WHITE PAPER

Sharpdome

Sharp images on every level

September 2020

AXIS COMMUNICATIONS

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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 points of interest.

PTZ cameras with the Axis feature *sharpdome* are even more versatile, with a field of view that extends above the camera horizon. With sharpdome, the camera is placed at the center of a spherical, tilted dome which enables clear and sharp images with less distortion compared with a conventional dome.

This white paper presents sharpdome, its functions, and applications.

2 Conventional dome limitations

A camera that is mounted in a conventional dome can't see clearly above its horizon. This is problematic when the camera needs to monitor areas with differences in altitude. The image will be more blurred the higher the camera is tilted, a phenomenon called mirroring.

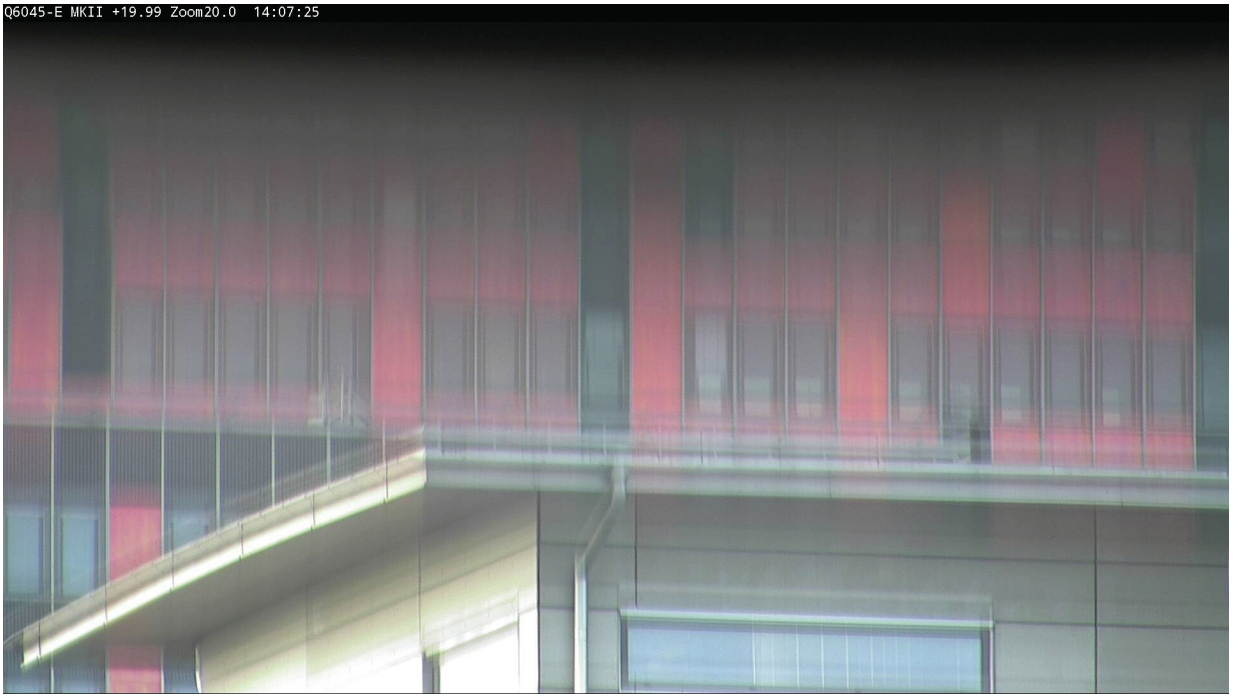

Figure 1. Mirroring in a conventional dome camera at 20° tilt, 20× zoom.

Another issue with conventional domes is that their transparent covering is not a perfect sphere, but consists of a half-sphere and a short cylinder.

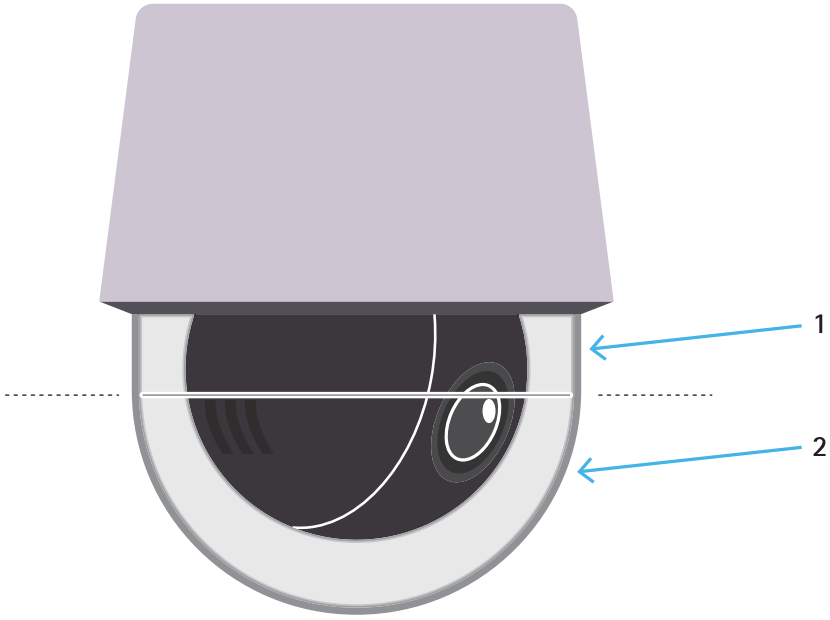

Figure 2. A conventional camera dome consists of a cylindrical part (1) above a half-spherical part (2).

The transparent covering acts as a lens, refracting the incoming light. Where the cylindrical 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 view of the camera is disturbed, blurring the image over a narrow, but vital area. It is possible to make the transition smoother, but that means that a wider area will be slightly affected.

Until now, there has only been a theoretical solution to this problem, and that is a spherical 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 can't be removed after the dome has been cast.

2.1 L-value

In most domes, the camera is placed lower than the center point of the sphere to avoid the error of refraction that arises where the spherical part meets the cylindrical 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. This 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.

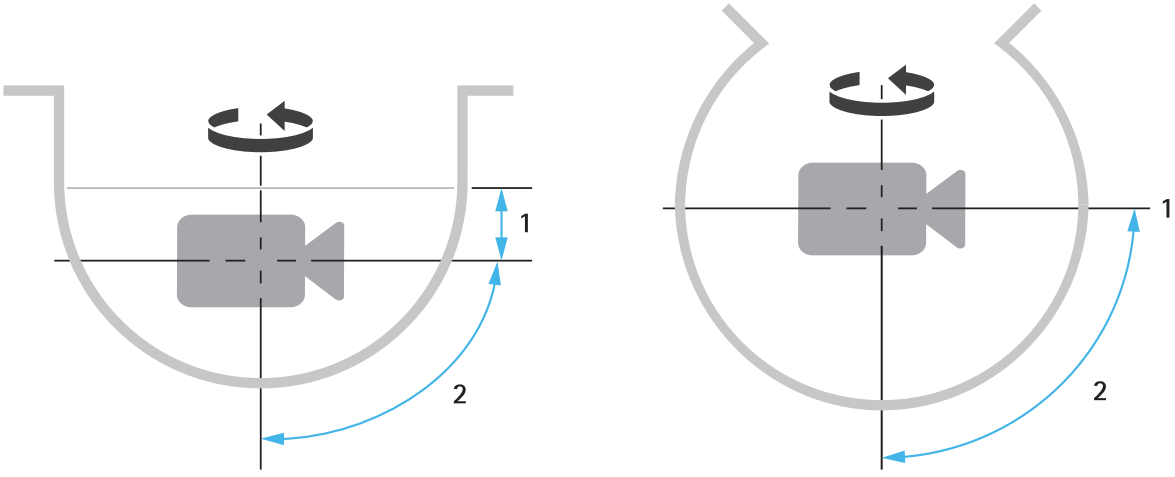

Figure 3. Placement of camera block in a conventional dome (left), and in an optimal dome (right). "1" marks the L-value (for an optimal dome, L=0) and "2" marks the 90° tilt angle.

3 Sharpdome

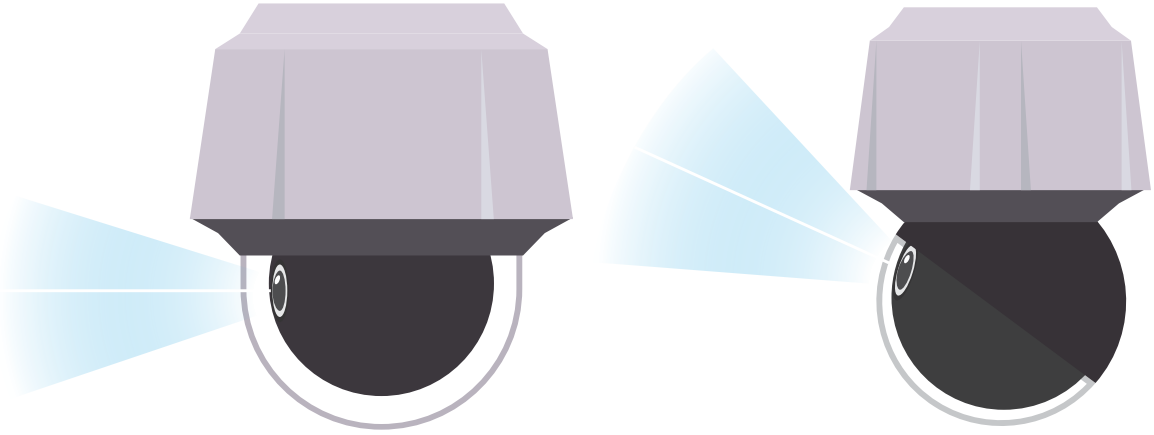

Figure 4. A conventional dome (left) and a sharpdome (right).

In sharpdome, the sphere has been tilted 39°, which provides several advantages. 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, 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. Objects

can be clearly identified as much as 20° above the camera horizon making these cameras very suitable for uneven terrain.

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.

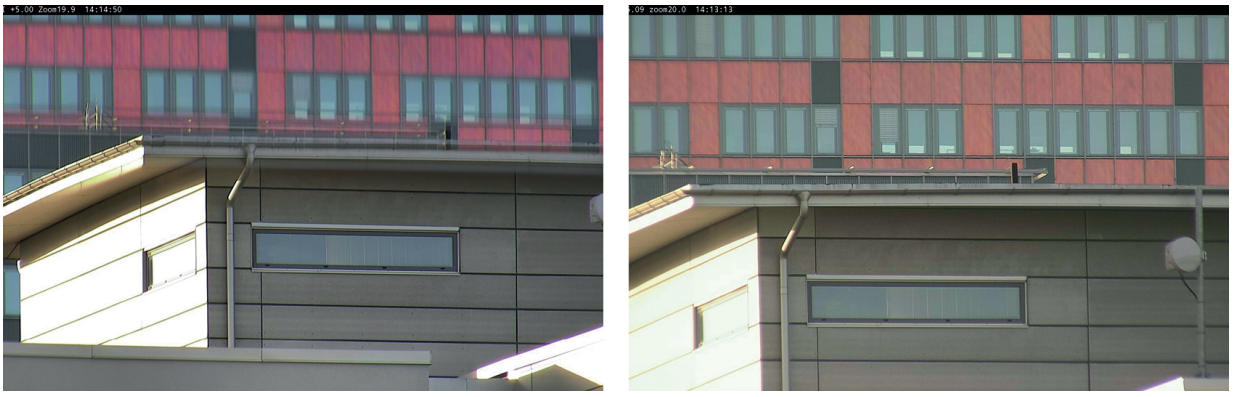

Figure 5. Images from a conventional dome (left) and sharpdome (right) at 5° tilt, 20× zoom.

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

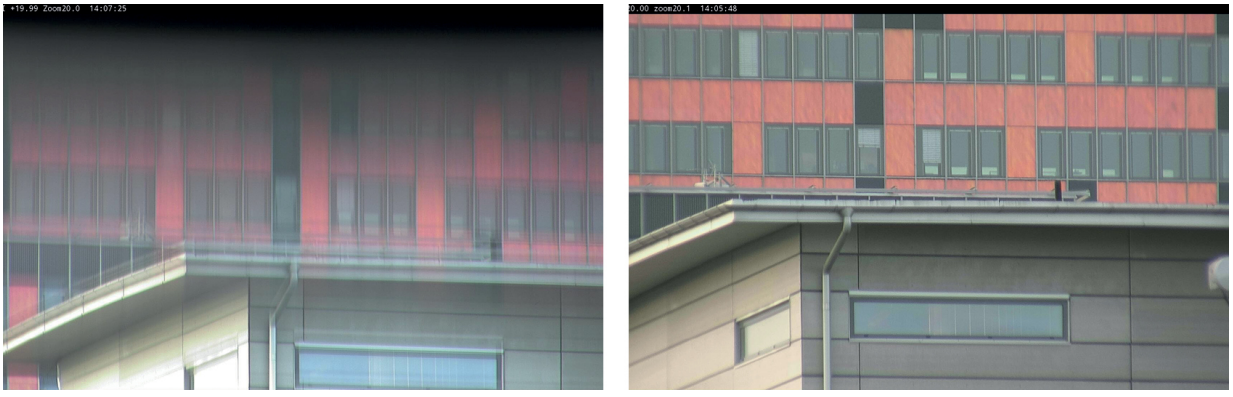

Figure 6. Images from a conventional dome (left) and sharpdome (right) at 20° tilt, 20× zoom.

3.1 Speed dry

Sharpdome includes the speed dry function that will help provide sharp images in rainy weather. It can also simplify dome cleaning, allowing for more efficient methods such as high pressure cleaning. Speed

dry rotates the dome in alternating directions at high speed. This will break the surface tension of the water and make the drops come off the dome glass.

Figure 7. Speed dry efficiently removes water drops from the dome.

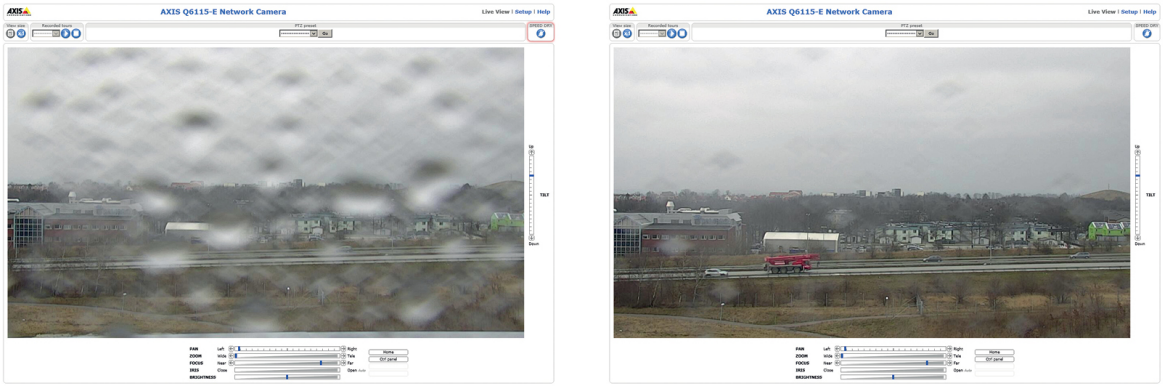

Figure 8. Snapshot from camera live view page before (left) and after (right) activation of the speed dry function.

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. A PTZ camera with sharpdome is ideal in uneven terrain and open areas.

Sharpdome improves surveillance in a lot of scenarios. For example, when an alarm reaches a fire department, an 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 storey.

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, a single sharpdome camera may be used to monitor all seats in a section, all the way from the top, down to the arena floor. With conventional domes, several cameras must be used to cover the same area.

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.

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About Axis Communications

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Axis has around 4,000 dedicated employees in over 50 countries and collaborates with technology and system integration partners worldwide to deliver customer solutions. Axis was founded in 1984, and the headquarters are in Lund, Sweden