VIVOTEK
BUILT WITH RELIABILITY

White Paper

Integrating WDR Technology into Surveillance Cameras

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What is WDR?

The human sense of vision has a very high dynamic range*, which enables us to see objects both in dim starlight and in bright sunshine, even though the difference in luminance between the two situations may be as high as a factor of one billion. Unfortunately, it is difficult to achieve or emulate the full dynamic range experienced by humans with the imaging technology in electronic equipment such as video cameras. Nevertheless, we can try to approach some of them by designing smart algorithms that allow an adaptive widening of the dynamic range. Therefore, a number of technologies— known collectively as wide dynamic range (WDR) in the case of cameras—have been developed to allow more accurate representations of the range of luminance levels found in actual scenes.

WDR functionality is intended to provide 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 so-called high-contrast scenes in such a way that details are clearly visible throughout the frame in the final still image or video. There are two common WDR approaches—multi-frame imaging and tone mapping, described later in this paper.

WDR applications in surveillance

WDR cameras are commonly used in surveillance systems because they overcome a common difficulty. When a subject of interest appears in locations where there is intense backlight, such as in bright sunshine or when the subject is directly in front of a source of artificial illumination at night, WDR technology allows the video to clearly capture detailed features.

WDR cameras are thus recommended for outdoor locations, as well as indoor locations where light enters from multiple angles, such as a room with large or numerous windows. WDR technology ensures that even if the subject happens to stand in front of an intense light source, the camera will be able to capture the detail necessary for identification purposes or other desired uses.

* The human visual system (HVS) has overall dynamic range of about 200dB, but it cannot operate over the entire range at the same time.

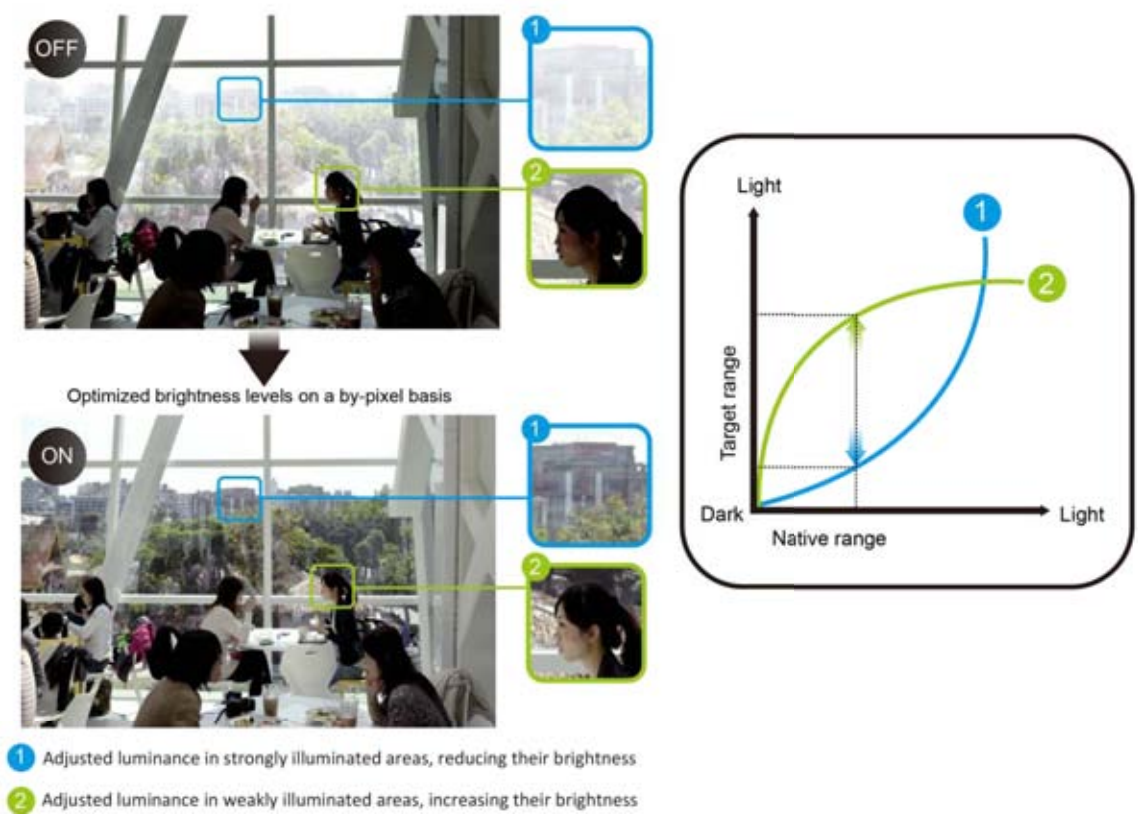
Implementations of WDR technology: VIVOTEK as an example
Surveillance vendor VIVOTEK has implemented two types of WDR solutions in its cameras.

WDR Enhanced

WDR Enhanced is VIVOTEK's branding for its tone mapping technology. Used in some of its SUPREME series cameras, WDR Enhanced works by reducing the dynamic range of the entire image, while retaining the contrast of the image. WDR Enhanced does not in fact raise the contrast ratio of the captured scene, it 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.

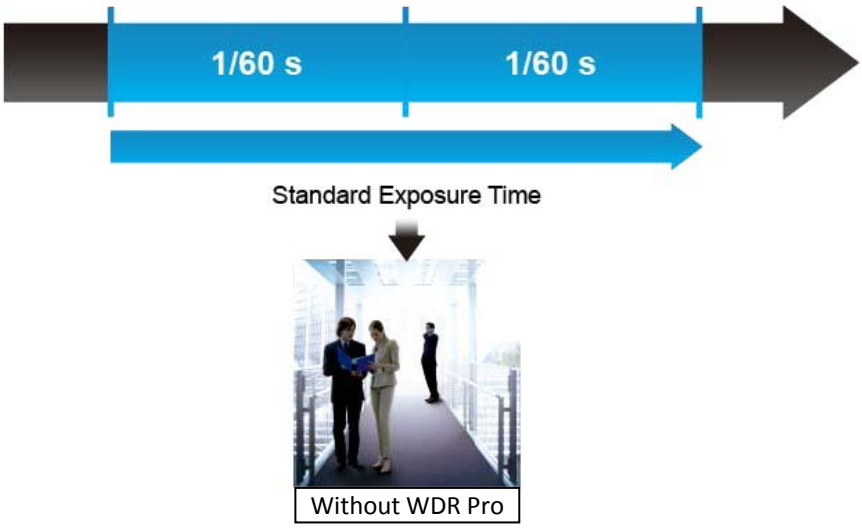
WDR enhancement produces superior results compared to conventional backlight compensation (BLC) because BLC relies on automatic evaluation of the brightness at the center of the field of view. If lighting levels there are too low, the brightness of the entire video frame is raised. The disadvantage of this approach is that areas in the field of view that were originally illuminated well may become overexposed.

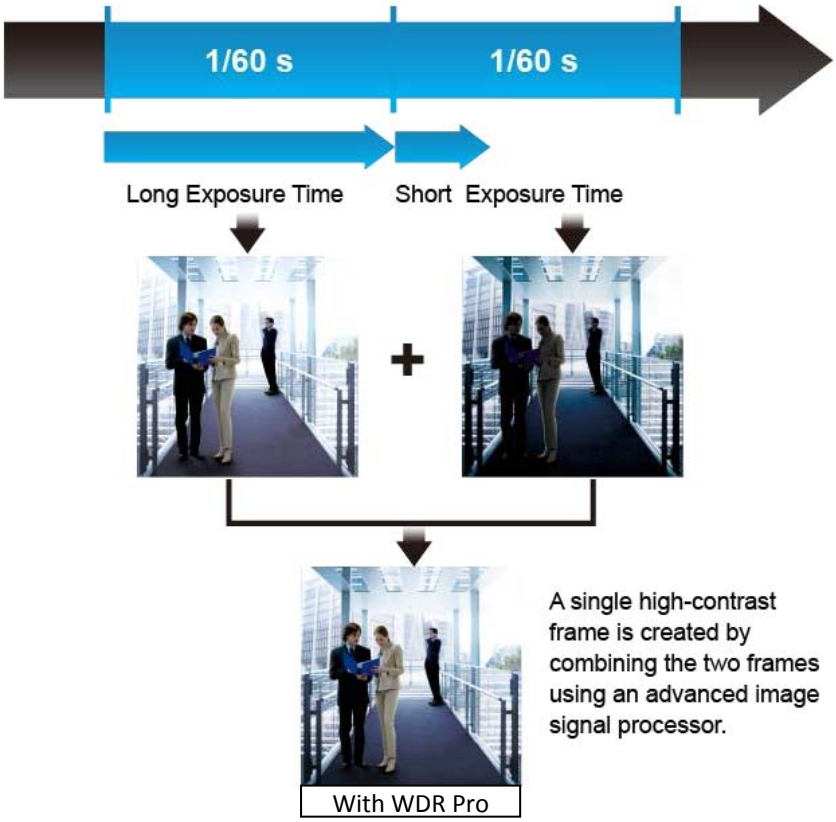
WDR enhancement rectifies this shortcoming of BLC by adjusting the tone curve evenly based on the brightness levels in different areas of the field of view, brightening dark areas and dimming excessively illuminated areas to increase visibility throughout the enhanced video. The approach is so effective that it approaches the sensitivity of the human visual system.



WDR Pro

The other WDR technology used by VIVOTEK, which it markets as WDR Pro, is a version of multi-frame imaging. WDR Pro works by capturing alternate frames using different exposure times. The frame with the longer exposure time, called the “long” frame, can capture details in the darker parts of the field of view, though the brighter parts will be over-saturated. The “short” frame with its shorter exposure time, on the other hand, accurately captures the brighter areas, but leaves the dark areas under-exposed and likely marred by image noise. An image signal processor (ISP) then uses a sophisticated algorithm to seamlessly combine the optimal portions of these two complementary frames to create a composite frame that retains detail in both dark and bright areas of the field of view. Moreover, because the dynamic range of luminance captured is expanded, the actual contrast ratio is improved, making WDR Pro the optimal choice for demanding surveillance applications.





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