

## Inter-Pacific Camera Selection Guide

Below is a guide to CCTV technical terms and to some of the possible ways to view your CCTV images.

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### CAMERAS

#### General Information

The images you see and record can only be as good as the images produced by your CCTV cameras. There are several critical specification factors which affect the performance of your cameras and consequently the quality of your camera images. These also influence the cost of cameras.

#### The Main Performance Factors are:

**IMAGING CHIPS IN THE CAMERA** – CCTV cameras produce images using CMOS or CCD chips. CMOS chips are usually found in cheap tiny cameras which produce poor quality images and have very poor light sensitivity. The CCD cameras are of much higher quality and come in ¼", 1/3" and ½" lens size. Panasonic and Sony are generally recognized as producers of the best CCD chips. Wherever possible use cameras with Sony chips.

**TV LINES** - Resolution is the ability of a camera to resolve detail. Simply put, the higher the resolution the sharper the image and the more lifelike. Resolution is known by the number of TV lines that the camera produces. The larger the number of TV lines the better the resolution and hence overall picture quality. For a black and white camera a medium resolution camera has approx 420 TV lines, where as a high resolution has 600 TV lines. For a color camera a medium resolution has 380 TV lines and high resolution has 480 TV lines.

**LIGHT SENSITIVITY**– Sensitivity ratings are generally given in "lux" (a light level

measurement). The lower the lux number, the lower the light levels at which the CCTV camera will produce an acceptable image. In other words, the lower the lux level rating, the more light sensitive the camera. B/W cameras generally have lower lux level ratings than color cameras. A lux rating of 1.0 or less is considered good for color cameras, while 0.1 lux or less is considered good for a B/W camera. Below are the light levels in Lux for different times of the day.

Light levels at different times of the day

LIGHTING	LUX LEVEL
Unobstructed Sun	100,000
Sun with heavy cloud	20,000
Sunrise/sunset	5000
Twilight	4
Full Moon	0.2
Quarter Moon	0.007
Moonless Night Sky	0.0007
Overcast Night Sky	0.00005

**F-STOP** – Aperture is the light gathering area of the lens. The aperture is measured by the F-stop number. A low F stop will mean the lens can pass more light in dark condition, allowing the camera to produce a better image in low light situations. A good minimum F stop number to look for is F1.2.

**WHITE BALANCE** – White balance feature compensates for the temperature color casts that different light sources can cause. Color casts can make white appear with a slight tint under different light sources. No single lighting type has a fixed color temperature thus accurate rendering of white cannot be guaranteed.

**AGC**- Automatic Gain Control. AGC compensates for fluctuations in illumination which would cause the video output level to be too low. It only applies gain to a reasonable level. So AGC should be left on because it only works when needed. However, light must be present at the scene otherwise a poorly light scene will appear noisy and grainy.

**EI** – Electronic Iris. EI is the opposite of AGC because it is used to compensate for increases in video level illumination. For example, the setting and rising sun can lead to too much light flooding the camera thus causing an overexposed white-out. EI can overcome this by varying the shutter speed in the CCTV

camera. Shorter duration shutter speed allows the CCD less time to gather sunlight preventing over exposure. However, too much light to the CCD from headlights can result in smearing.

**BACKLIGHT COMPENSATION** – Situations frequently arise where there is bright light coming from behind the subject of interest. The camera's exposure system sets itself to the average light in the scene. For example, a person entering a scene may appear as a silhouette. BLC shifts the exposure towards the light level in the part of the scene that is of interest to the viewer. Thus the subject will be seen more clearly although the lighter background may become a whiteout.

## **CAMERA TYPES**

**BOX STYLE CAMERAS** – Body cameras include the more professional range of cameras. Each camera is supplied only as a body allowing the user to add the most appropriate lens for the particular situation. Body cameras can be mounted in external housings and are suitable for use in conjunction with wireless transmitters and receivers.

**Box Cameras**

**Bullet Cameras**

**Dome Cameras**

**Covert Cameras**

**Pan Tilt Zoom (PTZ) Camera**

**Day/Night Cameras**

**Infrared Cameras**

**Board Cameras**

**Vandal Proof Cameras**

**Weather Proof Cameras**

**DAY/NIGHT CAMERAS** – Night Vision Cameras are intended to provide reasonable images in low or zero light conditions. There are some cameras available today which can provide images in zero light with no lighting whatsoever. However they are very expensive and we do not include any in our range of stock cameras. Where night vision is desirable, this can be achieved by using infra red lighting – invisible to the human eye but well within the range of today's cameras. We supply a range of cameras with in-built infra red lights (long life LEDs) which turn on automatically as light levels fall. Cameras which provide color images during the day will give black and white images at night. Where infra red cameras are used in conjunction with internal or external lighting some color variations may arise.

**OBSERVATION CAMERAS** – Our Observation cameras are designed to operate in conjunction with our Observation Kits. They provide video and audio reception and, in certain cases, two-way audio. However, they can equally well be used as part of a standard CCTV installation although audio, where the configuration allows it, will only be available one-way.

## **LENSES**

### **General Information**

It is important to use the right lens for the right conditions and desired field of view; otherwise the images seen and/or recorded will not be satisfactory. CCTV cameras with an integral lens do not offer lens choices and need to be selected in the light of your particular needs. The important factors that govern the choice of lens are:

**FOCAL LENGTH** – Lenses either have a fixed or variable focal length. Fixed length lenses, means that the angle of view is fixed. Manually variable focal length lenses are called Vari-Focal Lenses and provide an adjustable angle of view (at set up). The Vari-Focal lenses are easier to set up to meet your particular viewing needs and can be altered if you change the location of your cameras. Electrically powered variable focal length lenses are called Zoom Lenses and while they are often used in high-end video surveillance systems, they are generally too expensive for use in most systems.

Lens Focal Length (mm)	Viewable Angle (Degrees)		5 feet away	10 feet away	15 feet away	25 feet away	50 feet away	100 feet away
	Horiz.	Vert.	Horiz. Vert.	Horiz. Vert.	Horiz. Vert.	Horiz. Vert.	Horiz. Vert.	Horiz. Vert.
3.6	74	55	7.5 5.2	15.1 10.4	22.6 15.6	37.7 26.1	75.4 52.1	151 104
6.0	42	32	3.8 2.9	7.7 5.7	11.5 8.6	19.2 14.4	38.4 28.7	77 57
8.0	32	24	2.9 2.1	5.7 4.3	8.6 6.4	14.4 10.7	28.7 21.3	57 43
12.0	22	17	1.9 1.5	3.9 3.0	5.8 4.5	9.7 7.5	19.4 14.9	39 30
16.0	15	11	1.3 1.0	2.6 1.9	3.9 2.9	6.6 4.8	13.2 9.6	26 19

Note: the figures in the above table are approximate as there is always some variation between lenses.

The focal length of the lens is usually given in Millimeters (mm). Focal lengths of most CCTV camera lenses vary from 3.6mm to 16mm for fixed focal length lenses. In general short focal length lenses (e.g. 4mm) have wide fields of view. Objects appear to become smaller, rapidly, as distance from the camera increases. As the lens focal length increases, the field of view narrows and more distant objects are easier to define.

If, for instance, you wanted to be able to positively identify people 25 feet away from the camera, a short focal length of say 3.6mm would give such a large field view that recognition would be uncertain. An 8mm or even 12mm lens would be far better. In many cases the choice of lens will be a compromise between a desire for detail and the need for a reasonable field of view. A Vari-focal length lens will allow you to select the best compromise for your own situation.

**C AND CS MOUNTS** - Modern cameras and lenses are generally CS mount (e.g. CCD Camera) rather than C mount (e.g. CMOS). However, this is only a general rule. With CS mount cameras both types of lenses can be used but the C mount lens requires a 5mm ring to be fitted between the camera and lens to achieve a focused image. With C mount cameras it is not possible to use CS mount lenses as it is not physically possible to mount the lens close enough.

**THE LENS IRIS** – CCTV Cameras that are used in good and constant light conditions (e.g. indoors with electric lighting) will perform satisfactorily with a "Fixed Iris Lens".

In situations where there is either constant dim or very bright light a "Manual Iris Lens" can be used. The Iris aperture is adjusted to give the optimum camera image quality.

In varying light conditions, for example outside, the iris on the camera will need to be able to open and close to accommodate changes in illumination. Lenses with electrically powered irises which automatically adjust to light conditions are called "Auto Iris Lenses". These cost slightly more but do a much better job in varying light conditions.

## **OPTIONS TO VIEW CCTV**

### **THROUGH YOUR TELEVISION**

The easiest and cheapest way is by putting a SCART adapter on the end of the CCTV camera cable at base station and plugging it into the SCART socket of your television or video.

Alternatively the video and audio signals from a CCTV camera can be converted into the same type of signal used to transmit television programs. In this way your CCTV pictures can be viewed on your television as another TV channel. In order to achieve this, a device called a RF Modulator is needed which connects your camera output into your TV aerial. In this way it is possible to view CCTV images on any television connected to the aerial system.

Some cameras have in-built motion detectors (PIRs) which, when used with a TV switcher, can trigger viewing on your television or can activate a recording.

### **MONITORS**

A CCTV monitor is virtually the same as a television receiver except that it does not have the tuning circuits. A picture received directly from a camera and displayed on a monitor is an analogue representation of the scene. Thus the clarity of the picture is dependent on the quality of the camera, lens, the transmission system and the monitor.

A basic monitor can only display the video images from one camera.

More advanced monitors can display multiple camera feeds sequentially. There

are two channel B/W monitors as well as four channel B/W and color monitors that we stock. Two or four channel monitors come with manual or automatic switching between channels. The dwell time, which is the time between switching from one camera to the next, can be adjusted. Thus the dwell time will be the same for each camera in the system. If your camera has an audio facility it is possible to listen in at the monitor. This type of monitor is best suited to situations where there is little activity to view or record.

Quad monitors (real time) can display four channels at the same time in four segments, sequence the channels, display channels in a variety of layouts or display a single channel of your choice. They can even provide a freeze facility with zoom! Thus up to four cameras can be viewed and/or recorded simultaneously. Quad monitors are ideally suited to applications where there are areas being viewed which include high levels of activity and an immediate and constant view is desirable.

## **SWITCHERS**

A sequential switcher unit switches between cameras at a set delay. The delay can be adjusted by you. You can also over-ride the switching and select one camera.

## **QUAD**

A Quad can display and record four channels simultaneously. The display can be in four segments, or each channel can be viewed sequentially.

## **TIME LAPSE VIDEO RECORDERS**

Time lapse video recorders record images from 3 hours to 960 hours on an ordinary 3 hour video tape. The longer you set the tape to last the fewer the images recorded. The time and date are also recorded.

A normal video recorder can be used as long as it has a SCART adapter. However, it should be noted that in most cases the date and time are not recorded and will record for shorter periods.

## **DIGITAL VIDEO RECORDERS**

A Digital Video Recorder (DVR) is a method of storing video information in digital form as opposed to analogue recording. There are two main types of DVR which is a standalone hard disc based DVR or a Card which can be inserted into a PC. DVR's record all the time, by schedule, on alarm input or by motion detection. For review, rather than having to watch hours of tape, you can search by time and date and the activity bar clearly indicates when recording has taken place. The DVR has alarm inputs and outputs so if a motion detection device is

triggered it can start to record and trigger an output (e.g. dial to a telephone, pager or send an email alert).

A significant benefit of a DVR is that, once it has been set up, it can be located and left unattended in a secure location. The DVR can be accessed from other PCs via a local area network, wide area network or via TCP/IP. All camera images can be viewed real-time, recorded, or review previously recorded video from a remote PC anywhere in the world via the internet.

## **FRAME RATES**

## **HARD DRIVE RECORDING**

## **HOUSINGS**

Housings, in essence, are casings used to protect cameras from a variety of conditions. For cameras to work at their optimum, certain factors have to be taken into consideration when choosing a housing.

- Location
- Risk of vandalism
- The weight of the housing including the camera contents inside.
- The housing has to provide enough physical space for the camera, lens, wiring, connections as well as maintenance.

Housings should be mounted onto load bearing points. For example, not the top five or six levels of brickwork on a building.

Environmental conditions should be of primary consideration. For example if a camera housing is by the coast it will have to have a marine finish to protect it from the salt which can prematurely corrode the housing.

Climate changes constantly occur which can affect the workings of the camera. When the temperatures are hot, air blowers and sun shields are required. When temperatures are cold a camera may require a heater.

The degree of protection that a housing affords is defined by the IP number. As a general rule the higher the IP number, the higher the degree of protection offered (Also used for weatherproof/waterproof cameras).

The first digit is the degree of protection that is provided with respect to

equipment inside the enclosure.

1 <sup>st</sup> IP Digit	Degree of Protection	Definition
0	Zero protection	No Special protection
1	Protection against solids greater than 50mm	Large surface of human body such as a hand, none against deliberate access
3	Protection against solids greater than 2.5mm	Tools/wires etc. of thickness or diameter greater than 2.5mm
4	Protection against solids greater than 1.0mm	Wires or strips greater than 1.0mm
5	Dust protected	Total protection against dust is not provided but sufficient to allow satisfactory operation.
6	Dust tight	No ingress of dust

The second digit is the degree of protection that is provided with respect to harmful ingress of water.

2 <sup>nd</sup> IP Digit	Degree Of Protection	Definition
0	Zero protection	No special protection
1	Protection against dripping water	Vertically dripping water shall have no effect
2	Protection against dripping water when tilted up to 15 degrees	Vertically dripping water shall have no harmful effect, when enclosures is tilted at any angle up to 15 degrees
3	Protection against water spray	Water falling as a spray at an angle up to 60 degrees from vertical shall have no harmful effect.
4	Protection against splashing water	Water splashed against the enclosure from any angle shall have no harmful effect.

5	Protection against water jets	Water protected from a nozzle against the enclosure from any angle shall have no harmful effect.
6	Protection against heavy seas	Water from heavy seas or water projected by powerful jets shall not enter the enclosures in harmful quantities.

## VANDAL PROOF CAMERAS/HOUSINGS

It is sometimes required to mount cameras in situations where they could be subject to attack and vandalism. In these types of situation not only the camera has to be protected but also the cables. The type of housing used is constructed of heavy gauge steel with a thick laminated glass or shatterproof plastic window.

## CABLE

There are two main types of cable. These are Coax and Twisted Pair.

The most common type of coax cable is RG59 which has a maximum recommended range of 750 feet, beyond which it can suffer from electrical interference unless appropriate measures are taken. Pre-assembled lengths of coax are available with BNC connectors at both ends. Coax cable offers good quality images and has been the industry norm for many years. However it does have drawbacks. Coax cable does normally carry audio signals so if audio is required a second cable is needed. Also fitting connectors onto coax can have its frustrations. If a number of cameras are being connected via coax, the mass of cable can become unwieldy..

Twisted Pair cabling allows transmission of video and audio up to 1200 feet. Four pairs of cables are available in a single sleeve. The range of twisted pair cables can be extended to 2000 feet by using special "active" balun connectors. The main advantages of Twisted Pair cable are its ability to reject unwanted interference, lower losses at high frequencies per unit length and simpler connection.

## POWER

All CCTV equipment needs power in order to operate. CCTV cameras require DC12V or AC24V.

It is not always possible to have a power source local to the camera, e.g. in outbuildings, stables, etc. In this case it is possible to use composite cable (either coax siamese or twisted pair cable) which enables the power for the camera to be run from the monitoring location alongside the video/audio cables.

## WIRELESS CCTV

Wireless transmission consists of a transmitter at the camera end and a receiver at the control end. Wireless transmission systems require that there be as near as possible a **direct line of sight** between the transmitter and receiver. Normally there is one transmitter and one receiver for each camera although there are receivers that can receive multiple signals. The distance between the two locations is critical to the choice of equipment.

The performance of Wireless CCTV can be affected in many ways. Depending upon the frequency being used, radio signals find solid walls difficult to penetrate and metal almost impossible. Any camera located in a metal structure, e.g. barn, will need to be connected to a transmitter outside the building. Also the composition of walls and ceilings can play an important part in the success of a wireless CCTV environment. As a general rule, the denser the wall structure the harder it will be for the radio signals to penetrate. Thus old stone-built properties with solid floors and slate roofs can present problems unless transmitters and receivers are located externally. Inclement weather, e.g. fog and rain, and certain atmospheric conditions can also affect the effective range of wireless transmission. Thus, as a general rule, always have a transmitter which is capable of transmitting double the distance than you actually require. If you live in very close proximity to a TV transmission station or a local radio controlled taxi company you may also face problems (whilst they are not transmitting on the same frequencies, the strength of their high powered signals can disrupt signal transfer).

### Transmission Frequencies

There are a small number of frequencies which have been allocated for "short range" transmission of CCTV signals for which a license is not required. In addition to the restriction on frequency, there are also rules relating to output power of transmitters and bandwidths of signals.

2.4GHz is considered by many to be the "amateur" frequency. Many claims are made of the frequency's inability to transmit more than a few yards, and its

proneness to interference (e.g. Microwaves). Certainly a professional installation would probably not choose 2.4GHz, but it can produce quite acceptable results for most short range installations.

5.8MHz offers a greater flexibility with the number of channels (maximum 16 using a mix of vertical and horizontal alignments) and provide a better transition signal.

By installing high gain antennae on both transmitter and receiver it is possible to increase transmission ranges by as much as 14 times the normal range.