

JVC HM-DH30000U

The First D-VHS® Digital Recorder With D-Theater™ Prerecorded HD Movie Playback



GREG ROGERS

A New High-Definition Platform

The long wait for prerecorded HDTV movies is nearly over. Four major studios have announced plans to market movies in the new high-definition (HD) D-Theater™ video-tape format, and the JVC HM-DH30000U D-VHS® Digital Recorder is the first product that will play them. It features an analog HDTV video output compatible with the YPbPr input included on most high-definition displays.

The HM-DH30000U not only plays HDTV tapes, but it also records high-definition digital video and makes digital video recordings from standard-definition (SD) analog video sources. The D-VHS recorder is also fully compatible with conventional analog VCRs, and will record and play in the Super VHS and VHS formats. The HM-DH30000U is priced just below \$2,000, but is widely discounted.

Prerecorded HDTV

The HM-DH30000U will play prerecorded HDTV cassettes that support JVC's D-Theater content protection system. This is an optional security system within the D-VHS format. Thus far the home video divisions of four studios, Artisan Entertainment, DreamWorks SKG, 20th Century Fox, and Universal Studios have announced their intentions to release D-Theater-compatible HDTV movies during 2002. These movies will not play on D-VHS recorders without the

D-Theater system. But digital video recordings made on this recorder can be exchanged with other D-VHS recorders.

D-Theater movies are currently planned for release in the 1080i HDTV format, but the HM-DH30000U can decode D-VHS video recorded in any of the 18 ATSC digital video formats. It will output YPbPr analog component video signals in the 1080i, 720p, 480p, or 480i formats. It can also convert 720p recordings to 1080i output, or downconvert any digital format to 480i output. But downconverted video is only available from the S-video or composite video outputs when the YPbPr output is also downconverted. The HM-DH30000U will output MPEG digital video from its i.Link® (IEEE 1394) interfaces (four-pin terminal), but only when that video is not copy protected.

Digital Recording Of Digital Video

The HM-DH30000U makes D-VHS digital recordings at one of three input bit-rates—28.2 Mbps (HS), 14.1 Mbps (STD), or 4.7 Mbps (LS3). Two sizes of D-VHS tape cassettes are currently available—the DF-300 cassette with a 31.7 GB (gigabyte) data capacity, and the DF-420 cassette with a 44.4 GB data capacity. To save you some math, the DF-300 cassette records 2.5 hours and DF-420 cassette records 3.5 hours at the HS rate. The recording time is 5 hours and 7 hours in the STD mode, and 15

hours and 21 hours at the LS3 rate. (Here's the secret—the DF-number is the number of minutes in the STD mode.)

Technical Note: The bitrates and data capacities given above are for audio/video data and additional user data. They are comparable to the bitrate and data capacity numbers used to describe DVD formats. But both DVD and D-VHS use many more bits of overhead specific to each technology for error correction, data sync, and other data protocols. The bitrates recorded on the tape may also not match the input bitrates. For instance, the HS mode actually records bits on a tape track at the same rate as the STD mode, but two tracks at a time are recorded rather than one, to double the effective bit-rate.

Prerecorded D-Theater HDTV tapes are mastered in the 28.2 Mbps HS mode. This is a higher bitrate than the ATSC standard of 19.3 Mbps for HDTV, so D-Theater movies can have even higher quality than HDTV broadcasts. In fact, some terrestrial and satellite broadcasts do not even use the full ATSC bitrate.

The HM-DH30000U has no analog YPbPr component video input. Therefore, 480p and HDTV (720p and 1080i) analog signals can't be recorded. These formats can only be recorded using the digital i.Link interface. At the present time there are no standard HDTV set-top boxes with fully compatible i.Link interfaces (this includes the discontinued Panasonic set-top boxes that had an IEEE 1394 interface with different protocol), but JVC expects some future set-top



boxes to have compatible i.Link interfaces. However, other HDTV set-top boxes and satellite receivers are expected to support the incompatible DVI HDTV interface.

The HM-DH30000U will record the digital output from DV camcorders that are equipped with an i.Link interface. But DV video is a different compression format than MPEG video. The incoming DV video is converted to MPEG video, so the recording is not a perfect clone of the original DV recording. Some picture degradation will occur even though the transfer is digital. Hence it is advantageous to select the highest bitrate when recording. When recording standard-definition DV digital video, the STD and LS3 recording modes can be used, but not the HS mode.

Although, the HM-DH30000U accepts and processes incoming DV video across the i.Link interface, it will not output digital video in the DV format. So you can not use a DV camcorder to record the digital output of the HM-DH30000U. But it will output MPEG video from its i.Link interface.

Of course you won't be able to transfer copy-protected digital video across the i.Link interface. I was able to send digital video from DVDs that weren't copy protected to the JVC recorder, but most DVDs are copy-protected.

Another issue to consider when recording from the i.Link interface is that on-screen status information (such as a tape counter) from the source will normally not be transmitted across the digital interface. So if you are viewing the HM-DH30000U output on a monitor, you may need to switch to the S-video output of the source, or use another monitor, to set up the source for playback.

Digital Recording Of Analog Video

The HM-DH30000U includes A/D conversion and a standard-definition MPEG encoder to make digital recordings from its analog audio and video inputs. These recordings can be made at any of the digital recording bitrates—HS, STD, or LS3. Two-channel analog audio is also converted to digital and recorded in the 48 kHz PCM format. Digital recording requires a D-VHS cassette. The manufacturer's suggested retail price of a blank JVC DF-300 D-VHS cassette is \$15. The DF-420 cassettes are priced at \$25.

Digital recording of analog signals from a copy-protected source is not permitted. A message will appear on screen indicating that the source is copy protected.

When making digital recordings, the 7.5



IRE black level setup that is standard on NTSC analog signals should be removed prior to recording, but the HM-DH30000U does not perform that function. This results in non-standard digital levels when recording from analog signals. As a consequence, the TV display must be calibrated differently for recordings made from digital signals than for recordings made from analog signals. This must also be considered when transferring digital recordings across the i.Link interface.

Analog Recording And Playback

The HM-DH30000U is fully compatible with S-VHS and VHS recording at SP and EP tape speeds using standard S-VHS and VHS cassettes. It even has a special mode (S-VHS-ET) to record the S-VHS format on VHS cassettes. Since I was only able to keep the HM-DH30000U for a couple of days, I didn't try analog recording on S-VHS or VHS cassettes.

The analog S-VHS or VHS formats can also be recorded on a D-VHS cassette. But I can't imagine why anyone would want to do that when the digital recording quality is so much better, and the recording time capacity is longer.

Inputs And Outputs

The rear panel includes two groups of A/V inputs and two groups of A/V outputs. Each group has composite video, S-video, and analog stereo audio jacks. An identical group of inputs are concealed under a door on the front panel. Two RF connectors are located on the rear panel—an input for the built-in analog broadcast TV tuner and a TV output.

It's an unusual sight to see connections supporting HDTV on a consumer VCR. The rear panel includes a YPbPr component video output, an optical Toslink digital audio output (PCM, Dolby® Digital and DTS® Digital Surround™ "throughput,") and a four-pin i.Link connector. A second i.Link connector is located under the door on the front panel. (Note: With respect to DTS, there is a caveat—JVC is completing work on their DTS encoder so that future D-Theater titles can be encoded in the DTS bit stream. The HM-DH30000U will have to be returned to the manufacturer for a software upgrade to play the DTS bit stream when the encoding is available. Latter model units should ship with the modification to support DTS.)

The i.Link serial digital interface is a bi-directional input and output for MPEG video, digital audio, and device control signals between compatible products. The HM-DH30000U also accepts DV format digital signals over the i.Link interface to record the output of many digital camcorders, but it will not out-

put DV compressed digital video signals.

There are several other terminals for interfacing with external products. An IR controller plugs into the rear panel, which permits the VCR to automatically switch the channel of a cable TV descrambler or a satellite receiver when making timer recordings. There is also a JLIP terminal (Joint Level Interface Protocol—a JVC interface/ protocol), which permits computer-controlled video playback with optional JVC software. Finally, a Remote Pause/AV Compu Link jack provides features such as system power up/down and automatic input switching when used with compatible JVC products.

Front Panel Controls

The brushed-aluminum front panel has a hinged plastic cover that flips down for access to the cassette loading slot and most of the control buttons. A status display window is located below the cassette slot, but it can be viewed through the plastic cover. The buttons under the cover are: Pause, Rewind, Fast Forward, Record, Record Mode, Channel, Digital Noise Reduction, D-VHS mode, and S-VHS ET mode. Other front panel buttons include Power, Timer, Record Link, Stop/Eject, and Play.

The Record button begins recording immediately. The Instant Timer Recording feature sets and then increments the recording time in 30 minute intervals for each additional press of the Record button. The Record Link button enables a special mode to automatically start recording when a signal appears on the first set of rear panel inputs. This feature can be used with a satellite receiver or other source that turns on from a built-in timer.

Remote Control

The 9- x 2.5-inch wand-shaped remote control has large, distinctively shaped buttons for easier use in the dark, but they are not backlit. A smoothly operating jog wheel surrounded by a spring-loaded shuttle ring is located at the bottom of the remote. An arrow pad is included for navigating on-screen menus, and a numeric keypad also provides alpha characters for the advanced features discussed later. A three-position switch permits the remote to control the VCR, a TV, and a satellite receiver or cable box.

The remote includes a feature that I really like on video recorders—separate up/down toggle buttons to enter Start Time, End Time, Date, and Channel when programming timer recordings. It also includes the VCR Plus+ feature for those that find even the four-button entry approach too challenging. Up to eight programs can be entered into the timer-recording list.

S-VHS And VHS Playback

Fast forward and reverse scan are available using the shuttle ring on the remote control, or by using the separate scan buttons. The scan buttons operate in an intuitive fashion. If pressed and immediately released, the scan mode is locked on until the Play or Stop button is pressed. If held down, scanning continues until the button is released. The shuttle ring provides variable speed forward or reverse scan. The Pause button produces still pictures free of noise bars. From the pause mode, right and left arrow buttons initiate forward and reverse slow motion. The jog wheel is used to control single-step forward and reverse, and it can be spun with one finger to quickly move to a specific frame. A special Skip Search button advances the tape in 30-second increments each time it is pressed, up to a total of two minutes.

There is no digital audio output when playing S-VHS or VHS recordings. This is unfortunate since the product includes an audio analog-to-digital converter to make digital audio recordings in the D-VHS recording modes. Digital 3-D Noise Reduction, and a built-in time base corrector to reduce jitter, are effective in improving the playback quality of analog recordings.

D-VHS Playback

When HDTV or SD digital recordings are played, many of the usual VCR transport features are not available. The jog wheel and shuttle ring are disabled, so it's not possible to scan forward or reverse at variable rates, or single-step by frames. Slow motion is also unavailable. Scanning is limited to one speed forward or reverse using the scan buttons, and the pause control can be used. The scanning rate is 6x in the HS mode, 12x in the STD mode, and 36x in the LS3 mode. The latter is so fast that it is difficult to locate a specific scene on the tape. The 30-second skip function is available while playing D-VHS tapes.

The limited set of transport functions is a far cry from the navigational convenience features that we have come to appreciate from the DVD format, or even analog VCR technology. But the attraction of prerecorded HDTV is to view movies, and when watching with friends that is usually a linear experience. We start at the beginning and view until the end. It beats the local cinema, because you can stop in the middle for more popcorn or a comfort break.

Video Navigation—Prerecorded Tapes

The Video Navigation function is a key

feature to automatically locate programs or chapters on a tape. This feature can be included on prerecorded tapes or it can be used with tapes recorded on the HM-DH30000U. Pressing the Navigation button on the remote control produces a menu screen that includes the title of the tape (38 characters or less) and up to four chapters or section titles (22 characters or less). There can be multiple menu screens for additional chapter or section titles. The HM-DH30000U will automatically search the tape and begin playing at a selected chapter.

This is an excellent feature that partially compensates for the limited transport functions on D-VHS tapes. The prerecorded concert tape I received with the review unit had 16 chapters—one for each song and the closing credits. It took 1 minute and 43 seconds to find and start playing the 15th song, which was located 1 hour and 8 minutes into the tape. This isn't instant accessibility, but it is much better than searching a tape manually.

The Navigation screen and other menus are only displayed in the 480i format, so the YPbPr output temporarily switches to 480i when those features are used. The output also switches to 480i whenever the tape transport is stopped, even though a 1080i tape may have been playing. This is an inconvenience on rear-projectors that don't display 480i signals through their HDTV inputs. In that case, the TV will have to be switched to an S-video or composite video input to display menu information. My front projector accepts 480i through the same input as it does 1080i, but it then switches scanning modes, which is a major annoyance when you frequently use these valuable features. The HM-DH30000U is capable of overlaying the tape counter and other status information on the 1080i output, so I was surprised that capability wasn't used to display menus.

Video Navigation—Your Video Library

The Video Navigation feature provides even more benefits when you record your own video library. In that case, information about each tape is stored within the HM-DH30000U memory. Each time you begin recording on a new tape, a number is stored on the tape that corresponds to the information saved in the recorder's memory. When a new program begins recording, a navigation screen entry is made for that tape, which includes the date and time of the recording. Later you can enter or edit a title for the tape, and a title for each program recorded on the tape. The information to edit is selected from menus, so the specific tape doesn't have to be in the machine while editing. One menu feature lists all of

the tape titles in memory sorted by tape number, recording date, or a category that can be assigned to each tape. The menu also shows the percentage of memory use, but I couldn't locate any information on the total memory capacity. This is such a great feature I hope there is plenty of memory. (Editor-In-Chief Gary Reber was told that there was memory for about 2,000 titles!)

There is a restriction that requires recordings to be a minimum length to create a navigation screen entry. Recordings must have a length of at least five minutes in the HS mode, 10 minutes in the STD mode, 30 minutes in the LS3 mode, five minutes for the SP mode, and 15 minutes for the EP mode. I ran into this restriction when I made a number of short test recordings and wanted to create a navigation screen to find them automatically. But this would not be a problem when making normal recordings of TV programming.

When a tape is loaded, the navigation screen for that tape can be displayed. When a program title is selected it will be located and playback will begin automatically. The navigation screen also shows the amount of blank space between programs (if any exists) and the total blank space remaining at the end of the tape. This is a great feature for quickly determining if adequate space remains on that tape for additional recording.

Another outstanding feature is the ability to find blank space on tapes within your library without putting any tapes in the VCR. The Video Navigation menu provides a Blank Space List. When the desired recording mode and recording time are entered in a menu, all the tapes in the Navigation memory that have sufficient blank space are listed. The tape number, title, and the actual recording time of the largest remaining blank space are presented for each tape in the list. What a tremendous time saver this is!

The Demo Tapes

JVC provided two prerecorded 1080i HDTV tapes. One was a JVC demo tape with about 30 minutes of travelogue-type video shot in Japan, the U.S., and Spain. It was repeated twice on the tape, presumably to allow a user to more fully exercise the transport controls, but the Video Navigation screen didn't provide chapters to automatically locate the six sections. The audio was Dolby Digital with matrix-encoding for Pro Logic® playback. The video quality was outstanding, and I'll return to that in a moment.

The second tape, *Motley Crüe—Lewd, Crüed & Tattooed* (see review), came in what appeared to be finished packaging. While this tape doesn't demonstrate the ultimate video quality of D-Theater, it clearly differentiates the format from DVD. I com-

pared the D-Theater tape to the DVD version of the same live concert. Both were recorded in 5.1-channel Dolby Digital. The DVD was simply blurry by comparison. The strings on the lead guitar were often not visually distinguishable on the DVD, when they were clearly visible on the tape. Long distance shots of the crowd were soft and suffered from edge enhancement on the DVD. Conversely, faces were clear on the HD tape, and if you were in Salt Lake City for the original concert, I'm sure you would easily recognize others that were there. The writing on signs that sometimes could not be read on the DVD was perfectly clear on the D-Theater tape.

None of this was a surprise. DVD doesn't come close to matching the picture definition of HDTV. In this case, the D-Theater format reveals some of the limitations of the original source. HDTV is unmerciful in exposing less-than-perfect camera focus, and hand-held cameras making dizzying movements, coupled with a smoky haze from stage effects won't exercise the ultimate display resolution of the format.

The JVC D-Theater demo tape was an excellent example of the format's picture quality. The picture definition was equal or better than anything I have seen on terrestrial or satellite HDTV. The detail and textures reminded me of my best 35mm slides. The color was often brilliant, but never appeared unnatural. I've watched a great deal of HDTV, but I still continue to be amazed by the difference in color resolution between high-definition TV and DVD. Small details, which would be dull or even colorless on DVD, are rendered in vivid color on HDTV. This ability alone produces a realism that is lacking in any standard-definition format.

The only slight flaw I noticed on the JVC demo tape were some odd jaggies and moiré on a few scenes shot in Japan. Those artifacts didn't appear anywhere else on the tape, which made me wonder if that segment had been converted from another HDTV format. The picture was superb everywhere else. The Dolby Digital Pro Logic-decoded soundtrack was excellent, and a better example of surround sound music than the live concert tape.

From Tape To Instruments

I had limited time with the JVC D-VHS recorder, so I only measured its recording performance in three configurations—D-VHS STD mode using the digital i.Link interface, D-VHS STD mode using an analog S-video input, and S-VHS SP recording (on a D-VHS cassette) using the S-video input. Measurements were made using a Tektronix

VM700T.

One of the most noticeable differences between digital video and conventional VCR recording is the higher video noise on analog VCR recordings. Measured noise levels are shown in Table 1. The larger the negative number the better. Levels of -60 dB are essentially invisible to the eye. Most DVD players have luma and chroma noise levels between -60 dB and -75 dB, but some are even better. The best LaserDisc players had luma noise levels between -50 dB and -53 dB, and chroma noise levels between about -45 dB and -53 dB. None of these measurements include MPEG noise artifacts, which are not random and depend instead on the image content.

Video noise levels when recording digital signals were in the same range as DVD players, and invisible to the eye. Test signals recorded from the S-video interface picked up a small amount of noise in the analog circuits or during analog-to-digital conversion. But the noise when digitally recording analog S-video signals was excellent and unlikely to be visible on most recordings. The HM-DH30000U also performs quite well as an analog recorder in the S-VHS SP recording mode, but you can see some noise in analog recordings.

Another major difference between analog and digital recording is the video frequency response, which determines the horizontal picture resolution. (Table 2) The frequency response of the HM-DH30000U when digitally recording standard-definition signals from the i.Link interface, or the S-video input, is about the same as an average DVD player. But when S-video signals are recorded using analog S-VHS recording there is a major loss in high-frequency response (and therefore resolution), which is to be expected for analog VCR recording.

From Tape To Screen

In order to make a visual evaluation of recording quality, I recorded a complex six-minute sequence of DVD video using each of the HM-DH30000U recording modes. I evaluated each sequence using a Runco IDP-980 Ultra projector with an 89-inch wide Stewart Filmscreen. The 480i sequences were projected as interlaced video without a scaler to avoid any deinterlacing or scaler artifacts from interfering with the picture evaluation. An Altinex (www.altinex.com) TR6102HD Transcoder was used to convert the YpbPr output of the HM-DH30000U to RGBHV to drive the Runco projector.

My first two recordings used the i.Link interface to transfer digital video and audio between a Pioneer DVR-7000 DVD recorder and the JVC HM-DH30000U D-VHS recorder. This is not an ideal combination because

the DVR-7000 i.Link output converts the DVD MPEG compressed video to baseband digital video and then to DV video, which is another digital video compression format. The JVC recorder converts the incoming DV video to baseband digital video, and then back to MPEG-compressed video for recording. Although the data always remains digital, the extra conversions produce additional compression artifacts.

When DV video is transferred across the i.Link interface, only the STD and LS3 recording modes can be used. I recorded the sequence using both modes. The STD recording mode was clearly superior to the LS3 mode. In the STD mode, there was only subtle picture degradation in a few difficult video images. There was a small increase in mosquito noise in areas that already had minor mosquito noise on the DVD, and a slight color smearing in a few areas. Unless you were looking for problems, I doubt you would see them. In the LS3 mode, there was significantly more mosquito noise in additional picture areas along with some block-edge noise. Color smearing was slightly more obvious in some areas. Picture degradation would have been noticeable even if I hadn't been specifically looking for it.

Next, the analog S-video output was recorded using the 28.2 Mbps HS mode. The resulting picture was virtually indistinguishable from the input. This was clearly the best recording combination and it still provides 3.5 hours of recording on one cassette. The STD mode was next and it was also quite good. Only a very minor amount of mosquito noise was added to areas that already exhibited some MPEG noise. This illustrated the cascading effect of second-generation MPEG encoding. (The video had been encoded and decoded once for the DVD and a second time for the tape.) I recorded some additional analog video from a LaserDisc, which produced virtually no MPEG artifacts at the 14.1 Mbps rate.

Next I compared the same video recorded at the 4.7 Mbps LS3 rate. This time, significant artifacts were added to the picture in the form of mosquito noise and block-edge noise. I would estimate that the picture degradation would be visible to most critical viewers. I wouldn't use this mode for second-generation MPEG recording, but it could be used effectively for most routine analog TV broadcasts.

The S-VHS SP recording was evaluated next. The picture was noticeably softer than the digital recordings, but of course there were no additional second-generation MPEG artifacts since this was an analog recording. In fact, the softer picture rendered some of the MPEG artifacts from the original DVD invisible. The loss of color resolution was

significant, which dulled the vividness of the picture and removed some color detail. Luma noise was visible in some images, and some chroma noise was visible. But overall it was an excellent recording for analog S-VHS.

Finally, I compared the EP mode. The picture was even softer and noise levels were slightly higher. But it still would have been useful when longer recording times were required on an analog tape. But unless analog recordings are required for compatibility reasons, there is no reason to use this mode or the SP analog mode either. The digital recording modes are far superior and provide even more recording time.

The Tale Of The Tape

There is no escaping the fact that this is videotape. On a couple of occasions I experienced "dropouts" while viewing the JVC demo tape, in the form of a second or so of silence and usually a momentarily frozen image or a short burst of MPEG blocks. But surprisingly the defects were never repeatable on that tape. Each time I would rewind past the suspected "dropout" and play the same section again with no difficulty. On several other occasions I played the entire demo tape without any "dropouts," and I never experienced any problems with the Motley Crue tape.

However, one of the six-minute recordings that I made had three dropouts that were repeatable every time I replayed the tape. The picture would freeze and the sound would become silent for a second or so. But I never experienced dropouts anywhere else on that tape.

This recorder wouldn't be ideal for precision D-VHS editing applications. When the pause control is pressed the tape stops immediately. But when play is pressed again, the picture jumps forward three to four seconds before

resuming normal play on the digitally recorded tapes. It also took 97 seconds to rewind one hour of playing time on the JVC demo tape.

Although rewinding a tape or searching for a particular scene may seem agonizingly slow compared to DVD, just try to rewind or stop your HDTV satellite or digital terrestrial broadcasts. Of course you can't. Nor can you chose the day and time you want to watch a particular high-definition movie, which you can do with a D-Theater tape library.

It's More Than HDTV

The JVC HM-DH30000U isn't only about HDTV. This recorder also provides superb standard-definition digital recording quality that is far superior to anything available from an analog VCR. So if you keep a library of programming from satellite or terrestrial broadcasts, switching to digital tape will greatly improve picture quality and even save some space. Also the Video Navigation features provide some wonderful tools that will make creating your library easier.

D-Theater Or Not D-Theater?

After becoming spoiled by the operational features of DVD technology, it was a shock to return to tape. But there simply are no other current alternatives for prerecorded HDTV programming, and I believe political and economic issues still put a high-definition DVD introduction three to five years away.

Even though D-VHS is a step back in operating convenience, it is a giant leap forward in accessible video quality and the ability to choose what and when we watch HDTV. If convenience were the only tradeoff, I'm certain this new format would be a tremendous success. But will videophiles also accept a return to a LaserDisc-like

pricing structure for high-definition movies, and the knowledge that within a few years they will probably want to buy the same HDTV titles over again on HD-DVD? That, I think is the question. As always the market will vote with their dollars. But I know I'll soon be clearing off a shelf to start collecting my library of D-Theater movies. ■

JVC HM-DH30000U D-VHS D-Theater VCR

- Digital set-top box ready with Digital-to-Digital I connection via i.Link (IEEE 1394) terminal
- HDTV Digital Broadcast Bitstream Recording/Playback
- Built-in MPEG2 Decoder for Direct Connection to HDTV
- Record Any Type of Broadcast including HD, SD or Analog
- HS mode (28.2 Mbps) for up to 4 hours* HDTV recording
- STD Mode (14.1 Mbps) for up to 8 hours* SD recording
- LS3 Mode (4.7 Mbps) for up to 24 hours* long-time recording
- *Per DF-480 cassette
- D-VHS (HS, STD, LS3) S-VHS (SP, EP) S-VHS ET (SP, EP)
- HiFi VHS (SP, EP) VHS (SP, EP)
- Full-Spec HDTV Compatible (with all 18 ATSC broadcasting formats)
- DigiPure Technology for high resolution analog recording and playback
- 5.1 Dolby Digital Output (optical)
- 2 channel Linear PCM Audio Output capability
- 1080i, 720P, 480P and 480i
- 3 Sets of AV inputs
- 3 S-Video inputs
- 2 Sets of AV outputs
- 2 S-Video Outputs
- 1 Component Video Output (YPbPr)
- 1 x Optical Digital Output
- 2 x i.Link Terminal (IEEE 1394), DV input only for camcorders
- Front Inputs (AV, S-Video, i.Link)
- Video Navigation- Tape Number, Record date and Category sorting
- D-Theater compliant with the advanced D-VHS security system
- Frame Synchronizer for pristine analog-to-digital dubs
- MTS Decoder for SAP programs
- VCR Plus+ with provided cable box controller
- Express Programming
- Plug and Play for automatic tuner and clock set-up
- 1-year / 24-event programmable timer
- Av Compu Link
- Multi-Brand TV Compatible Jog/Shuttle Remote Control
- 90 days labor and 1 year parts
- Weight (In Pounds): 13.3
- Dimensions (WHD): 17-15/16 x 4-3/16 x 13-5/8
- Price: \$1,999.95

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Table 1

JVC HM-DH30000U Recording Noise Measurements

	Y	YPbPr Pb	Pr	Y	S-video Chroma AM	Chroma PM
	*	2.5 MHz	2.5 MHz	*	100 - 1 MHz	100 - 1 MHz
i.Link D-VHS STD	-74	-78	-78	-71	-60	-57
S-video D-VHS STD	-50	-51	-53	-50	-50	-52
S-video S-VHS SP	-45	-47	-50	-45	-46	-42

* = Unweighted

Table 2

JVC HM-DH30000U Recording Frequency Response

	0.5 MHz	1.0 MHz	2.0 MHz	3.0 MHz	4.1 MHz	5 MHz
YPbPr						
i.Link D-VHS STD	0.0	-0.2	-0.7	-1.5	-3.0	-4.2
S-video D-VHS STD	-0.3	-0.3	-0.6	-1.0	-2.1	-4.6
S-video S-VHS SP	-0.7	-1.7	-4.9	-6.1	-9.0	-18.0
S-video						
i.Link D-VHS STD	-0.2	-0.4	-0.7	-1.5	-2.8	-4.2
S-video D-VHS STD	-0.4	-0.5	-0.7	-0.9	-2.0	-4.6
S-video S-VHS SP	-0.9	-1.9	-4.8	-6.1	-9.0	-18.0