

Video Digitizer Choices

You can spend between \$22 and several hundred dollars buying video digitizers suitable for use with your home computer. What's the difference? What's good enough? A friend likened the video capture industry to the mythological hydra in the swamps of Lerna, slain by Hercules: when you chop off 1 head, 2 more grow in its place. In other words, there are enough confusing standards and qualities to keep anybody employed full time figuring it all out – and as soon as you do, it changes. This short article won't accomplish the Herculean feat of bringing you up to speed on everything, but it is an attempt to cut through the marketing trivia, summarize user feedback from the web, and simply let you know what to buy. I'll also include recommendations for ancillary upgrades to your computing environment. Be sure to refer often to the sidebar on video formats.

Introduction

There are basically two broad groups of video formats you'll come across – those meant for display on a PC computer and those meant for distribution on optical disks. Some of the formats meant for PCs are MPEGs, AVI, AVI-VF, Quicktime, WMF, Real Video, and DivX. Because my goal was to convert VHS tapes onto optical disks, the emphasis of this article is formats that are associated with optical disks such as CDs and DVDs that play in portable or stand-alone home entertainment type players.

Purchase Issues

Digitizing video, editing video, and burning onto optical media in a PC environment requires attention to hardware and software issues that are often intertwined. Deciding on a few primary issues will winnow the field of products down to a manageable number.

First, choose if you're going to work on a laptop or desktop. This directly influences your decision to purchase a digitizing board with a USB connection or a plug-in computer card. Because a 30 GB laptop hard drive probably isn't going to be enough storage space, I chose to do video work on a desktop.

You might want to consider a digitizing card that also has a TV tuner. They do the same recording operations as a video-only card, plus you can change channels under computer control. With a video-only unit, you use your VCR/tuner as a translator to change channels, but with an integral unit, you may gain the ability to mimic all the behavior of a TiVo unit. I have bad TV reception where I'm at, and I don't have cable, so I didn't do this option.

I had a chance to experiment with the hardware and software from two different models:

- K-World “V-Stream Xpert DVD Maker” VS-L883D. Software includes Cyberlink's Power Producer 2 Gold, and PVR-Plus. Out of pocket cost is about \$45 from on-line auctions, \$31 (or \$22 for bare-bones refurbished) mail order from Newegg's website.
- ADS “DVD Express” USBV701. Software includes CapWiz 3.1, Ulead Video Studio 7SE, Ulead Movie Factory 2SE, and MuveeAuto Producer. Street price is about \$90+s/h from mail order websites, or about \$83 from an on-line auction. Step up to the USBV702 “Instant DVD 2.0” if you want to *playout* to a video recorder or TV (~\$100 from web auctions). Step up to the USBV703 “Instant DVD+DV” if you want to connect directly to a digital video camcorder.

Choosing how much functionality is in the hardware vs. software is also a dominant issue. For instance, Plextor's PX-M402U USB unit is the first with a real-time MPEG-4 hardware encoder. Others, such as the PVR-Plus software, use plug-in modules to do this. Others, such as the ADS models mentioned above, don't do MPEG-4 at all. Generally, doing more in software gives you flexibility and upgradeability, but needs more computer power.

Even with a hardware encoder, you can't get totally away from software encoding, because often times you have to re-encode video after you've edited it. That's always in software, no matter what hardware you record with. Software encoding, or "rendering" can take a lot of time. On my 1.2 GHz Athlon AXP, saving DivX MPEG-4 to 6 Mbps MPEG-2 runs slower than real time. Rendering from MPEG-2 to MPEG-2 (6.8 Mbps max rate) ran about 10x faster than real time.



Illustration 1. AVIcodec identified 13 different codecs on my computer

Lastly, before you make a purchase decision, download a copy of the free program AVIcodec and study its output. The two main screens of information are shown here. The first shows you what codecs you already have on your computer. In my case, there are 13 different codecs. The second screen will scan any file or directory of files and tell you what video formats they are. In the sample printout, I had 14 files, all MPEG-2 of varying screen sizes, bit rates, and aspect ratios. If you use this program on your computer, it will give you knowledge to help you choose what to buy and how to make your own videos.

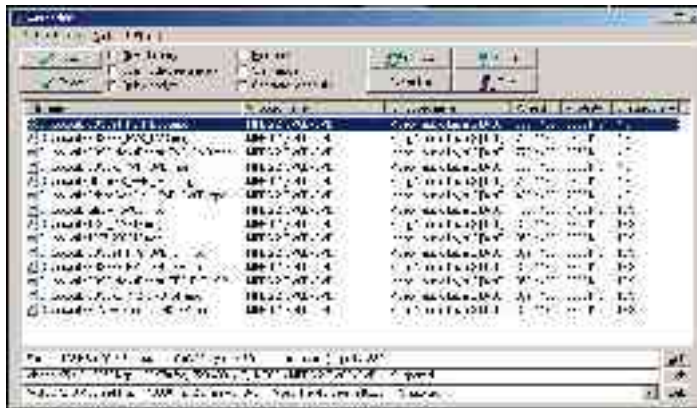


Illustration 2. The AVIcodec program shows 14 files, all MPEG-2 of varying screen sizes, bit rates, and aspect ratios.

Installation

Installation of a USB digitizer will dangle more cables over the back of your computer and requires another power strip plug-in. For a PCI card unit, you'll have to open up the box and install the card, which will put some load onto your existing power supply. In exchange, you'll be limited only by the CPU and bus speed rather than I/O bandwidth. For both the USB and PCI units I used, installing hardware was painless and straightforward.

Software

With most video software, you'll find a main display screen to edit clips, and some sort of a time line below to sequence clips and transitions. A dominant theme you'll experience over and over is that video editing software is centered around combining small clips of video into a movie. One of my goals was to edit sequences up to several hours and clip out unwanted pieces (such as moving

VHS tapes to DVD). This conflicted with the dominant theme of building videos from clips because clipping off just 2 seconds of lead-in garbage, required rendering of the entire remaining hour and 58 minutes!

For all the software, I would implore manufacturers to write real documentation. It gets really frustrating to read, for example, that the “enable high-quality preview” button enables a high quality preview. Oh really?! This is not documentation, nor a user manual. I need to know what high quality means, and what the choice impacts – why the choice is good or bad for certain circumstances, etc

ADV Software

ADV software used up more than an hour of time getting it to install happily on my computer. A turning point in my efforts to get CapWiz working was when I realized the install program generated ~/DVD-DV directories, and the software was looking for directories named ~/DVD. After manually fixing that, the software suite started operating fine.

The Video Studio console seemed slightly confusing For example, what’s the difference between clipping on the main display screen, or clipping on the “extract video” menu screen, or clipping on the main time line display? Similarly, Share, Export, and Save Clip options appear to have overlapping functions and unexplained sub-options.

When you load a video segment, Video Studio allows auto-scene detection similar to the Pinnacle Studio SE 8.8 software, although it’s hard to get the threshold set right to be useful (either it senses no scene changes, or senses way too many scene changes). Mostly, you have to know the sequence of scenes and manually specify boundaries. Video Studio reliably provides scene clipping accurate to one frame.

Using Movie Factory, separate clips you load up automatically become DVD default menu choices. You can edit, delete or add to the default menu. Burning clips to CD or DVD was no harder than burning an audio or data CD-ROM.

I was disappointed that for short video material, I could not burn DVD quality onto a CD. Movie Factory allows this, but unfortunately, it wouldn't play on my stand-alone DVD player. Even if your clips are short, you have to record on the DVD media to keep the DVD quality. Of course, you can just copy DVD-quality .mpg files onto a CD, but then the disk is made to be read by a PC, not a DVD player. If you save on a CD-ROM as Video CD or Super Video CD format, video quality degrades to that format's quality.



Illustration 3. Menu choices are on the left. To the right are all the clips you've browsed to or created. On the bottom is the sequence of clips that will become a single movie when you burn the disk.

K-World Software

The K-World digitizer hardware came with two programs. Cyberlink's Power Producer 2 Gold (PP2) is "granny's" version of acquisition, edit, and burn software. It looks pretty, acts predictably, and offers minimum confusing choices. It records DVD-class video using 3 pre-canned combinations of video parameters (HQ, SP, LP). It will also save in VCD- and SVCD formats, both of which have stabilized on a single set of parameters, so there are no quality choices. Additionally, instead of recording video, you can load existing video files, or rip from an unprotected DVD.

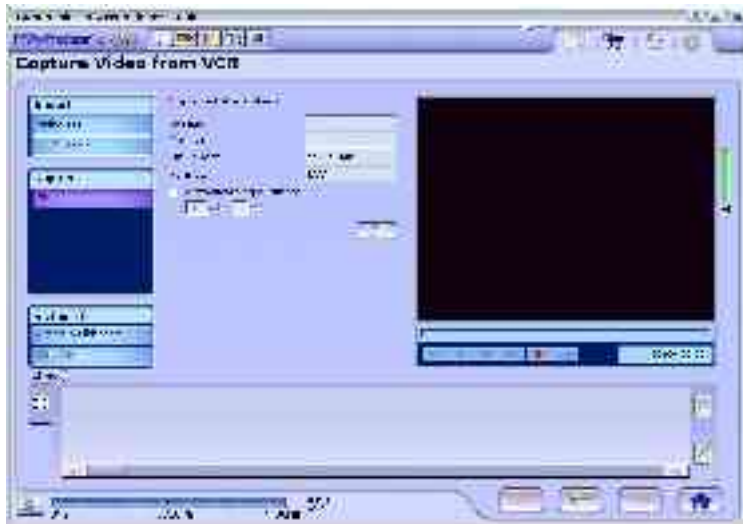


Illustration 4. Power Producer offered easy to understand options.

The down side is that such clarity limits capability. One Internet reviewer said the K-World software won't save .mpg files and this is what he was referring to. Notably, once the video is trimmed, you can't save it back to an .mpg file. You can save a project file that remembers the source videos and clips you've done and come back later, but the only destination for your work is to burn it on optical media. Overall, you're expected to repeatedly do the same simple process: record, mark clips, burn. No extra stuff.

PP2 does do variable encoding bit rates, similar to the Plextor or Ulead software. This saves disk space when successive frames of video are similar to each other. Audio volume is controlled by the Windows control panel, and I never could get enough volume for some tapes that had a weak sound track. It would be nice if video editors offered a "normalize to -3 dB" function for the sound track, similar to how the sound-editing program Audacity does.

The other K-Word package (PVR-Plus) appears to be more of a GUI control console for a number of separate programs, very reminiscent of the Linux way of doing things. It allows you to capture video, convert video formats, edit video, export disk copies, and burn optical disks.

The capture software requires administrator privileges to properly run. It is very versatile in terms of parameters you can set, which include bit rates, aspect ratios, color encoding, sound parameters, etc. The variety of settings helps mitigate the fact that it cannot record with variable bit rates. It does allow scheduling to record video at pre-determined times.

It can save video as MPEG-1, MPEG-2, DV-AVI, or AVI. If you separately download Microsoft's or DivX's MPEG-4 encoder, it allows recording to MPEG-4.

The editor GUI design is weak. It made me think of old DOS GUIs built with special extended ASCII characters, and I'm still grappling with the concept of merging filters, transition effects, and sound tracks when they're shown as alpha names in a time sequence, without the video clip they apply to. It does let you export MPEG-4 .avi files with even more options than the capture software. I particularly liked the DivX plug-in's option to specify a file size, and let it choose the bit rate to match. At times, the PVR-Plus editor added extra frames to the beginning or end of a cut, which was frustrating after waiting many minutes for an edit to re-render back to disk.

The MPEG converter allows you to read in AVI, DV-AVI, MPEG-1/2, ASF, WMF, DivX, and DAT files. The converter can output in 7 MPEG-2 formats, and 7 MPEG-1 formats, each with customizable parameters, *including variable bit rates as claimed below ??*

The PVR-Plus CD and DVD burning program is functional, but weak on features. For instance, it does no auto-conversion, expecting only 1 type of file for each of the formats: DVD, SVCD, or VCD. You must record everything in the right format, or use the convert program first. It can generate menus for DVDs, but not for DVD or SVCD.



Illustration 5. The smaller control window can bring up any of four separate programs. Video editing is shown here as the second program.

Squeezed between resolution and bit rate

Power Producer 2 has only three DVD qualities (HQ, SP, LP), and specific parameters are fixed. Resolution of the SP setting is 352 x 240, and I initially wanted to switch to higher screen resolution. But using the HQ setting generates enough bits so that only 86 minutes can be stored on a 4700 MB DV platter. I wanted something in between!

PVR-Plus does let me choose custom bit rates, but it doesn't do the more efficient variable bit rate within a recording. With a fixed rate, 5Mbps is the maximum to fit 120 minutes on a 4700 MB DV platter. I could do this and then run it through the PVR-Plus converter, which does allow variable bit rates. In contrast, ADV's CapWiz let me directly adjust rates and use variable recording. I often used a "Hollywood standard" of 720 x 480 at 4.5 Mbps maximum rate with CapWiz software. With the PP2 program, I've settled on 352 x 480 at 6.8 MBPS maximum bit rate. I can't tell the difference when played back on a TV screen.

GOAL: Fit The Disk

The primary issue affecting whether a video sequence will fit onto a disk is the bit rate. Predictably, this is also the most powerful indicator of video quality. Other issues are great for marketing folks to toss around when trying to sell a product, but the confusion doesn't help someone understand the necessary trade-offs. For example, as mentioned above, 720x480 at 4.5 Mbps looks the same to me as 352 x 480 at 6.8 Mbps. One has more screen resolution, but the other digitizes with less compression. The two phenomena balance out with about the same overall file size per minute of video.

I had a goal of putting 120 minutes of video onto a DVD. The PP2 DVD SP mode generates reasonable quality playback using a maximum of 6.8 Mbps. Video has few artifacts (aggregate pixel squares, blocks of colors, indistinct striated object edges, ripples around objects), but the screen resolution is only 352 x 480, and this creates slight overall fuzziness – indiscernible on a typical TV, but visible on a PC monitor if you know what to look for. Choosing the PP2 DVD HQ recording mode gives 720 x 480 screen resolution and to keep the same quality with finer

resolution, but rate goes up to 8 Mbps maximum. The tradeoff? Much larger files, limiting play time to about 85 minutes.

In order to escape this trap of the bit rate, I tried moving to MPEG-4 encoding instead of the DVD MPEG-2 standard. There are two competing encoding schemes widely used in the MPEG-4 family: Microsoft's 2 versions, and the DivX encoder. Both are freely available on the web.

The DivX encoder, operating at 15 MB/min, generally had the same visual appeal as the MPEG-2 encoder running at about 38 MB/min (the 120 minutes per DVD max rate due to size limits). Although switching encoder types let me get similar quality at lower bit rates, I still use mostly MPEG-2 because it's readable by more DVD players, and it doesn't matter to me if I fit 120 minutes onto a 4700 MB DVD in MPEG-2 with no space left over, or if I fit 120 minutes of MPEG-4 with left over space.

To press DivX's limits, I did two encodings while keeping the file sizes down to 15 MB/min. Sure enough, when I switched from 352 x 240 resolution to 720 x 480 resolution, horizontal striations showed up near the edge of moving objects on the video. As with the MPEG-2 encoder tests, higher screen resolution sacrificed compression quality, and "better" was a subjective preference.

The target for DivX and Microsofts MPEG-4 recordings seems to be PC viewing rather than distribution on an optical disks. If you'll play back videos only on a PC, MPEG-4 can help you store massive amounts of video on a 4700 MB disk in digital (mostly not DVD player compatible) format.

GOAL: Web Page video distribution

I also tried various methods to get the smallest file possible given a fixed video run-time. The most aggressive compression via MPEG-2 for a 1-minute movie was about 35 MB per minute. This is within a megabyte of Pinnacle Studio 8's export in .wmf format, and MPEG-4 offered similar results. Viewing quality varied among the formats, but if viewed larger than 2" x 2", they all looked pretty bad. Watching .wmf or 1-2 Mbps DivX files on a full screen reminded me of the pods growing in the movie "Invasion of the Body Snatchers" – bodies were often an indistinguishable blur, and slowly filled in with resolution if they stood still in the video frame.

Faced with video files that just can't go any smaller, I found humor in the marketing spin the video industry has accomplished. Since nobody would tolerate downloading huge files, a smart marketing person decided to call the never-ending download something else. Hence, we arrived at the concept of streaming video. Instead of "the download aborted", we now accept "the streaming video server got too busy." Amazing how flexible consumers are!

To be fair, streaming video sources are more flexible than downloading static video files. For instance, the X-Prize foundation offered live video when Spaceship One succeeded in winning the \$10 million dollar prize last October, and I'm sure other uses will be discovered as more people can receive it. You need a connection that will keep up with the streaming bit rate, but you can start watching the video before it's all downloaded.

Summary

I've settled on encoding VHS tapes with the K-World VS-L833D PCI card, and Power Producer 2 software package. After it's saved, I edit and re-save files using Visual Studio so I can retain an edited copy on my hard drive. If I want to archive MPEG-4, I convert using MVR-Plus. Lastly, I burn it to DVD with Movie Factory since it offers the most versatile DVD menu construction.

If I want scheduled recordings or MPEG-4, I use the PVR-Plus software. I didn't find any way to easily offer reasonable quality videos from my web page to people with limited download bandwidth.

Ancillary Upgrades

Working with video may convince you to do other upgrades or modifications to your computer. Here are some I'm aware of.

- Upgrade your video player software. Video generates big files (up to 4700 MB destined for a DVD). Can your media player play them? My DivX player could not play these large files. Microsoft's Media Player seems to work fine, but could not readjust the aspect ratio to make some recordings look right (with SVCD 480 x 480 formats, video is squished together sideways). Real Player could not read SVCD video files at all.
- Buy a big hard drive. I recently picked up a 160 Gig for \$37 after rebates. Less than 20 GB of free space will give you grief. You'll fill up 80 GB quickly. You must get rid of any FAT16 partitions, which are limited to 2.1 GB.
- I prefer to have a FAT32 disk partition on my computer, so files are read/write accessible by both Windows and Linux. Without heroics, FAT32 partitions are limited to 32 GB. You may fill this doing video editing, so plan for alternatives if you dual-boot.
- Video files can easily go over 2 GB, and there are problems with files this large (do a Google search on "2 GB limit"). For me, using Mandrake 9.2 Linux, I can copy them from Windows FAT32 to Linux ext3, but I get errors when I try to copy the file from my ext3 partition back to a FAT32 partition. Consider chopping your videos into smaller pieces (many programs have an option to do this automatically). Combining clips back into single movies is trivial.
- Buy RAM, especially if you'll do a lot of software encoding. The Windows 2000 Task Manager showed that rendering took 86% of my CPU and nearly 100% of my 256 MB memory, so I expanded from 256 to 768 for \$60 via an on-line auction.
- My 15" LCD screen is more than enough. Most video clips are at smaller resolution and don't press the limits of typical computer console screens.
- Upgrade your home network. Passing GB video files back and forth between computers is the first time my 10 Mbps Ethernet link appeared slow.
- If you buy a USB encoder, upgrade to USB 2.0. Most video capturing manufactures specify USB 2.0 to get its 40x faster I/O speed. I had no trouble running nominal digitization rates for a few days at USB 1.0, but I didn't test all the upper limits. After communication overheads, the 12 Mbps limit of USB 1.0 is very close to the video rates you'll want to acquire.

Author Bio



Brian is a Directed Energy System Engineer at Edwards AFB, and also works on the staff of the USAF Test Pilot School as an Air Force Reservist. He became involved with video editing when trying to synchronize data collected from various devices such as gun cameras, aircraft HUDs, and tracking cameras.