Troubleshooting guide for image quality

User manual

Trouble with image quality?

You've come to the right place! This guide helps you troubleshoot issues with image quality.

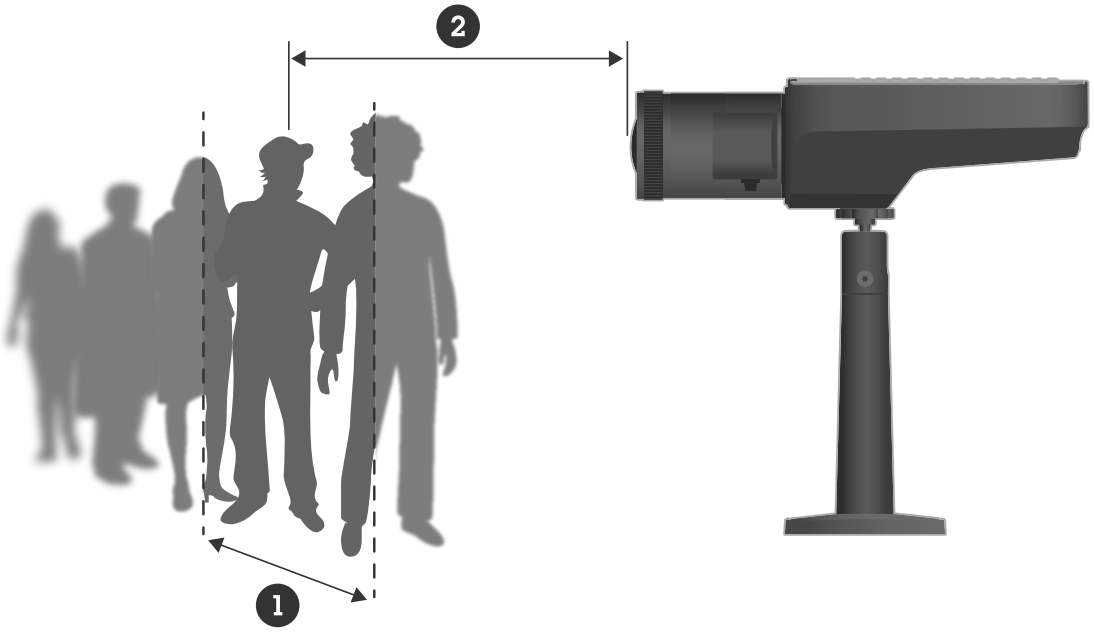
The correct image quality for your surveillance video depends on the objectives of your project. In this guide we go through some important parameters affecting image quality; settings such as depth of field, gain, resolution, color temperature, backlight compensation, wide dynamic range (WDR), as well as IR reflections and the effects of sunlight.

Check the basic image settings

Aperture

The opening or **aperture** of a lens, also known as the iris, affects the amount of light reaching the sensor. The f-number of the lens is the quotient of the focal length of the lens and the diameter of the opening. For example, a 50 mm lens with a 25 mm aperture would have a f-number of 2.0, as 50/25=2. The higher the f-number, the smaller the opening will be, and vice versa. A lower f-number means that more light will reach the sensor.

The aperture also affects the **depth of field**, that is, how much of the scene that is in focus at the same time. A wide open lens will have a very shallow depth of field. Objects slightly closer to or further from the camera than the set focus point will be out of focus. By increasing the f-number (thus closing the aperture), the depth of field increases, and the objects can be brought back into focus.



Having a larger depth of field means that objects appear sharp at a larger range around the focal point.

1. *Depth of field*
2. *Focal distance — distance from the camera to its focal point.*

Problem

General focus issues.

Possible solution

- In environments where light levels are constant, you can use a lens where the iris is fixed at a certain f-number. If the light level varies, you can compensate by adjusting the exposure time.
- A manual iris lens is adjusted by turning a ring on the lens to open or close the iris. This is not convenient in environments with changing light conditions, such as in outdoor surveillance applications. In outdoor environments we recommend an automatic iris (auto-iris or P-Iris).

Shutter speed

Another parameter directly connected to the amount of light available in the scene is the **shutter speed**. This is the amount of time that the shutter is opened for, allowing light to enter and hit the sensor and create an image, for example 1/50th of a second.

When there is more light available, the shutter does not need to stay open for as long, so faster shutter speeds are possible. As the light decreases, the shutter speed needs to be slower, to allow the sensor more time to get enough light to form an image.

When the shutter speed is very slow, anything moving in the scene will appear blurred in the image as the object's position changes during the capture. This is called **motion blur** and has a negative effect on both image quality and usability of video.

Problem

Moving objects appear blurry.

Example:
As long as nothing is moving in the scene, a video feed may look really sharp, even in low light conditions. However, if the shutter speed has been set too slow, a moving object in the video will become blurry. In the second image, the license plate of the passing car cannot be read because of the motion blur.

Possible solution

- In general, we recommend that you use the default settings on your Axis device. The default settings are a sort of sweet spot where the image settings and stream settings are optimized and balanced to provide a fluid video stream in most of the common scenes and scenarios. You can reset the settings in the web interface.
- When installing a camera, make sure you validate its performance in all the required lighting conditions and with the expected level of motion in the scene. Test footage recorded at night with no moving objects in the scene can look fine at a first glance. But chances are the camera has been tweaked with slow shutter speeds, and it might not actually work for its intended purpose.

To play around with settings and see how they effect the video fluidity, use our *Frame rate versus Shutter speed tool*.

Gain and noise

The **gain** function amplifies a weak signal resulting in a brighter image without affecting the shutter speed or the depth of field. However, a side-effect of the gain function is that imperfections in the image are also amplified and appear as **image noise**. Noise lowers the image quality and increases the bandwidth needed for the video stream.

Example:
When random noise gets amplified, it becomes apparent in the image. Each pixel value will deviate slightly, making uniformly colored parts look "grainy". At a certain point the noise renders the image useless for surveillance purposes.