

CCTV

A Close-up View: MP Lenses

Tapping into the Full Potential of Megapixel Cameras

Increasingly, megapixel cameras are conquering the security technology market, which offers not only high-resolution cameras, but now also megapixel lenses. The following technical report provides recommendations for applications with a megapixel camera and explains what you should keep in mind when using this kind of technology.

Quite a few users will be wondering why MP lenses are being introduced to the market. After all, when choosing a lens, you need to consider the view angle and the light intensity, but certainly not the resolution, right? Generally speaking, the choice of a lens is ultimately a compromise, because any visual image has an error of some kind. The problem with designing a lens is that if you manage to get around one error, there will inevitably be another one. Therefore, an error can never be fully eliminated, but only minimised. A good quality lens not only requires a good deal of design experience, but also a large amount of expertise in the production of it.

Resolution Is of Utmost Importance

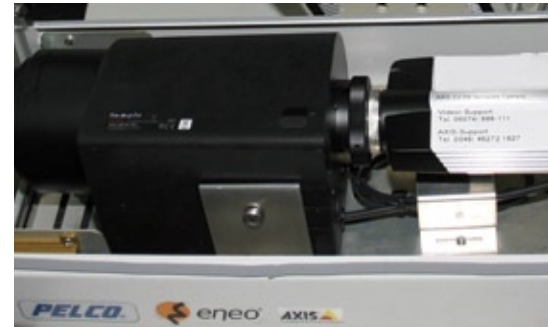
Resolution plays a key role in video surveillance and makes it possible not only to see objects, but to also clearly recognise them. High-resolution images make it possible, for example, when viewing the image material later on, to zoom in on details, such as faces. To analyse the resolution of lenses or rather the image quality, the modulation transfer function (MTF) is primarily used. The term resolution in this case refers to the number of details that are individually distinguishable – if two separate objects can be distinguished in an image, the lens has “resolved” them. Generally,

lenses for high-resolution IP or megapixel cameras cannot be compared with those used for analogue cameras: In a scene being monitored in an analogue environment the number of pixels is broken down into 600.000 pixels. When using megapixel technology the number is two million and more. A lens used with a high-resolution IP or megapixel camera should be able to present this high number of image pixels and allow them to be clearly distinguishable from one another in order to fully tap into the potential of these cameras. In the process, the resolution of megapixel lenses differs just as much as that of the cameras. Reputable manufacturers provide this information for optimal coordination of camera and lens.

Fixed Focal Length and Varifocal MP Lenses

When discussing megapixel lenses, professionals distinguish between fixed focal length and varifocal MP lenses. Fixed focal length lenses have a fixed focal length and are often equipped with a manual aperture. They are found in the machine vision sector, in which MP cameras have been used for a long time and which is the reason why a large number of high-resolution lenses are available on the market. However, for their use in CCTV cameras there are several disadvantages. Not only are these lenses highly inflexible because of the fixed focal length and the manual aperture, but they are primarily designed for rugged use in machines under constant mechanical stress loads. To that effect, these are typically priced higher than varifocal MP lenses for use in CCTV applications.

In most cases, varifocal lenses are used with CCTV cameras. The advantage of varifocal MP lenses is the fact that they are clearly much more flexible as compared to fixed focal lengths. In comparison to fixed focal lengths, the focal



▲ A complete solution for IP video surveillance: Housing, pan/tilt unit, IP camera and MP lens.

length is variable, meaning the view angle can be changed – just as with a camera with a zoom function. Automatic aperture controls also make it possible to adjust better to fluctuating lighting conditions. Varifocal lenses, however, are quite different from zoom lenses, for which, because of the lens design, the focus remains constant in the image when making changes to the focal length. Because the lens of a surveillance camera is usually set up for a specific view angle, in this case these corrective elements are not needed. If the focal length of a varifocal lens is changed, the focus must be corrected.

Day/night MP Lenses for 24 Hour Surveillance

Day/night cameras switch to black and white mode in poor lighting conditions and even if the lighting is extremely poor, they can still produce good images. When in this mode, the cameras do not work with normally visible daylight, but instead with infrared light. The sensors of these cameras are IR sensitive, which is why the camera delivers clear images despite low light levels. If lighting conditions are sufficient, day/night cameras use a retractable IR cut filter to block the IR light, because otherwise the results would have an incorrect colour reproduction. But why would special lenses be needed for these kinds of cameras? If one were to use a day/night camera with a normal lens, the image would be out of focus when switching from day into night mode. For day/night lenses, this effect does not occur; the image remains focused in both cam-



◀ The compact design of new MP zoom lenses with 1.3 Million Pixel resolution makes it possible to incorporate them into an already existing housing in a way that saves costs and in doing so expands the application options for megapixel cameras.

era settings. Special coatings prevent the infrared light from reflecting in the lens and the result is that these lenses allow more infrared light in than normal lenses.

MP Zoom Lenses for Day and Night Use

In surveillance cameras, MP zoom lenses are used less commonly than MP varifocal lenses. Zoom lenses are well-suited for surveillance of very large areas, for zooming in on details and thus for efficiently monitoring sensitive areas. Recently, the world's very first megapixel zoom lens was introduced by a leading manufacturer in a compact design for day/night megapixel cameras. The latter are being used more and more frequently and as a result quality expectations for lenses are increasing, for example the need for high resolution levels for distance surveillance in day and night applications. The compact design of this lens makes it possible to incorporate it into an already existing housing in a way that saves costs and in doing so expands the application options for megapixel cameras with MP zoom lenses. The combination of the optical and digital zoom provides the ability to produce high-performance systems in a compact design. One successful example is the system recently introduced by Videor in which an Axis 223 M network camera (a resolution of 2.3 million pixels) is used with a Fujinon megapixel zoom lens and the optical 32X zoom can be combined with a 2X digital zoom. This equals a 60X zoom, whereas the designs of the Fujinon D32X-10HR4D-YE1 used are 50 % smaller than a 60X zoom lens! This makes the housing and the pan/tilt unit significantly smaller, and because the entire system is controlled by a single LAN cable, which at the same time also transmits the image data, it can be easily integrated into existing video surveillance systems.

Zoom and varifocal lenses for security applications (Fujinon)



Conclusion

It has not even been three years since the megapixel lenses became available for the first time for video surveillance cameras and today they are already being supplied by various different manufacturers in fixed focal length versions or as varifocal and zoom lenses. By the same token, in the meantime series of lenses are being offered especially for high-resolution day/night or network cameras with respective characteristics. Not until very recently have high-resolution wide-angle and ultra wide-angle lenses become available on the market. With their sophisticated lens design and innovative technologies, these further expand the application possibilities in the field of high-resolution video surveillance systems.

When selecting the MP lens, what is critical is the type of application or rather the IP or megapixel camera used for this purpose: Decades of experience, a large selection of lenses and quality support services are a huge benefit when it comes to choosing the ideally suitable MP lens

for any surveillance scenario. One tool that helps you to become familiar with the available options is the ability to compare products on the website of a multibrand distributor, on which MP lenses being offered by several leading manufacturers are compared side-by-side.

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