

Videoguys Guide to Understanding HD Formats

If you are reading this article, I think it's a pretty safe bet that you have a big screen HD TV in your house. Now that you have it, you wonder how you ever watched sports or the latest action movie or a documentary or even the cooking channel without it. I know that now when I am in a situation that I have to watch standard definition TV, all I can think about is how much better it would look in



HD! Lets face it, everything just looks better in HD. Well maybe not everything or everyone, but I think you get the picture. It's an HD world, and the time has come for you to step up from your old DV or DVD camcorder into a new HD camcorder.

But which camcorder do you buy? What format to choose? Are some better than others? Are some HD formats better than others for editing and producing your video? The answer to all of these questions is YES. But it all depends on what you want to do and what gear you have to work with already.

The goal of this guide is NOT to help you choose a specific camcorder. For that our best advice is to go to your local store and check them out. Talk to your friends/ colleagues who are already shooting HD and ask them what they like best and least about their camcorder. If you can, try to borrow it and try it yourself. The goal of this guide is to provide you with a general foundation of knowledge about each of the most popular HD formats, so that you can use this information as part of your decision. It is not a technical manual. I am going to do my best to avoid tech speak and keep it in simple to understand terms. If you already have an HD camcorder, this guide will help you better understand the format you have, and its pluses and minuses for post production.

HD is not DV

This is a very important fact you need to understand and appreciate. Editing DV footage is a breeze. Even with a 3 or 4 year old computer it's a piece of cake. You don't need a ton of processing power or storage. You don't need special hardware and the workflow of importing DV footage into your computer via FireWire (or USB), editing it, encoding it and then burning it to DVD or publishing it on the web is simple, easy and works.



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Unfortunately working with HD footage isn't that simple, and each HD format has its own unique workflow that can require special settings, plug-ins, work arounds and even hardware. Don't let that scare you away. By the end of this article you will have a solid understanding of each HD format and a bunch of suggested workflows and solutions.

As always the Videoguys are here with the answers you need to the questions that are most important to your success as a video editor and producer. If you still have questions about HD formats and the post production process, do not hesitate to call us! 800 323-2325 - we are the HD Video editing and production experts!!

HD Camera Formats

Some HD formats are better for acquisition, but not so great for editing. This is because of the compression algorithms they use. While the image looks great, you need lots of computer power to be able to decompress and then compress the footage in order to edit it. The faster your computer, the easier these formats are to edit. Fortunately today's current computers and the latest versions of our NLEs will allow you to edit these formats pretty well.

Other formats have been created specifically for editing, you don't shoot in these formats, but you can capture to them or convert your files over before you edit. These formats are not as compressed and the compression algorithms they use are easier for the computer to handle, so editing is much easier and smoother. While files created using these formats are significantly larger than the heavier compressed HD acquisition formats, they are still small enough to be handled with affordable storage.

Each compression format has its own specific data rates storage requirements. We will talk about those storage requirements as part of each format's discussion. We will also let you know which of our NLEs will allow you to edit each format natively. At the end of each section are links to additional on-line resources with more detailed and technical info on each format.



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HDV

HDV is a tape based format that records HD footage onto DV tapes. Think of it as the HD version of DV. HDV is imported into your computer via FireWire, just like DV. I like HDV and I shoot with it using my Canon HV30. Canon, Sony and JVC make HDV camcorders for consumer prosumer and professional editing. HDV supports 1440 x 1080 resolution, which looks spectacular, but it is not the full 1920x1080 HD spec.

HDV

One of the things I like best about HDV is that it still uses tape. That gives me a long-term archive copy of everything I shoot. One of the biggest disadvantages of HDV is that it still uses tape, which means you have to capture all of your footage into your computer. The good news is that this is super easy. HDV is captured via FireWire. Any ordinary Firewire 400 port will do the job. The files created using HDV are basically the same (25 Mb/s) as DV. You need 13 GB of storage per hour of video. It still takes an hour to capture an hour of HDV footage.

Premiere Pro, Final Cut Pro, Sony Vegas, Avid Media Composer and Grass Valley Edius all support native HDV editing. Even if you are using an older copy (1 or 2 previous versions) from several years ago.

With the latest version of one of these software titles in a dual core or faster machine you will be able very well. While you may need some rendering if you get into multiple layers of video and graphics and filters, the workflow will be very productive. If you are doing projects that require lots of rendering, you'll need to upgrade to a faster machine with more cores or add in a realtime accelerator card like the Matrox RT.X2 LE.

Tim Kolb wrote an excellent article for the Creative Cow called Demystifying HDV Workflows

http://library.creativecow.net/articles/kolb_tim/demystifying_hdv.php

Douglas Spotted Eagle and the Gang at VASST have published a great HDV FAQ

http://www.vasst.com/index.php?option=com_xfaq&Itemid=87

Panasonic P2 - DVC Pro HD and AVC-Intra 100

P2 is Panasonic's tapeless HD workflow. You capture directly onto solid state P2 cards while you are shooting. P2 uses the DVC Pro HD or AVC-Intra 100 compression format, which each use a 100 Mb/s data rate. This translates into 60GB per hour. One of the big advantages of DVC Pro HD is



that the files are not super compressed, so working with them is pretty easy, as long as your NLE supports P2 workflows. DVC Pro HD records 720p footage as 960x720 and 1080i footage as 1280x1080. AVC-Intra 100 gives you full 1920x1080 HD resolution in full 4:2:2 color space. Editing AVC-Intra 100 compressed video requires a much faster computer than DVC Pro HD, so you'll want to make sure you have the horsepower to handle it.

The latest versions of Premiere Pro, Media Composer, Final Cut Pro and Edius support AVC-Intra and DVC Pro HD P2 workflows (Older versions will support DVC Pro HD only). Unfortunately Sony Vegas does not support P2 workflows and because it's Sony vs. Panasonic, we don't think it ever will. Media Composer 3.5 supports native editing of AVC-Intra without any transcoding or file conversions.

Unfortunately P2 media is still pretty expensive. A 32GB P2 card will store only a half hour of footage but it will run you almost \$1,500! While new, cheaper P2 cards were introduced at NAB, I'm not that excited about them because they have nowhere near the useful life or long term reliability. The Focus FS-100 DTE recorder is made specifically for use with P2 camcorders and gives you 100GB of storage for under \$1,000.

Panasonic has an excellent micro-site loaded with info about P2 HD workflows
<http://www.panasonic.com/business/provideo/p2-hd/white-papers.asp>
and an easy to read FAQ <http://www.panasonic.com/business/provideo/p2-hd/faqs.asp>



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Sony XDCAM

XDCAM is Sony's tapeless workflow format, which has recently been adopted by JVC as well. The original XDCAM format used optical media based on Blu-ray technology. The latest and greatest version is XDCAM EX which uses solid state memory sticks. It has evolved over the years from SD to HD. XDCAM Ex uses solid state SxS removable media, based on the newest PCMCIA ExpressCard Technology. A 32GB SxS card will cost you around \$1,000, but you get 140 minutes of SP recording time on it (100 minutes in HQ).



XDCAM EX supports the full HD resolution - 1920 by 1080. You actually get 2 modes SP 1440 x 1080 at 25 Mb/sec or HQ mode 1920x1080 at 35 Mb/sec.

The current versions of FCP, Premier Pro, Media Composer, Edius and Sony Vegas all support XD CAM workflows. You use the free Sony XD CAM EX clip browser to import your footage into your NLE. XDCAM EX Clip Browser serves many functions, including Clip Preview, Logging, Media Management, Rewrapping and Exporting media to various devices such as Sony PSP and Apple iPod. The latest version of Media Composer 3.5 actually allows you to edit directly off the SxS media without having to use Clip Browser!

We are seeing many news, cable and local broadcasters standardizing on XDCAM workflows. They call this a flat workflow. everything that comes in is either native XDCAM or captured directly into XD CAM for editing, producing and archiving.

Sony has a great micro-site that has downloadable XD Cam EX NLE workflow guides
<http://pro.sony.com/bbsc/ssr/micro-xdcamexsite/resource.downloads.bbsccms-assets-micro-xdcamex-downloads-XDCAMEXWorkflowDocs.shtml>

AVCHD

AVCHD is the latest and greatest HD format. AVCHD camcorders are very small and affordable. It supports 1080i, 720p and 1080p with the full 1920x1080 HD spec.



The image quality is incredible, but it uses very strong compression (MPEG-4 AVC/H.264) to pack the video into extremely small files. Video is recorded at 24 Mb/sec data rate, which means you can get over 2 hours of 1080p video on a cheap 32GB memory card. Amazing!

Unfortunately there is a downside to this compression. Because the files are packed so tight, it makes editing AVCHD footage very difficult, even with a super fast 8-core workstation. Only Premiere Pro CS4 and Vegas 9 support native editing of AVCHD files, but require a ton of processing power and even then it is a less than optimal workflow.

Today you have a couple of options to make life easier. The first is converting the files into a more editable format such as ProRes or Cineform. (more on these HD editing formats later in this article). Or you can capture the footage using the HDMI output of these cameras directly into a more editable HD format using inexpensive hardware like the new Matrox MXO2 mini (\$449).

HD Editing Formats:

Avid DNxHD

Avid DNxHD is a lossless HD compression format that allows you to edit HD footage at exceptional quality with manageable data rates. At the highest quality DNxHD, with a data rate of 220Mb/sec, requires 100 GB per hour of footage. Using Avid Media Composer 3.x you can a few streams of DNxHD footage using a dual-core processor or over 10 streams with a big 8-core workstation.



Currently only Avid NLEs like Media Composer support DNxHD footage. You also need special Avid hardware in order to be able to capture and encode into DNxHD footage on the fly. You can convert HDV, P2 or XDCAM into DNxHD, but the conversion time will depend on your processor speed and it will take more than real-time even with an 8-core workstation.

Avid has some great information on their DNxHD micro-website <http://www.avid.com/dnxhd/>

Apple ProRes

Apple ProRes is a nearly lossless HD compression that allows you to edit HD footage at exceptional quality with manageable data rates. At the highest quality ProRes 422 HQ requires just under 100 GB per hour of footage. Just about any Intel based Mac and faster G5s can edit ProRes. You can edit few streams of ProRes footage using Final Cut Pro on a dual-core processor or many streams with a big 8-core workstation.



Currently only Final Cut Pro supports ProRes footage. Unlike Avid, you do not require special hardware in order to be able to capture and encode into ProRes footage on the fly. With a Quad core Mac you can capture directly into ProRes using inexpensive I/O cards from Aja, Matrox and Blackmagic. Aja offers hardware (I/O HD and the new Ki Pro) that will capture directly into ProRes. Since the encoding is done in the hardware, you don't need a quad-core Mac to capture it, just a Mac that is fast enough to edit ProRes. You can convert HDV, P2 or XDCAM into ProRes, but the conversion time will depend on your processor speed and it will take more than real-time even with an 8-core workstation.

You can read Apples ProRes white paper here

http://images.apple.com/finalcutstudio/resources/white_papers/L342568A_ProRes_WP.pdf

I really like this article Tim Wilson did over at Creative Cow

http://library.creativecow.net/articles/wilson_tim/ProRes01/index.html

Cineform



When the first HDV camcorders were introduced the computer hardware readily available was not able to easily handle the MPEG2 based HDV compression. So editing HDV footage was a bear. For decent workflow you had to go with hardware accelerators like the Matrox RT.X2. The engineers over at Cineform had a solution. They created their own compression that maintained all of the quality without any of the hassle. With Cineform even a slow laptop could edit HDV footage using Adobe Premiere or Sony Vegas.

Fast forward to today. While current computers can handle HDV, complex productions can overwhelm even an 8-core machine. As we talked about earlier AVCHD is a bear and even an 8-core monster machine will struggle with it. Cineform NeoScene will allow you to convert your footage into the Cineform format and editing with Premiere, Vegas or FCP will be a breeze, even on a dual core machine. The Cineform format at 1920x1080 HD resolution requires about 35 GB per hour with a data rate of 10/Mb/sec.

Cineform has just launched a new website with some great information on their technology

<http://www.cineform.com/technology.php>

Uncompressed HD

Uncompressed HD is just what it sounds like. Pure digital HD footage without any compression added. No compression means it's the best possible video quality. This is very important if you do a ton of compositing using multiple layers of video. It is also important if you are collaborating on a project that will require multiple generations of rendering.



We do not recommend using uncompressed video. You are much better off using one of the easily edited formats described above. If you have to use uncompressed video, we hope you are keeping the clips short as well as the final project. Uncompressed video files are huge, and it requires special hardware to import and export it into your computer. Uncompressed HD footage at the highest resolution requires 558 GB per hour of footage. The throughput is so high you need specialized RAID storage and controllers in order to handle more than a single stream of it.

H.264

H.264 is a compression format used for delivering HD and SD content. It is not good for editing. It is used for Blu-ray, Flash, web streaming and mobile video. For delivering the very best quality HD video we do recommend your final encoding use the H.264 compression. Someday we may be able to edit H.264 footage natively, but today the latest versions of our NLEs will not allow you to edit it.



One of the drawbacks with H.264 footage is that it takes a ton of processing power to encode it. Compressing a 1 hour Pro Res video at the highest video quality settings into H.264 using Compressor on an 8-core Mac workstation can take well over 4-hours! Fortunately we have a solution for that. Matrox has introduced their CompressHD card and MXO2 family of products with MAX technology. Using the new Matrox hardware that same 1 hour video encodes to H.264 in under an hour! That's right, faster than realtime!

[Click here to learn more about Matrox Compress HD and MAX technology](http://www.matrox.com/video/media/pdf/products/compresshd/en_Matrox_CompressHD.pdf)
http://www.matrox.com/video/media/pdf/products/compresshd/en_Matrox_CompressHD.pdf

HD Camera Formats

HD File Formats

	HDV	P2-DVCProHD	AVC-Intra	XDCAM EX	AVCHD	DNxHD	ProRes	Cineform	Canonus HQ	H.264 Blu-ray	Uncompressed
Media	MiniDV	P2 Card	P2 Card	SxS Card	SD Card						
Cost for 1 hour of Storage	\$ 10.00	\$ 3,000.00	\$ 3,000.00	\$ 500.00	\$ 50.00						
Firestore Supported	FS-4 or FS-5	FS-100									
Resolutions											
720p	1280x720	960x720	1280x720	1280x720	1280x720	1280x720	1280x720	1280x720	1280x720	1280x720	1280x720
1080i	1440x1080	1280x1080	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080	1440x1080	1920x1080	1920x1080
1080p			1920x1080	1920x1080	1920x1080	1920x1080	1920x1080	1920x1080		1920x1080	1920x1080
Data Rates											
Mb/Sec	25	100	100	35	24	220	220	10	100	40	1185
GB/ Hour	13	60	60	20	14	100	100	35	60	6	558
Recommended G-tech Storage for up to 2 Streams	G-Raid	G-Raid	G-Raid	G-Raid	G-Raid	G-Raid	G-Raid	G-Raid	G-Raid		G-Speed XL
Recommended G-Tech Storage for 3+ Streams	G-Raid	G-Speed eS	G-Speed eS	G-Raid	G-Raid	G-Speed eS	G-Speed eS	G-Raid	G-Speed eS		G-Speed XL
NLE Support											
Adobe Premiere Pro CS4	x	x	x	x	x			x			x
Apple Final Cut Pro 6	x	x	x	x			x	x			x
Avid Media Composer 3.5	x	x	x	x		x					x
Grass Valley Edius 5	x	x	x	x					x		x
Sony Vegas 9	x			x				x			x



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