

FORTINET

WHITE PAPER

Wide Dynamic Range (WDR) in IP Surveillance Cameras



Executive Summary

Every surveillance camera relies on ideal lighting conditions to produce a high-quality image, so you can see events on your property both recorded and in real time. With too much light, the image is blown out; too little light causes the image to be dark and unusable. To balance in lighting for clear video images, Wide Dynamic Range (WDR) technology is a key criteria when selecting a security camera.

This white paper explains WDR technology and provides examples to help companies configure WDR settings in FortiRecorder that capture clear images even under challenging light conditions.

Where to Use WDR Cameras

Complicated light situations are a concern for many surveillance installations. If the background is too bright, the subject in front of the camera will appear dark rendering the captured video useless. Cameras equipped with WDR improve the image quality of any high-contrast lighting scene (the monitored area with portions of bright light and portions of dim light). WDR function enables cameras to capture image detail from both poorly and richly illuminated areas.

Indoor

The most common place for WDR cameras is monitoring entrance doors or against windows where there is intense backlight. Regardless if it is a store, bank, restaurant, or hospital—every facility must have entrance doors that can introduce bright light compared to the interior space. WDR cameras can compensate for the overly bright or overly dim area and provide a snapshot or video with clarity.

Garage

Cars often enter a parking garage where bright headlights often contrast a very dimly lit interior. A WDR camera will be able to better capture a clear and readable license plate.

Outdoor

The sun constantly changes position throughout the day. Outdoor surveillance cameras are frequently required to face strong sunlight in contrast to the shadow of the building or a covered porch at some points during each day. A WDR camera can compensate for this illuminance difference.

Objects emitting bright light

An opposite example of a bright backlight would be a dim background and a vehicle with bright headlights driving toward the camera. WDR cameras can do a better job of capturing a license plate image in this high-contrast scenario than a non-WDR surveillance camera.

IR illumination

Infrared (IR) illumination of an area sometimes provides overly strong illumination to close-by objects. WDR helps compensate for this effect and prevents overexposure.



Why Use WDR Cameras?

Have you ever taken a family portrait with the camera facing into the sunlight? The result is disappointing with dark faces and little detail. While photographers can rearrange the scene and use a flashlight or reflector to brighten up the subjects, this is not an option for video surveillance cameras. Finding an optimal position for lighting and exposure can make surveillance installations a hassle. WDR technology was adapted to resolve this issue.

What Are Shutter and Digital WDR?

Shutter WDR is a hardware-based sensor technology. **Digital WDR** uses a software algorithm to optimize the image quality of the dark areas by adjusting the gamma value. Shutter WDR provides better images with higher contrast of light and dark areas of the images.

All FortiCamera models support WDR.

- **Shutter WDR FortiCamera models:** FB50 / FD40 / FR50 / MB40 (>120dB), SD20B (>96dB)
- **Digital WDR FortiCamera models:** CB50 / MD50B

How Does WDR Work?

As previously mentioned, digital WDR is an image-processing step that changes the gradient of the image histogram in a way that stretches the darker parts and assigns more gray steps to these areas. The effect is a fill light appearance that reveals more details in the darker areas.

Shutter WDR works differently. Basic photography teaches us that if the aperture remains the same, the longer the shutter exposure time, the more light that will be exposed on the sensor or film. Conversely, the shorter the shutter time, the less light that will be exposed. Shutter WDR actually double-exposes the same image. It captures one image with shorter exposure time (for the brighter area of the picture) as well as another longer exposure (to capture the darker area of the picture). The digital signal processor (DSP) then uses an algorithm to combine the two images with different exposure times together into one frame to balance the brightness and sharpness of the entire image. The result is a clear, well-lit, and balanced image.



What Is the Unit dB Used in WDR Cameras?

Cameras with shutter WDR use a decibel (dB) value to represent the capability of the camera to display a high-contrast scene. Generally, the higher the dB value, the greater ability a camera has to capture high-contrast scenes. dB measures the ratio of the brightest and darkest area in the picture that can be captured by the camera sensor. For example, if the ratio of the brightest to darkest is 10,000 : 1, the dB value is 80. If the ratio is 10 times higher, 100,000 : 1, the dB value is 100. Certain FortiCamera models can support greater than 120dB (a ratio of 1,000,000 : 1).



Figure 1: Multi-exposures.

The above illustrations show how WDR imagery combines the overexposed image and underexposed image to create a well-balanced image. The balanced image shows clear detail in the dark areas as well as in the entrance with bright light.

WDR Image

In this typical scene with a bright backlight, the camera with WDR off shows objects appearing dark and not clearly identifiable. The camera with WDR on can compensate for the bright backlight; the subject is clearly identifiable.



Figure 2: FortiCamera FD40 with WDR off.



Figure 3: FortiCamera FD40 with WDR on.

How to Configure WDR Function in FortiRecorder

1. Log in to FortiRecorder and click on *Camera – Configuration*.
2. Select the camera model that you would like to configure for WDR (for example, *FortiCamera CB20B*).
3. Expand the Video options to set up Digital WDR or Shutter WDR supported by our FortiCamera models.

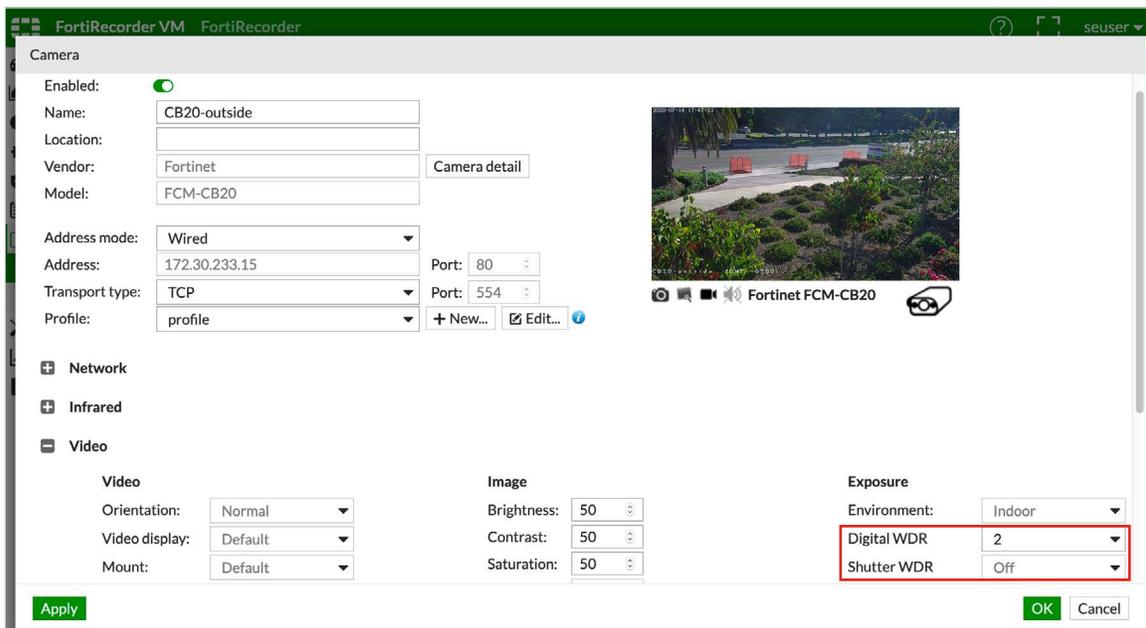


Figure 4: WDR configuration.

4. If your camera is capturing a high-contrast scene, the difference will be immediate and obvious after switching WDR on or off.

Summary

Many typical surveillance situations introduce a great variation of lighting conditions where a camera with WDR improves the overall picture readability. Selecting a camera model that features WDR is one of the specifications that is worth paying close attention to if complicated light conditions are expected within the installation.



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