WHITE PAPER

Laser focus

Built-in instant focus

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AXIS COMMUNICATIONS

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1 Summary

Laser focus is a completely automatic feature that is active whenever the camera is on. It provides instant sharp focus, also in challenging lighting conditions, and it is safe to use under all conditions. Even if someone looks straight into the laser, their eyes will not be harmed by its light.

2 Introduction

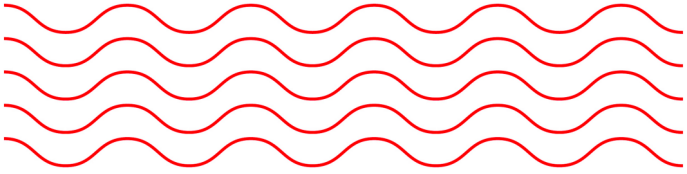
This white paper describes what laser and laser focus are and discusses the challenges with different lighting conditions.

3 What is a laser?

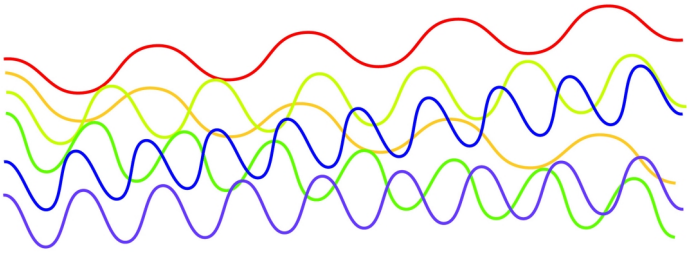
A laser is a light source that emits coherent and monochrome light rays, all aimed in the same direction. This means that all emitted light waves have the same size and shape (coherence) and color (wavelength). The emitted light does not have to be visible, but can be electromagnetic radiation with any wavelength, for example infrared (IR) or ultraviolet (UV) light. IR light has longer wavelengths (700 nm–1 mm) compared to visible light (400–700 nm), whereas ultraviolet light have shorter wavelengths (10–400 nm).

The coherence of the light enables the laser beam to stay narrow over great distances, making it suitable for industrial applications such as laser pointers, laser sights, and laser focus. As a comparison, normal light, such as the light from a common light bulb, contains many colors or wavelengths, and the emitted light waves do not have the same phase, as shown in *figure 1*.

The laser light used in the laser focus feature is not visible. Instead, the laser uses IR light with a longer wavelength than visible light. The laser waves are created by stimulated emission and the term *laser* is an acronym that means Light Amplification by Stimulated Emission of Radiation (LASER).



Laser light



Normal light

Figure 1. Difference between laser light and normal light.

4 Laser focus

Laser focus helps cameras find focus even faster than cameras with autofocus only. It finds focus in challenging lighting conditions, such as scenes with low light or contrast. The out-of-the-box-ready feature is a fully automatic solution, requiring neither setting nor programming to work. As soon as the camera is turned on, the laser focus starts working.

The laser focus feature includes a laser that assists focusing by providing a reference point. The laser module has a transmitter and a receiver, as indicated in *figure 2*. The transmitter sends out a laser ray that bounces off an object and returns to the receiver, providing the camera with a focus reference point. The IR light of the laser focus is neither visible nor harmful, and has a wavelength of 905 nm.

Figure 2. Example of a camera with a laser module.

1 *Transmitter*
2 *Camera lens*
3 *Receiver*

The laser focus feature verifies focus continuously when the scene changes. Since the camera already knows the distance to the object, it knows where to start searching, and the entire process is performed automatically within a fraction of a second.

5 Challenging lighting conditions

Some lighting conditions can pose a challenge to the autofocus feature, as described in the following sections. Laser focus is a solution to the problem with these conditions, as it finds focus instantly regardless of them.

The most common light conditions where autofocus may have difficulties finding focus are scenes with low light or low contrast, and scenes with point-shaped light sources, such as strong headlights from traffic. *Figure 3* shows an example of a scene with several point-shaped light sources and low light.

Scenes with low-contrast objects, for example, flames or smoke, do not provide the sharp edges and high contrast that autofocus searches for when trying to focus. A white wall that lacks contrasting edges or objects is another example of a scene with low or non-existing contrast.

In dark environments, edges do not look as sharp as they would in bright lighting conditions, that is, the contrast is lower. In addition, image noise is proportionally higher in low-light scenes. The noise covers objects and hides their sharp edges, impairing the ability of autofocus to find focus.

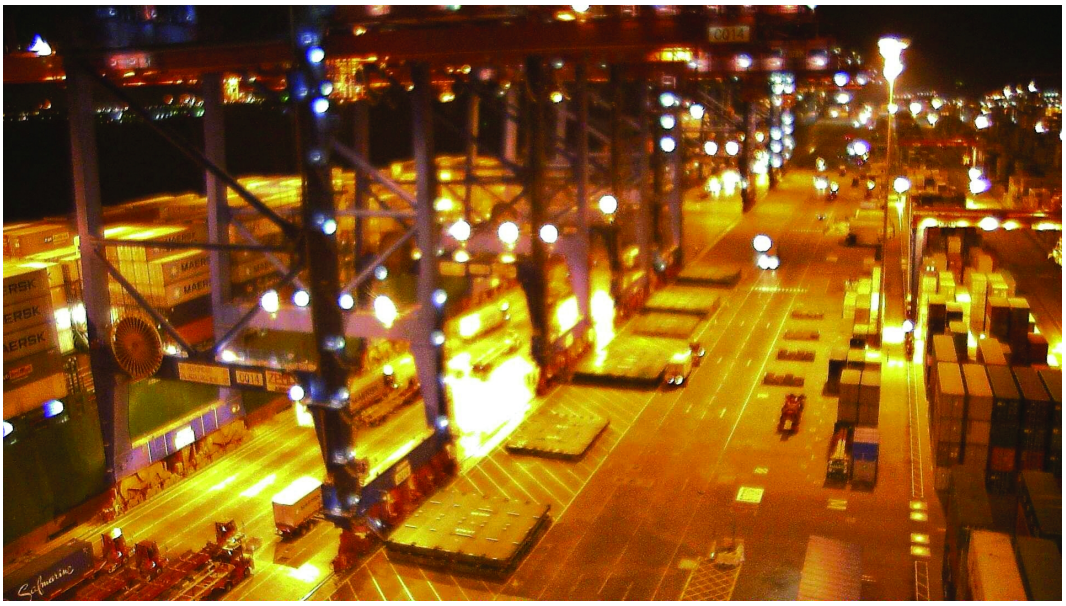


Figure 3. A Scene with several point-shaped light sources and low light.

The laser focus feature makes it possible to focus on bright objects or objects that reflect a lot of light, for example, solar panels, that autofocus may find challenging since the reflecting light blurs or hides the sharp edges that autofocus needs to be able to focus.

With moving objects and scenes that change quickly, laser focus will find focus instantly, making it possible to focus, for example, on the license plate of a moving vehicle, see *figure 4*.

Figure 4. Laser focus focusing on a license plate.

Laser focus is especially useful for pan/tilt/zoom (PTZ) cameras since the view changes dynamically when the PTZ function is used.

For more information, see *axis.com/products/ptz-cameras*.

6 Safety

Laser focus meets the international laser safety standard IEC 60825 Class 1, which ensures that the kind of laser used in the laser focus module is safe under all conditions of normal use. Even if the user looks straight into the laser transmitter with their naked eye or through a magnifying glass, telescope, microscope or similar, they will not be injured. Thanks to the safety of the laser, it is perfectly safe to use cameras with laser focus in public areas such as shopping malls, airports, and stadiums.

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