Panasonic

ideas for life

THE INVALUABLE GUIDE
TO THE AG-HVX200

This guidebook provides a comprehensive description of the functions and features of
the AG-HVX200, from detailed information on the HD multi-format system, variable
frame rates, and P2 card recording, to a variety of application examples.

Contents in this guidebook (Specification,Equipment design or others) are subject to change without notice.

SP-HVXMNLP1

HVXBOOK-601-ZM-1

A Camera-Recorder Packed with Leading-Edge Technology and Know-How

DVCPRO HD Image Quality and Performance

The AG-HVX200 records in all HD/SD formats, including 1080i, 720p, and 480i. For HD, it uses the broadcast-proven DVCPRO HD format.

P2 Card Speed and Future Potential

Video and audio signals are recorded onto the P2 flash memory card. This will revolutionize your workflow with the reliability, speed, and IT connectivity that only solid-state memory can offer. The AG-HVX200's two P2 card slots provide a host of new functions, such as hot swapping.

The Variable Frame Rate of VariCam

In addition to the 24p/30p frame rate for 720p images, a variable frame rate lets you add speed effects with the AG-HVX200, a technique that was previously possible only with a high-end AJ-HDC27F/H VariCam system. Since frame rate conversion can be done in-camera, the internal down conversion allows the user to create variable frame rate effects for standard definition DV projects.

Featuring DVX100 Series Operating Ease

The operating ease and popular functions of the DVX100 series, such as the cam-driven manual zoom, manual operation, focus assist, scene file dial, and user buttons, have been further refined in this advanced camera-recorder.

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1-1 High-Quality HD (High Definition)/ SD (Standard Definition) Multi-Format Recording

Leica Dicomar HD Lens

New High-Sensitivity Progressive CCD

1080p processing

New DSP with 14-bit A/D Conversion and 19-bit Processing

DVCPRO HD
DVCPRO50
DVCPRO
DV

P2 card

DV

Mini DV tape

Newly Designed Leica Dicomar 13x Optical Zoom Lens for HD Applications

Developed specifically for HD recording, the new Leica Dicomar lens features a large 82-mm (diameter) filter. Its powerful 13x optical zoom, cam-driven zoom ring, and Optical Image Stabilizer (OIS) are also designed for HD recording use.

New High-Sensitivity Progressive CCD

This 1/3" progressive CCD rivals many HD broadcasting cameras with its excellent balance of high resolution, S/N, and sensitivity. The camera section scans a high resolution 1080p image at up to 60 frames per second, and it is from this capture that all other signals are made.

New DSP with 14-bit A/D Conversion and 19-bit Processing

With its level of performance, this new digital signal processor includes gamma settings for a variety of image adjustments and handles P/I (Progressive to Interlace) conversion, cross conversion and down conversion for HD and SD formats.

DVCPRO HD Recording onto a P2 Card

The AG-HVX200 is the compact camera-recorder to offer 1080/24p (over 60i) shooting. You can also select 1080/60i, 1080/30p, 720/60p, 720/30p, or 720/24p in HD. The multi-codec lets you choose either DVCPRO 50, DVCPRO, or DV format for SD (480i) recording.

Built-in DV VTR

The DV VTR section allows the AG-HVX200 to also serve as a high-end DV camera-recorder with 16:9 aspect ratio and 24p/30p (over 60i) recording.

1-2 HD/SD Multi-Format Recording
with the AG-HVX200
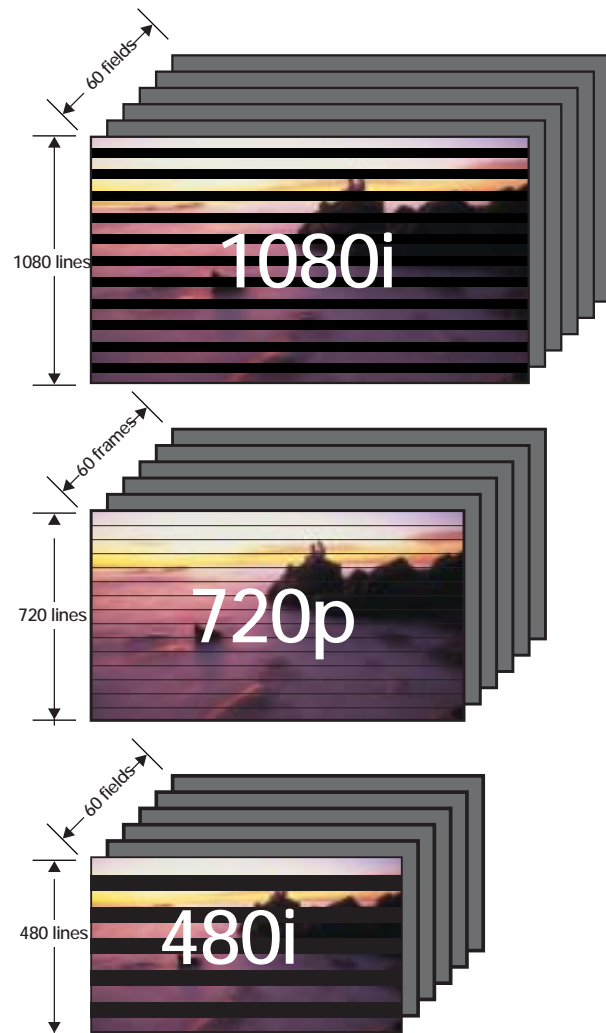
1080/60i

This HD format is supported by DVCPRO HD, HDCAM, and HDV. This is a popular broadcast HD format.

1080/24p (over 60i)

The 1080/24p format is commonly used for HD video masters of material shot on 35mm film. It is supported by HD-D5 and other high-end equipment. It is possible to record in this format, but it does not allow the use of speed effects because of its fixed frame rate. It also requires the use of high-end editing equipment.

720p (over 60p)

This format, which is used in the DVCPRO HD VariCam, is another popular HD broadcast format. The progressive shooting capability also offers smooth compatibility with computer graphics. After editing, it can be converted to 1080/60i, 1080/24p, or 480/60i if necessary. Besides the usual over 60p mode, AG-HVX200 has the recording capability in 720/24p and 720/30p native mode. It offers the advantages of a variable frame rate. See the details in Chapter 4 [What's a Variable Frame Rate?].

480/60i

Also called 525i, this is the Standard Definition (SD) format used in today's TV broadcasting. It is supported by almost all video equipment, including DVCPRO 50, DVCPRO, and DV equipment. It also supports 30p and 24p progressive shooting, but its output video signals are all 60i (through the pulldown).

Resolution and Frames per Second

720/24 p
❶   ❷   ❸

(over 60p)
❹

❶ The initial numbers "720" indicate that there are 720 scanning lines per frame. The larger the number, the higher the resolution as a still image.
❷ The number "24" after the slash indicates that 24 frames or fields are displayed per second. The larger the number, the more detailed the motion in moving images.
❸ The final "p" stands for progressive, or an "i" stands for interlaced. See the next page for details.
❹ Stands for the frame rate of the recording format. when it differs from the shooting rate of the CCD (❷), it should be indicated.

1-3 720 Progressive Scan HD Images with Higher Resolution than Interlaced 1080i

Interlace Image

Progressive Image

Many TV broadcasteres use the interlaced system, which divides each image into alternating odd and even horizontal scan lines. For example, in 1080/60i, each field displays 540 lines, or half of the total number of its 1,080 lines, every 1/60th of a second. Each field combines with the next field to create a complete frame. This naturally results in a time lag of 1/60th of a second, and none of the fields contain the information for a complete image.

If you look closely at a frame taken by a 1080i or 480i interlaced camera, you'll see blurring in fast-motion parts where the two images overlap. You'll also find smearing in finely detailed parts because of the relatively low vertical resolution.

Each frame of a progressive image, on the other hand, contains all of the image information, much like a film frame, because it consists of all of the scanning lines. In this way, progressive images share more similarity with the images of film cameras and computer graphics. From the viewpoint of versatility, there is a major advantage in using progressive scanning for your original images.

The AG-HVX200 features a newly developed native progressive CCD. It produces naturally high-quality images by capturing frames with complete image information right from the beginning.

Interlace Freeze Frame image
The picture on the left is an interlace freeze frame, and because it's interlace it doesn't have a lot of detail that is recognizable about the ball.

Progressive Freeze Frame Image
The progressive capture does an excellent job of conveying information about the design and make up of the ball.

Close-Up Interlace Freeze Frame
Please note fine engraving next to Jackson's head Compare to new style US $20 bill. But how does that relate to High Definition. These next few slides offer additional insight to the differences between interlace and interpolated information. This is a freeze frame from a 1080i camera, and notice that it has the same confusing areas of moire like what happens in Standard Definition.

Close-Up Progressive Freeze Frame
Please note direction of the fine engraving next to Jackson's head Compare with new style US $20 bill. Engraving pattern is correct.
However, the reality is the lines curve under as shown on this 720P image. So a progressive capture is more representative of the subject matter.

1-4 24p HD and a Cine-Like Gamma Curve Meet Film Production Needs

24 frame/s

Movie Film

24p

24 frames per sec.

60i

60 fields per sec.
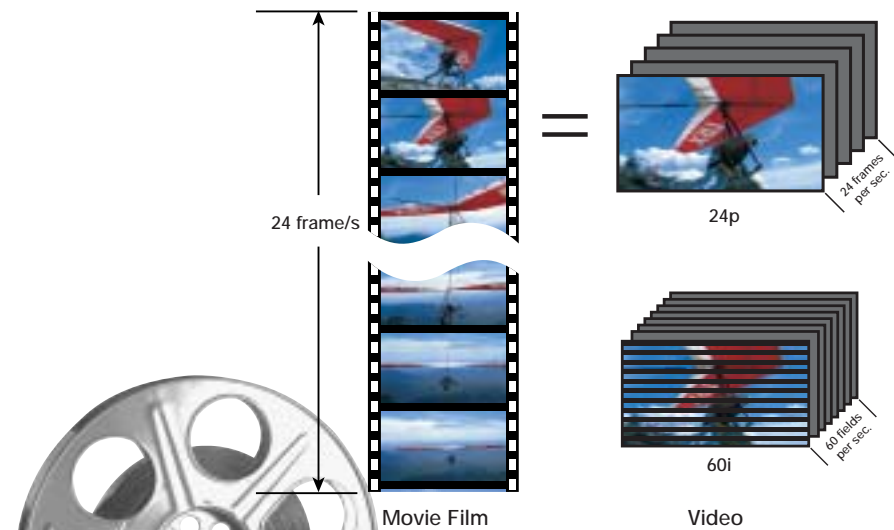
Video

The film cameras used in making movies have a longer history than TV broadcasting cameras, and capture 24 frames per second onto silver halide film. Film cameras are used more frequently than video cameras both in movies and in TV commercials and programs.

However, their use entails considerable expenses. In addition to the high cost of film and developing, the fact that the images cannot be previewed on-the-spot increases the labor expenses involved in production. This has led to the idea of using video cameras, which use inexpensive, reusable P2 card and videotape, and require no developing.

An alternative has arrived in the form of 24p HD shooting. Progressive scanning produces 24 frames per second, with complete image information contained in each frame. This provides the same frame speed and motion traits as film. The AG-HVX200 can shoot in 1080/24p (30p), 720/24p (30p), and 480/24p (30p).
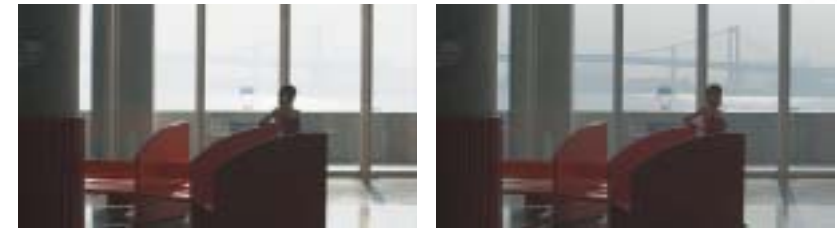
Video Gamma Image

Cine-like Gamma Image

Another distinctive point in film cameras is the image texture that results from the rich tonal gradation of their wide dynamic range. Panasonic has now achieved this same level of gradation in HD video with our original cine-like gamma curve.
The AG-HVX200 features eight gamma curves, including the innovative cine-like gamma curve.

SD NORM

HD NORM

CINE-LIKE_D

CINE-LIKE_V

and B.PRESS, HIGH, LOW, NEWS

Output

Input
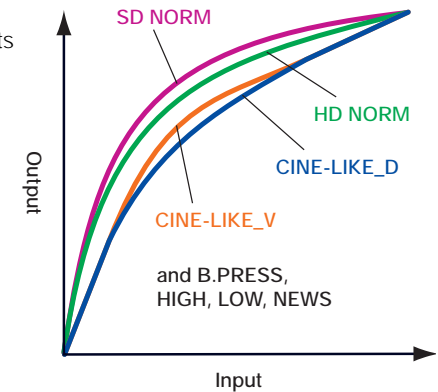
AG-HVX200 Gamma Mode

NEWS:	Minimizes washout to faithfully capture all visual information especially in the highlights
HD NORM:	Suitable for HD shooting
LOW:	Works to flatten out a high contrast scene
SD NORM:	Normal setting for SD (this was available in the DVX100 series)
HIGH:	Provides additional contrast and color gradation
B.PRESS:	Provides more contras and blacks in low contrast scenes
CINE-LIKE-D:	The Cine-Like mode shifted to prioritize dynamic range
CINE-LIKE-V:	The Cine-Like mode shifted to prioritize contrast

2. Advantages of DVCPRO HD

2-1 DVCPRO HD and the DVCPRO Family: A Proven Track Record in Broadcasting

DVCPRO HD — Developed for High End HD Production

A key advantage of the AG-HVX200 is that it uses DVCPRO HD (DVCPRO 50/DVCPRO/DV). Since this high-definition format was introduced in 2000, its image and sound quality, reliability, and operating ease have earned the acclaim of broadcasters and video professionals all around the world. The original (standard-definition) DVCPRO format, introduced in 1996, has also seen wide use in broadcasting and other professional applications.

Moreover, because a wide range of peripheral equipment has been developed for use with DVCPRO HD VTRs, DVCPRO HD gives you more versatility in editing and other post-production processes.

The DVCPRO Family: High Reliability, Wide Interchangeability

DVCPRO HD was developed as the highest recording format of the DVCPRO family. Since the first DVCPRO VTR reached the market in 1996, this expanding family of video formats has helped launch a major shift in the use of digital equipment in news gathering. In 1998, DVCPRO 50 was introduced, with its 4:2:2 sampling rate for improved image quality. And in 2000, the DVCPRO family grew again with the debut of the DVCPRO HD VTR.

The ongoing evolution of DVCPRO products and technology reflects Panasonic's ability to continually develop new, cutting-edge products that meet emerging worldwide needs in broadcasting, production and other pro video applications.

One hallmark of the DVCPRO family is its wide interchangeability. Panasonic's top-of-the-line HD studio VTRs can play DVCPRO 50, DVCPRO and DV tapes. This compatibility among products — and the flexibility it provides — remains one of the central design concepts underlining Panasonic's development of DVCPRO equipment.

In 2003, Panasonic began developing the DVCPRO P2 series. While upgrading the recording media from tape to the solid-state P2 memory card, Panasonic insisted on using the same DVCPRO/DVCPRO 50 codecs. Now, with the new AG-HVX200, Panasonic introduces a P2 camera-recorder that offers a multi-codec capability, allowing you to select from DVCPRO HD, DVCPRO 50, DVCPRO and DV as the recording format.
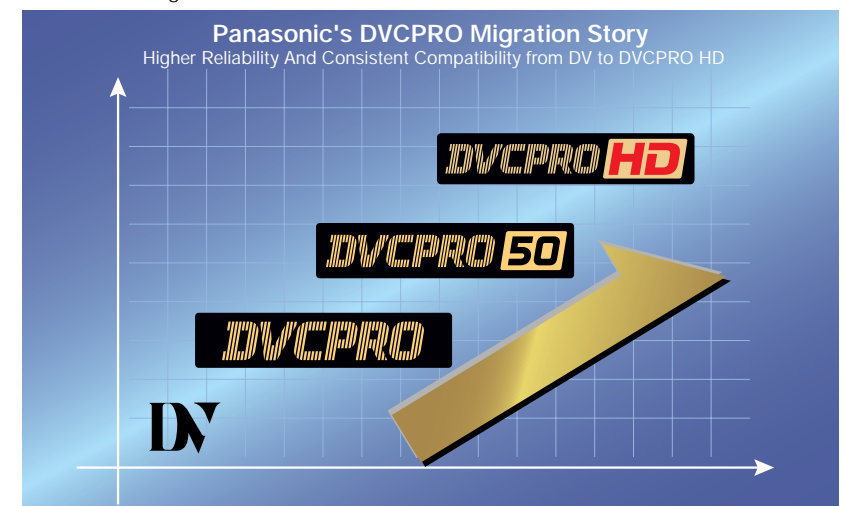
2-2 DVCPRO's Intraframe Compression System: Designed to Retain All Image Information

All DVCPRO equipment uses intraframe compression. Data is produced and compressed independently for each frame, even in the case of DVCPRO HD and the huge amount of data it captures. This helps maintain superior pictures, sound and reliability not only in nonlinear editing, but also in tape editing using VTRs. You get greater editing flexibility and higher-quality results.

Compared to DVCPRO, an MPEG2-based system uses interframe compression. A number of frames are formed into a group (called a GOP, for group of pictures) for processing. In each GOP, only frame I (for Initial) contains the entire set of image data. The subsequent frames P (Prediction) or B (Bi-directional) include the data that is different from the data in frame I.

DVCPRO, DVCPRO 50, DVCPRO HD

Motion Image

Recording Image

Data

Intra-Frame Compression
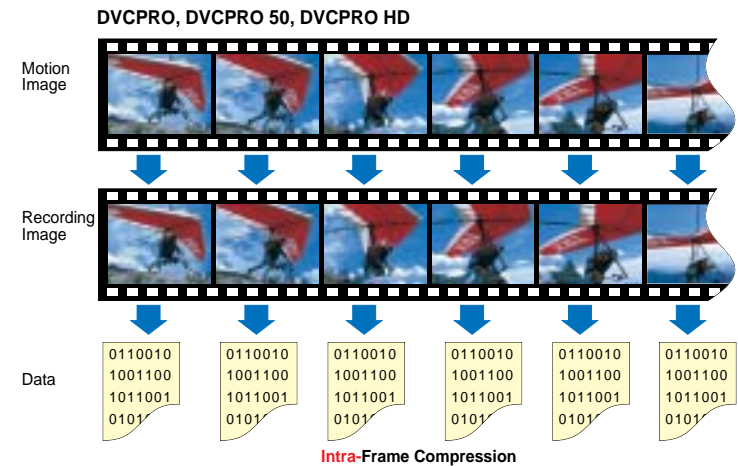
DVCPRO family: The data from each frame is compressed independently, so each frame can be reproduced singularly.

MPEG-2 (GOP)

Motion Image

Recording Image

I   B   B   P   B   B

Data

Inter Frame Compression
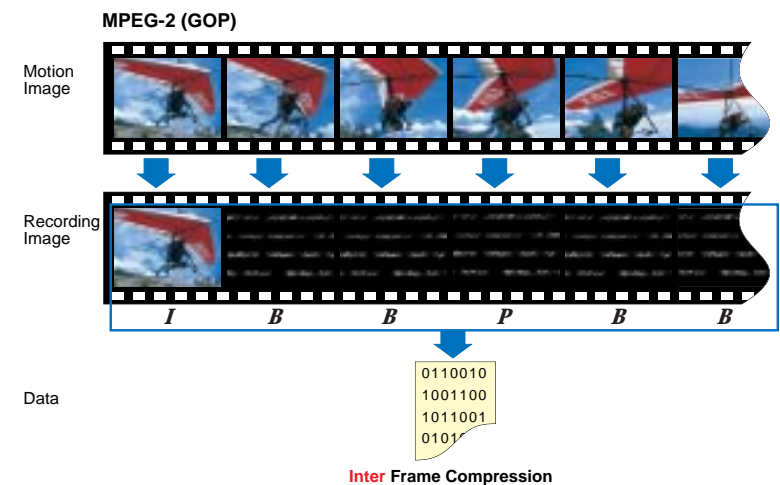
MPEG-2 (GOP): A number of frames (6, 12, or 15 etc.) are grouped together, and compression and reproduction are done on the entire group.

2-3 DVCPRO HD's 4:2:2 Sampling Rate Is Most Beneficial for Professional Video Production
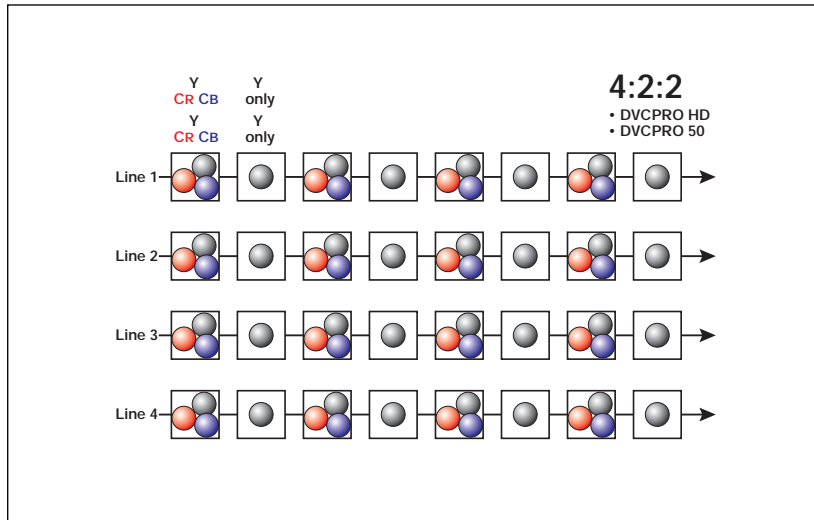
DVCPRO HD and DVCPRO 50 convert video signals to digital component signals at a 4:2:2 sampling (digitizing) ratio before recording. The resulting 4:2:2 digital component signal complies with the SMPTE259 Standard SDI signal specified in ITU-R601.

DVCPRO HD format samples the brightness signal (Y) at 74.25 MHz and the chroma signal (Pb/Pr) at 37.125 MHz, and combines each set of four Y samples with two Pb and two Pr samples. With the large amount of information it provides for the color difference signal, this system helps maintain outstanding color resolution.

As you know, 4:2:2 sampling is one of the conditions required for source footage and interfaces used in high-end production processes such as post-production.

This is because 4:2:2 sampling maintains rich colors that otherwise would be degraded in editing.

Another reason is related to chroma-key composition. Because 4:2:2 sampling

(ISO/IEC 13818-2 standard)
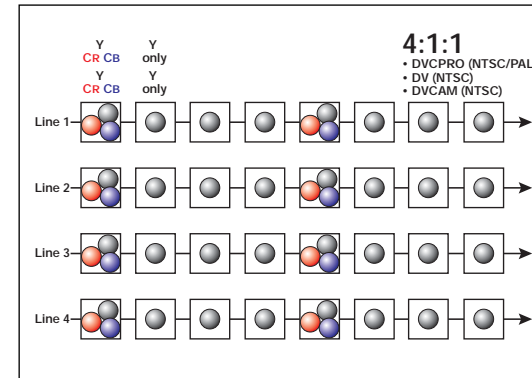
offers higher color resolution, it minimizes jaggies at chroma edges - and thus is suitable for image composition.

DVCPRO, DV (NTSC), and DVCAM (NTSC) use a 4:1:1 sampling rate.

DVCAM (PAL) and DV (PAL) use a 4:2:0 sampling rate.

Although these are the formats that the color signal resolution is half of what you get in 4:2:2 sampling their degradation of the video quality after duplication would be less, unlike HDV that also uses a different version of 4:2:0 sampling, because the luminance line is correspondent to the color difference line.
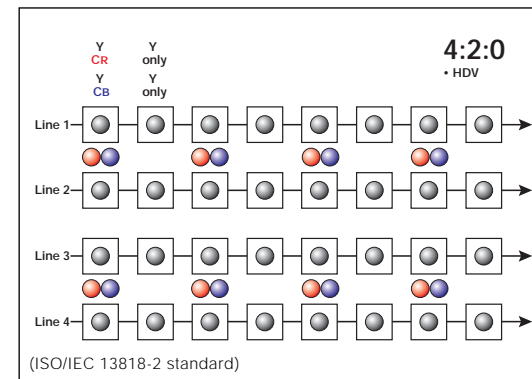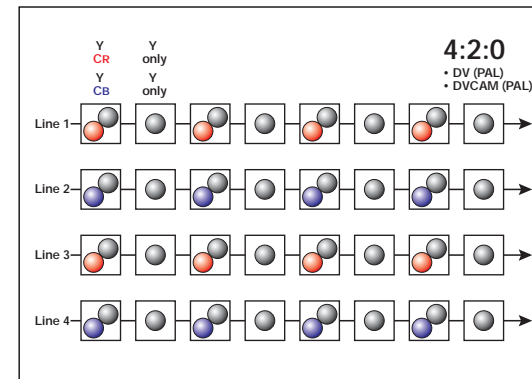
2-4 Differences in Audio Recording

DVCPRO HD format supports professional-level audio specifications with up to eight channels of uncompressed 48-kHz, 16-bit digital sound. AG-HVX200 itself can record up to four channels of audio.

In HDV, audio recorded in MP2 format is compressed to 384 kilobits per second.

Comparison between HDV and DVCPRO HD in Audio Recording

	HDV		DVCPRO HD
Compression	Compressed (MP2:MPEG-1 Audio Layer II)	Compressed (MPEG-2 Audio Layer II)	Uncompressed (Linear PCM)
Sampling	48 kHz	48 kHz	48 kHz
Quantizing	16 bit	16 bit	16 bit
Channel	2 channels	4 channels	8 channels (4 channels with AG-HVX200)

2-5 Video Format and Codec Supported by AG-HVX200

Recording Video Format*1		Codec	Media	Rec Time*3
HD	1080/60i	DVCPRO HD	P2 card	16 minutes
	1080/24p(over 60i)			
	1080/24pA(over 60i)			
	1080/30p(over 60i)			
	720/60p			
	720/24p(over 60p)			
	720/30p(over 60p)			
	720/24pN(Native)*2			40 minutes
	720/30pN(Native)*2			32 minutes
SD	480/60i	DVCPRO50		32 minutes
	480/24p(over 60i)			
	480/24pA(over 60i)			
	480/30p(over 60i)			
	480/60i	DVCPRO/DV		64 minutes
	480/24p(over 60i)			
	480/24pA(over 60i)			
	480/30p(over 60i)			
	480/60i	DV	Mini-DV tape	60 minutes
	480/24p(over 60i)			
	480/24pA(over 60i)			
	480/30p(over 60i)			

*1 24p=23.98p, 30p=29.97p, 60p=59.94p and 60i=59.94i
*2 In the Native mode, AG-HVX200 record only active flames.
*3 P2: using two 8GB P2 cards. (half with a single card)   DV: using a AY-DVM63 mini-DV tape

3. A Revolution in Recording with the P2 Card

3-1 The P2 Card — A Breakthrough in Professional Media

Many of the truly innovative functions of the AG-HVX200 are made possible by P2 card recording. The P2 card is a flash memory card developed by Panasonic as a professional AV media. Anyone who has used a digital still camera understands the advantages and convenience of file-based recording onto a memory card. The ultra reliability, fast data transfer, and ability to reuse solid-state memory breaks through the barriers of conventional videotape media to bring an exciting new, faster workflow to video production.

Select a clip from the thumbnail display for instant review. No need to search through scenes to record.

Dual slots allow hot-swapping for continuous recording onto two cards.

Super-Compact, Large Capacity and High Speed

P2, which stands for Professional Plug-in, is a compact solid-state memory card designed for professional AV use. Basically, four SD Memory Cards are packaged together to create a single P2 card. When striped as a RAID 0 array, this gives the P2 four times the transfer speed and four times the capacity of a single SD Memory Card. A slim, large-capacity 8-GB[*1] P2 card (AJ-P2C008HG) can hold 32 minutes of DVCPRO/DV codec recording yet weighs only about 45 grams. Compliant with PC Card standards (Type II), the P2 card plugs directly into the card slot of a laptop PC.[*2] AV data on the card mounts instantly, with each recorded as an MXF file. The data can be used immediately — no digitizing necessary — for nonlinear editing, or it can be transferred over a network. P2 far surpasses all other AV media in transfer speed, too. The P2 cards transfer data is up to 640 Mbps[*3], which can greatly speed up production processes.

P2 card Recording Time Reference

Model Number	Capacity Indication[*1]	Approx. Recording Time			
		DVCPRO/DV (Audio 2ch)	DVCPRO 50 (Audio 4ch)	DVCPROHD (1080/60i)	DVCPROHD (720/24pN[*4])
AJ-P2C004HG	4 GB	16 min.	8 min.	4 min.	10 min.
AJ-P2C008HG	8 GB	32 min.	16 min.	8 min.	20 min.

*1: Total card capacity includes space for data management such as system data; therefore, actual usable area is less than the capacity indicated on the card.
*2: The P2 card driver (standard equipped) must be installed. The P2 card driver operates under Windows XP and Windows 2000. The Mac computer may also use the PCMCIA slot to load in P2 data, providing the correct driver has been installed.
*3: This data transfer speed is a theoretical value. The actual data transfer speed varies according to operating conditions and other ancillary devices.
*4: Native recording mode. It records only active frames.

3-2 The New P2 Card Workflow

Panasonic has provided an SD (Standard Definition)-based news gathering system using the P2 card since 2003. Many of the world's broadcasting studios, which place top priority on speed and cost, have adopted the system and give it considerable and widespread praise. Here, the experience of NY1, an all-news station located in the U.S., is provided as an example of the kind of workflow that can be achieved by converting to a full P2 system.

Image Acquisition with P2 Camera-Recorders

The P2 card is extremely safe and reliable. Highly resistant to impact and cold, it prevents dropouts, and doesn't allow accidental overwriting of previous recordings unless the card is purposely initialized. The P2 card also helps to prevent shooting mistakes because you don't have to search for a blank space before recording. In fact, you can press the REC button even while previewing, to immediately start recording.

Using the P2 Card in a Nonlinear Editor

You can insert the P2 card directly into the PC card slot of a notebook PC, or connect the P2 drive to a desktop PC via USB. Recordings are mounted as MXF files, so the clips can be directly registered in your nonlinear editing application without the need to digitize them. Once the files are saved to the PC's hard disk, the P2 card can be initialized and reused again and again.

Easy Linking with Conventional Workflows Too

Because the codec used in the P2 system is the same as that used throughout the DVCPRO family, it enables easy connection to conventional production/transmission systems, analog or digital, based on VTRs. This allows a smooth shift from tape to data files.

3-3 P2 Card Recording Functions on the AG-HVX200

Dual Card Slots and Multi-Codec Recording

The AG-HVX200 has two P2 card slots, so you can record continuously onto two cards at a time. Choose from a DVCPRO HD, DVCPRO 50, DVCPRO or DV codec, or mix formats on the same card. An 8-GB card lets you record up to 32 minutes in DVCPRO or DV, 16 minutes in DVCPRO 50, or 8 minutes in DVCPRO HD. Recording time can be extended in 720p native mode, to give you 20 minutes of 24pN recording.

Hot-swap recording

Thanks to the AG-HVX200's two card slots, you can hot-swap P2 cards and have continuous non-stop recording. With multiple cards you can record for hours without interruption. Or, using an AJ-PCS060G, the "P2 Store," external hard drive, you can download recorded files from a P2 card and then initialize it (erasing the files), so it's ready for re-use.

Loop recording

Using two P2 cards and setting the AG-HVX200 for consecutive overwriting, you can repeatedly re-record during a particular recurring time slot, always maintaining a recording of the most recent period. Unlike video tape, P2 cards need no rewinding. They maximize your time and allow seamless, continuous recording. This makes them especially useful for unattended monitoring.

Pre-rec

While in standby mode, you can continuously store, and subsequently record, up to 7 seconds in DVCPRO or 3 seconds in DVCPRO HD of video and audio. In effect, this lets you record footage of events that occur even before you press the rec start button, giving you a way to "go back" and capture moments you otherwise would have missed.

Clip Thumbnail/Data Function

The AG-HVX200 records each cut as a clip (file) and automatically attaches a thumbnail image and file information to it. To preview a clip on the LCD monitor or to check clip data, simply choose the clip you want from the list of thumbnails. The thumbnails and time code information can also be displayed using nonlinear editing software*.

* Supported by Canopus, EDIUS.

Shot Marker Function

If desired, you can add a simple OK/NG shot marker to each clip either during or after recording. When a P2 card containing marked clips is inserted* in a PC, the PC will display with an M demarcation in the P2 viewer which of the clips is the one with the Marker.

* The P2 card driver (standard equipped) and P2 viewer (available on web at free for users) must be installed. These softwares operate under Windows XP and Windows 2000.

One-shot Recording

Convenient for producing animation, this mode records for a set time (from 1 frame to 1 second) each time you press the Start button.

Interval Recording

Recording one frame at a time at set intervals (from 2 frames to 10 min), this mode is useful for monitoring and special ultra-undercranking effects.

3-4 The P2 Workflow Following Acquisition

IEEE1394 (A/V Stream)
USB2.0 (File Transfer)

IEEE1394
(A/V Stream, File Transfer)

AG-HVX200   Windows PC   AG-HVX200   Macintosh

P2 card   P2 card

Capture on a Card, Then Link to Mac or Windows in PC Mode

P2 offers a highly simple solution to video production, because it lets you shoot, preview, and edit using only the AG-HVX200 and a notebook PC. In PC mode, the AG-HVX200 connects directly via USB 2.0 to a PC running Windows. In IEEE 1394 Device mode, it connects directly to a Mac. This lets you use the AG-HVX200 as a P2 card drive, providing easy access to recordings on the P2 card.

*Windows® is a registered trademark of Microsoft corporation.
*Macintosh® is a trademark of Apple Computer, Inc., registered in the U.S. and other countries.

P2 card (Recorded)

P2 drive

P2 store   P2 store

USB 2.0

AG-HVX200

P2 card (Blank)

P2 store

NLE
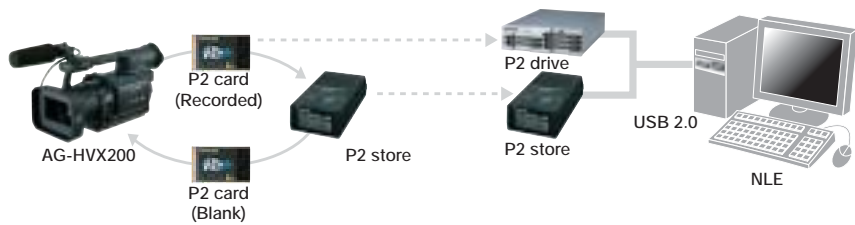
Capture on a Card, Then Mount to a Desktop Nonlinear Editor

P2 store mounts directly to your PC, which recognizes it as a hard-disk drive. The P2 card also loads directly into P2 store. P2 files in DVCPRO HD format has been supported by Apple, Avid, and Canopus.

Apple® Final Cut Pro®

Avid Xpress® Pro HD
Avid NewsCutter® family
Avid Media Composer® Adrenaline HD

Canopus EDIUS HD/SD/SP/Broadcast
Canopus EDIUS NX/NXe/Professional
with Broadcast Upgdare Option)

*Apple and Final Cut Pro are trademarks of Apple Computer, Inc., registered in the U.S. and other countries.
*Avid Xpress, Media Composer, and NewsCutter are trademarks registered in the United States of Avid Technology, Inc. or its subsidiaries.
*Canopus, EDIUS are registered trademarks of Canopus Co., Ltd..

AG-HVX200

IEEE 1394
(AVC)

AJ-HD1200A

DVCPRO HD Tape

DVCPRO HD VTR Workflow

AJ-SD93

DVCPRO 50 DVCPRO

DVCPRO 50 VTR Workflow

FOCUS FS-100   FOCUS FS-100

IEEE 1394
(AVC/SPB2)

NLE
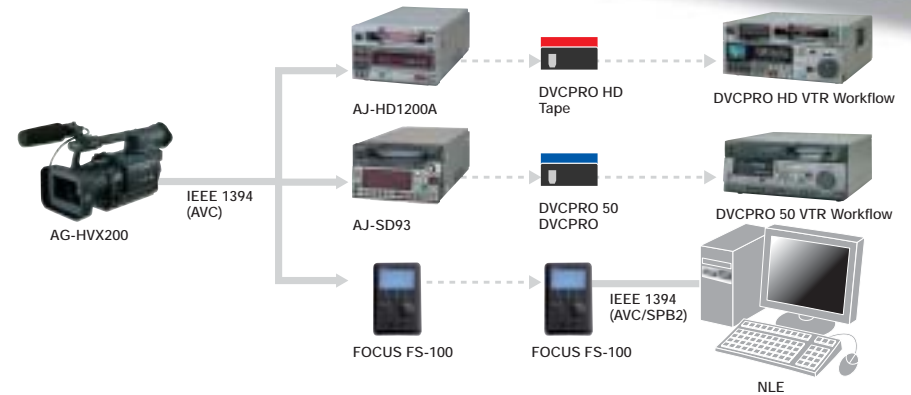
External Recording with IEEE 1394 Streaming

The IEEE 1394 interface can be used to control an external device synched with the camera's Start/Stop operation, making it easy to create backup recordings. Compatible devices include the AJ-HD1200A (for DVCPRO HD recording), the AJ-SD93 (DVCPRO 50/DVCPRO), and the AG-DV2500 (DV). Also, when used with the FOCUS FireStore FS-100, the AG-HVX200 can provide extended-time recording in all codec formats, including DVCPRO HD (except in native recording mode). *FOCUS and FireStore are registered trademarks of FOCUS Enhancements, Inc..

AG-HVX200

MiniDV Tape   DV Recorder

IEEE 1394 (AVC)

NLE

P2 card
(720pNative)   Conversion Dubbing   MiniDV Tape
(480i)
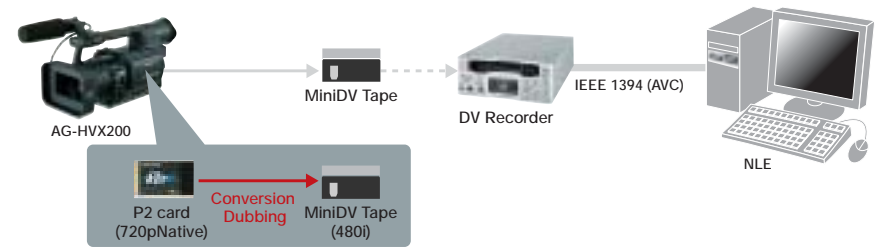
DV Tape-Based Recording Too

The AG-HVX200 is equipped with a mini DV tape drive. This allows recording in 60i, 30p, 24p or 24pA (Advance) modes, just like AG-DVX100 series models. It also lets you down-convert an HD source (1080i/720p) recorded on a P2 card and copy it to a mini DV tape. Certainly, 720p VFR recorded material can copy to DV tape. This lets you create special speed effects during DV production — until now, a feat possible only with a complete VariCam system. (See page 34.)

*When you shoot in HD on the assumption of down convert to DV, stronger Detail Level is recommended.(e.g. DETAIL LEVEL +5)

4. What's a Variable Frame Rate?

4-1 An Important Part of the VariCam's Creative Expressiveness

Movie Film Camera

Panasonic "VariCam" AJ-HDC27H

AG-HVX200

Shooting techniques called overcranking and undercranking are often used when producing movies with a film camera. They achieve unique visual effects by running the camera faster (overcranking) or slower (undercranking) than the standard playback speed of 24 fps. Playing an overcranked film at normal speed yields a slow-motion image, while an undercranked film shows the image in fast motion.

Conventional video cameras with a constant-speed interlaced recording system at 60 fps do not allow the use of these shooting techniques. Special editing is required to achieve a slow- or fast-motion effect with video recording. However, this still does not provide a natural effect with all of the image information intact, as a film camera is able to do. This is one of the reasons why many image creators prefer film cameras.

Panasonic's revolutionary VariCam (AJ-HDC27F/H) HD camera changed all that. Using the 720p HD recording format, the VariCam achieved a rate of 60 fps. This allowed overcranking and undercranking based on the standard rate of 24 fps. This variable frame rate function resulted in the rapid and widespread use of HD video recording systems in the production of both movies and TV commercials and programs.

The AG-HVX200 is the first compact camera-recorder to be equipped with the variable frame rate function. Like VariCam, the shutter opening angle can be set in degree(from 10 to 350 degree) in AG-HVX200.

Together with its high mobility, the AG-HVX200 offers the VariCam's popular special effect functions at a low cost.

	Film Camera	Conventional Video Cameras	VariCam or AG-HVX200 (720p mode)
Picture Frame	Full (Film)	2 fields Interlace	Full (Progressive)
Recording Speed	Variable	Fixed	Variable
Playback Speed	Fixed	Variable	Variable
Gradation	Film Tone	Video Gamma	Cine-like Gamma (selectable)

4-2 Overcranking and Undercranking by Changing the Frame Rate

Rec & Play 24 fps

Standard recording speed for Movie Production (Playback at Same Speed)

Overcranking

Rec 48 fps

2x Higher speed shooting

Play 24 fps

provide 1/2x slow-motion when standard playback

Undercranking

Rec 12 fps

1/2x lower speed shooting

Play 24 fps

provide 2x quick-motion when standard playback
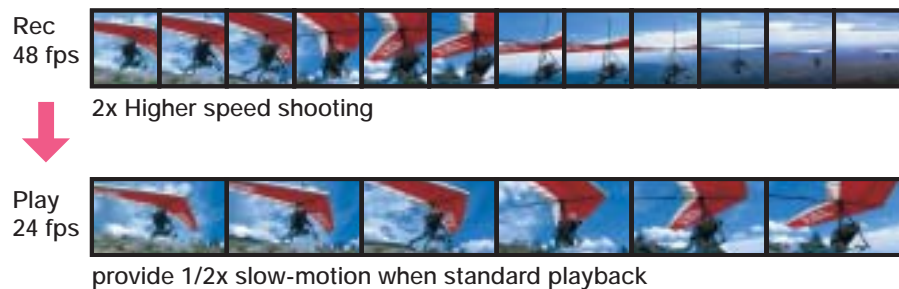
When set to 720p mode*, the AG-HVX200 lets you change the frame rate from the standard 24p/30p to any of 11 steps from 12p to 60p.

* In 1080 and 480 modes, the frame rate cannot be changed from the 24p/30p/60i setting.

Standard Recording Speed (24 fps) for Movie Production

When making movies that will be projected onto a screen, video is recorded at the standard (1x) frame rate of 24 fps, which is the same as the playback speed of film. The AG-HVX200 can also record at 1080/24p (over 60i) or 480/24p (over 60i), in addition to 720/24p.

Standard Recording Speed (30 fps) for TV Commercials and Programs

When producing HD/SD TV broadcasts, video is recorded at the standard (1x) frame rate of 30 fps. This gives commercials and music clips a high, film-like image quality, and is suitable for TV broadcasting too. The AG-HVX200 can also record at 1080/30p (over 60i) or 480/30p (over 60i), in addition to 720/30p.

Overcranking (26* fps or Higher)

Overcranking provides slow-motion playback, which is frequently used in climax scenes or for dramatic effects like car chases and action scenes. For example, a video clip recorded at 48 fps provides a slow-motion effect that is 1/2 normal playback speed (at 24 fps). This provides a high-quality slow-motion effect with high-density and a smooth frame transition, unlike the slow-motion effects of other video recording systems.

* 24 fps as standard speed. For a standard speed of 30 fps, 32 fps and higher achieve overcranking.

Undercranking (22* fps or Lower)

Undercranking is used for special effects in certain scenes, such as to add emphasis to a current of water or a cloud, a person standing in a busy crowd, or martial arts type action. A video recorded at 12 fps, for instance, yields a fast-motion effect of 2x normal speed in playback (at 24 fps).

*24 fps as standard speed. For a standard speed of 30 fps, 26 fps and lower achieve undercranking.

4-3 Slow-Motion and Fast-Motion Effects

Slow-Motion Effect

2.5 times slower when set to 60fps in 24p mode, two times slower when set to 60fps in 30p mode

Dramatic Effects for Decisive Moments in Sports Competition

Slow-motion is most commonly used to give a dramatic effect to crucial moments in sports scenes. To emphasize speed, a slower shutter speed is used to produce a soft focus. For example, a faster shutter speed can be used to make beads of perspiration drop like tiny balls of water.

Making Objects Appear Huge in Science Fiction Works

Slow-motion shooting has been used ever since moviemakers started producing science fiction films, with their monsters and other imaginary creatures and objects. By reducing the speed, the slow-motion effect makes monsters and miniature objects seem much larger. The degree of this effect can be adjusted by varying the shutter speed.

Explosions and Implosions

The slow-motion effect is also used to emphasize major moments in a movie. Although a fast shutter speed is commonly used to create a strong visual impression, a slow shutter speed can produce a highly distinctive effects during an implosions.

Retrospective Scenes

Slow motion can also be used to present imaginary scenes, such as recollections of the past. For these scenes, the slow-motion effect is often added with a change of color tone. The brightness is also sometimes adjusted, and the shutter speed is varied to achieve the intended effect.

Fast Motion

2 times faster when set to 12fps in 24p mode, 2.5 times faster when set to 12fps in 30p mode

Adjusting the Speed to Show Actors in Fast Motion

A fast-motion effect can be used to compensate for the slower movements of the actor wearing heavy costumes. For this purpose, the speed is increased only slightly to retain natural motion. The shutter speed is not usually changed at all.

Comical Effects

Fast motion can be used to create an unrealistic, entertaining effect in a comedy action scene. Extremely fast speed is often combined with computer graphics. The shutter speed is varied over a wide range according to the intended effect.

Special-Effect Scenes

A fast-motion effect can be used to create various effects. For example, it can make the main character appear to be stationary in a bustling crowd, or make a waterfall or river flow like moving silk. Here, the shutter speed is selected from a wide range.

CG-Like Effects

If a car's tail lamps or building lights are recorded with the shutter fully open while slowly sweeping the camera, a blurring effect results, rendering an image similar to a computer-generated image.

4. What's a Variable Frame Rate?

Special Techniques

Undercranking to Increase the Gain

When lighting is insufficient, the frame rate can be reduced to increase the gain while preserving image quality. A slower shutter speed produces an even more effective result.

Undercranking with No FRC

This technique uses undercranking for fast-motion recording. This technique cannot be used with images shot with a film camera. It is often used when producing commercials recorded with the VariCam.

The resulting image creates a fast-motion effect. It gives a blurry effect to a normal-speed image, to achieve a unique ambience. This technique is not recommended for scenes in which an object moves across the screen, since the motion will be somewhat jerky.

Table of Frame Rate and Speed Effect

Supported Frame Rate	Speed Effect in 24p base	Speed Effect in 30p base
12 fps	200% Quick	250% Quick
18 fps	133% Quick	167% Quick
20 fps	120% Quick	150% Quick
22 fps	109% Quick	136% Quick
24 fps	100% Standard	125% Quick
26 fps	92% Slow	115% Quick
30 fps	80% Slow	100% Standard
32 fps	75% Slow	94% Slow
36 fps	66% Slow	66% Slow
48 fps	50% Slow	62% Slow
60 fps	40% Slow	50% Slow

4-4 Native Mode (720/24pN and 720/30pN) for Special Effects Using only the Camera-Recorder

Frame Rate
Converter (FRC)

DVCPRO HD
Studio VTR

VARICAM

=

AG-HVX200
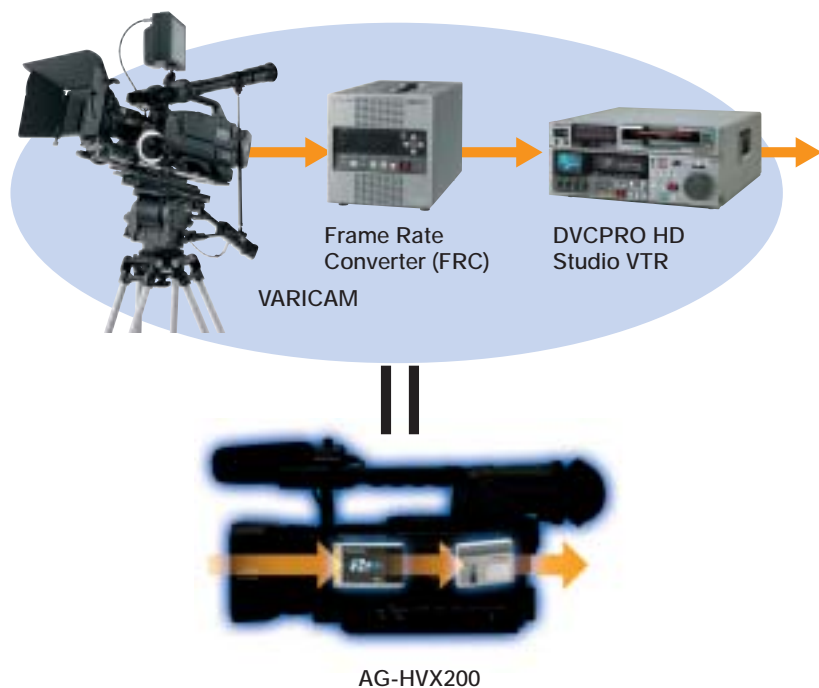
New Function: Native Mode(720/24pN and 720/30pN)

The use of the P2 card as a recording media has led to the development of a new function, native mode, for recording images at the frame rate used by the camera. Since the AJ-HDC27H VariCam uses tape as its recording media, its recording is based on 60p even when the image acquisition frame rate is varied. For example, in 24p mode, the AJ-HDC27H records 60 fps by applying 2:3 pulldown. Therefore, to preview the image effect, the recorded data has to be processed using a frame rate converter and the effective frames must be extracted.

In comparison, the AG-HVX200's native 24p mode (24pN) records only 24 fps onto a P2 card. This lets you preview the slow- or fast-motion effect of the variable frame rate function on-the-spot without having to use a frame rate converter.

Copying Slow-/Fast-Motion Recordings onto DV Tape

In addition to its P2 card slots, the AG-HVX200 is equipped with a mini DV tape drive. This allows DV recording and also lets you down-convert a DVCPRO HD source (1080i/720i) recorded onto a P2 card and copy it to mini DV tape. When copying, a recorded video image that has been overcranked or undercranked in the native mode remains in the frame-rate-converted condition during the down-conversion process. The AG-HVX200 lets you easily create special speed effects without using any other hardware or software. Until now, this was possible only with a complete VariCam system.

Frame rate conversion with over 60p mode recording (Ex. 40-fps)   active frame
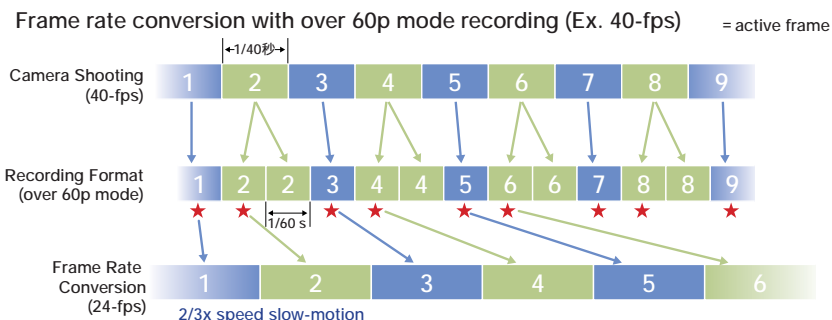
AG-HVX200 native mode recording (Ex. 40-fps)
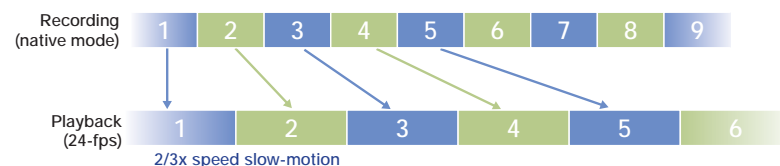
4-5 720p (over 60p) Mode Provides Extra Convenience for VariCam and Other Systems

P2 card

P2 drive

USB2.0

P2 card (recorded)

P2 store

USB2.0

P2 card (blank)

AG-HVX200

IEEE 1394 (AVC)

FOCUS FS-100

IEEE 1394 (AVC/SBP2)

NLE

IEEE 1394 (AVC)

DVCPRO HD Tape

AJ-HD1200A

DVCPRO HD Studio VTR
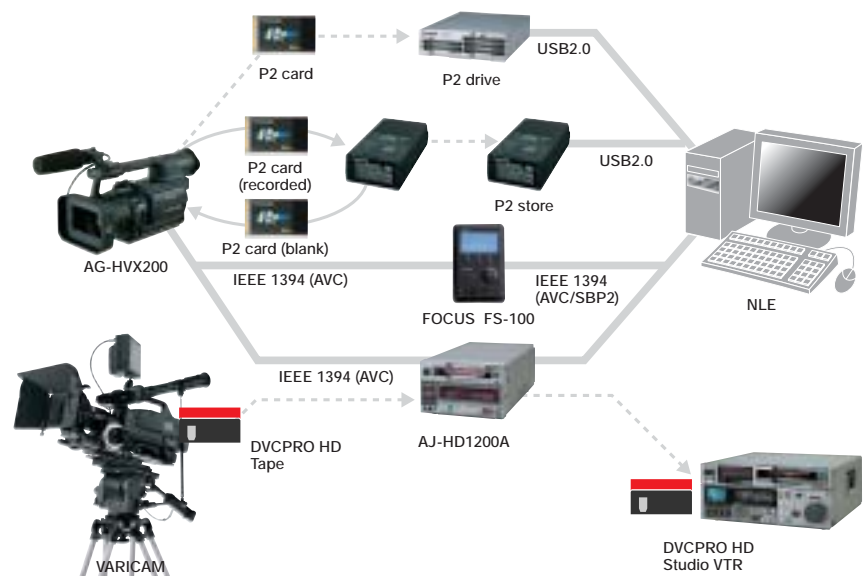
VARICAM

720p (over 60p) Mode Compatible with DVCPRO HD

The 720/Xp over 60p mode is fully compatible with VariCam. For instance, in 24p, this mode records 60 fps by applying 2:3 pulldown. Because the data recorded in this mode is in the same format as signals recorded onto DVCPRO HD tape by the VariCam, it can be incorporated directly into the VariCam production flow.

IEEE 1394 (AVC) A/V Stream Output

This mode offers another handy advantage. Since it is able to stream DVCPRO HD from the IEEE 1394 terminal while recording, an external HDD recorder such as the AJ-HD1200A DVCPRO HD recorder or FOCUS FireStore FS-100 (available soon) can be connected for backup recording.

1080/480 24p Advance Mode

Progressive recordings in 1080 and 480 can be converted to 60i in 24p/30p/24pA (Advance) mode. The 24p Advance mode uses 2:3:3:2 pulldown. When recording data is uploaded via IEEE 1394 interface to a nonlinear editing system* supporting this mode, 60i/24p conversion can be done with minimal image degradation, thus allowing you to maintain high image quality in production.

* Applicable systems and formats, visit our Website : <https://eww.pavc.panasonic.co.jp/pro-av/>, "P2 Compatibility Table".

• 24p Mode (2:3 pulldown)

24p (capture) | A B C D E F G H

60i (record) | A A B B B C C D D D E E F F F G G H H H
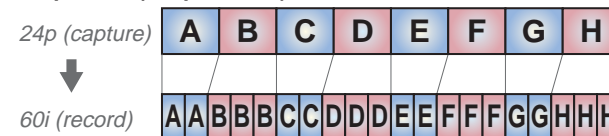
• 24p Advance Mode (2:3:3:2 pulldown)

24p (capture) | A B C D E F G H

60i (record) | A A B B B C C C D D E E F F F G G G H H

• 30p Mode

30p (capture) | A B C D E F G H I J

60i (record) | A A B B C C D D E E F F G G H H I I J J

Inheriting the Popular DVX100 Series Design

- Max. 1/12 sec slow/synchro/high-speed shutter (1/2000 sec.)
- Three user buttons
- 3-position white balance selector/auto-tracking white balance
- Mode check: Easy camera status display
- Two XLR audio input terminals with 48-volt phantom power supply
- Large, bright 3.5-inch color LCD monitor
- Camera-to-camera Initial Time-code copy via IEEE 1394
- User files and scene files can be stored on SD Memory Card for copying and use by multiple AG-HVX200 units.

- Leica Dicomar lens with 13x optical zoom and optical image stabilizer
- Eight gamma curves, including the cine-like gamma curve
- Matrix table selection, including the cine-like mode
- H detail, V detail, detail coring, and skin detail
- Chroma level, chroma phase, color temp, and master pedestal
- Knee point settings: Auto, Low, Mid, and High
- Cam-driven manual zoom ring
- Manual focus ring
- Focus assist function (zoom up center portion)
- Auto/manual selectors: Auto aperture (iris), auto gain, auto-tracking white balance, auto focus with single ON/OFF control for all
- Auto focus/infinity position/Push Auto button
- Manual aperture dial
- 3-position gain selector (0/+3/+6/+9/+12 dB)
- ND filters: 1/8 ND and 1/64 ND

5. Camera Functions and Operating Ease

- Analog Component Out for outputting 1080i/720p/480i (each 59.94 Hz)
- Remote control of focus, iris, zoom, and rec start/stop
- Large audio recording level controls
- Large tiltable electronic viewfinder
- Front and rear tally lamps
- 16:9 squeeze/letter box modes selectable in SD
- 6-position scene file dial
- Trigger and zoom button on upper handle grip
- Zebra function: Two patterns, 50% to 105% in 5% steps
- Center marker: Accurate numeric display of the brightness at screen center

Six Scene Files (Factory Setting)

F1: SCENE
File suitable for normal shooting.

F2: SCENE FLUO.
File suitable for shooting under fluorescent lights, i.e. indoors.

F3: SCENE SPARK
File suitable for shooting with greater extremes of detail enhancement, color and contrast.

F4: SCENE B-STR
File for broadening the contrast of dark parts, such as when shooting sunsets.

F5: SCENE CINE V
File suitable for shooting film-like scenes where the contrast is to be emphasized.

F6: SCENE CINE D
File suitable for shooting film-like scenes where the dynamic range is to be emphasized.

6. Applications and Workflows

6-1 High-End Production of Movies and Commercials

Mobility, Easy Operation and High Cost-Performance
The mobility of the compact, lightweight AG-HVX200 rivals that of a DV camera for use in high-end production, such as in movies and TV commercials. It allows the kind of active shooting that is difficult with a conventional shoulder-type HD camera, and introduces an entirely new level of video expression. Fitting a host of shooting and recording functions, such as a variable frame rate, into its sleek-looking body, the AG-HVX200 also offers great solutions to many tough shooting situations with its easy operation and high cost-performance.

Shots that Only a Mobile Handheld Camera Can Achieve

Inside a car
The AG-HVX200 fits into cramped car spaces where a shoulder-type camera could not. Its short body also allows it to be swung around easily inside the car.

Mounted to a car body
It is difficult to securely mount a large, shoulder-type camera to the side or hood of a car for action shots. The AG-HVX200 can be easily mounted just about anywhere.

On a bicycle or motorcycle
The AG-HVX200 lets you capture HD scenes at high speeds on narrow roads and pathways. Needless to say, this would be difficult with a shoulder-type camera.

Low-angle shots
The action of following or tracking an object in comical scenes for example, can be easily recorded with low-angle handheld shooting.

Aerial shots from a radio-controlled helicopter
A radio-controlled helicopter can be used to create low-budget aerial shots, and to capture scenes in places so narrow that only a toy helicopter can enter. More expansive images can be taken by using a wide-conversion lens (available soon from a third-party vendor).

Shots Employing a Variety of Functions

Shooting with a variable frame rate
It is easy to achieve slow- and fast-motion effects using the overcranking and undercranking techniques that were previously possible only with VariCam. Using the native mode, you can also check the effects right on the spot.

Multi-camera shots
Simultaneous HD multi-angle shots can be taken with comparatively low cost.

Multi-format shooting
By selecting a different recording format for different scenes, you can give each one a distinctive feel. The AG-HVX200 is the first to provide 480, 720, and 1080 formats and both interlaced and progressive scanning in a single camera.

HD progressive scanning for CG composites
The 720 and 1080 progressive HD images of the AG-HVX200 can be easily used in composite images with computer graphics or blue-back and green-back sets.

Clay animation
Use the one-shot recording function with the P2 card to take HD-quality clay animation shots.

Interval recording
HD images enable precise, accelerated views of slow-changing scenes, such as sunrises, cloud movement, or plant growth.

Capturing decisive moments
(using the pre-rec function)
Using the pre-rec function with the P2 card, you can go back and use footage from before you even pressed the rec button. This makes it easy to catch scenes that are difficult to time, like the sudden spouting of a whale at sea.

Unattended shots of animals, etc.
(using the loop-rec function)
Using the loop-rec function with the P2 card, you can record wild animals and other subjects in situations where you cannot stand immediately next to the camera.

6-2 Video and Independent Movie Production

High-Quality HD, Expressive VFR -- Versatile, Low-Cost Production
The AG-HVX200 lets you produce the same level of slow- or fast-motion HD images in high resolution that were previously possible only with expensive, high-end video systems. And it does it at a cost closer to the level of DV production. The AG-HVX200 is a powerful tool for anyone creating music video, promotional videos, or indies. This single camera lets you choose from among 720/1080 HD and 480 SD formats, and gives you versatility on a par with a DV camera, both in terms of mobility and recording modes.

Lower-Budget Production with VariCam Expressivity and Image Quality

Shooting with a variable frame rate
It is easy to achieve slow- and fast-motion effects using the overcranking and undercranking techniques that were previously possible only with VariCam. By recording ordinary scenes onto tape in DV mode, and recording only the parts using the variable frame rate onto a P2 card, you can then dub it all onto DV tape and use a standard DV environment for editing.

HD progressive images
The AG-HVX200 lets you record in 720 or 1080 HD format at low cost. Progressive HD images can also be easily used in composite images using computer graphics or blue-back sets, lowering costs even more.

Multi-format shooting
By selecting a different recording format for different scenes, you can give each one a distinctive feel. The AG-HVX200 is the first to provide 480, 720, and 1080 formats and both interlaced and progressive scanning in a single camera.

6. Applications and Workflows

16:9 native mode
You can use the 16:9 aspect ratio for shooting in 480i, 720p, or 1080i format. The 16:9 native CCD in the AG-HVX200 ensures superb image quality in each.

Low-budget HD nonlinear production
Recording onto the P2 card and using the PC mode of the AG-HVX200 lets you perform HD editing with the simple connection of a compatible nonlinear system (available from Apple, Avid, and Canopus). This allows you to produce HD content at a low cost that was previously impossible.

Multi-Format Shots Where Mobility Excels

Car-based shots
The short body and wide field of view of the compact, lightweight AG-HVX200 make it ideal for shooting inside cars or mounting to the car body.

On a bicycle or motorcycle
The AG-HVX200 lets you capture scenes at high speeds on narrow roads and pathways.

Low-angle shots
The action of following or tracking an object, and comical scenes, can be easily recorded with low-angle handheld shooting.

Aerial shots from a radio-controlled helicopter
A radio-controlled helicopter can be used to create low-budget aerial shots, and scenes in places so narrow that only a toy helicopter can enter. More expansive images can be taken by using a wide-conversion lens (available soon from a third-party vendor).

Shots Employing a Variety of Functions

Multi-camera shots
Simultaneous multi-angle shots can be taken with comparatively low cost. This is ideal, for example, for producing videos of live concerts or events.

Clay animation
Use the one-shot recording function with the P2 card to take clay animation shots.

Interval recording
Images enable accelerated views of slow-changing scenes, such as sunrises, cloud movement, or plant growth.

Capturing decisive moments (using the pre-rec function)
The pre-rec function with the P2 card makes it easy to catch scenes that are difficult to time, like the sudden spouting of a whale at sea.

Unattended shots of animals, etc. (using the loop-rec function)
Using the loop-rec function with the P2 card, you can record wild animals and other subjects in situations where you cannot stand immediately next to the camera.

6-3 Events and Other Professional Video Work

Adding high-end expression to DV production

The Variable Frame Rate function of the AG-HVX200 can add dramatic, film-like, slow-motion effects to lower-budget event and wedding videos. Richer expression and cinematic quality can also be achieved by using other AG-HVX200 functions, such as multi-camera simultaneous recording.

Record a wedding's flower shower in slow motion

Overcranking a close-up of the bride and groom in the climactic flower shower of a wedding, using a 60p frame rate in a 720/24p or 720/30p production will create the kind of beautiful, slow-motion scene that you see in movies. When using native mode, you can also check the results on the spot, and you can down-convert and dub the slow-motion images onto DV tape. This gives you DV source images without having to use any other equipment.

Capture the bouquet toss with multi-cameras

Using Initial Time Code Copy function, multi-camera shooting becomes easier, and you can have varieties of effective video images. And, the editing is easier using time code. For example, camera A can record bride from straight ahead, then zoom in to show her with the lucky girl who caught the bouquet. Camera B can follow the motion of the bouquet in flight with a series of shots taken from behind the bride. This dramatic effect can be increased by using the Variable Frame Rate function to shoot in slow motion.

Take aerial shots of the wedding site with a radio-controlled helicopter

A radio-controlled helicopter can be used to take aerial shots of the wedding site or outdoor wedding scene. Increase the effect by combining this with the dramatic release of balloons or white doves. A wide-conversion lens is also effective here (available soon from a third-party vendor).

Shoot in vertical 16:9

By holding the camera on its side and shooting vertical 16:9 images, you can take close-ups of the bride's wedding dress from head to toe. This shot would create a beautiful impression projected onto a vertical screen inside the wedding reception as a special dramatic effect.

6-4 Image Production Workflow
   Together with Tape

- Broadcast-quality DVCPRO HD acquisition
- Various kinds of video effects (slow- and fast-motion, blur, etc.)
- Reliable and quick operation with the P2 card
- Support for the DVCPRO HD tape workflow

SHOOTING   EDITING   DISTRIBUTION

DVCPRO HD tape

VARICAM
AJ-HDX400

IEEE 1394
(AVC)

AJ-HD1200A

IEEE 1394
(AVC)

P2 card

P2 drive

USB2.0

AG-HVX200
(DVCPRO HD)

P2 card
(recorded)

P2 store

P2 store

USB2.0

P2 card
(blank)

Field temporary back up

Nonlinear Editors
(Apple, Avid, and Canopus)

IEEE 1394
(AVC)

AJ-HD1200A
DVCPRO HD

Conventional System

IEEE 1394
(AVC)

FOCUS
FireStore FS-100

IEEE 1394
(AVC/SPB2)

Long recording time

Contents Archive

Data Tape

Tape
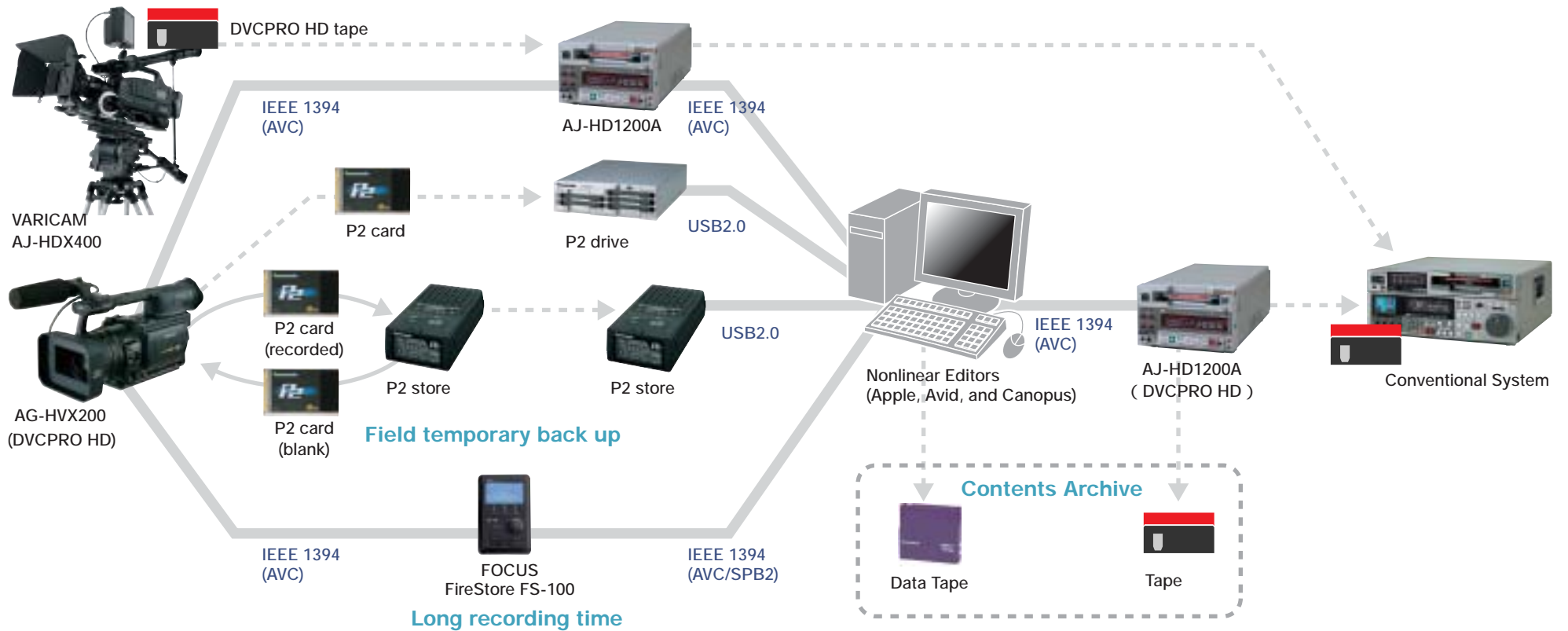
6-5 File-Based Image Production Workflow

- Broadcast-quality DVCPRO HD acquisition
- Various kinds of video effects (slow- and fast-motion, blur, etc.)
- Reliable and quick operation with the P2 card

SHOOTING   EDITING   DISTRIBUTION

IEEE 1394 (AVC)

AJ-HD1200A

IEEE 1394 (AVC)

P2 card

P2 drive

USB2.0

HD Monitor BT-LH1700W

Projector

DVD-R (VC1, H.264 etc.)

P2 card (recorded)

P2 store

P2 store

USB2.0

AG-HVX200 DVCPRO HD

Nonlinear Editors (Apple, Avid, and Canopus)

Player with HD playback capability

P2 card (blank)

- Thumbnail display
- Random access playback
- VFR recording

- File transfer (= No need digitize)

IEEE 1394 (AVC)

IEEE 1394 (AVC/SPB2)

PC

FOCUS FireStore FS-100

HDD

Blu-ray Disk DVD-RAM/R

Long recording time

Back Up

Contents Archive
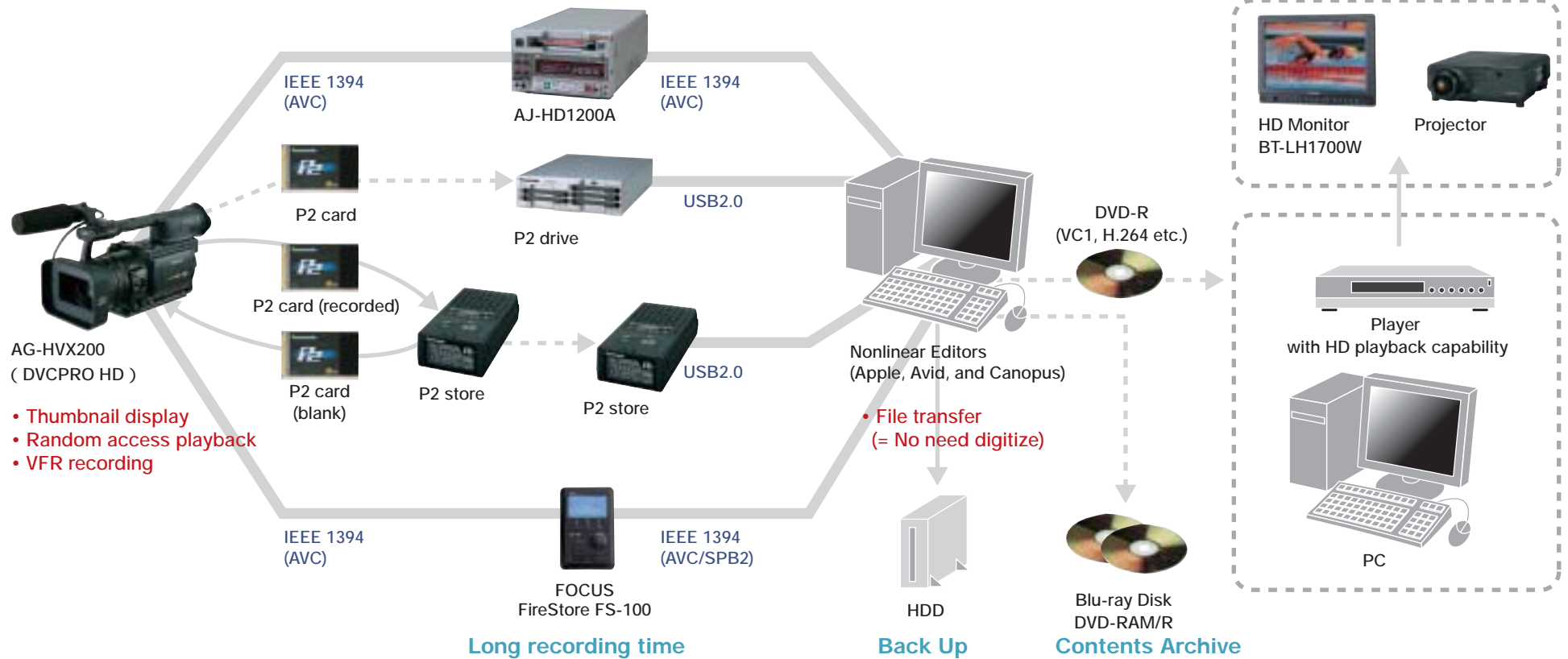
6-6 DV-Based Image Production Workflow

• Various kinds of video effects (slow- and fast-motion, soft focus, etc.) can be achieved in your existing DV production environment.
• Record with a variable frame rate onto a P2 card, then dub it onto DV tape to achieve speed effects in your existing DV environment.

SHOOTING   EDITING   DISTRIBUTION
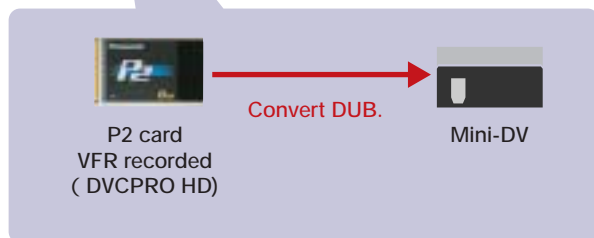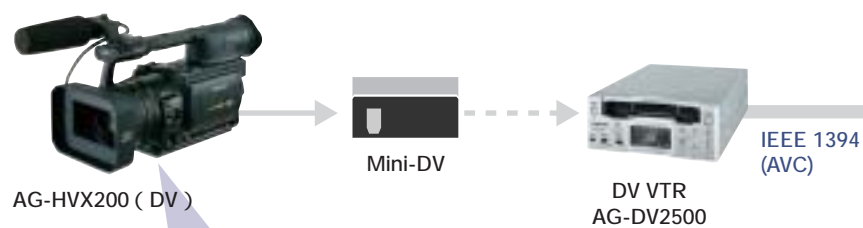
HD Monitor
BT-LH1700W

DVD-R

Mini-DV

DV VTR
AG-DV2500

IEEE 1394
(AVC)

SD
DVD-VIDEO
MPEG2

DVD Player

AG-HVX200   DV

Nonlinear editors
with DV tape compatibility
(Adobe, Apple, Avid, and Canopus also support 24pA.)

P2 card
VFR recorded
DVCPRO HD)

Convert DUB.

Mini-DV

DV VTR
AG-DV2500

Mini-DV

Record with a variable frame rate onto a P2 card,
then dub it onto DV tape to achieve speed effects
in your existing DV environment.

Contents Archive
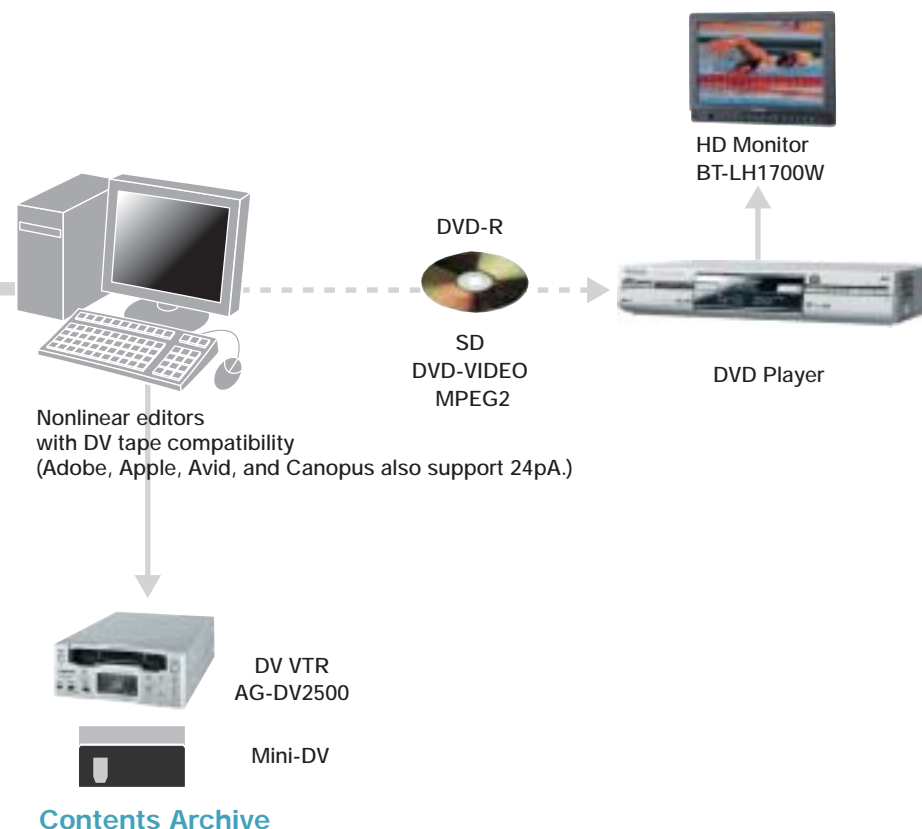
6. Applications and Workflows

6-7 News Workflow

- The P2 handheld camera is ideal for journalists
- SD/HD multi-format recording
- Versatile recording modes help to catch sudden shooting opportunities
- Reliable and quick operation with the P2 card

SHOOTING

EDITING

NETWORKING

Contents Aircive

P2 card
(recorded)

P2 drive

P2 store

P2 store

USB
2.0

AG-HVX200
DVCPRO HD

P2 card
(blank)

Field temporary back up

EtherNet

Nonlinear Editors
(Apple, Avid, and Canopus)

- **Speedy content checking and selection with the thumbnail display**
- **Loop-rec and pre-rec functions**

- **Transferring files for quick, easy uploading**

P2 card

Server

Database

IEEE 1394
(AVC)

Long recording time

FOCUS
FireStore FS-100

Workstation

7. Terminology

[P.1]

Cam-driven zoom: This zoom system lets the operator directly control the zoom lens by manually operating the zoom ring. The zoom lens is controlled by a cam mechanism, from which the name is derived. Because there is no time lag during operation, as there is with electronic zoom systems, you get exactly the zoom effect you're looking for.

S/N: Expresses the ratio of signal to noise. The larger the number, the lower the noise.

Scan: This refers to using the camera lens and circuitry to convert the image that enters the lens into an electric signal. The AG-HVX200 initially scans at 1080/60p, and then, according to the recording mode, converts the video signal from progressive to interlaced, or down-converts it to SD (standard definition). In this way, it begins by capturing complete, progressive HD (high definition) images, then converts them as necessary. This produces a level of image quality that is not possible by using interlaced scanning and then processing it with electronic interpolation.

DSP: Abbreviation for digital signal processor, which is an LSI that processes digitalized video and audio signals. The higher the bit count, the finer the resolution. Featuring 14-bit A/D conversion and 19-bit internal processing, the high-performance DSP in the AG-HVX200 rivals those used in broadcasting cameras.

Gamma: The gamma curve represents the characteristics with which changes in the brightness of the image are converted into an electric signal.

[P.2]

P2: Abbreviation for professional plug-in. The P2 card was developed for use as a professional AV media. By packaging four SD Memory Cards into a single P2 card, it provides four times the capacity and data transfer speed of the SD Memory Card. It also exhibits the kind of remarkable characteristics and superior reliability under harsh conditions that are possible only with a solid-state memory, resisting impacts up to 1,500G and vibration up to 15G, operating in temperatures from -20 to 60°C, and enabling storage from -40 to 80°C.

P/I conversion: The conversion from progressive to interlaced. The CCD system in the AG-HVX200 uses progressive scanning. Since a progressive frame with complete image information is divided into two interlaced fields in P/I conversion, the resulting fields form a complete image, with no shifting, when displayed as an interlaced image. This is not possible with cameras whose CCD system uses interlaced scanning. When two interlaced fields are combined to form a single frame showing movement, a certain amount of shift inevitably occurs between the two fields, which causes blurring and other problems.

Cross-conversion: Converting from HD to SD is called down-conversion, and from SD to HD is called up-conversion. Cross-conversion refers to converting between the two 1080 and 720 formats of HD (1080720).

Down-conversion: Converting a video signal based on a certain standard to a video signal of a lower standard. Example: (HDSD)

Codec: Abbreviation for compression/decompression. This is a program that compresses and decompresses data. Codecs for various formats are used to handle the large amount of data in video and audio files.

16:9: While current standard-definition TV broadcasts use a 4:3 aspect ratio (the ratio of vertical-to-horizontal screen dimensions), HD broadcasts use the wider, 16:9 ratio.

Aspect ratio: The horizontal-to-vertical ratio of the image size. Conventional TVs have a 4:3 ratio, and HDTVs have a 16:9 ratio. Aspect ratios for movies include the standard size of 1.38:1 and "vista" sizes of 1.66:1 or 1.75:1. The aspect ratio has a major effect on the dramatic elements and mood of the images and scenes displayed.

SDTV 4:3 / Standard 1.38:1 / HDTV 16:9 (1.78:1) / Vista Size 1.85:1 / Cinemascope 2.35:1
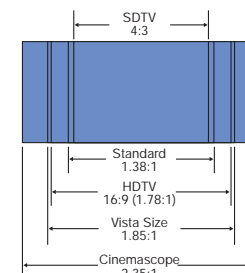
DVCPRO HD: An HD component digital format and codec. The DVCPRO HD codec applies the DCT (discrete cosine transformation) compression algorithm to HD component signals to achieve digital compression with superb image quality. Because it uses the same DCT process of intraframe compression as the other DVCPRO formats, it is able to handle data at a fast 100 Mbps, but its low compression ratio of 1/6.7 maintains high image quality. Its superior codec characteristics also allow it to preserve HD image quality and perform highly efficient data processing in nonlinear editing systems.

[P.4]

HDCAM: Sony's HD component digital format. It uses 8-bit sampling of the HD component signal, with a Y:Pb:Pr = 3:1:1 sampling rate, for a compression ratio of about 1/7.
*HDCAM is a registered trademark of Sony Corporation.

HDV: A format that records HDTV video signals (1080i) at about 25 Mbps (approximately the same as the DV format) onto DV cassette tape. In contrast with the DV format, it uses interframe MPEG2 video compression, resulting in a high level of compression. (MPEG2 MP@H-14: Main profile and high 1440 level)
*HDV and HDV logo are trademarks of Sony Corporation and Victor Company of Japan, Limited (JVC).

HD-D5: A full-specification HD component digital format developed by Panasonic. It uses 10-bit sampling of the HD component signal, with a Y:Pb:Pr = 4:2:2 sampling rate. It is able to preserve high image quality by covering the entire HD signal frequency range.

Frame rate: The number of images that can be recorded or played per second.

VariCam: A professional video camera that uses the DVCPRO HD 720p format. Featuring special gamma curves and the Variable Frame Rate function, VariCam is widely used in producing movies for cinema screening.

Variable frame rate: The ability to vary the number of images that can be recorded per second. By shooting at 60 fps (frames per second) and playing it back at the 24-fps speed, a 2.5x slow-motion effect can be achieved.

DVCPRO 50: A 4:2:2 component digital format and codec. Compared with DVCPRO (25M), the color signal (Pb:Pr) range is wider, so the image quality is higher. By using the Y:Pb:Pr = 4:2:2 sampling rate and DCT compression for an SD component video signal, the data can be compressed to about 1/3.3 that of the original signal. The name DVCPRO 50 is derived from its data transfer speed of 50 Mbps.

DVCPRO: A 4:1:1 component digital format and codec. This broadcasting and professional digital video format and codec applies the image-enhancing DV video codec (with DCT compression). The 4:1:1 component digital format was originally developed for recording digital signals onto 1/4-inch tape, but its compression process was also highly effective for codec use. By sampling an SD component video signal (Y:Pb:Pr) with the 4:1:1 sampling rate and applying the intraframe compression of the DCT algorithm, it allows the data to be compressed to about 1/5 that of the original signal while

7. Terminology

preserving high image quality. With a data transfer speed of 25 Mbps, DVCPRO is a professional-level format that differs from the DV format in that its audio data is synchronized with the video data (locked audio). It is also sometimes called DVCPRO 25M to differentiate it from other DVCPRO formats. Because the DV format also has a data transfer speed of 25 Mbps, some nonlinear editing systems do not distinguish between DVCPRO 25M and DV.

[P.5]

Progressive scanning: In an interlaced format, which has been the mainstream in TV broadcasting formats, fields containing either an odd-numbered or even-numbered line are alternately scanned, and a pair of these odd-numbered and even-numbered lines is used to form one frame. As a result, there is a time lag between the odd-numbered and even-numbered lines, and a shift in the image inevitably occurs between them when they are displayed together. Progressive scanning, on the other hand, scans all of the lines in each field, so there is less degradation in the resolution of moving images than in interlaced scanning, and less flicker.

[P.7]

Frame: TV images express motion by continually displaying 30 still images per second. Each of these individual still images is called a frame. With interlaced scanning, where odd- and even-numbered scanning lines are alternately displayed, each set of scanning lines is called a field and two fields are combined to form one frame.

[P.8]

Cine-like gamma: This is a gamma curve that allows a video camera to obtain the same wide range of latitude (ability to reproduce gradation) as movie film.

Dynamic range: The range within which values or variables change. The dynamic range for images refers to the luminance range.

Gradation: The steps of contrast in an image.

Gamma curve: A conversion curve used to allocate levels of image brightness to data in a nonlinear manner.

[P.11]

MPEG2: MPEG stands for the Moving Picture Experts Group, a committee that studies standardization of multimedia, established jointly by ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission). MPEG2 is one of the standards established by this committee, along with others, including MPEG1 and MPEG4. These standards are based on interframe compression technologies that compress data by detecting and saving only the image parts that express movement between one frame or field and the next, and combinations of intraframe compression technologies. MPEG2 is used in HDTV and other types of satellite digital broadcasting, and in DVD package media, among other applications.

Dropout: This is a phenomenon in which parts of the playback signal are lost or weakened because they are not properly transmitted. It occurs when particles peel off of a magnetic tape, or when foreign matter adheres to the magnetic surface of the tape.

[P.13]

4:2:2: Video component signals in which sampling frequencies for the brightness signal and color difference signals (Y, R-Y, B-Y) have a ratio of 4:2:2.

Digital component signal: A digital video signal in which the brightness signal is separated from the color difference signals. In a broad sense, component signals include RGB and Y/C signals, but they are more often used to refer to Y/Pb/Pr signals in which a matrix circuit separates the brightness signal (Y) and the color difference signals (R-Y, B-Y) from the three primary color signals (RGB).

Sampling: A process of dividing a signal along the time axis when converting from analog to digital. Also called digitizing.

SDI: Abbreviation for Serial Digital Interface. It is a standard for the packet transmission of digital video and audio signals. The SDI standard includes the SMPTE259M specification for SDTV and the SMPTE292M specification for HDTV.

Brightness signal: The brightness signal carries luminance information, and contains no color information. It is also called the Y signal or luminance signal. Black-and-white TV signals have only a brightness signal. When the brightness signal is combined with color signals, color images are displayed. The brightness signal expresses the shape, contour and gradation, while the color signals add color to them. Home VTRs divide video signals into brightness signals and color signals for processing and recording. In home VTRs, the brightness is frequency-modulated for recording, and the amplitude of the original brightness signal is converted to the amplitude of the carrier frequency for transmission. When the magnitudes of the three primary color image signals are indicated by R, G and B, the brightness signal is expressed by the following equation: $Y = 0.30R + 0.59G + 0.11B$. Here, each value is multiplied by a factor in order to adjust it in accordance with the unique sensitivity of the human eye to color. Unlike electronic imaging devices, the human eye does not perceive color with uniform sensitivity. The human eye is most sensitive to green, followed by red, and is least sensitive to blue. These color sensitivity characteristics are compensated for by the multiplication factors.

Color difference signals: The color difference signals are the components (R-Y, B-Y) that remain after the brightness signal (Y) is removed from a component signal. When transmitting color video signals, it is desirable to use all three color signals, R, G and B, since they are the three primary colors of light, but this requires a wide bandwidth of about 6 MHz for each signal. The color difference signal system was developed to improve the transmission efficiency. For the NTSC signal system, the process of producing a brightness signal from the R, G and B primary-color image signals is based on the following equation: $Y = 0.30R + 0.59G + 0.11B$. This equation can be rewritten as "$R - Y = 0.70R - 0.59G - 0.11B$ and "$B - Y = -0.30R + 0.41G - 0.11B$." These equations yield the following equation: $G - Y = -0.51 (R-Y) - 0.19 (B-Y)$. Since the G-Y signal can be produced by using 51% of the R-Y signal and 19% of the B-Y signal, only two color difference signals and the brightness signal need to be actually transmitted. The color difference signals are given a bandwidth of 0.5 MHz, applied with orthogonal modulation at an angle of 90° in order to prevent interference with the color subcarrier, and then placed at the same location for transmission using the same bandwidth as a monochromatic signal.

Chroma-key: A method for superimposing an image on top of a portion of another image. It is called chroma-key because it removes the chroma (color) level in reference to a standard key. This image composing technique is commonly used to replace the actual background with another image in order to make subjects (persons) appear to be at a different place.

[P.14]

4:1:1: Video signals in which the sampling frequencies for the brightness signal and color difference signals (Y, R-Y, B-Y) have a ratio of 4:1:1.

4:2:0: Sampling is done with a frequency of 13.5 MHz for the brightness signal and a frequency of 6.75 MHz for the R-Y and B-Y color difference signals. The R-Y and B-Y color difference signals are sampled for every other scanning line. In other words, only the brightness signal of some scanning lines is sampled (4:0:0), and the following scanning lines are sampled at 4:2:2. This system is often used for the low-resolution 625-line format since it is efficient and inexpensive as compared to the 4:2:2 system.

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Jaggy: Zigzag lines that are often produced at the edges of characters and figures in computer-graphic (CG) images such as composition images. Jaggies can be eliminated by anti-aliasing (a process for smoothing the edges of characters and figures).

[P.16]

24pA (Advance) mode: A recording mode in which 24p video is converted to 60i. The ordinary 24p mode employs 2:3 pulldown to record the first frame as the second field and the next frame as the third field in simple repetition. In contrast, the 24pA mode uses 2:3 pulldown for the first two frames and 3:2 pulldown for the following two frames, thus performing 2:3:3:2 pulldown repeatedly. The 2:3:3:2 pulldown system was developed to minimize image degradation during nonlinear editing in which the video signal is returned to the native 24p. A video recorded in 24pA mode must be processed with a nonlinear editing system supporting the Advanced conversion system.

[P.33]

Frame Rate Conversion/Converter (FRC): An FRC is a device that converts the frame rate in order to record or play back only the effective frames in source materials recorded using a variable frame rate function.

[P.35]

SBP2: There are two modes in the IEEE 1394 interface: 1394/AVC for AV streaming input and output, and 1394/SBP2 for file input and output. SBP2 is a protocol for controlling peripheral equipment that is connected to a PC via IEEE 1394.

[P.37]

Detail: A function that enhances contours. It electrically emphasizes image borders to sharpen images.

H Detail: A function to enhance both edges of vertical lines. "A" indicates the H rate and gives a positive effect. On the other hand, "B" gives a negative effect. In actual images, the H Detail affects contour lines in the vertical direction.

V Detail: A function to enhance the top and bottom edges of horizontal lines. "A" indicates the V rate and gives a negative effect. In actual images, the V Detail affects contour lines in the horizontal direction.

Detail core: When the V/H detail rates are raised, high-frequency noise also increases. Coring removes noise by slicing the signal during the production of detail signals.

Skin detail: When the skin detail function is turned on, details in skin-color sections are deemphasized to make the skin appear smoother. This function is used mainly for the images of newscasters.

Chroma: Chroma means color and is abbreviated as "C." While the brightness signal (Y signal) expresses luminance, the chroma signal (C signal) contains color information. In TV signals, the chroma signal is frequency-multiplexed onto the brightness signal for transmission. In TV signal processing, chroma often refers to the chrominance signal.

Chroma level: The chroma level is the color signal level (numerical voltage value). The color bar generated by a signal generator contains white, yellow, cyan, green, magenta, red and blue, from left to right. Since the brightness signal and color signal levels are strictly specified, the performance of video equipment can be evaluated by measuring the brightness signal and color signals.

Chroma phase: The chroma phase indicates the level (phase) at which a cyclically oscillating waveform is at a given moment. In the case of a color signal, the phase determines the hue, such as red, green and skin color. Generally, a phase expresses, in angle, how much a signal waveform deviates from the reference. On a vector scope, the phase of each color signal is indicated in the counterclockwise direction based on the B-Y color difference signal as a reference (color burst is specified to have an angle of 180° from the B-Y axis). In a color bar, the phase becomes larger in the order of magenta, red, yellow, green, cyan and blue. After one complete circle, it returns to the starting color, but all subtle intermediate colors are included in this 360° range. When skin color becomes pinkish or yellowish, the phenomenon is referred to as hue shifting. This occurs when the phase deviates from the normal skin color.

Color temperature: A value used to express the color of light. It is used as a reference value for light sources, such as incandescent lamps, fluorescent lights and sunlight. The color temperature is expressed with the unit K (kelvin). The higher the color temperature value, the more bluish the color. A low color temperature value makes the color reddish. The AG-HVX200 allows fine adjustment of the color balance after the white balance has been adjusted.

Master pedestal: The value of black in reference to the image.

Knee point: The knee point is the level of compression applied to the CCD-generated high-brightness video signal to minimize washout.

Gain: If the fully opened aperture cannot provide sufficient light, the image can be made brighter by electrically amplifying the video signal. Gain refers to the rate of amplification of the amp circuit designed for this purpose. For example, when the gain is 6 dB, the brightness becomes twice as high.

White balance: A process of setting white color according to the light conditions at the shooting site by adjusting the color balance in order to achieve natural-looking color.

ND filter: The ND (natural density) filter reduces light intensity without altering color. It is used when acquiring images in a bright place. The AG-HVX200 has two filters with light intensity reduction rates of 1/8 and 1/64.

[P.38]

Synchro: Synchro refers to the shutter speed used to acquire an image of a TV screen or a PC monitor.

Phantom power supply: Supply of power (+48 V) to a microphone that supports phantom power supply, such as the AG-MC100.

[P.39]

Iris: The lens aperture. This mechanism regulates the amount of light reaching the imaging area.

Tally lamp: A red lamp that lights to indicate that the camera-recorder is recording.

Squeeze: The squeeze function compresses camera images in the horizontal direction before recording. When compressed images are played back on a monitor TV compatible with the wide-screen format, they are displayed in the 16:9 aspect ratio.

Letterbox: An image display format with black bands above and below the centered image. It is designed for recording wide-screen images for viewing on a 4:3 screen.

Zebra function: Indicates that the brightness of the subject being shot exceeds the set value. When this happens, the zebra function shows a striped pattern to indicate the need to prevent washout. In AG-HVX200, the level set for displaying the striped pattern can be set between 50% and 105%, in 5% steps.

Center marker: The marker function indicates, in percentage, the level of the brightness signal within the marker area on the screen. It indicates a level between 0 and 99%.

7. Specifications

GENERAL

Supply Voltage:	DC7.2V / 7.9V, Battery or DC Input
Power Consumption:	11.6W (when viewfinder is used, and recorded in HD format) 12.0W (when LCD monitor is used, and recorded in HD format) 14.0W (Max)
Operating Temperature:	32°F to +104°F (0°C to +40°C)
Operating Humidity:	10% to 85% (no condensation)
Weight:	Approx. 5.5 lb. (2.5kg) excluding battery and accessories Approx. 6.3 lb. (2.85kg) when with two P2 cards and a battery
Dimensions (WxHxD):	6-11/16″ x 7-1/8″ x 15-3/8″ (168.5 x 180 x 390 mm) excluding prominent parts

CAMERA

Pick-up Device:	3 Progressive 1/3" interline transfer CCDs
Lens:	LEICA DICOMAR lens with optical image stabilizer, motorized/manual mode switching,13 x zoom, F1.6 (f=4.2mm to 55mm) (35mm equivalent: 32.5mm to 423mm)
Filter Diameter:	82mm
Optical Color Separation:	Prism system
ND Filter:	1/8, 1/64
Gain Selection:	60i/60p mode: 0/+3/+6/+9/+12/+18 dB (0 dB fixed when slow shutter speed) 30p/24p mode: 0/+3/+6/+9/+12 dB (0 dB fixed when slow shutter speed or when 12/18/20/22 fps frame rate)
Frame Rate:	variable 12/18/20/22/24/26/30/32/36/48/60 fps (frame/sec)
Shutter Speed (Preset):	60i/60p mode: 1/60 (OFF), 1/100, 1/120, 1/250, 1/500, 1/1000, 1/2000 sec. 30p mode: 1/30, 1/50 (OFF), 1/60, 1/120, 1/250, 1/500, 1/1000 sec. 24p mode: 1/24, 1/50 (OFF), 1/60, 1/120, 1/250, 1/500, 1/1000 sec.
Shutter Speed (Variable):	60i mode: 1/60.0 sec.to 1/249.8 sec. 30p mode: 1/30.0 sec to 1/249.8 sec. 24p mode: 1/24.0 sec.to 1/249.8 sec.
Aperture Angle:	10° to 350° by 0.5° step (with "FILMCAM" scene file)
Slow Shutter Speed:	60i/60p mode: 1/15, 1/30 sec. 30p mode: 1/15 sec. 24p mode: 1/12 sec. (720p mode only)
Minimum Luminance:	3 lux (F1.6, +12 dB gain, 1/24 sec. shutter speed)

Video P2 General (DVCPRO HD, 1080i/720p)

Sampling Frequency:	Y: 74.25 MHz, Pb/Pr: 37.125 MHz
Quantizing:	8 bits
Compression:	Compression ratio 1/6.7, DCT + variable length code
Recording Bit Rate:	100Mbps

Audio P2 General (DVCPRO HD, 1080i/720p)

Sampling Frequency:	48 kHz / Quantizing 16 bits / 4ch
Frequency Characteristics:	20 Hz ro 20kHz
Wow & Flutter:	Below measurable limits

Memory Card

Recording Format:	DVCPRO HD/DVCPRO 50/DVCPRO/DV selectable
Video Recording Signal:	1080/60i — 24p/24pA/30p (all convert to 60i and record) 720/60p — 24P/30p (all convert to 60P and record), 720/24pN, 720/30pN 480/60i —24p/24pA/30p mode (all convert to 60i and record)

Audio Recording Format:

Audio Recording Format:	PCM digital recording 48 kHz /16 bits 4ch (DVCPRO HD / DVCPRO 50), 2ch/4ch selectable (DVCPRO / DV)
Recording Time*: (Approx.)	8 minutes with one AJ-P2C008HG (DVCPRO HD, 1080/60i) 20 minutes with one AJ-P2C008HG (DVCPRO HD, 720/24pN)

VTR part General

Recording Format:	DV (25Mbs only, 4:1:1, 5:1 compression)
Tape Format:	Mini DV cassette (6.35mm width metal evaporated tape)
Recording Video Signals:	480/60i (NTSC), 24p/24pA/30p mode (all convert to 60i and record)
Recording Audio Signals:	PCM digital recording, 16 bits: 48kHz/2ch or 12 bits: 32kHz/4ch
Recording Tracks;	Digital video / audio signals: helical track Time code: helical track (sub-code area)
Tape Speed:	SP mode: 18.812mm/sec, LP mode: 12.555mm/sec
Recording Time:	SP mode: 63 minutes, LP mode: 94 minutes (When using AY-DVM63MQ)
FF/Rew Time:	Approx.140 sec. (when AY-DVM63MQ is used)

VIDEO connectors

Video Out:	Analog component, Y: 1.0Vp-p , 75Ω, Pb/Pr: 0.7Vp-p , 75Ω
Video In/Out:	Phono, Analog composite, 1.0Vp-p , 75Ω (In/out automatically switched, Input DV tape mode only)
S-video In/Out:	4-pin, Y/C Y: 1.0Vp-p , 75Ω, C: 0.286Vp-p , 75Ω (In/out automatically switched, Input DV tape mode only)

AUDIO connectors

Audio In/Out:	Phono x 2 (ch1,ch2), (In/out automatically switched) Input :316mV, High impedance, Output:316mV, 600Ω
Microphone/Line Input:	XLR x 2(Input 1 / Input 2), LINE / MIC selectable Line: 0dBu, MIC: -50/-60dBu (selectable in menu)
Internal Microphone:	Stereo Microphone
Phones:	Stereo Mini jack (3.5mm diameter)

OTHER connectors

IEEE 1394:	4-pin Digital input/output, based on IEEE 1394 standard
USB:	Type mini B connector (USB ver.2.0)
Camera Remote:	Zoom, Rec (Start/Stop) Super Mini jack (2.5mm diameter) Focus Iris, Mini jack (3.5mm diameter)
DC Input:	7.9V

Monitor, Speaker, AC Adapter, and Other packages

LCD Monitor:	3.5 inches, LCD color Monitor, 210,000 pixels
Viewfinder:	0.44 inches, LCD color Viewfinder, 235,000 pixels
Internal Speaker:	28mm round shape x 1
AC Adapter:	Weight: 160g, Dimensions: 70 (W) x 44.5 (H) x 116 (D)mm
Supplied Accessories:	AC adapter/charger, AC Cord, DC Cord, Battery (5400mAH), Wireless remote controller, Microphone holder, Shoulder strap, Component Video cable, P2 card software driver install (CD-ROM)

* Time shown above is when you record a series of 1 shot to P2 card.
 Depending on numbers of shots you record, time will get shorter than the number shown above.