More flexibility for Alternative Content

Kinoton's Markus Näther explains the technology behind the company's DMS Scalers

D-Cinema projectors using Series II 2K DLP Cinema® technology support not only true 2K content, but also different video formats. If it comes to alternative content, though, they quickly reach their limits – the range of different picture resolutions, video rendering techniques, frame rates and refresh rates used on the video market is simply too large. Professional media scalers can convert incompatible video signals into the ideal input signal for D-Cinema projectors, and in addition enhance the projector's capabilities of connecting alternate content sources.

The two HD-SDI inputs of the D-Cinema projector are occupied by D-Cinema servers, so normally only the two DVI inputs are open for alternative content. Analog content sources cannot be connected at all. Scalers, on the other hand, are designed for input flexibility. Depending on the model, they boast a variety of additional inputs. The range goes from analog component, composite, S-Video and VGA inputs for connecting PCs or laptops, DVD players, satellite receivers, digital encoders, cable receivers and many other sources, up to HDMI inputs for Blu-Ray players etc. Premium scalers even offer SDI and HD-SDI inputs for professional sources.

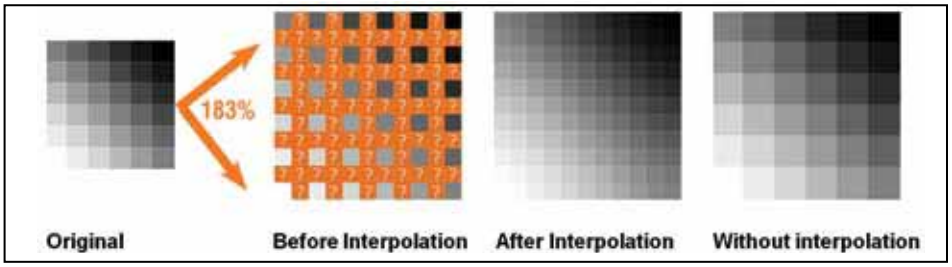
Perfect Image Adjustment

The different video sources – like classic TV, HDTV, DVD or Blu-Ray, just to name the most common ones – work with different image resolutions. The ideal screen resolution for the projection of alternative content with 2K projectors is 1920 x 1080 pixels, which corresponds to HDTV resolution, respectively true 2K resolution with 2048 x 1080 pixels.

In order to trim the different video signals to this ideal width-to-height ratio, the scaler leaves out certain pixel rows or columns in the images, and adds new pixels where necessary. Simple doubling or omitting existing pixels, however, would lead to ugly staircase effects. That's why high-quality cinema scalers employ very complex mathematical algorithms to achieve smooth transitions. Pixels to be added are interpolated from the interim values of their neighbouring pixels, and if pixels have to be deleted, the same principle is used to smooth the transitions between the residual pixels.

How well a scaler accomplishes this demanding task basically depends on its processing power. Kinoton's premium scaler model DMS DC2 PRO realises image format changes without any loss of sharpness, the base model HD DMS still provides an acceptable image quality for normal theatrical use.

Image 1: When a digital picture is enlarged, new pixels have to be interpolated to achieve crisp pictures.



Turn Interlaced into Progressive

TV signals and video material produced for television are usually interlaced, meaning that the individual frames are not exhibited completely, but split up in scan lines. The pictures you see on your screen are refreshed twice per frame, the first field displaying all even scan lines and then second one all odd ones.

D-Cinema projectors, however, exhibit progressive pictures, as full frames are called in video lingo. Interlaced images must be deinterlaced to get full frames suitable to be projected on the cinema screen. Though Series II projectors are in fact able to do this, their interlacing capability is quite rudimentary. Powerful scalers can visibly improve the quality of the deinterlaced images.

There are different methods to blend interlaced fields into progressive frames. What

Image 2: Deinterlacing turns interlaced fields into progressive frames suitable for cinematic exhibition

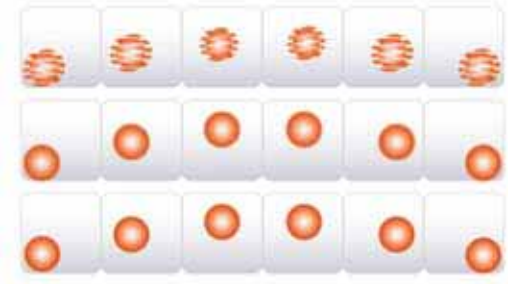


Image 3: The picture quality depends on the deinterlacing method

makes things difficult is that many television or video cameras record the fields in succession, so each individual scan line field shows another moment in time. The most primitive interlacing method called Weave simply blends two successive fields into one frame, thus combining two different phases of movement in one picture. As a result, the generated full frame is disfigured by ugly comb effects (Image 3). High-quality deinterlacing methods use interpolation to add the missing scan lines, thus upgrading each single field to a complete frame.

Motion Adaptive

The Digital Cinema Scalers DMS DC1 and DC2 PRO DMS for example apply the most sophisticated deinterlacing method called Motion Adaptive Deinterlacing. When interpolating the missing field scan lines, they do not only take the existing scan lines of the present field into consideration, but also the scan lines of the fields before and after the respective field. In other words, they allow for the motion sequence, ensuring crisp and clear frames and smooth movements. Even Kinoton's HD DMS basic media scaler converts interlaced images easily into progressive images, though not quite achieving the image quality of the premium models.

Frame Rate and Refresh Rate

What's the difference between frame rate and refresh rate is easy to explain if we have a look at our good old film projection: A 35-mm projector transports 24 individual film images through its film gate in every second, so the frame rate is 24 frames per second (fps). The rotating 2-blade shutter blocks the light during the pull-down, and a second time while the frame is dwelling in the film gate. In effect each frame is illuminated twice, doubling the original 24 Hz refresh rate to 48 Hz to rule out any flicker.

Most classic TV content features a refresh rate of 50 Hz (European PAL standard) or 59.94 Hz (NTSC standard, used in Japan and the USA). The refresh rate of HDTV differs extremely, ranging from 23.79 Hz, 24 Hz, 25 Hz and 30 Hz up to 50 Hz, 59.94 Hz or 60 Hz, with other refresh rates lurking beneath the surface. Computer signals are typically between 60 Hz and 75 Hz.

Videos that feature other refresh rates than supported by your DLP Cinema® projector must be appropriately converted by a scaler before they can be projected, otherwise the screen will stay black.

If you make a point of presenting alternative content in a perfect "film look", you better make sure your scanner can convert certain video signals into the 24p output format, such as Kinoton's DMS DC2 PRO. 24p offers 24 frames per second, presenting "only" 24 stills of the motion sequence – just as 35 mm film does. This causes a slight motion blur which accommodates the viewing habits of the cinema audience, making even TV productions look almost like real cinema movies.

Image Enhancement

Cinema scalers offer various features to further improve image quality, like tools for touching up sharpness, brightness and colour temperature, or for adjusting distorted images. Here again scalers from different price categories provide quite different outcomes regarding the image quality. How crisp, detailed and natural-looking video content is displayed on the screen is above all determined by the quality of the scaler's processor chip, which in turn dictates the price of the scaler. Quality does have its price.

The premium DMS DC1 and DC2 DMS PRO Digital Cinema Scalers, for example, boast a Per Pixel Noise Reduction which accurately minimises the image noise of poor content sources. This technique observes the environment of every single pixel, specifies disturbing pixels and adapts them to their neighbors, this way e.g. replacing red and green speckles in a blue sky with matching blue pixels. This results in clear and sharp images with smooth contours. The basic scaler model DMS HD cannot really keep up with this processing power, and therefore makes do with less sophisticated noise reduction methods.

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