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Lumagen VisionHDQ™ Video Processor

Video Upconversion & Switching

Greg Rogers

Advanced 1080i Deinterlacing

The VisionHDQ™ is the newest product from Lumagen—a Pacific Northwest company—that provides advanced video processing technology at affordable prices. The VisionHDQ ($1,999), and its less expensive siblings, now include 1080i film-mode deinterlacing for high-definition movies and pixel-based motion-adaptive deinterlacing for 1080i broadcast video. The versatile VisionHDQ provides fully programmable scaling and input switching for 10 video sources, including up to four DVI or HDMI signals.

Appearance

The VisionHDQ features a low-profile, 1.75-inch high, all-metal case. Its black-anodized, brushed-aluminum front panel includes an IR receiver and a single LED power indicator, which also blinks when an IR remote control command is received. The user can select whether the LED remains illuminated during operation or is turned off in a dark theatre. There is no fan, so the video processor operates silently.

Inputs And Outputs

The rear panel provides 10 video inputs, which the user can configure to accept multiple signal types. There are two composite (BNC) inputs and two S-video (4-pin mini-DIN) inputs. The S-video inputs can also be configured for composite video. There are four DVI-I inputs that accept digital video or RGBHV analog video signals. There are two sets of YPbPr/RGsB (BNC) inputs that are compatible with standard-definition (SD) or high-definition (HD) signals. They also accept RGBS or SCART signals. Finally, there is a separate standard-definition SDI (Serial Digital Interface) video input, which may be used instead of a composite video BNC input.

There is one DVI-D digital video output, and one analog video output. The analog output (five BNCs) produces YPbPr or RGB signals. DVI and analog RGB signals can be output simultaneously, but DVI and YPbPr signals can't be output at the same time.

An RS-232 connector is provided to operate the VisionHDQ from a personal computer or home theatre controller, or to update the firmware with new enhancements. The RS-232 serial interface commands are included in the user manual, and firmware enhancements are posted on the Lumagen Web site (www.lumagen.com). An external power module supplies five volts DC to a rear panel jack.

> "The VisionHDQ reaches the pinnacle of performance deinterlacing 1080i high-definition movies."

Analog Signal Compatibility

The composite and S-video inputs are compatible with NTSC, PAL, and SECAM formats, and a 3D comb filter is included to minimize dot crawl and cross-color artifacts. The YPbPr/RGB inputs accept 480i/p, 576i/p, 720p, and 1080i formats. The analog YPbPr inputs can be configured for Rec. 601- or Rec. 709-encoded signals. High-definition signals should always have Rec. 709 encoding, but some DVD players and other sources that upconvert SD video to HD video incorrectly retain Rec. 601 encoding—so this feature can be used to correct that error.

SPECIFICATIONS

Inputs
Ten inputs: One composite, two S-video, two SD/HD component/RGB, four DVI-D/DVI-A inputs and one SDI input. NTSC, PAL, SECAM supported.
Selectable SDTV or HDTV YPbPr color-space.

Processing
Per-pixel motion adaptive and inverse-telecine deinterlacing for SD and HD sources.
Proprietary scaling algorithms provide detail-enhancement.
Adjustments for sizing, black-level, contrast, color, Hue, color/Hue offset, and Y/C delay.
11-point parametric gray scale and gamma calibration.
Source aspect ratio selection of 4:3, 4:3 nonlinear-stretch, letterbox, 16:9 and 1.85.
Two zoom steps for each source aspect ratio.
Four independent configuration memories per input.

Output
DVI-D/HDCP and analog outputs to 1920 by 1080 at up to 60 Hz
Selectable SDTV or HDTV YPbPr output color-space.
Eight independent output configuration memories.
Resolution: 480p to 1080p in line increments, plus 1080i.
Vertical refresh rate: 48 to 120 Hz in 0.01 Hz steps.
Output aspect ratio: 1.10 to 2.50 in 0.01 steps.
Output size and position programmable in pixel increments.

Dimensions (WHD In Inches): 17 x 3.5 x 10
Weight (In Pounds):
Price: $1,999

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The analog RGB output can be configured to include embedded bi-level or tri-level sync-on-green, or separate HV or composite sync signals (selectable polarities). Bi-level or tri-level sync, and Rec. 601 (SD) or Rec. 709 (HD) color encoding, can be selected for YPbPr output signals.

Analog and digital output formats are programmable from 480p to 1080p in-line increments, plus 1080i or 1080p24sf (segmented frame). The vertical sync rate is

programmable from 48 to 120 Hz. The line length in pixels is programmable for the DVI output, and the horizontal line rate is programmable for the analog output. There is also a Timing menu, which permits the total and active line and pixel counts, and the vertical and horizontal sync and front porch lengths to be programmed. These features can be used to match displays that don't implement industry standard video formats, or don't implement them correctly.

DVI/HDMI Compatibility

The DVI inputs accept 480i/p, 576i/p, 720p, and 1080i digital video from sources with DVI or HDMI outputs. Lumagen plans to provide a firmware upgrade to add 1080p24 and 1080p24sf input compatibility for high-definition DVD players, but 1080p60 input capability isn't supported by the hardware.

The DVI inputs can be enabled to accept digital RGB, 4:4:4 YCbCr, or 4:2:2 YCbCr formats. However, YCbCr can only be used if sources can be manually set to output those formats. The VisionHDQ can be configured to accept RGB-video (16 to 235 for black to reference white) or RGB-PC (0 to 255) input levels. RGB-video levels are preferable because they permit signals to go below black and above the white reference level.

The DVI output can be configured to produce digital RGB Video or PC levels, but not YCbCr digital video. It can drive an HDMI input by using a DVI to HDMI cable or simple adapter. The DVI inputs and outputs are compatible with HDCP encryption.

Configuration Memories

The VisionHDQ has an array of versatile input and output configuration memories, which allows it to be calibrated for multiple input signal types, diverse operating environments, or several displays. Some configuration memories can be manually selected, while others are automatically recalled based on the input signal format.

There are four independent configuration memories for each input. Each input configuration memory stores all of the settings included in the input menu. The user may manually select each of the configuration memories, or may chose to have two memories dedicated for NTSC sources and two for PAL sources. In addition, each input that accepts both SD and HD signals has four sub-memories for each of its four input configuration memories. The sub-memories are automatically recalled based on the input signal format. There are separate sub-memories for 480i/p (576i/p), 720p, 1080i, and PC signals. That allows sources that provide multiple formats, such as an ATSC receiver or an SD/HD DVD player, to output the native format of the source, and automatically have different processor settings applied to each format.

By default, all input configuration memories share the same output format, or one of eight independent output configuration memories can be assigned to each input configuration.

The input and output configuration memories are extremely powerful but can be a little confusing to initially set up. COPY functions are included that allow the current input or output settings to be copied to one or all configuration memories. A SAVE command must be used to store configurations in non-volatile memory, which prevents accidental changes from being made to the configuration memories.

Remote Control

The infrared remote control buttons are backlit and feature distinctive sizes and shapes that make it easy to use in a dark theatre. A numeric keypad selects any of the 10 inputs by pressing a single button. However, those buttons aren't labeled by function (DVI, S-video, etc.) because several inputs accept multiple signal types. Menu, OK, Exit, and cursor buttons provide navigation of the on-screen menu, but there are dedicated buttons for selecting the input configuration memories, and the input (source) aspect ratio. Component configuration files (.ccf) for a Pronto remote control are also posted on the Lumagen Web site (www.lumagen.com).

Operation

The VisionHDQ retains Lumagen's rather basic on-screen menu system—consisting of four lines of text to present a fairly deep tree of hierarchical menus that spread out horizontally across the screen. Some of the menu items are cryptically abbreviated and a bit confusing to find initially, but once you become familiar with the menu structure, it works efficiently.

The most commonly used features are arranged into four top-level menus—IN, OUT, MISC, and SAVE. Some special features are not available in the on-screen menus, and require the entry of a short numeric sequence on the remote control. That simplifies the menu structure, and it provides a way to initially configure the processor for a display that only accepts a limited number of formats. But I dislike having to go back to the manual to look up numeric sequences, even if they are only used in rare situations.

Input Features

The IN menu includes TYPE, OUTSEL, CONFIG, and COPY submenus. TYPE selects the signal type (DVI-D, YCbCr 4:4:4, YCbCr 4:2:2, RGB, etc.) for inputs that accept more than one type of signal. OUTSEL links one of the eight output configurations to an input memory when the processor is in an Independent output mode.

The CONFIG submenu includes several layers of submenus. Among the functions are Black Level, Contrast, and Color adjustments. The Color adjustments include the usual saturation and hue settings, but also include additional red and green saturation and hue offset adjustments that can be used to correct color encoder errors in sources, or color decoder errors in displays. However, be sure that the correct color encoding/decoding matrices have been selected in the source, the display, and the VisionHDQ before using this feature.

The service mode provides the ability to calibrate gray scale and gamma at 2, 5, or 11 signal levels. This is a powerful and well-implemented feature, but it should only be used if a display fails to provide satisfactory calibration adjustments. The relationship between gray scale and gamma is rather complex, so these adjustments should be made by a technician with the knowledge and instruments to make them correctly.

A CUE filter can be enabled to reduce the Chroma Upsampling Error that is found in some DVD players, and in some other sources with MPEG decoders. The ADJ submenu provides input size and position adjustments, an adjustable non-linear stretch mode for 4:3 (1.33:1) input formats, independent Cb and Cr delay adjustments, a sharpness adjustment, and DVI input level selection. There is also a black level pedestal setting for analog inputs, but that feature has not been implemented. A CNTRL submenu selects deinterlacing modes and the genlock mode. A DVI submenu selects how DVI features are reported to a source for compatibility purposes. The NAME submenu permits the input configuration memories to be assigned names with up to six characters. The COPY submenu allows the current input memory to be copied to all or selected input memories.

Output Features

The OUT menu provides adjustment of the output format. The RES submenu can be used to select the number of active scan lines, the vertical frame rate, the horizontal line rate or pixel length, and the output size and position. There is also a TIMING submenu that allows adjustment of all output format parameters in pixels and line increments. The ASPECT submenu sets the output screen aspect ratio between 1.10 and 2.50 in 0.01 increments.

The POS adjustments reposition the output image horizontally and vertically within the total scan lines of the frame. The SIZE adjustments scale the image to occupy more or fewer scan lines, and more or fewer pixels per scan line, without changing the total number of scan lines in the frame, or the total number of pixels per line. The SIZE and POS adjustments work well with CRT projectors, but may have limited utility with DVI output signals and fixed-pixel displays.

The MISC submenu includes adjustments for the intensity of gray sidebars when displaying a 4:3 image on a wider screen, and adjustments for the intensity of the top and bottom areas of letterboxed images. The latter is provided in the service mode. A LEVL submenu permits a black-level pedestal (7.5 IRE setup) to be turned on or off for analog output signals. This should normally be set to 0 IRE unless it is necessary to match signals from another source that also drives the display. The DVI output level can be set to Video or PC levels, and the DVI sync polarity can be selected. Most displays are ambivalent about the DVI sync polarity, but you may occasionally find an older display that will shift horizontal position with sync polarity. In that case, you should first try using the EIA/CEA 861-B standard DVI sync polarities, which are positive for 720p and 1080i/p, and negative for 480i/p and 576i/p. Lumagen may want to set those polarities as default values. The HV sync polarity for analog signals, which often affects horizontal positioning, must be entered with remote control numerical command sequences.

The MODE submenu selects the single output configuration mode, the eight independent output configurations, or the auto independent output configuration mode. The latter automatically selects an output configuration based on an NTSC or PAL input. There is also a COPY submenu to copy the current output configuration to other output configurations.

Other Menu Features

The MISC submenu provides the ability to enable or disable on-screen status messages, lock configurations to prevent changes, set the power-up state, enter a user-defined power-up message, set up the RS-232 port, and select test patterns. Red, green, blue, and gray fields, gray windows, and a crosshatch pattern are included. The intensity of each pattern can be adjusted in 10-IRE increments from 0 to 100 IRE. There are also overscan, raster, and contrast patterns.

The SAVE menu provides a command to save the current configuration in non-volatile memory and an UNDO command that restores the configuration that was overwritten by the last SAVE command. There are also items to restore a calibrator's hidden configuration or the factory defaults.

Input Aspect Ratio

The remote control and Input menu provide four Input Aspect Ratio selections—4:3, letterbox, 16:9 (1.78:1), and 1.85. The Input Aspect Ratio settings resize input signals so they are properly displayed for the selected output aspect ratio.

Zoom

The Zoom function enlarges the image by 15 or 33 percent. The latter will fill the height of a 16:9 screen with a 2.35:1 widescreen movie image, but a significant portion of the film frame will be lost on each side. The remote control's up/down cursor buttons adjust Zoom when a menu is not on screen. The Zoom factor can be changed to produce five-percent increments by entering a numeric sequence from the remote control.

Film-Mode Deinterlacing

The VisionHDQ provides inverse-telecine deinterlacing and motion-adaptive deinterlacing for 1080i sources, in addition to standard-definition sources. The 1080i processing is accomplished using custom, proprietary FPGA (field programmable gate array) algorithms developed by Lumagen. The standard-definition deinterlacing is accomplished with a Silicon Image SiI-504 video processor, which has been used in other Lumagen products.

Inverse-telecine deinterlacing is an ideal, artifact-free process that converts interlaced video transferred from film to progressive video. The video processor locks onto the 3-2 field pulldown cadence that results from transferring 24 frame-per-second film to 60 field-per-second interlaced video. It then merges the odd and even video fields that originated from the same film frames. That eliminates interlaced line twitter and avoids vertical interpolation that would soften the image. Inverse-telecine deinterlacing is particularly effective in reducing moiré patterns and eliminating line flicker during vertical movement of closely spaced horizontal lines. Some common examples include a moving automobile grille, or Venetian blinds in the background of a moving camera shot.

The 1080i inverse-telecine deinterlacing performed marvelously. It provided superior sharpness and superb vertical detail, even during slow image movement. There was no line twitter as a camera moved vertically over the horizontal slats of a park bench in the D-VHS® D-Theater™ transfer of *X-Men*, which is a difficult test that some more expensive processors with 1080i inverse-telecine deinterlacing have been unable to duplicate.

The SiI-504 is still an excellent video processor for deinterlacing standard-definition film-source video. It does an excellent job of detecting the 3-2 field pulldown pattern that is used to convert film to interlaced video, and smoothly handles breaks in the cadence at edit points. It handled the transitions between the film and video segments of *Video Essentials*' "Montage Of Images" flawlessly. There were no glitches or flashes of line combing at any transition, and there were no noticeable problems while watching DVD movies.

48/72 Hz Output

The VisionHDQ can produce 48 Hz or 72 Hz judder-free progressive video from 480i or 1080i film-source video. Normally the 3-2 pulldown cadence in film-source video causes smoothly moving objects to stutter when they alternately appear at one position for three fields and then another position for only two fields. That is called judder in video terminology. Even when 480i film-sources are converted to progressive video, judder still occurs because a sequence of three frames followed by two frames is repeated to produce 60 frame-per-second video from 24 frame-per-second film. The VisionHDQ can eliminate that judder by repeating each progressive frame exactly twice (48 Hz) or three times (72 Hz). (Note: the actual video frame rates in North America are the abbreviated frame rates divided by 1.001, which is approximately 59.94, 47.95, and 71.93 Hz.)

Judder-free 48 or 72 Hz frame rates are produced by first performing inverse-telecine deinterlacing to reconstruct the original 24 Hz film frame rate. Then the output is locked to an exact multiple of that rate. That is required to ensure that each progressive video frame is produced with precisely the correct number of repetitions. Without locking the frame rate, the 72 Hz video would slip into a 4-2 frame sequence rather than the correct 3-3 frame sequence, which would make judder worse instead of eliminating it. Some devices that produce 48 or 72 Hz video don't have that crucial ability to lock frame rates (known as genlocking).

To benefit from the 48 or 72 Hz frame rate, you must have a display that will produce images at one of those rates. Most CRT front projectors will accept and display 48 Hz and 72 Hz rates, but 72 Hz should be used to prevent wide-area flicker on a CRT display. Only a few non-CRT displays can actually display video at those rates. Many reconvert the incoming video back to 60 Hz, which recreates the judder.

Be sure that you only use the 48 and 72 Hz frame rates with movies. Original 60 field-per-second interlaced video already produces motion without judder because each field captures an image at a different instant in time. When those interlaced fields are converted to progressive frames, each frame represents the same instant of time as one field. Judder will be created if that 60 Hz video is converted to 48 or 72 Hz. Also note that the VisionHDQ only genlocks to the 48 and 72 Hz frame rates when there are no menus on screen.

I have been a proponent of using a 72 Hz frame rate to view movies in home theatres for many years. Most of us are so accustomed to judder while watching film transferred to video that we are conditioned to ignore it. But once you watch movies without judder in your home theatre, I believe you will find it a much more satisfying and cinema-like experience.

Video Deinterlacing

It is much more difficult to deinterlace original video sources, since the images originate as interlaced fields instead of frames. Unlike film-source video, there's no 3-2 field pulldown cadence, which allows inverse-telecine deinterlacing to reassemble original film frames. Instead, each odd or even field of original interlaced video captures images at different instances in time. Most projectors and standalone scalers have traditionally converted 1080i video to 1080p using vertical interpolation to scale each individual 1080i field directly to a 1080p frame. The actual vertical resolution of the displayed image is then limited to the 540 line vertical resolution of each interlaced field. Furthermore, vertical interpolation acts as a filter, which further reduces the vertical resolution and softens the image.

The VisionHDQ converts 1080i video to 1080p using pixel-based motion-adaptive deinterlacing, which merges information from odd and even fields in static image areas. Merging field information produces 1080 line vertical resolution in the static areas, but interpolation must be used for the areas in motion, which softens the image in those areas. More expensive 1080i motion-adaptive deinterlacers also include directional interpolation to reduce jaggies on diagonal lines and improve the resolution of areas that are in motion, but that feature is not included in the VisionHDQ. As a consequence, it produces a few more jaggies and less resolution than a processor with directional interpolation, but it produces more resolution and fewer jaggies than processors that don't have motion-adaptive deinterlacing. The more common field interpolation method can also be selected in the VisionHDQ menu, so you can directly compare these methods.

A common problem with first-generation 1080i motion-adaptive deinterlacing was resolution pumping, also called breathing, which occurred when the image resolution suddenly and severely decreased with movement as the processor switched from field merging to field interpolation. The VisionHDQ makes pixel-based (per-pixel) motion decisions, which marginalizes this otherwise annoying artifact. As a result, breathing artifacts were seldom intrusive.

The VisionHDQ uses the SiI-504 to perform motion-adaptive deinterlacing for standard-definition sources. Line twitter and jaggies are more apparent in standard-definition formats where the spacing between the original video lines is greater. As with all motion-adaptive deinterlacing algorithms, there are inevitable tradeoffs between jaggies, line twitter, and picture softening, depending on image content and the specific processing algorithms that are used. I evaluate those tradeoffs using the *Video Essentials'* "Montage Of Images" as a repeatable source of difficult to deinterlace, standard-definition interlaced-video sequences. The VisionHDQ does an excellent job with the zoom and pan shots of the bridge structures and the difficult zoom into the leafy tree. Jaggies appear along the frozen branch as it bounces, and the waving American flag, but there was no color bleed between the red and white stripes of the flag. The difficult zoom out of the city has moderate line twitter in building windows and other structures.

Scaling And Overscan

Lumagen's proprietary scaling algorithms include additional processing to eliminate edge artifacts and improve image clarity. When 480i, 480p, or 1080i digital signals were scaled to 720p, there was no overshoot (bright outlining) or ringing artifacts along horizontal or vertical edges. There was only a single pixel along the edges that fell within the rise or fall time of the scaled lines. The scaling quality was also outstanding for analog signals. Even the AccuPel HDG-3000 calibration generator's fast-edge mode (PC-like) analog signals were scaled without overshoot or ringing. However, edge transitions on analog high-definition signals were slowed by the bandwidth of the analog inputs.

The overshoot suppression processing produced some aliasing on a resolution-wedge test pattern during vertical movement, but I was unable to find any instance of that effect while viewing normal video. Instead, the absence of overshoot or ringing on edges produced exceptional clarity and image definition.

Overscan varied at each frame edge, and for each format. I had to recalibrate the input sizing controls to adjust overscan for each input format. The overscan adjustments for 480i and 480p analog signals interacted, so I used a separate configuration memory for each.

There is no signal-bypass mode, but a menu setting can be enabled to bypass the scaling portion of the video processor when the input and output formats match. When 720p digital signals were input and output, a single-pixel vertical line was still blanked at the right side of the frame and a few pixels were missing on the last line in the bottom right corner of the frame.

The Sharpness control should be left at the default (0) setting. Just a single increment of the Sharpness control adds significant sharpening but emphasizes noise and appears less natural, particularly on a fixed-pixel projector. Further increases add outlining (halo) around diagonal edges. There appeared to be some residual sharpening effect at the default setting that only affected 1080i analog signals.

The chroma response for S-video signals extends to about 1.7 MHz using the *AVIA Pro* Polyphasic Chroma Sweeps. The analog YPbPr chroma response had negligible roll-off at the 3.375 MHz DVD chroma frequency limit.

Viewing Impressions

I used a Yamaha DPX-1300 720p DLP projector to display the DVI digital video output of the VisionHDQ, and a CRT projector to view its analog output. The DPX-1300 displays a spatially "pixel perfect" image when driven by 720p digital video signals. Each pixel from the source is displayed as a single-projector pixel, which precisely reveals the VisionHDQ deinterlacing and scaling performance. I also used a prototype of the Digital Projection dVision 1080p DLP projector to evaluate the processor's 1080i deinterlacing. It displays a spatially "pixel perfect" image when driven by 1080p digital signals.

The VisionHDQ should be used with a DVD player that doesn't add edge enhancement, which would degrade its outstanding scaling quality. Use an HDMI/DVI or an analog YPbPr output that is free of ringing and edge outlining. Also use 480i signals to avoid a standard-definition DVD player's internal deinterlacing, which may be inferior to the VisionHDQ inverse-telecine deinterlacing. The SDI input can also be used to receive 480i digital video from sources that have a professional SMPTE 259M SDI output.

The 72 Hz genlocked frame rate of the VisionHDQ produced marvelous images on the CRT front projector. The smooth judderless motion and the processor's lack of edge outlining or ringing artifacts would be referred to as "film-like" by many observers, although I would describe the images as exceptionally natural. The standard-definition DVD format can't provide the full resolution of film, which is the main reason we need high-definition video to obtain truly "film-like" images.

The VisionHDQ and the 720p DLP projector also produced exceptionally fine images, although I missed the fluidity of motion provided by the CRT projector's 72 Hz frame rate. Nevertheless, the excellent deinterlacing and superb scaling produced exceptional detail and clarity in *The Fifth Element* and other excellent DVD transfers. There is slightly less perceived sharpness without the processor adding artificial edge enhancement, but the clarity of detail and the naturalness of images are maximized. The facial features of Jody Foster in *Flight Plan* become harsh if the processor produces any edge outlining, but they look quite realistic with the VisionHDQ. Even *Pretty Woman* (15th Anniversary Edition) looked her best despite less than pristine film elements.

Color accuracy is another critical component of home theatre performance. I used the DPX-1300 color management system to precisely match the projector's primary and complementary colors to the SMPTE-C (Rec. 601) standard colorimetry, which is used to master DVDs. The VisionHDQ and DPX-1300 produced virtually perfect color accuracy, and excellent chroma detail.

I tested the processor's 1080i motion-adaptive deinterlacing using the DPX-1300 720p DLP projector, and a prototype of the Digital Projection dVision 1080p DLP projector. NBC's *Tonight Show With Jay Leno and Late Night With Conan O'Brien*, and the CBS *Late Show With David Letterman*, provide the finest examples of 1080i broadcast video. The VisionHDQ provided significantly clearer images, with fewer jaggies and less line twitter, than a high-quality video processor without 1080i motion-adaptive deinterlacing. Strands of hair, guitar strings, and threads in suits and ties were rendered with better clarity. The difference was more apparent on the 1080p-native DLP projector, but was also significant on the 720p projector.

The DPX-1300 projector and the dVision 1080p projector's external processor include Silicon Optix' Realta HQV video processing, which provides 1080i motion-adaptive deinterlacing with directional interpolation. The dVision 1080p video processor is sold separately for $5,999, which is triple the price of the VisionHDQ. The Realta HQV processing produced even fewer jaggies along diagonal edges and further improved broadcast image definition. The texture of suits and sweaters, and the suede on chairs and couches, were better resolved. Lumagen has also announced its own Realta HQV-based video processor (now $3,999), which will include Lumagen's proprietary scaling and calibration technology. That product is scheduled for introduction in late 2006.

The VisionHDQ reaches the pinnacle of performance deinterlacing 1080i high-definition movies. It was flawless in converting 1080i HDMI signals for D-Theater™ movies to 1080p for the dVision 1080p projector. That combination produced the sharpest, most detailed movie images I have seen in a home theatre. The 1080i inverse-telecine deinterlacing eliminates any interpolation that would soften the picture, and there was almost no visible line twitter or jaggies. The horizontal bar code lines on soft drink containers in *X-Men* were resolved with exceptional clarity, and the submarine interiors in *U-571* and the planetarium scenes in *K-PAX* were rendered with superior definition. But most impressive were the astonishingly intricate details in the wall carvings and floor designs of *The Haunting*.

Summary

The Lumagen VisionHDQ is an outstanding product that provides 1080i film-mode deinterlacing for high-definition movies, and pixel-based motion-adaptive deinterlacing for 1080i broadcast video. Lumagen's 10-bit video processing and exceptional scaling algorithms avoid edge-outlining artifacts and maximize image resolution. The versatile VisionHDQ provides 10 video inputs, including up to four inputs for DVI/HDMI sources, and can be configured to support virtually any projector or monitor.