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The Integrator's Manufacturer

White Paper

Comparing a Surveillance Camera's Low-light Performance

A guide for Integrators and Installers on the data they will need to make a meaningful comparison of low-light performance of surveillance cameras.

How can you determine what type of image a camera will provide in a low light environment? After all, there is really no way that you can get your hands on the actual cameras and test them, one by one, in the field to determine which camera will perform best in a specific low illumination locale.

It's a major problem for most integrators, who typically are confronted with a wide selection of camera choices from a variety of manufacturers, all with contrary and confusing parameter specifications. For instance, most understand that the higher the megapixel count is, the smaller the pixel size will be. Smaller pixel sizes yield a smaller light gathering surface, which means less sensitivity to light. Nonetheless, it is virtually impossible to determine which camera will perform best by quickly comparing data sheets. So what can an integrator, and their customer, do?

Good news! There is a way to measure a camera's performance in low-light conditions by analyzing the technical specifications. However, it is not a simply crosscheck of one data sheet with another.

Related White Papers from Infinova

Infinova has a series of white papers aimed at helping Integrators, CSOs and senior security management to make the technical and business decisions needed to manage security and surveillance installations. Some of the titles in the series are:

- Coexistence strategy at the heart of a cost-effective move from analog to digital security video.
- Selecting cameras – analog to IP-based as well as megapixel and high definition.
- Fiber optics enhances the operation and business bottom line of surveillance solutions.
- Storage options and ways to determine which are the best for the needs of the enterprise.
- How to conduct a security site survey leading to a risk and vulnerability matrix.

These white papers are available for download at www.infinova.com

Don't Rely on a Bad Assumption

If the sensitivities of Camera A and Camera B are 0.1 LUX and 0.05 LUX, would you assume that the low illumination performance of Camera B will be better? Many may be tempted to assume this but they would be wrong. If you judge only the sensitivity values, you easily can end up with the wrong camera.

Here's why. Yes, the parameter of 0.1 LUX means that Camera A can work in a 0.1 LUX illumination environment…but…what is its output video in a low-light condition? Perhaps the camera's sensitivity is 0 LUX when disregarding infrared light imaging. Does this mean the camera can provide images when there is no light? Of course not! The images will be totally dark and useless.

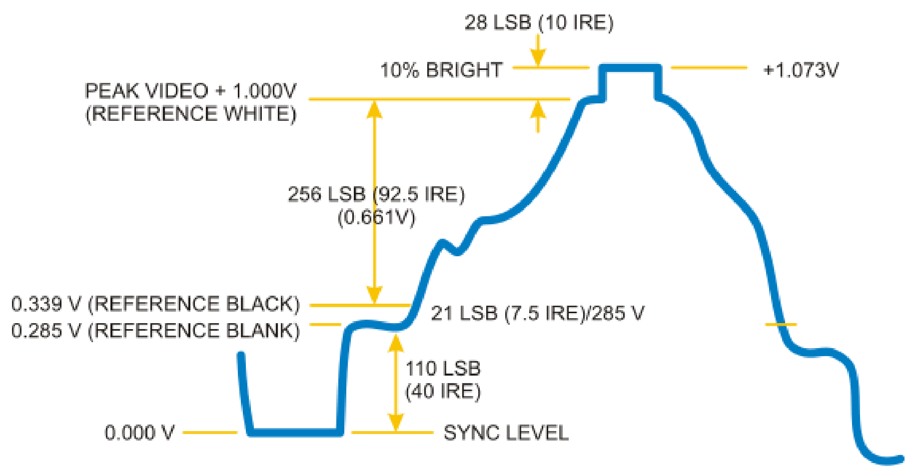
Since both the testing condition and display results must be specified when describing the low illumination value of a camera, try using this formula for both color and black and white modes:

- Color Mode: XXLUX @FX (X IRE, AGC XX)
- B/W Mode: XXLUX @FX(X IRE, AGC XX)

As a result, your new value will be based on at least three parameters, the lens' F-stop value, the IRE (Institute of Radio Engineers) signal value and the camera's AGC (Auto Gain Control) status. If these three parameters are provided (for day/night cameras, they are needed for both color and black and white mode), it's possible to determine which camera will be the best choice in low light.

Let's Get into the Details

Let's start with the F-stop value, the aperture coefficient of a lens. We all understood that an aperture gets larger to allow more light in when the F-stop value decreases and gets smaller when the F-stop value increases. In other words, the F-stop value is in inverse proportion to the amount of light available. Since the amount of light that gets into the camera is decided by the lens aperture, the F-stop value becomes an important variable for low illumination performance. Thus, to test a camera's low illumination performance, it is necessary to open the aperture to the utmost to ensure that the maximum light gets in. The greater the amount of light, the greater the video signal amplitude will be.



Now, let's review the IRE value. The lower the IRE value, the darker the black areas are, while the higher the number, the lighter they are. Generally speaking, the IRE value expresses the video signal amplitude. A video signal is useless when lower than 25 IRE (175 mV) since the video displayed on the monitor will be totally dark. Therefore, the IRE value is most often described as a number above 25, generally around 30 and, sometimes, as high as 50.

Thus, the video amplitude and IRE value decrease as illumination is reduced. You want the IRE value to be as small as possible when measuring for the low illumination index.

The last variable to understand is the AGC value. Cameras have an amplifier that magnifies the original video signal. A DSP (Digital Signal Processor) chip detects this signal when sent from the CCD (Charge Coupled Device) sensor. If the original signal is poor, the DSP instructs the amplifier to magnify this signal. This defines the AGC function. When activated, the amplifier automatically magnifies the video amplitude under faint light. However, the amplifier is active only the AGC function turns "on."

Beside the AGC "on" and "off" functions, some cameras also have other options that adjust magnification, such as AGC 20 db and 40 db. These values must also be described when expressing low illumination performance.

With the above terms understood, we can now determine how a camera's low illumination index is created. For example, if a camera's low illumination index in black/white mode is 0.24LUX @F1.2 (25 IRE AGC "on"), it means the illumination of the viewed object is 0.24 LUX under the following conditions:

1. The AGC function is activated.
2. The F value of the lens is 1.2 and the aperture is opened wide.
3. The video amplitude is 175 mV.

Now, we can compare the low illumination of two cameras. However, we must be sure that the following conditions are met:

- The color mode or black/white mode is identical.
- The amount of light is identical (i.e. the F-stop value is identical)
- The IRE value is identical.
- The AGC function is identical ("on," "off," or "maximum").

At this point, we can return to the problem discussed at the very beginning. If the low illumination of Camera A is 0.1LUX@F1.2 (30 IRE AGC "on") and Camera B is 0.05LUX@F1.2 (30IRE AGC "on"), we can clearly say that the low illumination of Camera B is better than Camera A.

Why is this? Camera A needs an environmental illumination of 0.1 LUX and Camera B needs only 0.05 LUX to produce the same signal amplitude in the same conditions. If we place the two cameras in the same environment with 0.1 LUX, we can infer that the amplitude of Camera B will be more than 30 IRE and the video shown in its monitor will be brighter than that of Camera A.

A problem we will encounter looking at cameras from different manufacturers is that the parameters to put in our formula after "@" are seemingly always different. Nonetheless, we can still roughly judge the low illumination performance using the above method.

Three Examples

Let's run some more calculations to see how this works out.

Example One:

Let's check the following parameter in black/white mode
Camera A: 0.1LUX@F1.2 (30 IRE AGC "on")
Camera B: 0.1LUX@F1.4 (30 IRE AGC "on")

In this example, the F-stop value of Camera B is greater than Camera A. Therefore, the amount of light available in Camera B is less than Camera A in the same conditions. If the amount of light gathered by Camera B were to be set the same as that of Camera A, the video amplitude of Camera B's output signal will be larger. In this example, as it reaches 40 IRE, the low illumination performance of Camera B will be indicated as 0.1LUX@F1.2 (40 IRE AGC "on"). If the amplitude of Camera B is kept at 30 IRE, then the illumination required by Camera B to produce the signal will be less than 0.1 LUX. If camera B only requires 0.05 LUX to produce this signal, the low illumination performance of Camera B will be equivalent to 0.05LUX@F1.2 (30 IRE AGC "on"). Thus, the low illumination performance of Camera B is better than Camera A.

Example 2:
Camera A: 0.1LUX@F1.2 (30IRE AGC ON)
Camera B: 0.1LUX@F1.2 (50IRE AGC ON)

Note that all parameters are the same except that the IRE value of Camera B is greater. In other words, the video amplitude of Camera B (350 mV) surpasses that of Camera A (210 mV). Therefore, the illumination required by Camera B to produce the same signal amplitude as Camera A will be less than 0.1 LUX. If Camera B only requires 0.05 LUX, the low illumination performance of Camera B will be equivalent to 0.05LUX@F1.2 (30 IRE AGC "on"), confirming that the low illumination performance of Camera B is superior.

Example 3:
Camera A: 0.1LUX@F1.2 (30IRE AGC ON)
Camera B: 0.1LUX@F1.2 (30IRE AGC OFF)

In this example, everything is the same except that Camera A produces a video amplitude of 210 mV when AGC is "on" while Camera B produces the same amplitude if AGC is "off." So, let's infer that the signal amplitude of Camera B will increase if AGC is "on." If it reaches 50 IRE (350 mV) with the AGC "on", the environment illumination required by Camera B to produce a signal of 210 mV amplitude will be less than 0.1 LUX. If it is 0.05 LUX, the low illumination of Camera B will be equivalent to 0.05LUX@f1.2 (30 IRE AGC "on"). Therefore, the low illumination performance of Camera B is better than that of Camera A.

As you use this tool for measuring a camera's low illumination, be sure that you use an identical environmental illumination for the different cameras. Employ the same lenses with identical focal lengths to shoot the same object in the same conditions. Also, set the AGC function to the same level. Then, the brighter the video, the better the low illumination.

By helping channel partners provide their customers with complete, affordable, best-in-class, large and small video surveillance solutions, Infinova helps integrators generate more business more profitably. Leveraging a manufacturing process certified to ISO 9001:2000 standards and over 250 engineers with a list of video industry firsts, Infinova channel partners provide their end-users with industry-acknowledged product reliability and technical leadership.

So that Infinova channel partners can create complete solutions, Infinova provides IP surveillance cameras and components, CCTV analog cameras, DVRs and components, camera accessories, monitors, power supplies and fiber optics communications devices. Infinova also has the technical ability and manufacturing flexibility to let integrators propose customized solutions. In addition, Infinova will partner with other manufacturers making other surveillance equipment and software to help its channel partners create turnkey solutions. Contrary to most other companies, Infinova will back-up their partners' products as well as its own to assure both the integrator and its customers that one call – to Infinova only – takes care of everything.

Infinova works diligently to assure its channel partners can provide cost-conscious solutions. With Infinova's hybrid systems, channel partners can propose systems that protect a customer's investment in its already-installed analog surveillance system but that also put them on a dynamic migration pathway to IP systems.

Infinova is lauded for its exceptional maintenance programs. A major highlight is the company's 24-hour advanced replacement policy in which a substitute product is shipped immediately upon notice of a problem.

With such customer focus, Infinova is often referred to as "the integrators' manufacturer."

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