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CCTV Cameras Explained

how do i choose the best CCTV system?

The latest CCTV camera technology is advanced and sophisticated, requiring specialist knowledge to install and set up correctly. There is a vast array of CCTV security options, together with technical terminology that you may not have heard of before. So CCTV Smart Systems decided to create this easy read guide to help you understand CCTV cameras better when considering the best-Closed circuit TV installation for your home or business. If you need any help while reading this guide.

please call us on 0800 0132341 or use the contact form.

When thinking about buying a high definition camera system, many factors must be considered, for example how the system will be used or used for, technical specifications and constraints of the environment into which the system is installed. Each section of the buyer's guide below will inform you about the different aspects of CCTV cameras.

CCD Chip Size & Chip Sets

The main function of a CCTV camera is to capture light and convert it into a perfect video signal. At the core of a CCTV camera is a CCD sensor (Charge Coupled Device). This converts light into an electrical signal. Signal processing converts the electrical signal to a video signal that can be displayed on the screen or recorder.

A typical CCD is made up of optical detector integrated circuits that use semiconductors. The CCTV camera lens focuses light on the CCD image sensor. Photodiodes sense the image areas of light and dark and this results in an electrical charge in proportion to the level of light. Then the brighter area will result in a higher charge. The photodiodes form a matrix of rows and columns and are called picture cells or Pixels. The charge on the diodes is then processed.

CCDs have a variety of surface sizes, typically 1/2 inch, 1/3 inch, 1/4 inch and 1/8 inch. To summarise, these are not the actual sizes of the sensors, but based on their video camera tube equivalent, as historically, image sensors were used to replace video camera tubes, so a sensor with a 1/4 inch digital sensor is more accurately described as a '1/4 inch video camera tube equivalent'.

Analogue Versus Digital CCTV Cameras

What is Analogue CCTV? In an analogue camera system, the camera captures an analogue signal and this is transferred via a coax cable to the DVR (Digital Video Recorder). The DVR converts the analogue signal to a digital one, compresses it and this is stored on a hard drive within the DVR. The footage can be viewed on monitors attached to the DVR or the signal can be sent across a network to be viewed on a computer screen. The DVR can be set up to transmit over the internet and when this is done with an analogue system, all of the cameras' signals are sent as one stream using one IP address and this makes it very efficient.

Digital IP Network Camera

With digital IP (Internet Protocol) cameras, each camera captures an analogue signal, but this is converted to a digital signal within the camera itself. Digital processing may also occur within the camera. The digital signal is then sent via a LAN (Local Area Network). The cables used here are Ethernet, e.g. Cat5e.

Instead of the analogue system's DVR, for IP cameras, the video from each camera is compressed and recorded onto an NVR (Network Video Recorder). The key difference is that the signal is digital and a much higher resolution (see further down in this guide) than analogue. The NVR streams the video from all cameras and broadcasts over LAN and over the internet for remote viewing.

DSP – Digital Signal Processing

Digital signal processing cameras utilise a DSP chip to convert analogue video signals to digital. The analogue signal is generated by a CCD chip (charge coupled device – see above) and then the DSP chip converts to digital. DSP camera benefits include increased brightness, greater stability of the image, a sharper image and better power efficiency. There is also reduced sensitivity to noise.

CCTV Camera Cables and Connections

An effective CCTV camera system requires correct and high-quality cabling and connectors to connect the components of the system together.

Siamese Coaxial Cables

This cable is two cables joined together to supply power and the video signal. This cable is otherwise known as RG59. The video element of the Siamese cable allows transmission of the video signal from the camera to the DVR. The power cable supplies power to the camera from the power box. The power cable uses a BNC connection. Siamese cable is compatible with analogue camera systems or High Definition (HD) systems that utilises coax, e.g. HD-CVI or HD-TVI cameras.

CCTV Smart Systems think that it's very important to use the right gauge cable, i.e. the thickness of the cable. Gauge is measured in AWG (American Wire Gauge) and the smaller the gauge the thicker the cable. Thicker cables allow it to use power more effectively and cable gauge should be chosen based on the application.

CCTV over Cat5e Ethernet Cables

Cat5e cable can be used for analogue or IP cameras and allows video transmission of up to 3000 feet.

This cable uses the RJ45 connector. This is a popular cable for CCTV systems and is vital to IP camera systems. Cat5e is ideal for analogue systems but needs to use a video balun (converter) to allow traditional coax to be replaced.

Cat5 cables are poor quality and not to be used with CCTV systems, Cat5e is the better cable for these applications.

How you power your cameras is something else to keep in mind with Cat5e. There is a system called PoE, Power over Ethernet, which we will discuss now.

PoE – Power over Ethernet

PoE (Power over Ethernet) is a technology that allows cameras to be powered from a single Cat5e network cable. Normally a camera requires 2 cables, one for video signal and one for electrical power. If a camera is enabled with PoE then only one cable is required that supplies power and also handles the video signal.

What are the Benefits of PoE?

Saves time and cost – savings can be made by not having to install electrical cabling. Network cables do not require a qualified electrician for installation.

Location of cameras – as cameras do not require a power outlet, they can be located anywhere and can be relocated easily if required.

Safety – PoE is an intelligent system and protects equipment from incorrect installation, power overload, or underpowering.

Reliability – power originates from one source rather than disparate wall sockets, so improves the reliability of power. PoE can be backed up with another power supply in case of failure.

Scalability – distribution of the network is easier with PoE.

Wired and Wireless
Cameras can be wired or wireless.

Wired cameras use cables with PoE (Power over Ethernet). PoE means that you only have one cable attached to each camera, making installation easier.

The signal from wired cameras is not affected by the loss of internet or interference, so the signal is more reliable. Wireless cameras are affected by the loss of Wifi or a weak Wifi signal caused by walls and weather for example.

Wireless cameras have the major benefit that no holes need to be drilled into walls and if you remove the wireless camera installation then the property is unaffected and left as it was prior to the installation.

Wired cameras are usually used in commercial and business settings whilst wireless is more popular for residential use.

WIRED CAMERAS
ADVANTAGES DISADVANTAGES

1. Limited interference from other devices More difficult to install
2. Signal is not easily hacked or jammed
3. Holes drilled in walls to feed cables
4. Good for different protected zones
5. Not portable and easily moved to another location.
6. Good for large buildings
7. Picture quality better than wireless

8. Signal more stable than wireless

WIRELESS CAMERAS ADVANTAGES DISADVANTAGES

1. Quick and simple to install
2. Can be affected by interference causing failure or false trigger of motion detection
3. No holes in wall required
4. Potential to be hacked
5. Cameras can be located anywhere but need to be within Wifi range
6. More expensive than wired systems
7. Portable and can easily be moved to another building
8. Needs one cable for power

Book one of our engineers to come help with wireless security cameras.

What is the best CCTV Camera Resolution

Camera resolution is defined as the amount of detail that a CCTV camera can capture. Resolution is measured in pixels. A higher number of pixels means more detail and larger images without blur or being grainy. Resolutions are measured in Megapixels, which is just over one million pixels, 1,048,576 to be precise. The horizontal resolution is multiplied by the vertical resolution to arrive at the total value in megapixels.

CCTV Camera Common Video Resolutions

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Hikvision	5 Megapixels 2592 x 1944	4. Channel System	£899 + Vat
Qviz	4 Megapixels 2592 x 1520	4 Channel System	£799 + Vat
Swan	2 Megapixels 1600 x 1200 1080p HD	4 Channel System	£599 + Vat
UNV	3 Megapixels 2048 x 1536	4 Channel System	£699 + Vat

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HD – High Definition: As of 2017, Analogue HD CCTV supports resolution of 720p and 1080p, whilst digital IP cameras support 720p all the way to 5 Megapixels.

Frame Rate: Typical frame rates of CCTV cameras are 25 FPS (frames per second). This means smooth video, whilst also keeping file size lower on the DVR hard drive.

Lenses: A CCTV lens is made from glass and focuses light from the scene onto the camera's image sensor.

Field of View: This is the width or height of the scene monitored by the CCTV camera.

What is Depth of Field?

The depth of Field (DoF) can be defined as the zone that is focused on the video image, on the front to back axis. So, in all video there will be an area in front and behind the target area that is in focus. Sometimes there will be a very small focused zone and this is called shallow depth of field and a large zone of focus is called deep depth of field. Three key factors affect DoF: aperture, camera distance from the subject and the lens focal length.

Focal Length: The lens' focal length determines the field of view at specific distances.

Varifocal Versus Fixed Lenses: With a fixed lens, you cannot adjust the focal length, zoom or angle of view. Most fixed lens cameras use a wide angle. On a varifocal lens, these settings can be adjusted.

More about Varifocal CCTV Cameras

Varifocal lens security cameras are generally more expensive than the fixed spectacles but offer the following advantages. With a fixed lens, your installer would have to physically move and reinstall the camera to adjust the field of view. With a varifocal lens, the installer can adjust the focal length to change the field of view. With a varifocal lens, the settings can be adjusted to capture a specific localised area at your premises, whether that be a doorway or a window etc. Even if a camera is positioned far away across a room then it's still possible to zoom in and focus on the doorway. In other words, it's easier with varifocal to capture the action you need. The people or objects in that area will be larger and therefore better for identification and to use as evidence. Sometimes the only location for a camera outside is under a roof overhang, but this may be too far away from the area you want to view and the solution without moving the camera mounting position is to use a varifocal lens and zoom into the scene you want to capture.

CCTV Smart Systems recommend and use varifocal lenses for our installations as we can adjust the lens easily and they are generally easier to work with.

Types of Iris: Auto, Fixed & Manual Iris. **What is an Iris?**

An iris is an opening or aperture that controls the level of light that travels through the lens. This is known as ‘exposure’. A CCTV camera iris works in a similar way to a still camera, the more open the iris is, the brighter the image will be. Control of the iris is important in increasing the quality of the image. The iris ensures an optimal light level to the CCD image sensor so that images are clear, sharp and have good resolution and contrast (see further down this guide).

Fixed Iris: A CCTV camera with a fixed iris is ideal for settings where the light levels are constant, for example indoors. These cannot be adjusted and are the least expensive.

Manual Iris: Similar to fixed irises but can be adjusted manually when installed. Again, suitable for indoor use.

Auto Iris: An auto iris is part of a motorised lens and has the ability to automatically adjust to keep a constant level of light in the video image – this is useful for environments where the light levels change, for example outdoors.

P-Iris: This is a ‘precise’ iris. It auto adjusts like the auto iris, but additionally, the camera’s software allows improved video clarity and depth of field. The key aim of the P-Iris is to improve the quality of the image by allowing optimal iris position so that the central, best-performing part of the lens is used as much as possible.

CCTV Smart Systems generally uses auto iris as it’s commonly available and because the camera adjusts itself in various light conditions, saving time and cost.

What is Pan, Tilt, and Zoom (PTZ)?

Pan, tilt, zoom (PTZ) is a type of IP camera where it's possible for a user to control the position and movement of the camera lens remotely using an internet browser or specialised software.

Panning is the horizontal movement of the lens, left and right. Tilting is movement in the vertical axis, up and down. Zoom is the changing of the focal length of the lens to bring the subject closer or further away.

PTZ CCTV cameras often have the ability to have preset positions, so that the operator can easily monitor different images. Some PTZ cameras use 'triggers' so that when triggered by moving the camera is directed to a preset position, e.g. a doorway or valuable object. Some cameras also use auto-panning so that the camera moves automatically between presets, allowing a wider surveillance area.

The benefits of PTZ is that remote operation of pan, tilt, zoom allows an operator to cover a much wider area with one camera, saving money. Also, large areas can be covered with automatic presets.

Some PTZ cameras can use their PTZ functions to track moving targets.

What is Video Motion Detection?

Video motion detection (VMD) is the ability of a CCTV system to detect movement and switch on the recording. The VMD is controlled by the Digital Video Recorder.

For a business setting, VMD allows the operator monitoring the CCTV to not be continually focused on camera footage where there is no change in the image. The VMD system processor monitors the cameras continuously. Where there is no operator, VMD is useful to save hard drive space on the DVR as it will only record footage where motion is detected. Also, all the footage that is recorded will have movement events which can be played back to monitor, saving time on monitoring.

Motion detection will compare the current image to the previous one and if any of the pixels have changed then it has detected movement.

grey-white-varifocal-dome

Auto-Tracking Objects with PTZ CCTV Cameras

Automatically tracking moving objects can be achieved with PTZ auto-tracking, which is a type of camera software closely associated with motion detection. Auto-tracking takes motion detection one step further and calculates which part of the image is moving and then defines it as an object. The camera will then move to keep that object in the frame. This is useful for tracking an intruder and generating evidence.

What is Contrast? Contrast is the separation between the brightest and darkest areas of the video image. Increasing contrast increases the separation between bright and dark, so shadows, for example, will appear darker, whilst light areas will be brighter. If the contrast is decreased then shadows will become lighter and highlights darker, bringing each one closer to each other.

Monochrome Versus Colour

Cameras are available that capture video in colour, monochrome (black and white) or switch between these. The switching cameras are used for low lighting environments and the reason for using these is that monochrome is more sensitive to low lighting environments. Also, monochrome can be used with infrared lighting.

What is Night Vision? Night vision is the ability for a camera system to have a vision in complete darkness or improvement of vision in low light.

Near-infrared illumination is a popular method of night vision. With this method, the camera's CCD detector is sensitive to near infrared radiation which is invisible. This is coupled with the infrared light emitting LEDs on the camera. At night, a lux (unit of illuminance) sensor on the camera detects low light levels and then switches the camera chip to monochrome and turns on white led lights and red infrared lights, the camera then records in black and white and you can see a clear picture recorded on the system.

Many incidents of crime will occur in the night time and so it's important to install cameras that perform well at night.

What is License Plate Recognition CCTV Cameras?

Camera systems can also be enabled with LPR (License Plate Recognition). The British Police first invented LPR in 1976 and initially, it was a crude system with limitations, but several decades later though it is advanced and reliable.

LPR captures images or video of license plates and when processed this results in a text entry of the license plate.

What are Best Branded Versus Non-Branded cameras?

Branded Hidden cameras are preferable to cheaper non-branded models. With branded cameras there is a quality control process, the cameras comply to all relevant standards in Europe and they are more durable and reliable cameras. Unbranded cameras are not certified products. We use branded products as they are better quality.

QVIS is a good quality brand, but high-security organisations such as banks use Honeywell as they offer even better quality. Sony and Samsung are also very high quality.

Physically, unbranded and branded cameras may look the same or similar, but unbranded do not perform as well in terms of image quality.

My Final Thoughts

As you can see from reading this article, there are many parameters involved in choosing a CCTV camera. The variety of options can be bewildering and for the uninformed, choosing the right cameras for a specific application is not straightforward. Every link in the chain in a CCTV system is important, from the actual camera and its functionality to cabling and electrical power considerations. Each element needs to work together in harmony to deliver the best possible video image. We hope that you now have a better understanding of CCTV cameras and their application.

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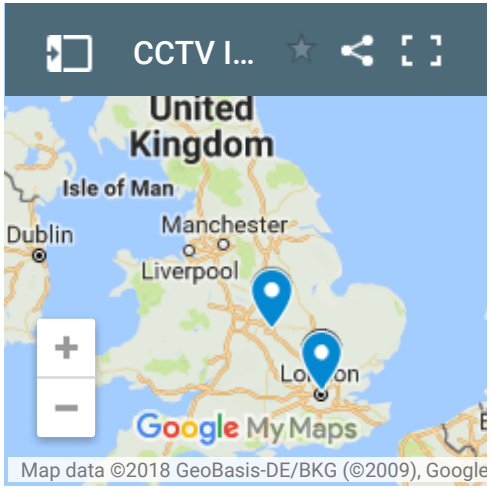

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