

Sharpdome

Sharp images on every level



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1. Introduction

Pan-Tilt-Zoom (PTZ) cameras are highly useful for monitoring a vast variety of public locations, such as shopping malls, roads or sports arenas. The camera can pan and tilt to cover wide areas, and zoom in on different points of interest. However, a camera mounted in a conventional dome cannot see above its own horizon. This poses a problem in surroundings with differences in altitude, such as escalators, hilly roads or steep stands. The inability to see upwards limits the usefulness of PTZ cameras mounted in conventional domes.

Due to the manufacturing process, a conventional camera dome is not a perfect sphere. Because of this, the image produced by the camera inside the dome will be distorted. Also, when the camera is tilted, the distance between the camera lens and the transparent covering varies, which gives rise to reflections. With Sharpdome, these problems are now part of the past.

2. Conventional dome limitations

The transparent covering of a conventional camera dome is not a perfect sphere, but consists of one curved part, in the form of a semi-sphere, and one straight part, see Figure 1.

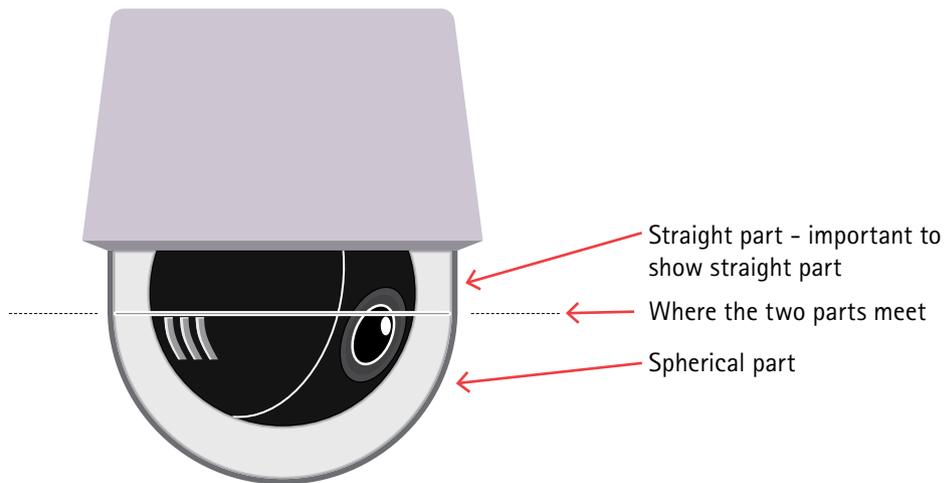


Figure 1: An example of a conventional camera dome.

The transparent covering acts as a lens, refracting the incoming light. Where the straight part meets the spherical part the refractive characteristics of the covering change, distorting the image produced by the camera. The transition is caused by the manufacturing process and constitutes a common problem throughout the surveillance camera industry. The area where the two parts meet disturbs the view of the camera at that specific height, blurring the image over a narrow, but vital area. It is possible to make the blurred area less disturbing by widening it, making the transition smoother, but this will make the view blurred over a wider area.

Until now, there has been only one—theoretical—solution to this problem, and that is a circular dome. However, such a dome is not possible to manufacture with injection molding, which is the only method that can assure high optic quality. With injection molding, both an inner and an outer tool are needed, and the inner tool cannot be removed after the dome has been cast.

Another concern is that a camera that is mounted in a conventional dome cannot see clearly above its horizon. This is problematic where the camera needs to monitor areas with differences in altitude. The image will become more blurred the higher the camera is tilted, a phenomenon that is called mirroring, see Figure 2.



Figure 2: Mirroring in a conventional dome camera at 20° tilt, 20× zoom.

2.1 L-value

In most domes, the camera is often placed lower than the center point of the sphere to avoid the error of refraction that arises where the spherical part meets the straight part of the dome. The lowered position of the camera gives a greater tilt range. The greater the tilt range, the wider an area the camera can monitor. However, the loss of image quality also increases with the lowered position of the camera.

The vertical distance, or misalignment, between the center point of the sphere and the optical axis of the camera block is called L-value, see Figure 3.

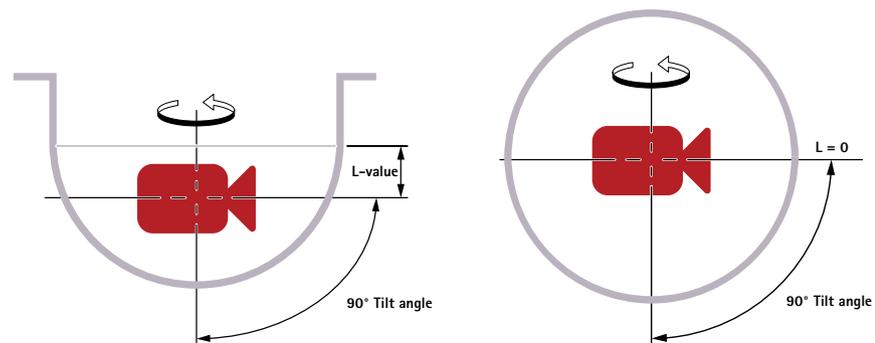


Figure 3: The L-value of most domes versus optimal placement of camera block.

The L-value is an important value that sets the conditions for the image resolution. To achieve optimum image quality, the optical axis of the camera block should be at the center point of the sphere, that is, where the L-value is 0.

3. Sharpdome

Sharpdome is an innovative technology that solves problems that occur in a conventional dome. In Sharpdome, the sphere has been tilted 39°, optimizing image quality. Figure 4 shows a tilted Sharpdome and a conventional, level dome.

There are several advantages to tilting the dome. The tilt makes it possible to place the camera at the center point of the sphere, which gives the ideal L-value of 0. Since the transparent covering acts as a lens, the camera lens should always be placed at an even distance to the transparent covering at all tilt angles, to avoid distortion and double images. With the tilted dome, the entire field of view of the camera is spherical and the camera is always at the same distance to the transparent covering, which makes it optically optimal, minimizing errors of refraction and double images.

In contrast to a conventional dome where the camera rotates inside a fixed dome Axis' Sharpdome offers innovative mechanics that makes the entire dome rotate. This is combined with a unique dome geometry that enables the same optimal image sharpness and full scene fidelity in all pan and tilt positions. This results in the unique possibility to clearly identify objects as much as 20° above the camera horizon making these cameras very suitable for uneven terrain.

Due to the elaborate mechanics of Sharpdome, the entire dome can rotate, in contrast to a conventional dome where the camera rotates inside a fixed dome. The rotation of the tilted Sharpdome enables the same optimal image in all pan and tilt positions.

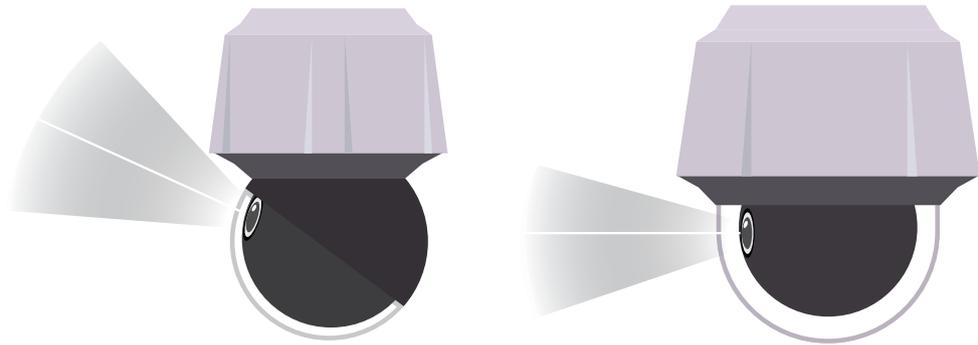


Figure 4: A Sharpdome (to the left) and a conventional dome (to the right)

Already at a small tilt angle, the difference between a Sharpdome and a conventional dome is prominent. The difference in L-value exerts a considerable influence on the image quality of the two types of dome. Figure 5 shows an image from a conventional dome and Sharpdome at a 5° tilt.

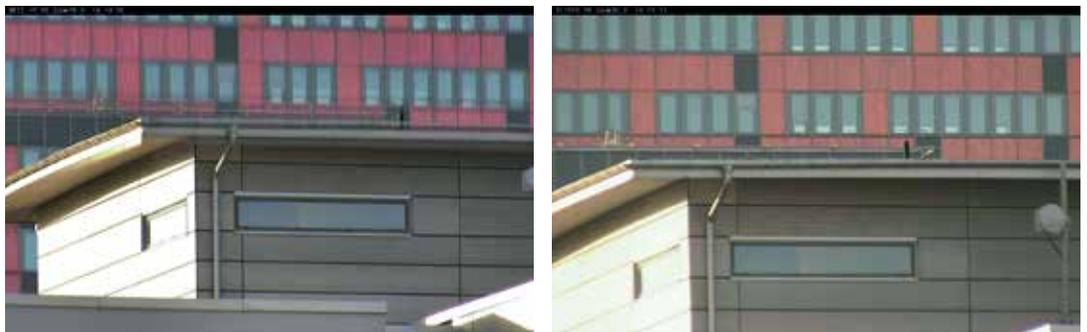


Figure 5: A conventional dome (to the left) and Sharpdome (to the right) at a 5° tilt, 20x zoom.

At a wider tilt angle, the difference becomes even more evident. Figure 6 shows the same view at a 20° tilt.

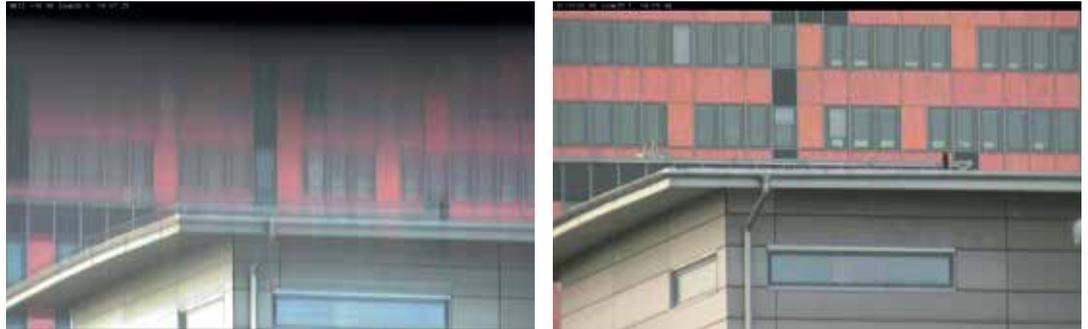


Figure 6: An image from a conventional dome (to the left) and Sharpdome (to the right) at a 20° tilt, 20x zoom.

3.1 Transparent covering material

The thicker the transparent covering surrounding the camera is, the better it will withstand heavy blows. However, the risk of imperfections in the material grows with increased thickness. Material imperfections are usually not a problem neither in thick nor thin domes, but thick domes increase distortions and the distance between double images, impairing the image quality of the camera. They also reduce magnification.

The covering can be made of either acrylic or polycarbonate. Polycarbonate domes cannot be made as thin as acrylic ones, since molten polycarbonate does not flow as easily as acrylic when injection molded. Acrylic domes usually cannot be UL approved because they are too brittle and fail mandatory UL impact tests. Sharpdome is made of polycarbonate in order to meet requirements from Underwriters Laboratories (UL).

See Section 7, Useful links, 'Transparent covering', for more information on covering materials.

3.2 Axis Speed Dry function

The Sharpdome technology includes the unique Axis Speed Dry function that will help to provide sharp images in rainy weather. It can also simplify dome cleaning, allowing for more efficient methods such as high pressure cleaning. The Axis Speed Dry function rotates the dome in alternating directions at high speed. This will break the surface tension of the water and make the drips come off the dome glass.

Figure 7 Illustration of Axis Speed Dry function



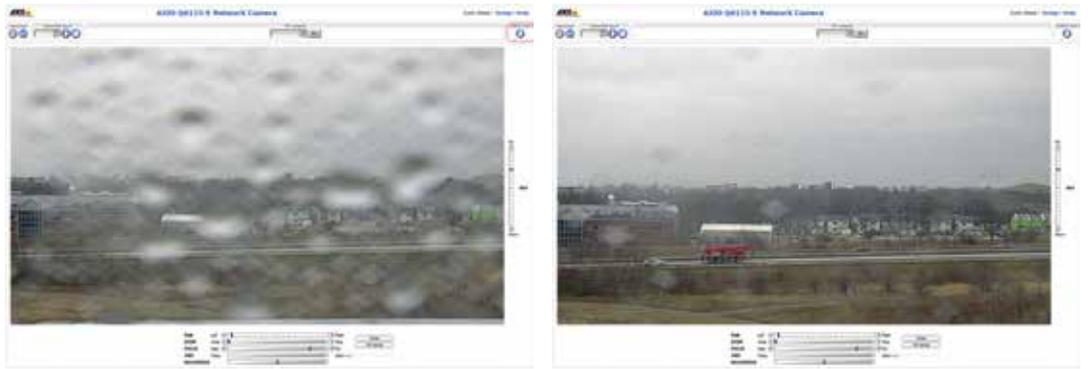


Figure 8 – Snapshot from camera before (at left) and after activation of Speed Dry function from camera Live View page (at right).

4. Application areas

Since it provides the same, high quality resolution on all levels, Sharpdome is well adapted for use in public locations with differences in altitudes, such as sports arenas or hilly roads. Sharpdome is ideal for city and perimeter surveillance, monitoring shopping malls, open parking places and other open areas.

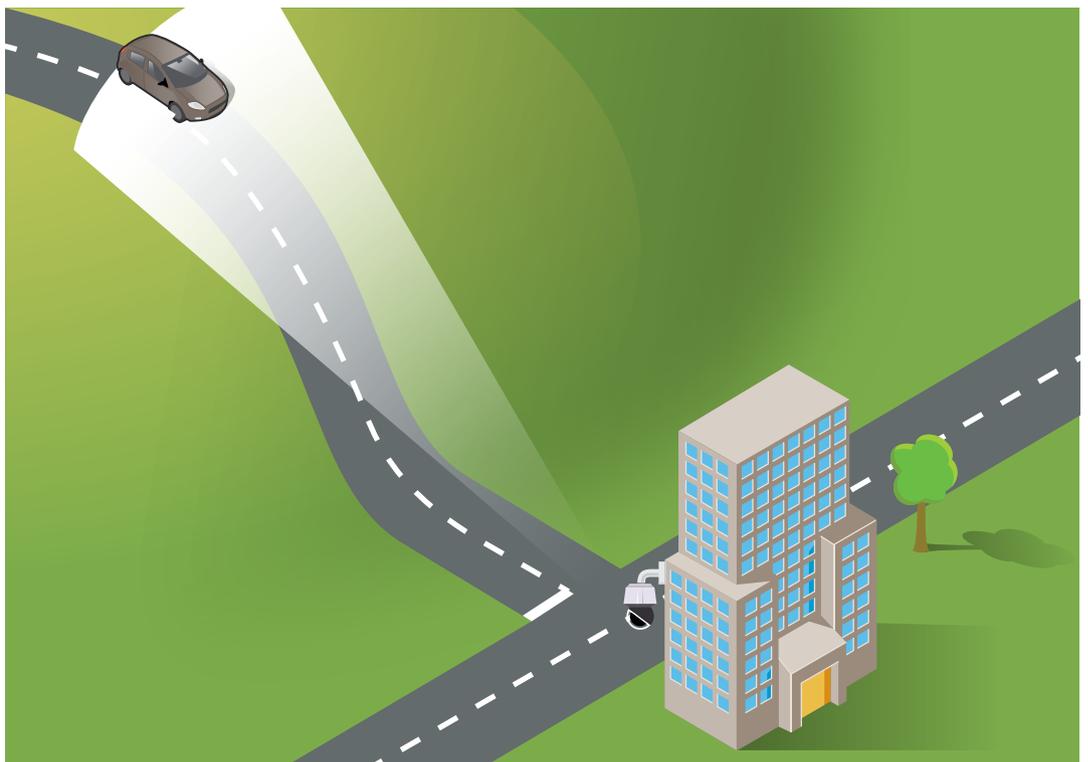


Figure 9: Example of differences in altitude in a city environment.

Sharpdome improves surveillance in a lot of varying scenarios. For example, when an alarm reaches a fire department, the operator can use city surveillance cameras to inspect the alarm location. Using Sharpdome cameras, they can check for smoke, getting sharp images of every single story.

In shopping malls, it is possible to monitor escalators to prevent accidents or misuse. If the operator sees a small child by itself on the escalator, they can stop the escalator to prevent an accident. If an emergency stop button has been pressed, security staff can see whether an accident has happened, or whether the emergency stop was pressed for some other reason.

In a sports arena, it is impossible for a camera set in a conventional dome to monitor seats all the way from the top, down to the arena floor. With conventional domes, several cameras must be used to cover every section from top to bottom. With a Sharpdome camera, on the other hand, all seats in a section can be monitored by one single camera.

In road traffic surveillance, a Sharpdome camera can identify license plates at 300 meters (up to 1,000 ft.), even where the ground has large differences in altitude.

5. User benefits

With Sharpdome, the image quality of the camera is improved, as a result of the constant L-value. Image resolution of the camera is increased vastly on every level—Sharpdome is qualified for use up to 4K Ultra HD.

In a conventional dome, the camera must be placed at a certain distance from the transparent covering, to avoid the camera from interfering with the covering when tilting. The increased distance gives rise to more reflections, disturbing the image quality of the camera. Because of the ideal L-value in Sharpdome, the camera can be placed closer to the transparent covering, giving the same, high quality resolution on all levels. The image quality will be clear and sharp in all directions, even above the horizon.

6. Conclusion

Sharpdome represents the latest development in PTZ camera technology, with benefits for city surveillance, traffic monitoring, stadiums and many more applications. Using it improves the image quality of the camera inside the dome, as Sharpdome drastically reduces distortion and eliminates the problem of double images. Since the camera can see above its own horizon, fewer cameras are needed to monitor areas with large differences in altitude, keeping down hardware costs. There is no longer any need to make compromises regarding resolution, reflections or a limited field of view. The tilted Sharpdome makes all such considerations unnecessary.

7. Useful links

For more information, see the following links:

Axis Communications – 'Transparent covering'
www.axis.com/products/video/about_networkvideo/transparent.htm

Axis Communications – 'Sharpdome'
www.axis.com/products/video/camera/about_cameras/sharpdome.htm

About Axis Communications

Axis offers intelligent security solutions that enable a smarter, safer world. As the global market leader in network video, Axis is driving the industry by continually launching innovative network products based on an open platform – delivering high value to its customers and carried through a global partner network. Axis has long-term relationships with partners and provides them with knowledge and ground-breaking network products in existing and new markets.

Axis has more than 1,900 dedicated employees in more than 40 countries around the world, supported by a network of over 75,000 partners across 179 countries. Founded in 1984, Axis is a Sweden-based company listed on NASDAQ Stockholm under the ticker AXIS.

For more information about Axis, please visit our website www.axis.com.