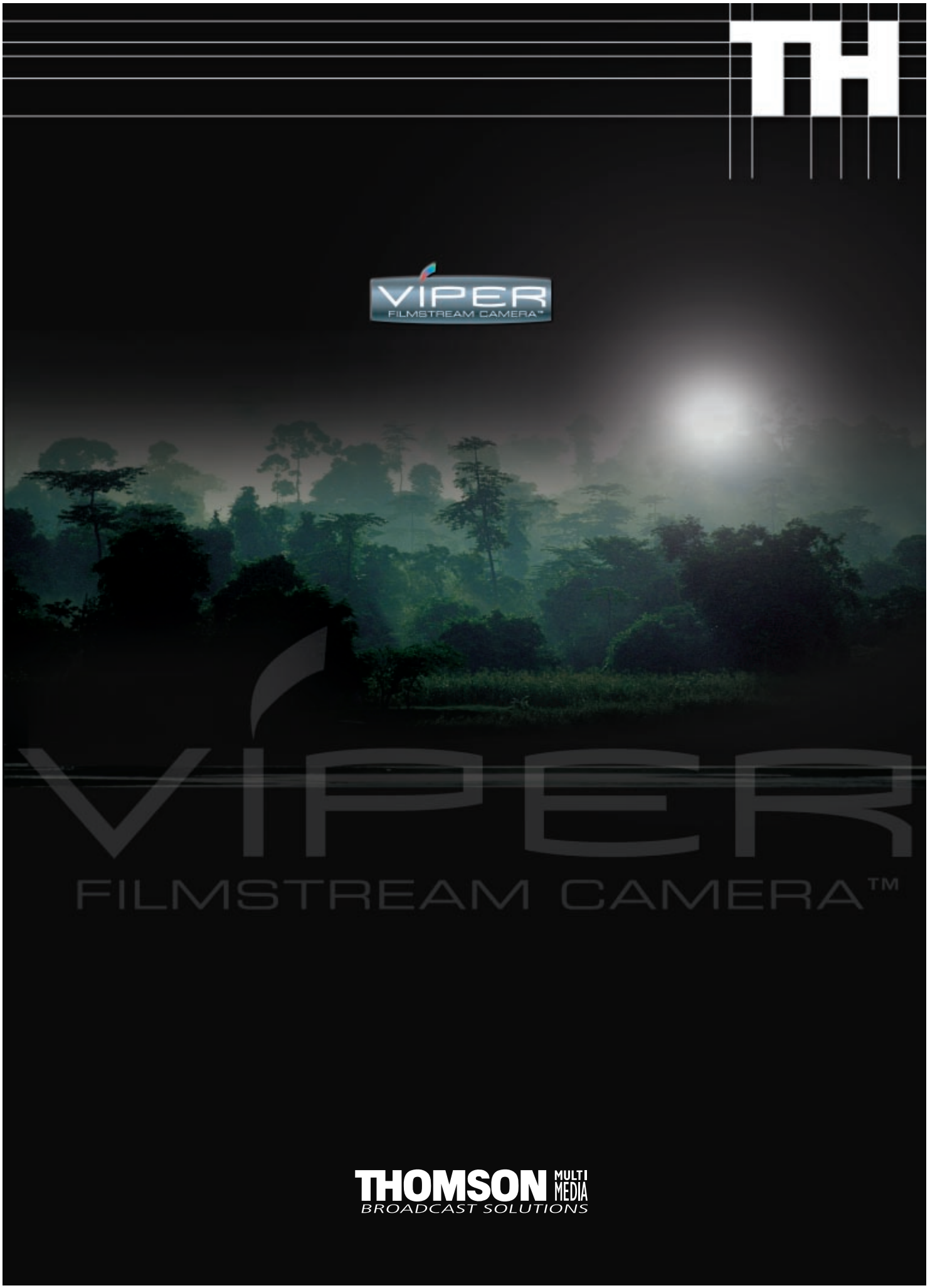


THOMSON MULTI MEDIA
BROADCAST SOLUTIONS


FROM THE CREATIVE WISH
TO
VIPER

THE TECHNICAL REQUIREMENTS

Film or Video?

During the past few years, the subject of Digital Cinematography has resulted in many, sometimes heated, discussions. As these discussions continue, it has become clear that video, as well as film cameras, offer their own set of advantages and disadvantages. Consequently, both will co-exist for many years to come.

While discussing this subject with many experts in the field, and looking at the total chain from image capture to image display, Thomson realized that a different approach was needed — an approach which took advantage of the benefits of both video and film without the disadvantages. The result is the Thomson Viper FilmStream Camera concept.

Shooting the Video Way

Video cameras have improved significantly over recent decades: from black and white to color, from tubes to CCDs, from analog to digital, from interlace to progressive scan, and from standard definition to high definition. Development efforts in video cameras have been targeted at getting the best possible picture quality in all different kinds of circumstances: different scenes, and different scene lighting. The goal has always been to give video producers the best possible picture quality, with little or no true ability for picture improvement further in the production chain. "Getting optimum results as soon as possible," was the mission of camera designers. To achieve these goals, many tools have been invented to manipulate the video picture before it comes out of the camera. Various gammas, complicated knee circuits, matrices, non-linear and linear contour and aperture corrections, gain, white and black balance, and other tools are used to pre-process and filter the video image we are all used to seeing.

Shooting the Film Way

Due to the nature of film, the impression of a picture that will finally be projected in the movie theater cannot be viewed on the set. Directors of photography have the difficult task of lighting and setting the scene, choosing the right film stock, and adjusting the camera exposure in such a way that an impression will be achieved during projection that will best match the complete, complex situation; the story, the moment, the emotion that needs to be transferred, as well as the transition to previous/future clips. Getting this just right is of vital importance to the success of the film production, regardless of whether it is a feature film, an episodic, or a commercial. To achieve this result, the final decisions on settings are increasingly made during post-production; in black, white, gamma, and several other parameters. The high resolution and dynamic range of film, which captures an image in its purest form, helps to make this possible.

Film or Video? . . . . It's both!
The Viper FilmStream Camera Concept

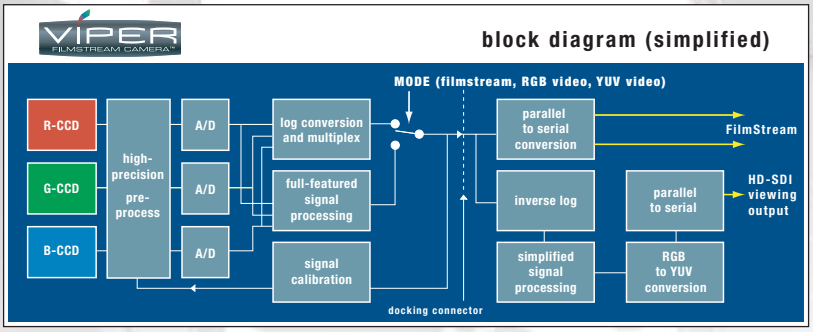
Clearly, a video camera can not automatically adjust itself to the photographic vision that the director and director of photography want to achieve. When shooting, there is minimal time to set the many video parameters that influence the final result. Additionally, a film set is not the right location to judge video pictures. Too many parameters vary which do not equate to the environment in a movie theater.

Unfortunately, video-processing tools in the camera are often irreversible, or partially irreversible, thus limiting the possibilities to get a really perfect end result. When errors are made in the field, the options for improving the pictures are limited.

The Viper FilmStream Camera concept addresses these issues. The Viper FilmStream Camera concept differs from other forms of electronic and digital image capture in that it captures every bit of information the scene has to offer in a transparent and reproducible way. With the Viper FilmStream Camera concept, post-production tools actually know how many photons reached every single CCD picture element. This gives post-production operators the freedom to change the visual and emotional impression that the picture gives in any way they like since no information has been lost through video pre-processing and filtering. The Viper FilmStream Camera's signal processing can be regarded as completely non-destructive and transparent; the only limitation is that of the CCD sensors themselves.

VIPER FILMSTREAM CAMERA™

A MARRIAGE BETWEEN



To achieve this goal, the Viper FilmStream Camera's CCD signals, from pure black to CCD saturation, are captured with 12-bit A/D converters and are converted to RGB data values using logarithmic calculations. The end result is then converted to 10-bit data values and transferred to the recorder as a FilmStream datastream using a dual HD-SDI link as a carrier. Full resolution is maintained: true-progressive 1920 x 1080 pixels for every color. No color sub-sampling, no color space conversions, no irreversible video manipulations, no further quantizations, and no compression. This also allows Viper FilmStream Camera users to get excellent performance for blue/green screen applications and video effects.

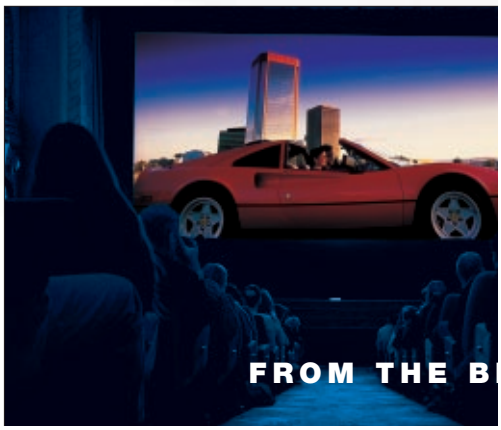
Designed by Thomson, Powered by Technicolor

The ability to achieve true film-like quality with digital cinematography is finally possible because of the combined imaging talents of Thomson and sister company Technicolor. Working together, Thomson and Technicolor have designed the Viper FilmStream Camera's 10-bit logarithmic output to look more like film than any other digital cinematography system available.

Shooting the Viper FilmStream Camera Way: Not Film, Not Video .. True Digital Cinematography

During production, the Director of Photography (DP) does not have to worry about the many complicated video-processing parameters of conventional video and digital cinematography cameras. There is no need to tweak camera parameters for a certain "look" especially when the production environment does not allow for accurate adjustments. As long as the Viper FilmStream Camera exposure is close, the information is captured. Even though shooting electronically, the DPs can focus their talents on the same tasks as when shooting with film.

Just as the images captured by motion picture film can not be adjusted by the film camera, the Viper FilmStream Camera does not have any adjustable visual parameters for the FilmStream outputs. That even includes the most common adjustment required with all video and digital cinematography cameras — white balance.



To set the proper exposure, the Viper FilmStream Camera offers tools through the viewfinder that indicate where in the picture overexposure occurs. In general, camera exposure should preferably be maximum with overexposure only in those areas that do not really matter (such as the middle of a car headlight at night).

For the camera and lens operators, framing, focussing and setting exposure are the only true keys to excellent results just as with film. Scenes that do not contain significant highlights which need to be preserved, can now drive the CCD sensors to their maximum ability to capture brightness. In conventional video cameras, this top 70% of the CCD range can only be used to compress highlights. With Viper FilmStream Cameras, this important part of the CCD exposure range can now be used to obtain exceptionally clean pictures.

In the Viper FilmStream Camera, adjusting gain, white or black balance, or modifying any of the other conventional video parameters only affects the viewing output, which is similar to a conventional video tap.

The FilmStream data remains rock solid and untouched, transferring image “as is” with maximum accuracy, and with all the information every individual CCD image sensor has to offer.

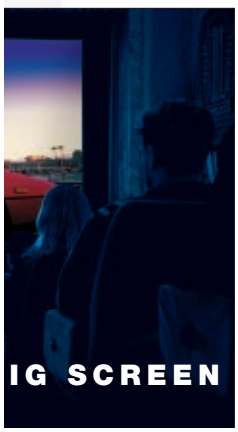
And there’s more . . .

To capture the type of images required for true digital cinematography, the Viper FilmStream Camera is based on a unique 9.2 Megapixel CCD that allows the camera to work in several formats; 1080 lines at 24/25/30 frames per second or 720 lines at 24/25/30/50/60 frames per second. When set in the 720 lines mode at 60 frames per second, slow motion effects can be achieved at many different playback speeds during post-production.

The Viper FilmStream Camera provides a perfect complement for theatrical release motion picture film as a Cinemascope aspect ratio is supported without the need to use anamorphic lenses. With the Viper FilmStream Camera there is no need to crop the image and lose resolution to get this aspect ratio.

While camera focussing is done by measuring the camera-to-object distance and then setting the lens, the Viper FilmStream Camera makes it easy to check focus by an instantaneous 2x viewfinder zoom, without affecting the picture at the output.

Last, but not least, a large benefit of the Viper FilmStream Camera is its small size and low weight, making handling and operation a joy.



About Log Curves

The Viper FilmStream Camera uses a 10-bit logarithmic format per color (30 bits in total). '10-bit log' means that digital information is represented by 10 bits, or 1024 code values, rather than using a more limiting 8-bit system, or 256 code values. There are two major reasons for using the logarithmic system:

1. The human eye responds to light in a logarithmic way.

The human eye can see more color values and is more discerning the darker the scene. Therefore, more bits are needed for the darker regions of the CCD range than for the brighter parts. A logarithmic transfer curve does exactly that. Much smaller steps are used for the lower part of the range than for the upper part. The logarithmic data format can express more color tones. In fact, 10-bit logarithmic values would require more than 12-bits of linear values to maintain the same visible color space in order to express the full contrast range of the CCDs.

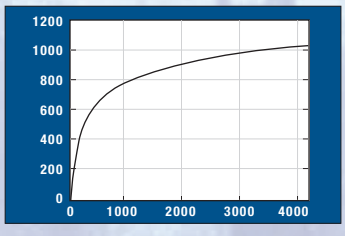
By digitizing the CCD signals with logarithmic encoding, the best use is made of the bits. The bits are used in the area where they are needed in terms of the eye's sensitivity.

2. The logarithmic data format guarantees that the quantization steps are always significantly smaller than the noise level

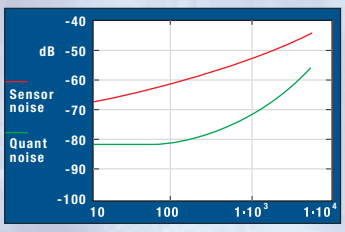
In CCD cameras, there are two major sources of noise. The first is independent of the light exposure of a pixel. The output amplifier of the CCD causes the bulk of this noise. Even though it is equivalent to no more than 10-20 RMS electrons, for the darker parts of the scene it is a dominating factor.

The second major source is photon shot noise. The mechanism of photon shot noise can best be explained by comparing photons to rain drops. When you put two glasses in the rain and remove them after a while, you will see that they differ in the number of raindrops they have gathered. Actually, the RMS fluctuation of the number of raindrops is equal to the square root of the average number of raindrops. So, the absolute RMS fluctuation increases with the amount of rain. In CCDs, exactly the same thing happens with the number of photons that reaches each pixel. So, above about 1000-4000 electrons in a pixel, the photon noise becomes the dominating noise factor. In the higher part of the CCD range, the photon-shot noise is several hundreds of equivalent RMS electrons.
By using smaller quantization steps for the darker parts of the CCD range, and bigger steps for the higher range, the quantization steps are better matched to the varying noise levels of the CCD. In this way, the quantization noise can always be kept several dBs under the other noise levels (see figure).

To get accurate and reproducible results, especially between cameras, the Viper FilmStream Camera uses on-line digital calibration technologies that insure that both the black and saturation points of the CCDs are exactly aligned to the correct digital data values regardless of ambient temperature, humidity, or camera age.



This figure shows the mapping of the output of the A/D converter to the 10-bit FilmStream output



This figure shows the sensor noise as a function of the signal level, and the total system's quantisation noise (incl. A/D converter and log conversion). As can be seen in the graph, the quantisation noise always has a safe distance from the random sensor noise

FILM AND VIDEO

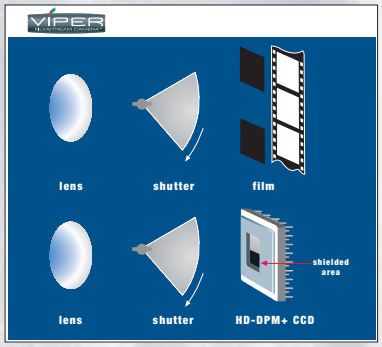
IG SCREEN TO THE SMALL SCREEN

FROM THE SENSITIVITY OF THE CREA

TO THE FULL RE

HD-DPM+ Image Sensors

The Viper FilmStream Camera employs three 9.2 million pixel HD-DPM+ CCD sensors, the result of a dedicated in-house development. This CCD sensor is based on the Frame-Transfer principle, which is best suited for progressive images and provides many unique features.



Due to the Viper FilmStream Camera's mechanical shutter, CCD exposure has a similar ramp to film cameras, thus causing similar motion characteristics.

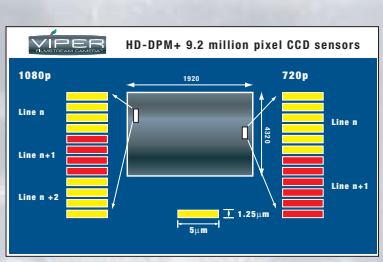
The Frame-Transfer principle is highly comparable to the exposure method used in film cameras. During a certain exposure time (shutter angle in film cameras), the light is projected on the photosensitive surface. Then, the mechanical shutter moves in front of the imaging area, effectively blocking the incoming light. During the time in which the shutter shields the photosensitive surface, the image is transported to a shielded area where the image is read out, line by line. The complete surface of the sensor is effective, which helps to suppress fine detail moiré patterns.

9.2 million pixels

The HD-DPM+ CCD sensor consists of 1920 horizontal pixels and 4320 vertical sub-pixels (effective pixel count). By grouping the vertical sub-pixels, the vertical line count can be set. Full resolution is preserved and the horizontal viewing angle stays the same.

TIVE EYE

SOLUTION OF FILMSTREAM IMAGES

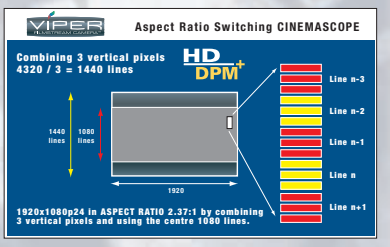


1080P

When four vertical sub-pixels are combined per scanning line, the total line count becomes 1080 lines (4320/4 = 1080). So, a 1920 x 1080 image sensor is obtained with a 16:9 aspect ratio.

720P

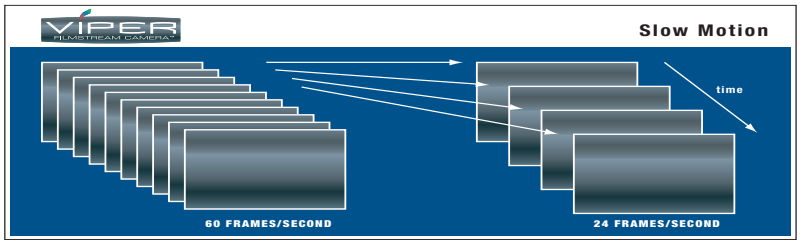
When six vertical sub-pixels are combined per scanning line, then the total line count becomes 720 lines (4320/6 = 720). So, a 1920 x 720 image sensor is obtained with a 16:9 aspect ratio. The advantage of working with this lower line count is that higher frame rates can be realized so that slow-motion effects in post-production can be generated.



Cinemascope Aspect Ratio

When three vertical sub-pixels are combined, it results in 1440 vertical lines (4320/3 = 1440). By using the middle 1080 lines, a 2.37:1 aspect ratio is achieved without the need for anamorphic lenses while maintaining full 1920 x 1080 resolution.*

**** In this mode, due to the smaller vertical size of the pixels, the dynamic range is somewhat lower than in the 16:9 aspect ratio mode.***



Shooting for Slow Motion (Over-cranking)

Thanks to our HD-DPM+ image sensors, Viper FilmStream Cameras can switch to several different image formats. One of the possible formats is 1920 horizontal pixels by 720 vertical lines at a rate of 60 frames per second. To arrive at the 720P standard, Viper FilmStream Camera's output then switches to 1280 x 720 at 60 frames per second.

During post-production, these 60 frames per second can be slowed down to 24 frames per second thus giving a 2.5 times slow motion (60/24 = 2.5). Other slow-motion factors are possible, but require more computation in post-production. Shooting with 60 frames per second provides the temporal detail to derive many speeds, even though at 2.5 times the slow-motion effect is most accurate. Often, the 1280 x 720 sample grid will be converted to 1920 x 1080 to arrive at a single format for the production process. Although there is some loss of resolution in the slow-motion mode, since the CCDs keep running on 1920 pixels horizontally, the visible loss is remarkably small.

Flexible Video RGB and YUV Modes

The Viper FilmStream Camera allows for superb pictures and freedom in post-production, thanks to the FilmStream logarithmic RGB data. Sometimes, however, there is no time to color-correct the image data to get to these perfect results. In this case, excellent in-camera video processing is required with detailed adjustment options.

To accommodate this need, Viper FilmStream Cameras also support a full resolution RGB video mode, and a YUV video mode via a single HD-SDI cable. In these video modes, the Viper FilmStream Camera enables use of all the video-processing tools that modern video and digital cinema cameras have to offer including several adaptive knee functions, matrices, gammas, black stretch, and coarse and fine detail circuitry. In this mode, Viper FilmStream Cameras can also work as top performance video cameras offering high-quality YUV over HD-SDI, or full resolution RGB video over dual-link HD-SDI. Needless to say, all other features that Viper FilmStream Cameras have to offer (such as multi-format capability) are still available in these video modes.

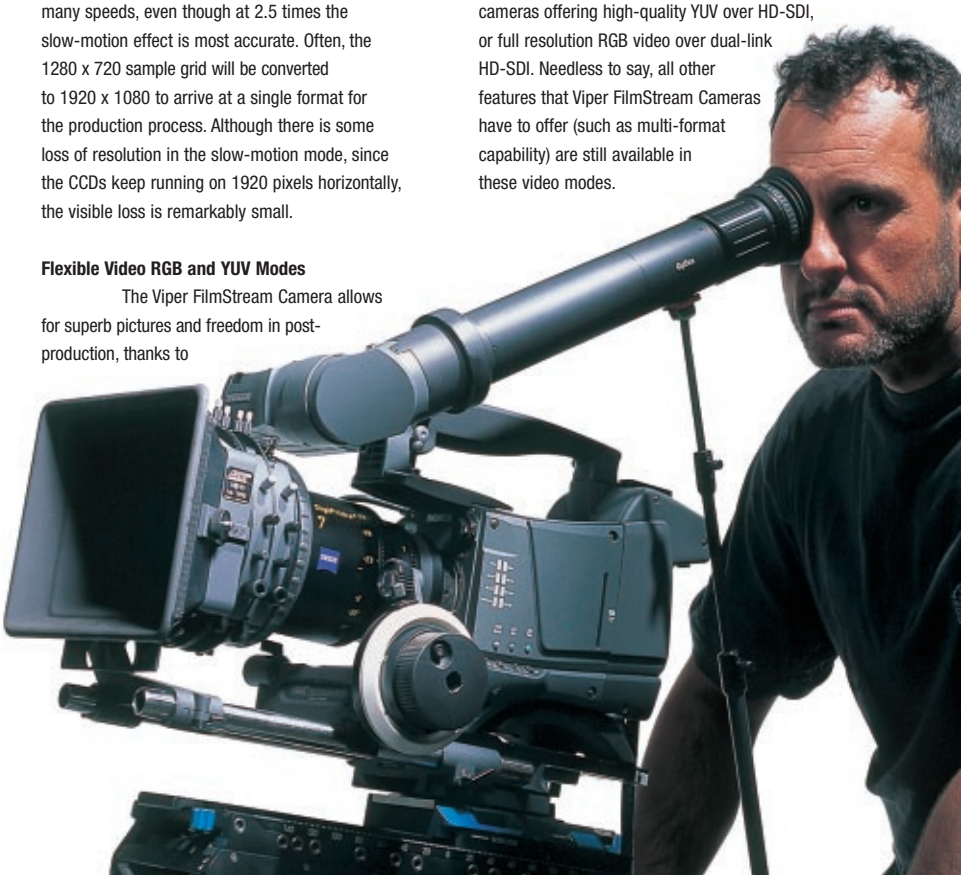
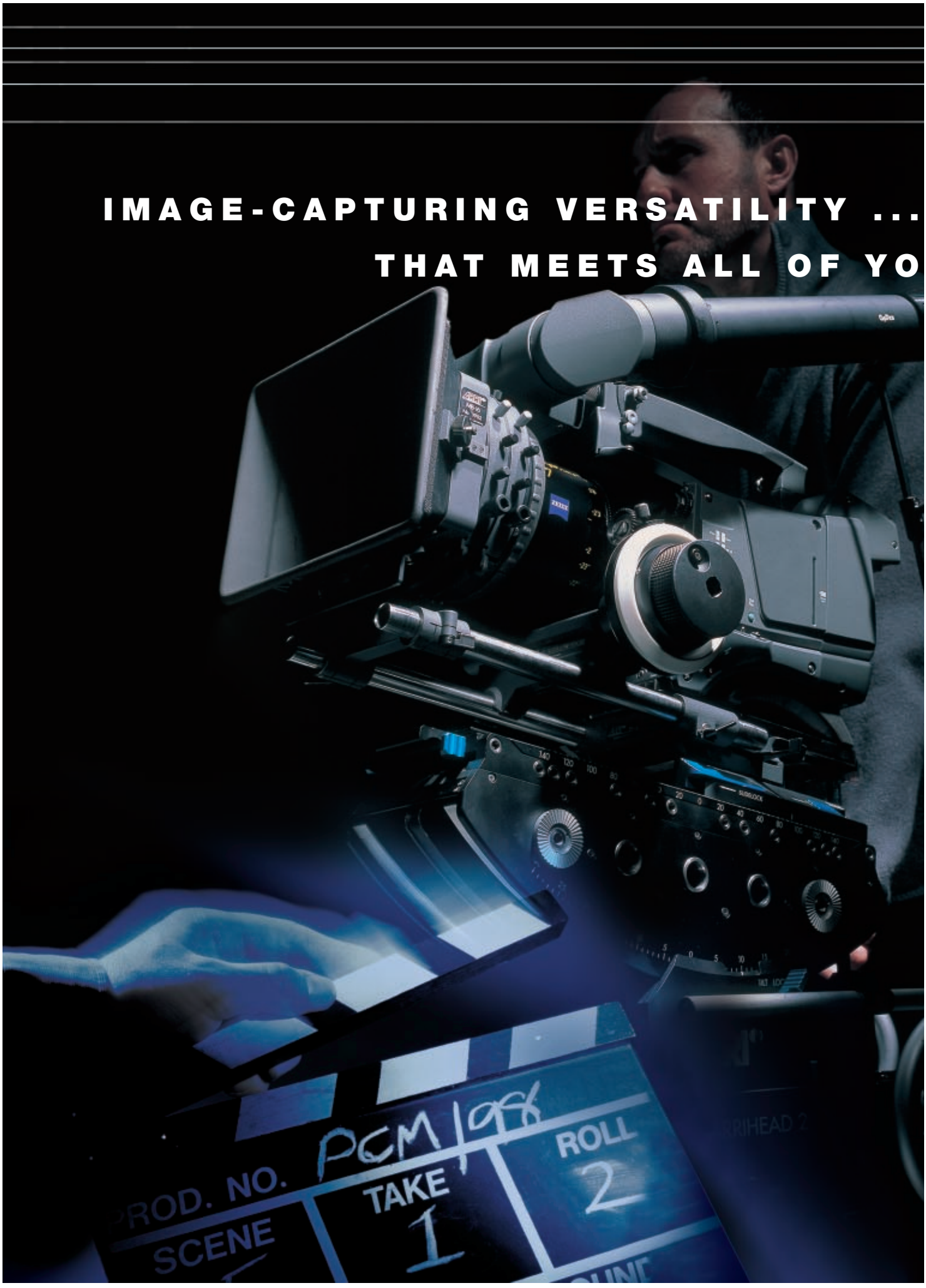


IMAGE-CAPTURING VERSATILITY ...
THAT MEETS ALL OF YO



UR DIGITAL CINEMATOGRAPHY AND VIDEO NEEDS

The Viper FilmStream Camera: Made for the Professional Digital Cinematographer

Whatever the application, the Viper FilmStream Camera demonstrates a number of important benefits to help achieve the excellent results expected by a system with the Thomson and Technicolor nameplates on it.

For feature film, the Viper FilmStream Camera is perfect. Full-quality, full resolution images are transferred to post-production affording remarkable freedom to create the precise artistic impression desired, without the presence of compression or quantization artifacts. The Viper FilmStream Camera's Cinemascope aspect ratio means never having to use anamorphic lenses.

For commercials, where video effects and blue/green screen work are increasingly becoming a standard process step, the full resolution per color (and in 10-bits) makes the effect look as realistic as possible.

All types of production benefit from Viper FilmStream Camera's slow-motion capability. The method of capture, using a mechanical shutter, is highly comparable to film. With proper grain insertion, intermixing film with Viper FilmStream Camera images is not only possible, but also practically seamless. This can be important for super-slow-motion above 60 frames per second, or for scenes that absolutely require cable-less cameras.

For television episodics, where color correction possibilities during post-production are often limited because of time constraints, Viper FilmStream Cameras offers state-of-the-art video processing with all the tools that modern video and digital cinema cameras have to offer.

When it comes to shooting high-speed events, Viper FilmStream Camera's progressive, 60 frames per second mode (with 720 active lines) allows for optimal conversion to any video or film standard, interlaced or progressive, and even still pictures.

Best of all, the Viper FilmStream Camera's compactness proves invaluable when shooting under confined or difficult circumstances.

The Thomson Viper FilmStream Camera… choosing a camera has never been easier.

VIPER FILMSTREAM CAMERA™


VIPER
FILMSTREAM CAMERA™
VIPER
FILMSTREAM CAMERA™
More information can be found at
www.viperfilmstreamcamera.com

THOMSON MULTI MEDIA
BROADCAST SOLUTIONS

3122 787 36600