

JVC HDV Camcorder GY-HD100 technical report



JVC (Victor Company of Japan, Limited) was the first in the industry to develop and market a consumer digital Hi-Vision camcorder, the GR-HD1, in 2003. Subsequently they released a professional application model, the JY-HD10. These gave a major impact on the HDTV content production industry as a cost-effective high-precision video recording system. Based on this development in September 2003, four companies — Canon, Sharp, Sony, and JVC — unified their HDV format standards, and proposed it as the HDV format for the industry. Since then the number of companies onboard with this format has grown to 52 (as of August 26, 2005), proof of the high expectations associated with HDV.

JVC (Victor Company of Japan) announced the HDV format professional-use camcorder



BR-HD50

GY-HD100U and the recorder BR-HD50U at this year's NAB 2005. The product has been released in the markets since July 2005. It has been delivered over 3000 units to the customer (as of September 2005).

This report explains about the process behind product development and the reason for adopting the HDV720p method.



Global marketing



Global marketing is the origin of development

It is understood that the environment surrounding video production is in a period of transition in the trend toward digital broadcasting, now being driven forward throughout the world as seen in the format change from SD to HD, downsizing of cameras for more mobility through reduced weight and size, and the transition of recording media from tape to HDD, DVD, and silicon memory. We have thus far reflected the voice of the market in our products to offer the best value to our customers through high-resolution/high-quality technologies. In the planning for this product, we started the marketing phase two years ago in which we conducted hearings directly with users about what professionals think about these changes and about the usability and issues associated with camcorder downsizing.

Marketing has extended globally to such an extent that we were able to contact various customers including people at network stations, CS/CATV stations, Hollywood movie productions, as well as event photographers, professional-use equipment rental shops and image production vocational schools. Among the opportunities we had, we were able to join an actual TV drama shooting, and had an

enthusiastic exchange of opinions with professional camera operators. We were able to confirm the need for "affordable HD", namely cost-effective HD equipment at an early stage in the transition of workflows from SD to HD. At first, our product concept was "a small handheld type HDV camera recorder", but the

direction of the concept was partly modified at an early stage of marketing. This was due to the camera operators' commitment to the lens. To enable precision framing of a scene or to respond to the cameraman's touch requires a professional lens, and those who are accustomed to professional lenses knew well the limits of lenses on existing compact handheld type camcorders.

In addition, a camera design with a firm and comfortable grip was required to realize stable camerawork. Therefore we reconsidered the concept as "the compact shoulder-type HDV camcorder which can be equipped with a professional lens". At the end of 2004, we equipped it with a lens jointly developed with Fujinon Corporation, finishing up a high-precision prototype in terms of both texture and mass, which led us to conceptualize the final completed form as an "HDV camera recorder with interchangeable lens" and we thus resumed marketing. This concept received positive response from customers we visited for marketing, who even gave us their on-site demands for detailed specifications. And, in April 2005, we released the camcorder GY-HD100U and recorder BR-HD50U at NAB 2005 in the U.S. (both for North America). The extent of expectations toward JVC was seen at the GY-HD100U studio corner where visitors

arrived in a steady stream during the entire event, boosting our confidence greatly.

Furthermore, the superior originality and concept of the GY-HD100 were evaluated highly and it won the Award for Innovation in Media from NAB. In addition, we won a number of awards from various magazine houses, giving us momentum for launching the products into the market.

About adoption of HDV720p method

The HDV standard is the standard that enables recording of high-definition images and sound onto the currently widespread DV cassettes. Based on the GR-HD1 which we introduced into the market in March 2003, it was drawn up by the four companies Canon Inc., Sharp Corporation, Sony Corporation, and Victor Company of Japan, Limited, and published as a written standard for an HDV format in September 2003.

The HDV standard has two recording methods, 720p (progressive) and 1080i (interlace), both with distinct characteristics, but, of these, the GY-HD100 and BR-HD50 adopt the 720p method. We as a company want to promote the 720p method from the standpoint of progressive images, large-scale pictures, compatibility with PCs, and MPEG encoding.

As for the final stage of displays, the

mainstream is moving towards flat panel displays such as LCD, plasma, SED, and organic EL, many of which display in progressive format. Consequently, from the overall point of view of high picture quality including the displays, we continually proposed and adopted the progressive format 720p.

About the advantages of Progressive

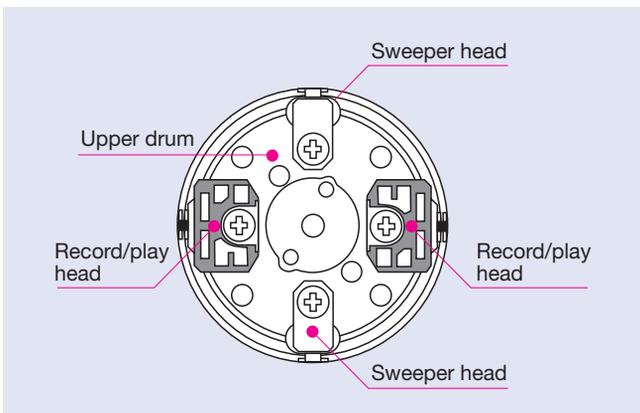
Progressive scanning has already been referred to as “All-pixel readout” or “Non-interlace” and used in image processing systems that are required for capturing high-definition images, and in machine vision systems used to inspect minute defects in LCDs. In addition, motion pictures (movies) which are the oldest of picture technologies, can be considered as using the progressive scanning method since it projects complete frames in succession. In the progressive method, because each image offers full resolution like movies do, we can adopt various frame rates such as 24 frames/sec., 25 frames/sec., 30 frames/sec., 50 frames/sec. or 60 frames/sec.

Progressive scan not only has this degree of freedom in frame resolution but also offers superior compatibility with related equipment such as flat panel displays and DVD. Recent DVDs tend have progressive scan playback capability to pursue high resolution that goes along with the growing amount of film content. It can be said that the progressive method is desirable since it performs conversion only for the number of frames of the recorded picture.



Features for professional use

The GY-HD100 and BR-HD50 are products planned as an HDV camera and recorder for professional use, adopting the aforementioned HDV720p format. Packed with functions and specifications demanded by professional applications, we refined it to raise reliability, taking into account the future expansion of the system.



1. Adopting interchangeable lens system

The GY-HD100 assigns a newly developed HD compatible 1/3-inch CCD for each RGB channel. In conjunction with this, we adopted a 1/3-inch standard bayonet lens mount. Adopting this method enabled mount size conversion and the attachment of various cinema lenses + mat boxes, allowing a wide selection of lenses in accordance with filming situations such as cinematic applications. A 35mm lens mount adapter was already announced from abroad by Optex Co., Ltd., widening further the enormous potential for increased use. We equipped a 16x Hi-Vision lens (5.5mm max. wide) developed jointly with Fujinon. We will also be offering an optional 13x short zoom lens (3.5mm max. wide), and even more optional lenses are on the table.

2. Supports SMPTE time code

The GY-HD100 adopts a system where time code information is recorded in the GOP header area of MPEG data, and interpolated frame by frame using the frame update information. This enables recording and playback of SMPTE time code and equivalent information.

3. Native 24p recording and playback

One of the reasons that we adopted the progressive method was to support native 24p recording/playback. Today the use of 24p is spreading widely not only in motion picture production such as digital cinema, but also as a means to create a film-like picture effect. With the 24p progressive recording mode on the GY-HD100, recording to tape is performed by 2:3:2:3 (2:3:3:2 can also be set for HDV 24p recording) pull-down to record effective frames within the 30 frames/sec., and only these effective frames are reproduced at the time of playback. Furthermore, a full-progressive 24p workflow can be completed by editing in a corresponding non-linear system.

4. Cross-conversion function

During HDV tape playback, recorded HDV native signals are always output from the IEEE1394 terminal, and cross-conversion (720/60p, 1080/60i) signals are output from the analog component terminal (by menu choice). Furthermore, from the composite terminal, down-converted 480/60i signals are output. These cross-conversion functions enable multi-format output. Additionally, the BR-HD50 outputs the up-converted (720/60p, 1080/60i) signals from the analog component terminal and the HDMI terminal (selectable via menu) when playing back existing DV cassettes.

5. Adopting highly reliable mechanism and system established for Professional DV

- 1) A highly durable mechanism developed for professional use: We improved on the high durability mechanism we developed for professional DV and achieved durability with allowance for long-term use.
- 2) Head drum with a pre-head to prevent dropouts: A dummy head was installed immediately before the record/playback head to clean dust or magnetic powder residue on the tape in advance to dramatically reduce dropouts.
- 3) Multi-track error correction mark: Unlike error correction marks located within each track for DV format, the HDV format adopted a method to disperse and arrange correction marks on multiple tracks. Because the total number of error correction marks is the same, the correction ability for a random error is equal. However, in the case of a block errors comprised of multiple errors on the same track, the local correction capability will improve as much as 10 times. Random errors are easily generated from application irregularities or the like in the production process of tape, and block errors can easily occur when an alien substance is inserted between the head and tape momentarily. Accordingly, this new error correction method contributes greatly to a reliability improvement because in current DV most of the errors that cannot be corrected are block errors.
- 4) MiniDV tape for HDV video recording: Recommended tape M-DV63HD realized one of the industries' top-level low error rates by adopting our original evaporation technology and achieved a 15% improvement in output characteristics compared with our former products. Video recording time is set at 63 minutes in professional usage.

6. A new and universal design for professional use



Out-of-focus image



In-focus image

The edge of the in-focus subject is shown in colour, telling the operator that the subject is in focus. One main benefit of this system is that it operates in real time.

In the development of GY-HD100, we particularly focused on its design and user-friendliness. From its looks, feel and presence as a video camera, to its switch layout, we aimed at achieving completeness as a professional tool. In addition, a feeling of "unity with the camera" that is unattainable by handheld type products, was realized by adopting a sliding shoulder pad for a comfortable shooting position, and ear pads equipped with small monitor speakers that offer an improvement in holding comfort.

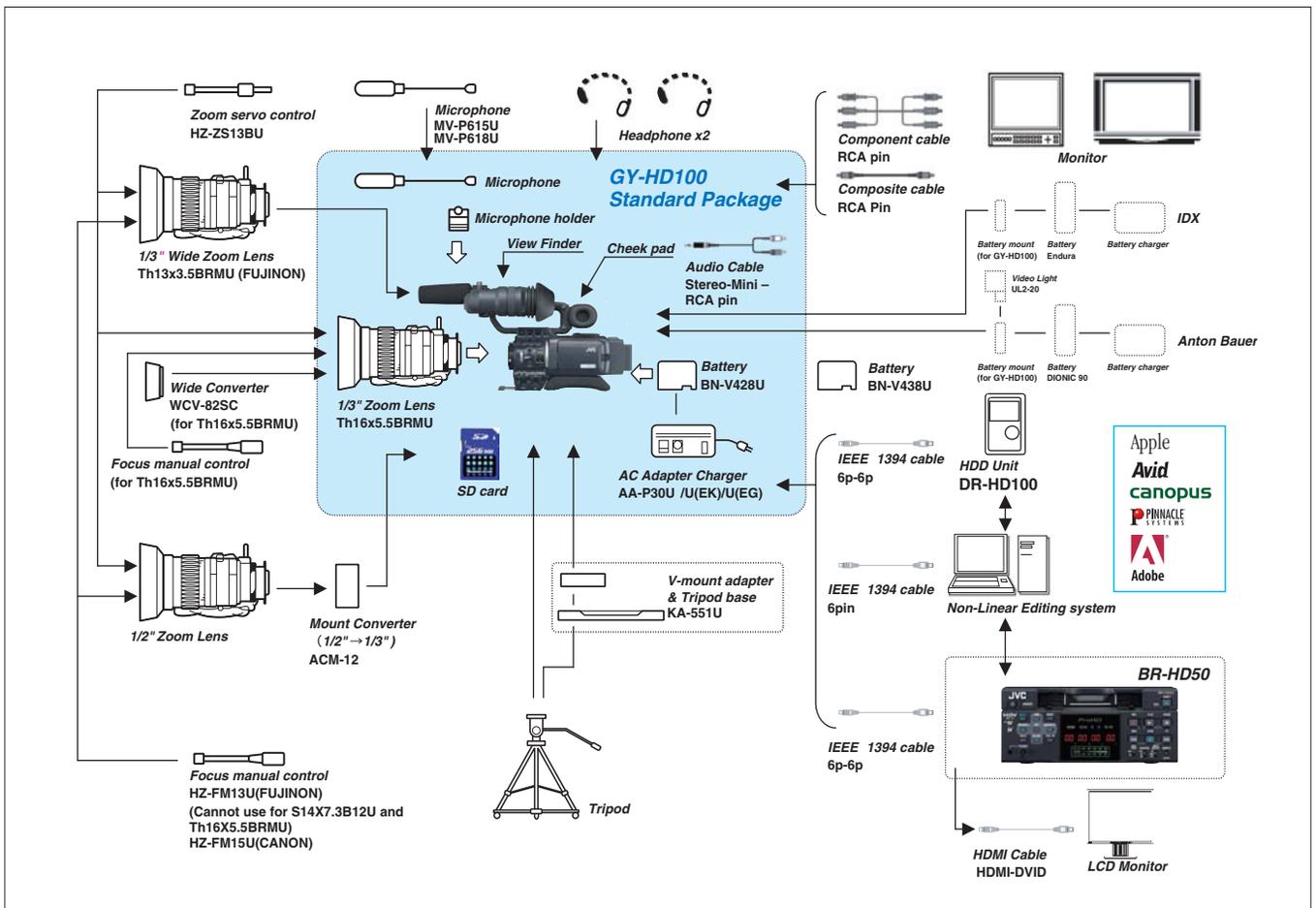
Furthermore, a Focus Assist Function has been newly developed to provide accurate focusing, which tends to become more demanding during HD movie recording. In addition to a conventional peaking indication, the function allows the viewfinder to display temporarily in monochrome, with only the edges of focused images on the screen being displayed in color (selectable from R, G or B).

The start switch was equipped on the handle grip and to the left of the peak volume. What's more, by assigning the function to the lens' RET button through menu setting, the user can easily engage the Focus Assist Function using only the right hand on the lens grip. This user-friendliness was highly praised from on-site cameramen in a prior test drive.

In addition, it supports various peripheral devices for professional use. It supports various professional use applications by offering accessories that have been adopted for ENG cameras, by offering compatibility with large capacity batteries made by IDX Co. Ltd.

and Anton/Bauer Inc., by adopting the V type mount tripod base that enables the tripod to be easily attached and detached, and by offering a lens servo unit compatible with the studio specs.

System Configuration

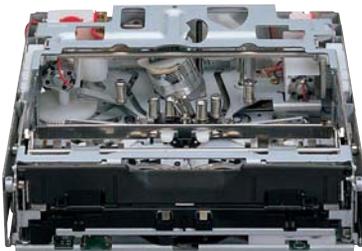


HDV Recorder BR-HD50



Now let's talk about the recorder BR-HD50 which will be released along with the GY-HD100. The basic format follows the GY-HD100, and it was developed as a non-linear HDV/DV switchable spooler. Furthermore, in consideration of long-time recording with HDV and the practical use of existing DV cassettes, we adopted a mechanism that is compatible with standard DV/Mini-DV cassette.

Assuming that high definition LCDs will become the mainstream for display and preview applications, we adopted HDMI output terminals. Since a strong demand for previewing of recorded content or reviewing edited work in full definition was seen in our marketing stage, this will offer a major benefit to its users. The product is equipped with IEEE 1394 as its digital interface, enabling MPEG2 TS and DV input/output.



In addition, it is equipped with an analog component terminal, Y/C, and composite terminal, along with an HD/SD cross-

convert function, enabling it to be seamlessly incorporated into existing systems.

Our product strategy

The GY-HD100 and BR-HD50 were developed

for HDTV, based on our basic strategy that had been implemented for our professional-use video equipment – namely offering high quality audiovisual systems that are reasonable in price and easy-to-use while maintaining compatibility with existing systems for professional-use based on the consumer electronics infrastructure.

The GY-HD100 we have released can be connected directly with FOCUS Enhancements' DTE, the DR-HD100, to enable not only tape recording but also HDD recording, so that non-linear editing work may be carried out more smoothly. In the field of consumer electronics, we developed and produced Everio, the world's first camcorder equipped with a compact hard disk drive. And for the future, we are planning to promote new product development keeping in mind the shift in media in the professional field.

As mentioned at the beginning, non-linear systems and HDV compatible equipment have been announced one after another from the manufacturers that agreed to the HDV format. Starting with the camcorder and recorder (GY-HD100 and BR-HD50), we will aim at establishing a cost-effective and easy-to-use HDTV production system (the HDV world) as well as spreading the HDV format together with other format-participating manufacturers.

Thank you for your kind attention.

* HDV and an HDV logo are trademarks of Sony Corporation and Victor Company of Japan, Limited (JVC).