Why Should Camera Specifiers Care?

It's always been the Achilles' heel of video surveillance, with analog or digital cameras, those nasty shadows, glares, reflections and direct sunlight that turn captured images into darkness or wash them into a brilliant, undetectable white. Higher resolution cameras simply exacerbate the problem.

The introduction of megapixel and high definition cameras gives the promise of better images from a surveillance system. That's why more and more end users are selecting them. However, many end users become very disappointed when the system goes live. Because of varying lighting within the scene, they seem to be no better off than when they deployed their standard definition analog or IP cameras. The entrance to the facility is overexposed because of glare, destroying the possibility of identifying who has come in. However, just to the left, shadows in the scene wipe out any possibility of seeing interactions between check-out clerks and customers. All that money invested in high resolution cameras seems to have been for naught.

Wouldn't it be nice if the lobby camera clearly showed people coming through the glass door along with the cars and objects in the parking lot behind them, even if reflections or bright sunlight are shining right into the camera? Banks would cheer if the camera at the outdoor ATM could compensate for shadows and sunlight to identify facial features and overexposed regions in bright lights and underexposed regions in dark areas.

Contrarily, an all-digital technology can provide Wide Dynamic Range (WDR) in which each of the hundreds of thousands of pixels acts like an individual, self-adjusting camera. Wide Dynamic Range (WDR) is the ratio of the brightest pixel than can be captured by the imaging system to the darkest pixel that can be captured. With high resolution cameras especially, users need a WDR of 17 bits, > 100db.

The catalyst for WDR is the inclusion of an analog-to-digital converter (ADC) within each pixel of the image sensor. The ADC translates the light signal into a digital value at the immediate other details. In retail applications with storefront windows, reflections and glare would no longer render foreground objects undistinguishable.

Problem Defined and Solved

In traditional CCD cameras, all the pixels in the array have the exact same shutter speed. They capture the entire image as a whole. Conventional image processing – exposure, contrast, color, etc. – is done as an average for the entire image. There is no image processing done at the individual pixel level. Overexposure and underexposure are handled on a limited basis after the image is captured. In challenging lighting conditions, the resulting image will show normal exposure with blown-out highlights, dark shadows or both. The viewer sees point of capture, thus minimizing signal degradation and crosstalk – pixel images overlapping each other, resulting in ghosting – in the array and allowing for greater noise reduction methods. Once the data is captured in a digital format, a variety of digital signal processing techniques are used for optimal image reproduction.

Because each pixel has its own analog-to-digital converter and the information generated is captured and processed independently, each pixel in effect acts as its own camera. The exposure time for each pixel is adjusted to handle the unique lighting conditions at that pixel location in the image sensor array. Thus, the unit essentially has hundreds of thousands of individual cameras, each of which produces the best image possible.

It increases exposures in darker areas and decreases exposure in brighter areas. Each pixel is processed while the image is captured, sampling multiple times per second. If an individual pixel senses that it is overexposed, it will close and quit gathering light while pixels capturing shadowed, dark and potentially underexposed image areas continue to gather light. These images are then combined to create a high quality video frame or picture. As a result, details otherwise lost are simultaneously captured vividly with more clarity and color vibrancy regardless of lighting conditions.

That's why traditional CCD cameras can't “see” well in varying, non-optimal lighting conditions. For instance, since they generalize pixel settings, they can't capture true color. They cannot provide noise-free images without vertical smearing, pixel blooming or camera blindness. It's why images used as evidence from traditional cameras can be suspect and create problems in a court of law.

With a WDR solution, the user obtains accurate color, skin tone and facial features in the darkest and lightest area of a scene simultaneously. Viewers can detect the age and color of the suspect easily, quickly determine if an employee is swapping a stack of dollar bills for 20's or see other sleight-ofhand cheats regardless of the lighting conditions. An all-digital solution eliminates image-degrading noise and glare so images are always clear. All-digital solutions also

minimize noise that can go undetected, such as random artifacts (irregular variations), speckles and edge jitter.

Without an all-digital WDR camera, sampling and conversion noise can often increase DVR video storage 3-times (3X) over an all-digital WDR solution.

What to Look for in the Specifications

Don't pass over the specifications sheet when deciding on a camera. Dig into the specifications and look for the term “designated DPS (Digital Pixel System).” You also want to see that the definition of high resolution is a minimum 540 HTVL x 460 VTVL. Make sure the new camera uses an all-digital chip set and supports both NTSC and PAL video formats.

To illustrate, a data sheet might read, “The V5413-A3 series indoor WDR color fixed minidome camera, based on DPS (Digital Pixel System), features 120dB super wide dynamic range. In addition, the WDR camera has decisive superiority over CCD cameras, providing higher S/N Ratio, improved color rendering and better image quality.” In the listing of specifications, one will find terms such as “Effective Pixels – 720 x 540” and “S/N Ratio: > 52 dB (AGC OFF).”

Lastly, verify the GB of storage per 24 hours of video captured. Look at the difference between CCD and an alldigital solution –

Medium Resolution CCD ---- 52 GB
High Resolution CCD ---- 38 GB
All-Digital ---- 31 GB

The all-digital solution uses 18 percent less disk space than high resolution CCD and 40% less space than medium resolution CCD.
Remember, effective resolution is the best indicator for video security professionals of how effective a CCTV camera is really going to be in terms of capturing detail in an image that might have to be used as actionable evidence. WDR via an alldigital solution is key to getting the best resolution.


Wide Angle

Why Should Camera Specifiers Care?

Wide Angle

– John Monti, Pixim, Vice President, Marketing & Business Development
– Mark S. Wilson, Infinova, Vice President, Marketing