



# Integration of Wide Dynamic Range Technology in Surveillance Cameras

White Paper



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# Introduction

Human vision has a very high dynamic range\*, enabling us to see both in dim starlight and in bright sunshine. While it is difficult to achieve the full dynamic range experienced by humans with the imaging technology in electronic equipment such as video cameras, a number of approaches—known collectively as wide dynamic range (WDR) technology in the case of cameras—have been developed to allow more accurate representations of the range of luminance levels found in real-world environments.

\* Human vision has an overall dynamic range of about 200dB, but only a portion of the full range can be perceived at any given time.

WDR functionality provides high-quality images even when there are simultaneously both very bright and very dark areas in the camera’s field of view. WDR technology enables the camera to capture such high-contrast scenes in so that details are clearly visible throughout the frame in the final still image or video.

## WDR applications in surveillance

WDR technology is commonly incorporated in cameras used for surveillance applications. The technology allows a camera to clearly capture detailed features even when a person or an object of interest appears in locations where there is strong back illumination, such as outdoors during the day or in front of artificial lighting at night. WDR capabilities are strongly recommended for cameras used to monitor locations where

light enters from multiple directions, ensuring that at whatever angle to the camera a person or object of interest appears, sufficient detail can be captured for reliable identification. Examples of locations where difficult high-contrast lighting conditions typically prevail include building entrances, ATMs, transportation facilities, and any indoor space with windows.



Transportation



Parking Lot



Window Side



Loading Deck

# Implementations of WDR technology: VIVOTEK as an example

Surveillance solutions vendor VIVOTEK has implemented comprehensive range of WDR technologies based on tone

mapping and multi-frame imaging for its cameras.

## WDR Enhanced

WDR Enhanced is VIVOTEK's branding for its tone mapping technology by reducing the dynamic range of the entire image, while retaining the contrast of the image. WDR Enhanced draws on research on how the human eye and visual cortex actually perceive a scene to achieve a final result that closely mimics what people can actually see.

field of view. If lighting levels there are too low, the brightness of the entire video frame is raised. The disadvantage of this approach is that areas in the field of view that were originally illuminated well may become overexposed.

WDR enhancement produces superior results compared to conventional backlight compensation (BLC) because BLC relies on automatic evaluation of the brightness at the center of the

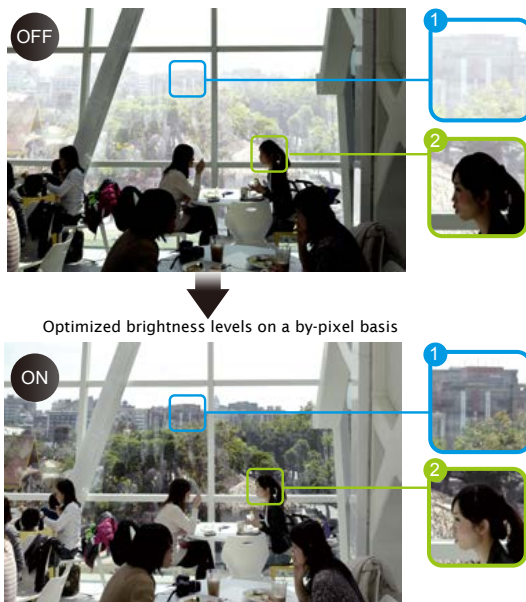
WDR enhancement rectifies this shortcoming of BLC by adjusting the tone curve evenly based on the brightness levels in different areas of the field of view, brightening dark areas and dimming excessively illuminated areas to increase visibility throughout the field of view.



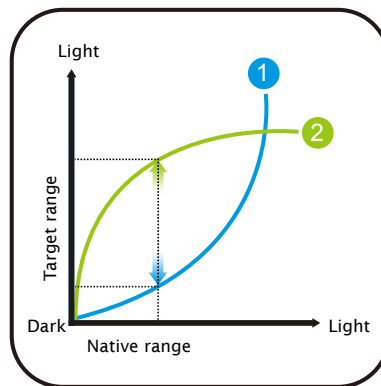
Without WDR Enhanced



With WDR Enhanced



Optimized brightness levels on a by-pixel basis

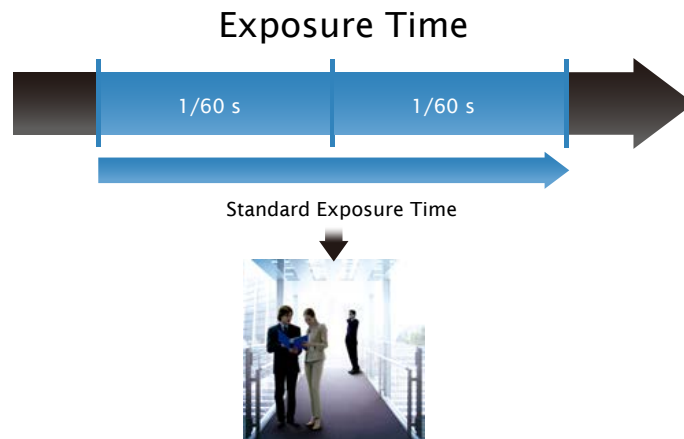


- 1 Adjusted luminance in strongly illuminated areas, reducing their brightness
- 2 Adjusted luminance in weakly illuminated areas, increasing their brightness

## WDR Pro

VIVOTEK also offers WDR Pro, which is based on its implementation of multi-frame imaging. WDR Pro works by simultaneously capturing two or three images of the field of view at different exposure levels. An image with a longer exposure time can capture more detail in the less illuminated areas in the field of view, though the brighter areas may be over-exposed. An image with a shorter exposure time, on the other hand, will more accurately capture the brighter areas, but may leave the less illuminated areas under-exposed.

An image signal processor then uses a sophisticated algorithm to seamlessly combine the “long” and “short” images into a single video frame that preserves detail in both darker and brighter areas of the field of view. Moreover, because the effective dynamic range of the video is expanded, contrast ratio is enhanced, further accentuating detail clarity.

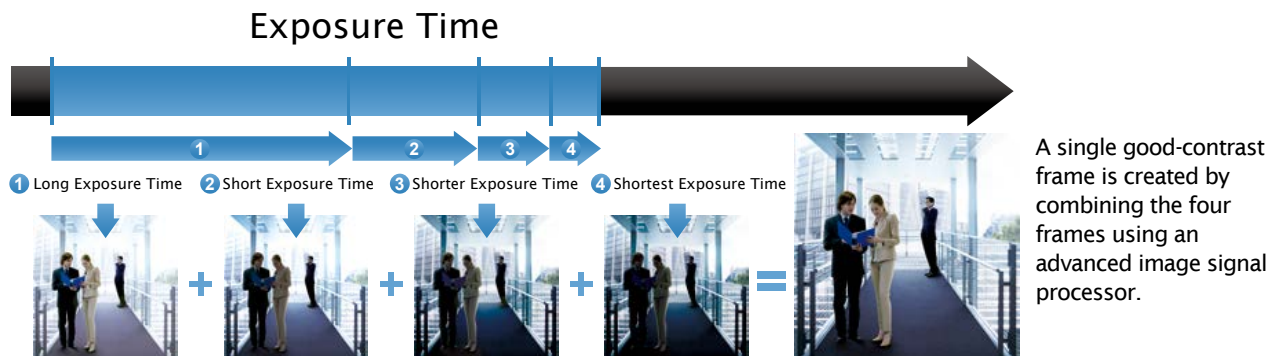




## WDR Pro II

WDR Pro II is the next-generation of WDR Pro, taking the technology a step further by capturing four images at four distinct exposure levels. This advance enables cameras incorporating WDR Pro II to optimize image quality for even

relatively modest differences in illumination levels. The end result is even greater detail, even more clearly rendered, over the entire field of view.



Due to these attributes, WDR Pro is an extremely valuable technology for any surveillance environment. WDR Pro II, in particular, ensures that whatever the lighting conditions present in a monitored location, or how an object or person of

interest is situated relative to the camera and light sources, a high level of detail can be clearly captured and composed for positive identification, accurate tracking, and other demanding applications.



Without WDR



With WDR Enhanced



With WDR Pro



With WDR Pro II



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