

Fixed Dome Cameras

Expanding Horizons



BOSCH
Invented for life

Housing camera systems in protective domed enclosures has been common for some 15 years or more. The market for domed cameras is divided into high speed pan-tilt-zoom (PTZ) camera systems typified by the Bosch AutoDome and other similar products, and smaller “fixed” camera systems such as the Bosch FlexiDome range. A few companies have also introduced special domed cameras designed for harsher conditions and vandal resistance. In the early days, numerous design compromises limited the effectiveness of small fixed dome solutions in more challenging environments. Nevertheless, the advantages of dome cameras including all-in-one packaging, aesthetics and ease of installation mean that there is an increasing demand for higher performance domed cameras for use in ever more difficult applications. This article will concentrate on the Bosch Security Systems answers to the demands made for fixed dome cameras to meet these challenges.



Price versus performance

Initially fixed domes tended to be low in price and performance, one might say designed down to a price rather than up to the conventional CCTV demands. A good example is the power supply unit found with most low-cost dome cameras. Typically, low cost domes are direct current (DC) powered which prohibits the use of line locking to synchronize the camera's video signal, leading to performance generally considered unacceptable in a professional CCTV system. Although there are still many low cost dome cameras available, they usually deliver mediocre performance. High performance, quality products are also available from the main players in the security camera market.

Until recently fixed dome camera limitations meant that some applications could only be satisfied by using

specialized “boxed” cameras. To meet the challenges imposed by these applications, a number of aspects must be addressed:

- Picture Quality – the better the picture quality you begin with, the better image you get at the monitor, recorder or VCA system. This is absolutely essential when using CCTV for instant identification and apprehension
- Sensitivity – essential for most 24/7 operations, particularly in outdoor applications with low light.
- Camera protection – allows the camera to be used in extreme environments and hazardous situations
- Flexibility – allows installation in variety of configurations and satisfying a wide range of applications
- Transmission options – from Coax and UTP (unshielded twisted pair) to IP
- Ease of Installation – often considered a given, but frequently poorly executed



The Bosch Focus Aid compensates for the Bubble thickness when setting the focus.

- Quality and Reliability – again usually considered a given, but tends to be the result of inherent good design and the manufacturer standing behind the product.

Let's look at each of these aspects in detail.

Picture Quality

One often thinks of picture quality in terms of just the camera. With a conventional camera, you can demonstrate the picture quality with a very high priced lens so that the result is flattering. A domed camera is a complete system made up of three key elements: the camera, lens and the bubble, what most people forget.

Modern security cameras can produce fantastic images, and 540 TV lines of color resolution is becoming the industry

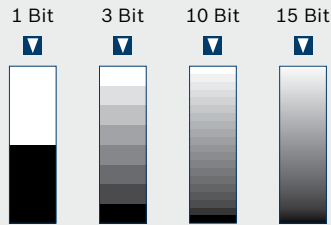
standard. Wide dynamic range – using techniques such as dual shuttering or 15-bit processing, dynamic noise reduction and auto black to ensure good contrast – is becoming prevalent in leading manufacturers' dome cameras. However, unless the lens is chosen for quality and special care is taken with the construction of the bubble, even the best image generated by the camera can easily be lost.

The bubble's impact

With fixed dome cameras, the lens is focused with the bubble removed to provide access to the lens control. But the bubble, especially a thicker vandal-proof type bubble, acts as a secondary lens and when the bubble is in place, it slightly defocuses the camera. Until Bosch introduced the FlexiDome^{XT} range it was a matter of trial and error to get a sharply focused image. The Bosch FlexiDome^{XT}



XF-Dynamic combines with 15-bit DSP technology to ensure exceptional video clarity, extending the dynamic range to a full 90 dB and maximizing image quality.



Wide dynamic range allows details in both light and dark areas to be seen simultaneously

introduced a focus aid, effectively a compensator for the bubble effect, which allowed more accurate focusing without trial and error. Another Bosch innovation now implemented in domes is the Lens Wizard. To ensure accurate focus, the lens should be focused with the aperture wide open. The Lens Wizard in the Bosch Dinion and domed cameras forces the aperture wide open, irrespective of the light level, and adjusts the video level with the shutter. So focusing is now as accurate as it can be, with fewer steps and improved results.

As mentioned previously, the bubble of a dome camera acts as a lens so its design is critical to the optical performance of the camera. Typically, bubbles are pressed from flat sheet plastic of uniform thickness. This is certainly a cost-effective way to manufacture the bubble, but it makes a poor lens, generally exhibiting astigmatism which significantly limits optical performance. Deliberately designing the bubble as a lens and making it a part of the total optical system of the dome ensures optimum sharpness. This patented technology¹ is available in the latest Bosch FlexiDome camera systems.

Wide Dynamic Range

As the demand grows for higher performance in domed cameras, wide dynamic range functionality is required to address the critical issues of dynamic range and variable luminance imaging. Found in cameras such as Bosch's FlexiDome^{XF} and FlexiDome^{DN}, XF-dynamic technology is enabled by 15-bit image processing and advanced CCD chipsets to produce an exceptionally high number of grey levels. This results in a 32x improvement in dynamic range and more accurate, high-quality reproduction of both dark and highlighted areas of the image. Wide dynamic range technologies, such as XF-dynamic, enable cameras to overcome problems caused by reflections from wet flooring or puddles, reduced contrast due to fog, mist, or glare, and poor lighting such as shadows or strong backlighting.

Sensitivity (day/night image)

1/3-inch format sensors are now the standard in the industry. However, sensor size is not enough to get the ultimate sensitivity from a camera built around these sensors. Ultra low noise pre amplifiers, advanced digital signal processing, and of course dynamic noise reduction ensure the best signal-to-noise ratio.

¹ Patent pending – Bosch Security Systems

However, it does not end there. SensUp, which integrates the signal from a number of frames, can increase the signal-to-noise ratio, thereby increasing camera sensitivity, by as much as 10x in low-light conditions. In addition, switching from color to monochrome mode and integrating the signal from a number of pixels provides as much as a 9dB improvement in sensitivity in the case of Bosch Cameras with NightSense.

True day/night cameras go even further, by removing the infrared (IR) filter needed to get good color rendition in color cameras. This allows IR radiation to contribute to the signal, also effectively improving the sensitivity. It is not necessary to use specific IR illuminators as commonly used tungsten and halogen lamps have a high IR component and prove very useful in traffic, parking and commercial building applications.

Camera Protection

There are many situations where the camera may be housed in a standard protective dome enclosure without mishap. However, it is becoming increasingly necessary to protect the

camera against the environment, and of course mechanical damage from vandals in many CCTV applications.

When using the camera in outdoor environments, it is essential that the unit, including its mounting, be protected against dust and water ingress. IP66 and NEMA4 are the commonly accepted standards, (see tables of IP/Nema ratings). NEMA4X rated products also meet corrosion standards, indicating products that are suitable for coastal and industrial environments.

However, water protection requirements are not confined to outdoor environments only. In dusty or in highly polluted areas it is necessary to clean the dome periodically to remove built-up dirt. The easiest way to do this is to wash or spray the whole camera with a high-pressure water jet, so water protection is essential, even indoors. Cleaning operations can also cause scratching of the bubble, leading to lower optical performance. Modern domes have a scratch proof coating to minimize this type of damage. The same characteristics are critical for cameras installed where dust and sand storms are a threat.

Summary of Ingress Protection (IP) Codes

Numeral	First Numeral Protection against solid bodies	Second Numeral Protection against liquids
0	No Protection	No Protection
1	Objects greater than 50mm	Vertically dripping water
2	Objects greater than 12mm	Angled Dripping water 75-90°
3	Objects greater than 2.5mm	Sprayed water
4	Objects greater than 1.0mm	Splashed water
5	Dust - protected	Water jets
6	Dust - Tight	Heavy seas
7		Effects of immersion
8		Indefinite immersion

Example IP66 – Equipment is dust-tight and protected against heavy seas

Comparison of IP Codes and NEMA Rating

IP Rating	NEMA
30	1
31	2
32	3R
64	3
65	12, 12K and 13
66	4 and 4X

External temperature can be a challenge to protecting the camera from damage. Most domes have an upper operating temperature of 50° C (120° F). This generally means that it can operate long term at these temperatures within specifications and without any loss of performance. However, short term operation at even higher temperatures should not lead to loss of video or damage. The material selection is essential, as the wrong choice can lead to some unexpected changes, as shown in the accompanying figure. Of course, in much of the world, operation at temperatures well below 0° C (32° F) is essential too, so a dome that can operate at a temperature of -50° C (-58° F) is a necessity, not a luxury.

Bosch FlexiDomeXT+, XF and DN are ruggedized for harsh environments and feature heaters to ensure good operation at extreme temperatures, whether natural in mountainous or arctic areas, or artificially controlled, as in walk-in frozen food storehouses and freezers.

Vandal Protection is often used as the term to describe protection of the camera against violent attack, either with intent or by accident. This includes the classic baseball bat attack when the dome is within reach in corridors, sports halls, metro platforms and the like. Attacks can include other weapons, accidental collisions (e.g. vehicles brushing the camera at toll booths), warehouse operations and stones or objects thrown at the dome. Simply providing a metal back and polycarbonate bubble is not sufficient: vandal protection is of little value if the bubble survives the attack but the camera stops sending video at the crucial moment. Tests show that even a tough polycarbonate bubble will distort enough to damage the camera and lens unless additional protection is provided. In the Bosch FlexiDome series, the black inner liner serves both to mask the direction in which the camera is pointed and to provide additional impact protection for the camera. Last but not least, if the camera and lens are not installed on shock absorbing mounts, the camera could still sustain damage or misalignment if subjected to a violent impact. Refer to the accompanying figures.

But how can you judge the protection afforded to any camera? Luckily, there are standard impact tests, just as there are for dust and water resistance. The IEC 60068-2-75 makes it simple to ascertain a product’s protection level.



Typical indoor domed camera subjected to prolonged elevated temperatures.



Bosch FlexiDomeXT+ is designed to produce high quality video under difficult lighting conditions as well as in the harshest environments.

Last but certainly not least, the camera should be protected against tampering, by use of anti-tamper bolts.

Flexibility and Ease of Installation

One of the key areas of consideration when using domed cameras, with all their inherently modern advantages, is the ease of mounting them in a wide variety of environments. At a minimum, a modern dome system should allow for surface and corner or flush mounting on walls and ceilings, ideally on standard electrical gang boxes. In addition, wall and pipe mounts should be available for situations where the application demands the camera cannot be mounted close to the wall or ceiling.

Transmission options

The vast majority of cameras installed today are still attached to conventional analog systems by a coaxial video cable connected via a BNC connector. However, some systems use unshielded twisted pair (UTP), often referred to as telephone cable. Ethernet networks, found in many modern buildings, also make use of Cat 5 or Cat 6 UTP cable. These can also be used for transmission of analog balanced video signals. The Bosch UTP converter fits into the surface mount box to provide a discrete and protected solution.

The use of Internet Protocol (IP) to transmit video signals over a conventional data

network is rapidly increasing in popularity. In this type of network, a video encoder converts analog video signals to IP so that the images are sent digitally at Internet speeds to the video recorder or central station monitor, improving rapid response and reducing costs. Bosch offers a full range of Video Encoders that translate analog video signals to digital for use with dome CCTV systems.

Ease of Installation

Sadly, easy installation is often talked about but rarely achieved. The inherent design must be such that the dome and camera are installed and adjusted without special tools by a single person. As an example, a dome should have a test video output accessible when the camera is mounted, to allow camera alignment and focusing at the camera site. A three-dimensional hinge (pan, tilt and rotation) makes adjustments especially easy and provides installers with the ability to select precisely the exact camera angle needed. This mechanism allows the camera to be rotated as well as moved horizontally and vertically. As necessary to capture all activity within its field of view.

With fixed cameras it is essential to set up the view at the installation site. To ensure the correct view can be set easily, and the lens is properly focused, Bosch VariFocal lenses on FlexiDome cameras are equipped with a miniatur



IEC 60068-2-75 Impact Test

In this test, a weight is mounted on a one-meter arm or lever. The weight is allowed to fall and impact the test object. The higher the arm is raised, the more energy is dissipated.



monitor jack. Cameras can be fine tuned locally using the programming buttons and on screen menus. However, it is also possible to use Bosch Bilinx two-way communications over the video cable to fine tune the set up remotely, from the Allegiant Matrix system, Dibos or Divar Digital video recorders or the configuration tool on a PC.

Quality and Reliability

Quality is the result of good design and extensive testing in development, including accelerated lifetime tests. Reputable products are tested against a wide range of standards, not just the minimum to satisfy UL, FCC and CE requirements. The lifetime of a camera should be long often demonstrated by multiple year warranties from the manuf-

acturers and of course a high Mean Time Between Failure (MTBF) figure.

Thanks to the recent advancements in dome camera design, combining innovative, high-performance features and a rugged dome provides a solution that is ideal for a very wide range of applications and opens up new opportunities that meet even the most demanding surveillance requirements.

The Bosch series of FlexiDome cameras now offers all advancements of high definition imagery while keeping a low profile on surveillance.

Bosch Security Systems, Inc.

For more information please visit

www.boschsecurity.us

866-CCTVREP

All rights reserved.