that the S3 requests only 32MB of virtual memory, rather than the 64MB it actually requires. If the BIOS allocates the memory for the capture device (such as the SVR III) right above the S3 board's range,

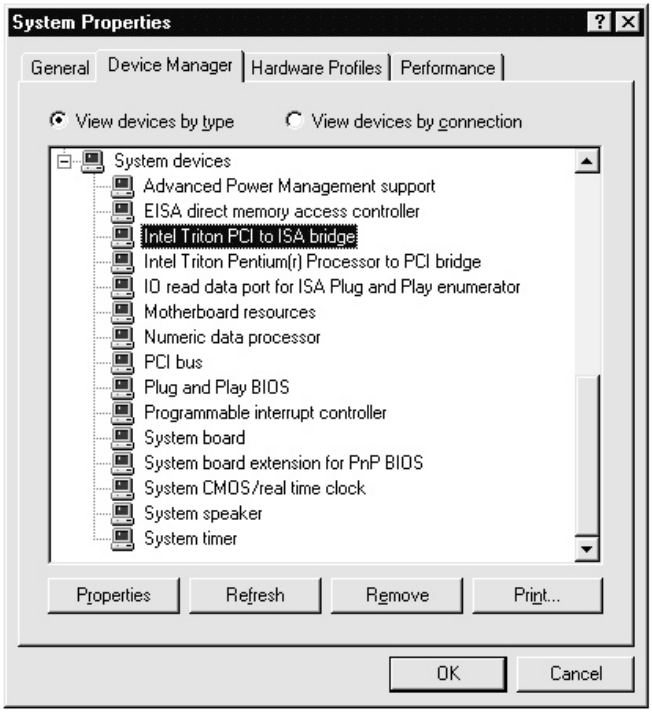

FIGURE 47-8 Locating the "PCI to ISA bridge" in Device Manager

the system will lock up. To correct this problem, you'll need to change the memory address range used by the video capture device:

1. Open the Device Manager and double-click on the capture device (the Intel Smart Video Recorder III). Ignore the exclamation point next to it, if it has one.
2. Click on the Resources tab, and then un-check the box titled "Use Automatic Settings."
3. Double-click on the memory range and enter an address of **FFFBF000–FFFBFFFF** (the spaces on each side of the "-" symbol are needed). Click on OK.
4. If Windows 95/98 returns the message "The setting you have chosen conflicts with another device," click on NO, and then scroll with the up and down arrows next to the address range until no conflict is noted. Click on OK.

The device conflict in the preceding steps is *not* apparent in Device Manager.

Some installations have also noted that reinstalling Windows 95a or installing a video graphics card *not* based on the S3 968 chipset may also correct this problem.

SYMPTOM 47-37 There is a gray background in the live video window display

This problem sometimes happens with the Video Logic Captivator family. There are some PCs that have a problem displaying live video using Captivator Pro/TV and instead show a gray background. If the window is moved around or covered by another window, then the Windows background may show

through—it's as though the live video is "transparent." Verify that all cabling and software for the video/MPEG device is installed properly.

PCs using the VIA VT481/495 chipset on the motherboard are known to have this problem (such as the Unisys MPI46664-540 model 486/66MHz). The problem is due to nonstandard ISA bus timing used by the motherboard, so sending data to the video/MPEG device (the Captivator Pro/TV) registers results in the card being reset by accident. There is no known workaround or patch except to use a different video/MPEG device.

SYMPTOM 47-38 The video device locks up in 8-bit (256-color) display modes This problem is known to occur with Prolab VideoWorks, but it can also occur with other video/MPEG devices. You might experience system lockups on PCs when displaying live video in 8-bit display modes with DirectX 5 installed. This problem occurs only with graphics cards that use *color keying* rather than *hardware overlay* to display live video (for example S3 Vision 968 based graphics cards). The only known workaround at this time is to run in a 16-bit display mode.

APPLICATION SYMPTOMS

SYMPTOM 47-39 CU-SeeMe video software locks the system when it tries to start the video capture system This is a problem between CU-SeeMe software and the initialization of your VIDCAP driver. You *must* make sure the VIDCAP mode is set to 24-bit RGB or 16-bit RGB *before* you start CU-SeeMe. For example, suppose you're using Ulead software to capture in MJPEG format and then you exit that software—your capture settings are stored in the VIDCAP driver. The moment you start CU-SeeMe, it tries to communicate with the VIDCAP driver, but it won't work because the VIDCAP software is set to MJPEG, and CU-SeeMe understands only RGB data. You have to launch your video capture software again and set it to RGB (and also QCIF size image), and then exit; you should then be able to start CU-SeeMe.

SYMPTOM 47-40 Your video adapter supports the "overlay surface" mode, but the video capture system diagnostics report "primary" or "not supported" In most cases, the problem here is related to the video adapter, its configuration, or the drivers being used. Check the following points:

- *Change your color depth.* The color depth may be set too high or too low. Set the color depth to 16-bit in Display Properties and retry the video capture diagnostic test.
- *Change your resolution.* The desktop area may be set too high. Set the desktop area in Display Properties to 800 x 600 (or lower) and retry the video capture diagnostic test.
- *Change your driver.* You may be using a generic Windows driver or an older version of your graphics card. Your video card's driver may also be corrupt. Reinstall the latest version of your video card's driver.
- *Check the DirectX installation.* You may not have DirectX installed properly. Download and install the latest version of DirectXINCLUDEPICTURE \d "/images/redline.gif"

SYMPTOM 47-41 The correct overlay type is reported, but the video in your capture window is not "full motion" In most cases, tINCLUDEPICTURE \d "/images/redline.gif"he capture application (VIDCAP or Adobe Premiere) has "Overlay" selected, but there must also be a selection made for "Overlay while recording." Look at the two examples below:

- In VIDCAP, open the Options menu and make sure there is a check mark in front of the Overlay option. If there is no check mark, click on Overlay and a check mark will appear. Next, go back to the Options menu and select Video Display. Verify that there is a check mark in front of "Overlay while recording." If no check mark is present, click on the box and one will appear. Save your changes and reboot if necessary.
- In Premiere 4.2, open a capture window, and then use the Movie Capture menu and make sure there is a check mark in front of the Overlay option. If there is no check mark, click on Overlay and a check mark will appear. Next, go back to the Movie Capture menu and select Video Display. Verify that there is a check mark in front of "Overlay while recording." If no check mark is present, click on the box and one will appear.

SYMPTOM 47-42 **The quality of your overlay image appears poor** There are several possible issues that can have this effect on the overlay window. First, checkINCLUDEPICTURE \d "/images/redline.gif" the quality settings for the video in your overlay window. For example, if you're capturing in VIDCAP, open the Options menu and select Video Display. Set the "Overlay scaling" to High Resolution. If you're capturing in Premiere 4.2, open a capture window, and then use the Movie Capture menu and select Video Display. In the Video Display window, set the "Overlay scaling" to High Resolution.

The color depth or desktop area (resolution) on your video card may be set too high. If you reduce the color depth and/or the desktop area under Display Properties, the quality of the overlay may improve. Overlay is normally somewhat grainy, and the colors are a bit washed out in comparison to the NTSC/PAL output. Remember that the quality of the overlay window does not affect the capture or playback quality. Finally, you might need to change the memory range that the video capture card is using:

1. Click Start, select Settings, and then click Control Panel.
2. Double-click the System icon.
3. Select the Device Manager tab.
4. Click on the plus (+) sign next to "Sound, video and game controllers."
5. Double-click on your video capture card listing to review its properties.
6. Select the Resources tab.
7. Disable (uncheck) the "Use automatic settings" option.
8. Highlight the Memory Range resource and click on Change.
9. Select a new memory range that has a different first digit (either number or letter) from the range that was originally used. You may have to try several different ranges in order to find one that works.

SYMPTOM 47-43 **You get a VxD VMM error when capturing with VIDCAP** You may have to set VIDCAP to capture to memory. As a rule, always capture to *disk* when capturing in VIDCAP. This setting is located by selecting Video on the Capture menu. The default VIDCAP setting is "Capture to disk," and that is always the recommended setting.

SYMPTOM 47-44 **You receive a GPF or IPF error during scene detection** You're probably using a buggy or outdated driver or application software. Check with the video capture device manufacturer and see if there's an update or patch that you can download and install to correct this type of problem. In the meantime you may be able to workaround this problem by turning off "scene detection" in your video capture software.

SYMPTOM 47-45 The video capture software will not capture when you click the Capture button You're probably using a buggy or outdated driver or application software. Check with the video capture device manufacturer and see if there's an update or patch that you can download and install to correct this type of problem.

SYMPTOM 47-46 The hue slider won't work properly in capture mode You're probably using a buggy or outdated driver or application software. Check with the video capture device manufacturer and see if there's an update or patch that you can download and install to correct this type of problem.INCLUDEPICTURE \d "/images/redline.gif"

SYMPTOM 47-47 The video capture software locks up when you try to capture You're probably using a buggy or outdated driver or application software. Check with the video capture device manufacturer and see if there's an update or patch that you can download and install to correct this type of problem.

Check for an audio driver problem. For example, the Studio DV10plus video capture system can experience problems with the Creative Labs Sound Blaster PCI 128 (driver version 4.05.1205) and Gateway G6 computers with on-board audio that use the Creative Labs Audio PCI 64D (driver version 4.05.1135B). You can use the Device Manager to see if you have any "offending" devices. Often, updating the sound card's drivers may clear some compatibility problems.

Try capturing using the basic VIDCAP applet that accompanies your capture device. Also try disabling the audio device in Device Manager:

1. Click on Start, select Settings, click Control Panel, and then double-click the System icon.
2. When the System Properties dialog appears, click the Device Manager tab.
3. Click the plus (+) sign next to "Sound, video and game controllers."
4. Locate your main audio driver and double-click on it.
5. At the bottom of the General tab, *select* the check box labeled "Disable in the hardware profile."
6. If you check the Device Manager again, you'll see a red *X* indicating that the sound card is disabled.
7. Try your capture again.

If you can capture with VIDCAP or with the sound card disabled, chances are that you have an audio capture driver problem. Check for updated audio drivers or check with the video capture manufacturer for updates or patches that might improve the compatibility with your sound card.

SYMPTOM 47-48 You get a "pink screen" when testing your video input This is usually a video overlay or DirectX compatibility problem. Check with your video card and sound card manufacturer and make sure that you're using the latest drivers for each device. You may also need to download and install the latest version of DirectX from Microsoft's web site. If the trouble persists, try changing your display settings (that is, change your resolution and color depth).

SYMPTOM 47-49 When outputting video to tape (or TV), the video window on the monitor continues to show video Normally, the clip window on the PC monitor should appear gray or black *without* the video playing there. In many cases, the "Output to video" option is not activated in the video capture display driver. This driver is always in operation when a capture program is started (or an AVI compressed with MJPEG has been opened). This driver runs in the background after being acti-

vated and can be brought to the foreground by pressing the ALT and TAB keys simultaneously. Activate the "Output to video" feature by selecting the appropriate check box in this window.

It is also possible that the AVI file to be output is *not* compressed with MJPEG. Some video capture hardware will not output a video file to tape or TV unless that file is in the correct format. You may need to rebuild the video clip so that it has been properly compressed with MJPEG, and then try the output again.

SYMPTOM 47-50 **Your audio signal drops out during the capture** In most cases, the problem is with the video capture software rather than the hardware. For example, Studio DV software version 1.03 software fixes this type of issue. If there's a README file available, review it to see what the file fixes before you download the file. Make sure that the video editing software is *not* running when you apply the patch.

SYMPTOM 47-51 **You can't import bitmap or still image files into the Intel DVP 4.0 application** If you can import WAV and AVI files, but can't import BMP and other static image files, there are three files you need to move from the DVP 4.0 directory to the \Windows\System directory. The files are DSEQFI40.DLL, TGAFIL40.DLL, and FLIFIL40.DLL. These .DLL files are copied to the DVP 4.0 directory by the DVP 4.0 setup program, and in very rare cases, the location of the files results in the error *"Can't import this media type"* when trying to import single image file formats. Manually moving these .DLL files to the \Windows\System directory should fix the problem.

SYMPTOM 47-52 **You get an error such as "The following entry should be in your system.ini file: [drivers] Msvideo=stlthcap.drv"** You are then asked to press OK to add, or Cancel to exit. This symptom means that, for some reason, the capture driver for your capture card was not installed in the SYSTEM.INI file. All you'd need to do is click OK to have the software add it for you. The driver might have been replaced if you've had another capture driver (from a different video capture board) installed recently. Click OK to reinstall the current capture software.

PLAYBACK SYMPTOMS

SYMPTOM 47-53 **Your video playback appears "jittery" after rendering the final MPEG file** In most cases, you'll find that you've reversed the field order (A-B or B-A) during the final render of the MPEG project. You can either re-render the video clip in frame mode or use "field order A" (RRS) or "field order B" (RRG).

SYMPTOM 47-54 **The video playback appears to "tear"** In virtually all cases, the monitor's refresh rate is too high (above 60MHz). You can usually reduce the monitor's refresh rate below 75Hz through the Display Properties dialog.

SYMPTOM 47-55 **You see the error "MMTASK ERROR >> GPF IR30.DLL 0003:0B85" when trying to play a captured file** You encounter this error when trying to play a captured file with a utility like Media Player or VIDEDIT and there is video and sound in the same file (it does not occur if audio is not captured). The audio track can be played if video is not played. This problem is known to be related to drive overlay software. For example, a Western Digital 1GB drive using an overlay software was known to conflict with the IR30.DLL file. Drive overlay software is used so that DOS can read a drive with more than 1024 cylinders. If you upgrade the motherboard BIOS or drive controller to support LBA mode operation, you can eliminate the use of overlay software, and the error should disappear.

SYMPTOM 47-56 The video playback is choppy or contains dropped frames This is typically not related to the video capture board. For most video capture systems, playback speed and quality is very dependent on machine speed—faster machines with higher-performance equipment will play back video files better than slower, simpler systems. Make sure that your customer's system is equipped with at least the minimum amount of hardware to ensure a proper playback. If playback performance still seems choppy, your customer may have to upgrade the hardware platform. If a platform upgrade is out of the question, try reducing the system load during capture and playback. For example, close all unused Windows and DOS applications, close any unused data files, and select a larger virtual memory size.

This is also a symptom that appears frequently in EISA systems—even on fast EISA systems of up to 50 MHz. In many cases, the afflicted EISA system CMOS was not reconfigured properly after adding memory. An EISA configuration disk may have to be run in order to cache new memory, even though the new memory may be recognized correctly. Try booting the EISA system from its configuration disk and adjust the system from there.

SYMPTOM 47-57 You see an initial flash of color when playing back video files Chances are that your customer is trying to play video files using an older version of VIDEDIT or VIDCAP utilities in *Video for Windows*. This is a *known* problem with these older utilities, and current versions of the software should correct the problem (**www.microsoft.com**). Until you can download and install updated versions of *Video for Windows*, there is little that you can do other than playback video clips using the Windows *Media Player* or *Media Browser*.

SYMPTOM 47-58 There is no sound heard during playback Not all video capture products capture sound at the same time video is captured. If no sound was captured (intentionally), no sound will be heard when the video clip is played back through *Video for Windows*. Some capture boards (such as Intel's SVR family) *do* capture sound and video simultaneously as long as audio is made available on the composite or S-Video signal cables, and the Audio box is checked in the Video Capture options dialog. Also check the Audio Setup and Audio Level settings in *Video for Windows* before proceeding.

If all is well with *Video for Windows*, check to make sure that sound was provided to the SVR during capture. If sound was recorded, you should check the configuration of your sound board. The sound board should contain appropriate hardware settings (such as I/O, IRQ, and DMA). The proper Windows device drivers for the sound board must also be installed, and the driver must be loaded with other Windows drivers. Missing Windows sound drivers will inhibit sound. If the system is configured properly and sound is available but no sound is recorded, the capture board may be defective—try another capture board. If sound is being captured by the sound card, the sound card may be defective.

SYMPTOM 47-59 When playing video, the system locks up when Power Management features are enabled This typically required a cold reboot. Unfortunately, video playback is often incompatible with a PC's power management features such as APM (even screen savers can cause this problem). For the immediate future, disable all APM or screen savers when using video playback features. For the long term, check with the capture card maker and see if new drivers and/or playback software are available that can support APM or screen savers.

SYMPTOM 47-60 The system locks up when changing resolutions or color depths while using MPEG playback or video capture functions This is a common problem that is typically caused by the behavior of the MPEG or capture software. You must close all MPEG and capture functions prior to changing resolutions or color depths.

SYMPTOM 47-61 **There are sound gaps, and the image appears choppy during playback** This is a symptom associated with capture boards (such as Intel's SVR family) that integrate audio and video into a single AVI capture file. The integrated file prevents audio and video from slipping out of sync. However, playing synchronized capture files requires substantial processing power. If a system is not fast enough, sound can "hiccup," and the video can be choppy. Unfortunately, this kind of playback problem is not a fault or defect—it is a limitation of slower PC systems (usually i486-class systems).

First, remove any Windows or DOS applications running in the background so that Windows can concentrate on *Video for Windows* or another playback application. If playback does not improve enough, try running the playback in a smaller window. For example, try playing back in a 160x120 window instead of a 320x240 window. Smaller windows require less processing overhead for each frame. Beyond that, the hardware platform may need to be upgraded.

SYMPTOM 47-62 **There are blue or green flesh tones in the live video and MPEG playback** This corruption is often caused when an MPEG player application (such as MPEG Player 4.0) is loaded on a system that *already* has a video/MPEG player installed. This problem has been reported with the Captivator Pro/TV by Video Logic. You can correct the problem by reinstalling the video/MPEG driver for the particular device:

1. Close down all MPEG and live windows.
2. Start a DOS window.
3. Select the directory where the video/MPEG driver file resides (for the Captivator, the driver is PSTREAM.DRV, normally in the VLPOWER directory).
4. Rename this driver file to something else.
5. Expand the driver file from your original MPEG player installation disk into your current directory, such as: **EXPAND A:\PSTREAM.DR_ PSTREAM.DRV** (assuming that the Microsoft EXPAND utility is on the path).
6. Exit DOS and Windows.
7. Restart Windows and check the video again.

SYMPTOM 47-63 **You cannot scale an MPEG movie clip to full screen when using 16.7 million colors** This kind of problem is known to be linked with the Diamond MVP 2000, but it can occur on other video capture/playback platforms. You are usually missing an entry from the video device's INI file. For the MVP 2000, you can add the following line to the [System] section of your STLTHMVP.INI file if you wish to play back MPEG full-screen in 16M color mode:

```
NoVideoSizeLimit=1
```

If you are experiencing lockups when playing MPEG clips full-screen in a 16M color mode, you may be encountering bandwidth limitations on your system. If you encounter this problem, you should change the following line to the [System] section of your STLTHMVP.INI file:

```
NoVideoSizeLimit=0
```

SYMPTOM 47-64 **The video looks grainy (or otherwise poor quality) when playing back or recording** This is a symptom that can occur across *all* video capture devices. Image quality is closely related to the color depth of your Windows video driver. Many older Windows 3.1x installations

and some low-end Windows 95 platforms use the default 16-color VGA video driver supplied with the Windows operating system. The 16 colors are almost never adequate to define a video image, so the image will look washed out or very grainy. You must install a 256-color (or higher) video driver written for the video board in your system. Contact the video board manufacturer for the latest Windows 3.1/Windows 95 drivers. Most manufacturers will send a driver for free, or place the driver on a BBS or Internet web site for free download.

SYMPTOM 47-65 With Active Movie installed, the MPEG options do not show up as a device under Media Player If you install the MPEG video playback drivers while ActiveX (Active Movie) is installed on your system, you will not see the correct menu options in the Media Player. To correct this, uninstall the ActiveX software, and reinstall the MPEG video playback drivers. To remove the Active Movie portion of ActiveX:

1. Click the Start button, select Settings, and choose Control Panel.
2. Once in Control Panel choose and open the Multimedia icon.
3. Click on the Advanced tab.
4. Click on the plus (+) sign next to the Video Compression Codecs.
5. Select "Intel Indeo(R) Video Interactive 32-bit Driver [IV41]" from the list of Codecs and, when it is highlighted, click on the Properties button.
6. Click on the Remove button.
7. Apply or OK the selection.

You are now ready to install the MPEG video player drivers and then reinstall the ActiveX software later.

ActiveX (Active Movie) is included with most versions of Microsoft Internet Explorer 3.xx. If you install the ActiveX software *before* installing the MPEG video playback drivers, you will not have the option to use the MPEG video player for hardware MPEG playback.INCLUDEPICTURE \d "/images/redline.gif"

Further Study

Aitech: **http://www.aitech.com**

Creative Labs: **http://www.creaf.com**

Hauppauge: **http://www.hauppauge.com**

Intel: **http://www.intel.com**

Matrox: **http://www.matrox.com**

Video for Windows: **http://www.microsoft.com**

Video Logic: **http://www.videologic.com/**