

What Is CCTV

Closed Circuit Television, also known by the acronym CCTV, is a private or closed video system where viewing of the video is restricted to a specific group of individuals. Systems can range in size from being within a single building, to a complex of buildings, to large campuses and city centers, and can even span across a continent. Such monitoring of areas and/or activities may be used for security, safety, industrial, or private purposes. The visual images created by a CCTV system may be viewed while an event is happening or recorded for 'after-the-fact' review either on-site or off-site. Review is done via the use of VHS videotapes, CD, DVD, and/or other such tape or computer based mediums. Such reviews of prerecorded visual information may also be done 'remotely' through the use of telephone lines, fiber optics, microwave, the internet, and/or a host of other such transmission methods according to the design and complexity of the CCTV system.

CCTV is a visual surveillance technology designed for monitoring a variety of environments and activities all at the same time. CCTV systems typically involve a dedicated communications link between cameras in the field and monitors at one or more control centers. Systems can be made up of technically mature analog cameras and image storage devices, or newly developed digital cameras and image storage devices, or a mix of the two technologies.

CCTV systems may provide real-time, time-lapse, event, or digitally recorded surveillance information to help in detecting, responding to, investigating and providing evidence for security, safety and related incidents. A CCTV system may also be used to prevent security breaches by allowing security personnel to monitor access control systems at entry points to secure areas.

A CCTV system usually involves a linked system of cameras able to be viewed and operated from a series of control rooms and/or a central point of operation. Cameras come in many configurations, but can be classified under two general categories; stationary and moving. Stationary cameras are pointed at a specific scene of interest, such as a hallway, and broadcast that one scene to the control site 100% of the time. Stationary cameras can be adjusted to compensate for the specific lighting conditions of that scene. Stationary cameras can be fully exposed, or contained within a large variety of enclosures designed to meet the specific requirements of that site, such as discreteness or vandal resistance.

Moving cameras, commonly called PTZ (for pan, tilt, zoom) allow a system operator to move the camera by remote control to follow an object of interest, such as a person or a car, over a large area of interest. This is typically done by use of a joystick in the control center that provides side to side (pan), up and down (tilt) and zoom control. PTZ devices can also be programmed to move in user-defined PTZ sequences to provide general surveillance of areas of interest. PTZ devices can be further programmed to automatically move to areas of interest, such as when a door or gate opens, or when motion is detected. Because the camera can be aimed at scenes with different lighting conditions, these cameras typically have many automated adjustments, such as auto focus and auto iris to keep the image optimized for accurate viewing.

Some systems may involve sophisticated technologies or electronic interfaces such as; night vision or low light cameras for operations at night; computer-assisted operation; interfacing with electronic alarm systems; interfacing with electronic access control systems; and much more. For example, a camera that is integrated with a motion detection system would enable alerted security staff to remotely investigate potential security incidents from a central control center as the event is happening. Other sophisticated CCTV systems incorporate technologies that make possible features such as the multiple recording of many cameras, in different locations. CCTV is also sometimes used to capture images for a facial recognition biometric system.

CCTV System Effectiveness

CCTV systems have proven to be essential tools in most any surveillance and security application. Just a partial list of applications includes banking, retail, hospital, traffic management, and city centers. In all of these applications, video cameras are used as visual tools of the security staff or security design. CCTV systems greatly increase the geographic areas that can be covered by one security professional. No longer are long, arduous guard tours needed, requiring an individual to walk or drive long distances to provide security. And once an event has transpired, video can be used for investigation and evidence in criminal and civil liability cases. The installation of CCTV security systems thus provides a large deterrence to unlawful activity, and provides a strong sense of security to patrons of facilities that use CCTV. Due to great advances in the controlling or manipulating interfacing systems, video systems can be automated to great degrees.

Advancements in 'video motion' detection has given the system designer the ability to use video cameras in place of fence alarms, outdoor microwave motion detection systems, outdoor modulated infrared photo beam systems, leaky coaxial motion detection systems and more with higher degrees of effectiveness and accuracy. The video motion system may be programmed to do the following: detect motion when it is moving in a specific direction; detect motion of objects of specific sizes; detect motion within three dimensional areas; etcetera. Additionally, cameras on pan/tilt systems can be designed to automatically follow or track individuals or targets throughout their visual range.

Video non-motion detection systems may be designed into a CCTV system to detect the lack of motion of objects. This allows a large, open area to be view for objects left behind. Such technology also allows guards to concentrate on other facets of security.

To protect the privacy of individuals, advanced CCTV systems are available with many features designed specifically for this need. PTZ camera systems can be programmed so that specific areas of the viewed scene are overlaid with opaque shapes to prevent viewing of non-public areas, such as into homes through their windows. In addition, control systems can be configured so that only specific security professionals can view video from specific cameras that may be viewing "sensitive" scenes.

The net result or effectiveness of any/all CCTV systems is determined by the sophistication of the interfacing modules and to the extent that the system is designed as a visual tool for the security team.

Security Surveillance Performance

In modern video systems, it is very possible to have hundreds or even thousands of cameras. Therefore, the idea that an individual or group of individuals would be able to 'monitor' or 'view' the overall system, becomes inconceivable. For this reason, modern designs try to obtain systems that are "view free" and "hands free".

View free video is accomplished through recording "events" versus continuous recording of empty areas. Event recording is accomplished through various forms of 'alarm interfacing'. I.e.; A magnetic switch may be added to a door to trigger the camera's assigned recording device to record the image from the camera in the 'event' that the door is opened. This saves video storage room (tape, disc, or hard-drive) as well as precious time reviewing video information.

Hands free video systems are also accomplished through the use of various types of electronic, programmable triggers. I.e.; the door opened, the video recorder started recording automatically and continued until the door closed. This action frees the guard from being needed to control the function of the system versus responding to the situation.

Many systems today have the ability to be 'pre-positioned programmed'. This gives the designer or operator the ability to set up multiple view points in advance of need. In this way, cameras on pan/tilt systems (either mechanical or digital) can be programmed to automatically move from point to point in a pre-determined route. Additionally, alarm points (such as the door in the previous paragraph) can be added to automatically move the camera's view to the alarmed position when needed. Once again the operator is freed up to respond to versus operate the system.

CCTV System Resolution

The resolution of [CCTV](#) system is usually measured by TV lines in the field. The vertical TV lines have a maximum 350 TV lines in 525-line NTSC system and is not variable. But the horizontal TV lines, which are used as the parameter of picture quality, vary depending on the quality of camera, lens, transmission and monitor.

Camera Resolution

The industry of [CCD](#) video camera sensor uses pixels (picture elements) as its quality parameter. Medium resolution of B/W camera in EIA system is 510 horizontal pixels by 492 vertical pixels and is equivalent to 380 TV lines. High resolution is 768(H) x 492(V) pixels and equivalent to 570 TV lines. Color camera's medium resolution means 330TV lines and high resolution needs more than 460 TV lines.

Monitor Resolution

The monitors in NTSC system have 525 vertical scanning lines regardless of their size. The horizontal 700 TV lines of B/W monitors represents medium level and more than 900 TV lines means high resolution in EIA system. The color monitor's horizontal resolution of 300 TV lines means medium quality and that of more than 450 TV lines means high resolution.

To maximize the system's resolution, it is recommended to choose a monitor which has better resolution than that of the camera.

What is a CCD Chip

A CCD (charge coupled device) consists of several hundred thousand individual picture elements (pixels) on a tiny 1/2", 1/3", or 1/4" chip. Each pixel responds to light falling on it by storing a tiny charge of electricity. The pixels are arranged on a precise grid, with vertical and horizontal transfer registers carrying the signals to the camera's video processing circuitry. This transfer of signals occurs sixty times per second.

The 1/3" CCD chip is the most widely used sensor format these days; its size is 5.5mm (diagonal), 4.4mm (horizontal) and 3.3mm (vertical). The 1/4" sensor format, recently being used in color cameras, is 4mm (diagonal), 3.2mm (horizontal) and 2.4mm (vertical).

The CCD chip's [Electronic Shutter](#) plays a major role in making a fantastic and reliable picture.

* A C-MOS (Complementary - Metal Oxide Semiconductor) chip, also a video image sensor, produces much lower quality picture than CCD chip.

What is Electronic Shutter

Electronic Shutter, one of the major features of [CCD](#) camera, is not really a moving shutter, but a clever piece of signal processing. Under low light conditions, the CCD is allowed to gather signal at the electronic shutter speed of full 1/60th of a second. Under brighter lighting conditions, the video processing chip automatically responds by reading the CCD and then immediately "early purging" it, resulting in precise control over the video level. Even at a shutter speed of 1/100,000th of a second, the CCD camera is still delivering 60 images per second, but each image is gathered over a much shorter period of time. It doesn't end with the CCD...the image is constantly monitored and optimized by advanced on board signal processing circuitry. The end result is a fantastic picture, with no fiddling, no adjustments, and best of all, unbelievable reliability.

CCTV Camera Power Options

12VDC

Most board cameras, mini cameras and about one third of the professional cameras work with 12VDC, 100mA to 200mA for B/W cameras and 150mA to 300mA for color ones. These cameras usually have DC jacks to accept DC power plugs. You should be careful about the polarity (positive and negative) for this power source. 12VDC power can be supplied by AC Adapter or battery pack. You may even use a "power cord" plugged to the cigarette lighter in a car.

24VAC

About two thirds of the professional cameras work with 24VAC, 20VA to 40VA. The cameras usually have screw type connections and you don't need to worry about the polarity. This power is usually supplied by AC Adapter and you need to prepare separate power cable for the connection. Unlike 12VDC, this power can be transmitted to a long distance up to 450ft and is proper for the cameras that are to be installed outdoor or when you don't have the power outlet near the camera.

< DIN Cable >

When a camera is connected to a monitor by [DIN cable](#) like in most "observation system*", the power (usually 12VDC) is supplied from the monitor so that you don't need to worry about the power for the camera. (* The "observation system" means the monitor has a built-in quad splitter or switcher and has usually 4 [DIN jacks](#). But, some observation systems which are packaged by dealers or retailers may have a monitor without DIN jack and the power for the camera should be supplied separately.)

Camera Len Mounts

C-Mount Lens

The flange back (distance from the surface where the lens comes in contact with the camera to the focal point) of C-Mount lens is 17.526mm (0.69 inch). This is the only difference between the C-Mount lens and CS-Mount lens. C-Mount lens, as well as CS-Mount, is 1 inch diameter with 32 TPI (threads per inch). A C-Ring (5mm spacer ring) is required when a C-Mount lens is to be mounted to a CS-Mount camera unless the camera has built-in Flange-back Adjusting Ring.

CS-Mount Lens

The flange back of CS-Mount lens is 12.5mm (0.492 inch). This is 5mm shorter than the C-Mount lens and you need a 5mm spacer ring (or, C-ring) when you mount a C-Mount lens to a CS-Mount camera. (So, CS-Mount camera is always compatible with C- or CS-Mount lens. But, C-Mount camera is not compatible with CS-Mount lens. Most professional cameras are CS-Mount cameras and include a C-ring.)

Fixed Mount Lens

While C- or CS-Mount lens can be changed according to your application, the fixed mount lens, usually found on board cameras and mini cameras does not have standard mount size and can not be changed as easily as C- or CS-Mount lens.

Focal Length and Angle of View

Focal Length (FL) is the distance from the center of a lens to the focal point ([CCD](#) sensor chip). FL, as well as the CCD chip's format, is the major factor to determine the angle of view of a lens. For example, a 6.0mm FL lens on 1/3" sensor format has 56.8 degree of diagonal angle of view and a 5.0mm FL lens on 1/3" sensor format has 66.9 degree. But, the same 6.0mm FL lens can see 75.5 degree on 1/2" sensor format. The angle of view also varies a little depending on the manufacturer of the lens.

For 1/3" CCD chip camera, the following formula is a simple way to determine the focal length of a lens needed.

(Distance to subject / Width of subject) x 4.5mm = Focal Length.

For example, if you want to watch a subject of 5.5ft width at 10ft distance with a 1/3" CCD camera, you will need an 8.0mm FL lens ($10\text{ft} / 5.5\text{ft} \times 4.5\text{mm} = 8.18\text{mm}$). An 8.0mm FL lens mounted on 1/3" CCD camera will cover the subject you want to watch.

Camera Lens Optical Speed (f-number)

Optical Speed is about how fast a lens collects lights and is defined by the f-number like f/1.2, f/2.0, etc. This speed is determined by the [Focal Length](#)(FL) and the Diameter(D) of a lens; **f-number = FL/D**.

Larger FL, if the Diameter is same, makes higher f-number (like f/4 or f/8) lens that collects less lights to the camera sensor and results a slower lens. Lower f-number (like f/1.2 or f/1.4) lenses pass more lights to the camera sensor. Larger Diameter, if the FL is given, will make a lower f-number lens which can operate in lower light level.

In conclusion, the lower the f-number, the more lights reaching the camera sensor and the better the video picture. The f-numbers are usually marked at the iris rings of lenses.

Wireless Transmitters and Receivers

When it is difficult to run a cable to transmit video signals of the camera to the monitor, you might want to consider wireless transmission. But, the wireless signals may be attenuated or blocked by heavy metal walls, high voltage power lines, microwave equipment and others.

Currently, the most commercialized wireless systems are;

- a) 900Mhz Frequency with 300ft maximum transmission,
- b) 2.4Ghz Frequency with 300ft maximum transmission, and
- c) 2.4Ghz Frequency with 700ft maximum transmission.

A 5.8 GHz Frequency with maximum 7 miles transmission distance is also commercialized but it is not yet widely used because of its high cost.

The wireless system is strictly controlled by the FCC. The commercialized models are usually FCC approved by the manufacturers and you don't need to get a separate FCC approval. But, you can not change or modify the specification of each model without prior approval from the FCC. Each manufacturer has different bandwidths of frequency approved from the FCC and will not be compatible with other manufacturer's models.

Most commercialized wireless systems have 4 channels; you can not use more than 4 transmitters in one area due to conflicts of the overlapped channel(s). But you can have as many additional wireless receivers as you want.

Some transmitters have a built-in camera. Others do not and are to be connected with external video cameras (or other video sources) to transmit the video (and audio) signals. Wireless receivers are available with manual 4 channels or with automatic sequential switcher built-in 4 channels. Wireless receivers are to be connected to [CCTV](#) monitor, VCR or standard TV by [RCA connectors](#).

Remote Transmission of Video and Data

The technology in this field enables us to use the Internet or intranet line as a video transmission method. DSL and T-1 are for the Internet connection and LAN (or WAN) is for intranet.

DSL

DSL, Digital Subscriber Line, is commercialized with the speeds from 144 Kbps to 1.1 Mbps. (More than 1.5 Mbps speed is called T-1). To connect a web camera to a DSL, you need a router with RJ45 jack. The router is usually provided by DSL supplier. If you need to connect multiple web cameras, you should have a hub which has multiple RJ45 jacks and which is to be connected to the router. You will have static or public IP address (provided by the DSL supplier) to assign to the [web camera\(s\)](#). This [IP address](#) will work as a web site address on the Internet.

At the site of web camera, business grade SDSL (Symmetric DSL) is recommended. SDSL has same upstream and downstream bandwidth, while other DSL (IDSL or ADSL) has larger downstream bandwidth than upstream. As web camera's video data should be uploaded to the Internet, a SDSL is much better for the web camera. But to see the pictures from the camera, that is to download it, a residential DSL or even Cable TV line will work fine. (See more details about [the bandwidth and the speed](#) of a web camera)

LAN

LAN, Local Area Network or WAN, Wide Area Network has intranet network in a limited area or organization and has a lot of computers connected to the network. Web camera servers, as like other computers, can be connected to LAN or WAN so that other computers can share the video data. [Web camera servers](#) can be connected to LAN or WAN through RJ45 jacks.

Web Cameras

Web Camera (or Web Camera Server) is a [CCTV](#) Camera with built-in computer server so that you can connect it to a network line such as [DSL](#) or T-1 for the Internet or [LAN](#). When you assign an [IP address](#) to the camera, you can see the camera's video at any place where an Internet browser (Microsoft Internet Explorer or Netscape) is available because the IP address works as a website address.

The most important thing you have to know about the web camera is [the speed](#). That is, a web camera should have a good image compression technology which can compress the video images to a size small enough to go through the network line with fast speed. For now, the [Wavelet](#) is the best compression algorithm with compression rate 30% to 300% higher than other technology such as [JPEG or MPEG](#).

Another excellent feature of web camera is that you can program it to send you an email with up to 5 pictures when a movement is detected by the camera. And it usually has enough flash memory for you to customize your own Internet homepage.

IP Address

Internet Protocol (IP) Address works as a website address on the Internet. When it is assigned to a [Web Camera](#), you can open its video page with any web browser such as Microsoft Internet Explorer or Netscape by typing in the IP numbers. (Sample of an IP address: 65.104.93.35 - If you type these numbers in the "Address" box of any web browser, you will see a live video from web camera.)

Public IP Address and Private IP Address

Public IP Address is for the Internet like the above mentioned sample numbers. It's like a public phone number that you can call from any phones connected to the telephone service. Private IP Address, like an intercom numbers inside an organization, works only within a limited area such as [LAN](#) or WAN system. If you assign a private IP address to a Web Camera, you can see it in the LAN or WAN system, but not on the Internet. It is a Public IP Address that works on the Internet. There are two types in Public IP Address; Static and Dynamic.

Static IP Address and Dynamic IP Address

Static IP Address, like above mentioned sample numbers, is an independent address that you can own yourself. Dynamic IP Address, or Floating IP Address is not an independent address and you have to share it with other subscribers. This also works on the Internet, but unlike Static IP Address, the address changes every time you log in. When you want to open the camera assigned with a Dynamic IP Address, you should go to the web site of the web camera's manufacturer where they have a list of all the web camera users who have Dynamic IP Address. Though it works, Dynamic address is not as convenient as Static IP Address. So, you'd better get a Static IP Address when you install a DSL for a web camera.

Image Compression and Transmission Speed

Video Image Compression Technology is the core of [web cameras](#) because the compressed video file size should be small enough to run fast through a network line of the Internet or [LAN](#). Another main factor to decide the speed of a web camera is the speed (bandwidth) of the network line itself.

How to Compute Transmission Speed

a) " The speed of a network line" divided by 8 is numerator. Please note that 8 bits is 1 Byte. For example,

if you use 192 Kbps [DSL](#) line, the numerator is 24 KBps (192 divided by 8)

if you use 384 Kbps DSL line, the numerator is 48 KBps (384 divided by 8)

if you use 1.1 Mbps DSL line, the numerator is 137 KBps (1,100 divided by 8)



b) " The size of the compressed file of a video picture" is denominator. It depends on the format a web camera uses to compress the video picture. For now, Wavelet is the best format for this function. Following table compares the Wavelet and other formats.

Format	Picture Resolution	Compressed File Size
Wavelet	720 by 486 pixels	50KB/frame
	360 by 243 pixels	3 KB/frame
JPEG, MPEG, ETC	720 by 486 pixels	more than 250KB/frame
	360 by 243 pixels	more than 15 KB/frame

Now, if you send video pictures of 360 by 243 resolution over 384Kbps DSL line, the speed is ;
(Wavelet Format) 48 KBps divided by 3 KBpf = 16 fps (frame per second)
(Other Formats) 48 KBps divided by 15 KBpf = 3.2 fps,

if you send a picture of 720 by 486 resolution over 1.1Mbps DSL line, the speed is ;
(Wavelet Format) 137 KBps divided by 50 KBpf = 2.7 fps
(Other Formats) 137 KBps divided by 250 KBpf = 0.5 fps

*Above speeds are the maximum. Actual speed may be lower depending on the traffic and other conditions.

CCTV System Equipment

What are the Basic Components of a CCTV System?

Camera

The modern CCTV video camera is available in both monochrome (black and white) and color. Modern cameras use a CCD (Charged Couple Device) imaging device to create an image. Color cameras have the advantage of providing color information to describe a subject. Monochrome cameras have the advantage of higher night time sensitivity.

Monitor

A monitor is very similar to a standard television set, however, it lacks the electronics to pick up regular television. Monitors are available in both monochrome and color versions. CCTV monitors usually have up to two or three times the horizontal resolution of a regular television and so reproduce an image with superior quality or resolution. In digital systems, standard SVGA monitors may also be used to view video.

Time-lapse Recorders

This style of recording allows time to lapse between taking individual images or pictures. "Real time" recording is 30 pictures (NTSC, 25 pictures PAL) per second. By allowing time to lapse between images, fewer images are recorded per second and less storage medium (video tape, disc, hard drive, etcetera) is required for 'recording' the action. Ie; 240 hour mode allows 10 days of continuous recording to be stored on a single 2 hour cassette. This is because 1 picture is recorded each 2 seconds versus the normal 60 images in the same amount of time. Playback of the images is directly reflected by the lack of continuity ... therefore, the total length of the time allowed to lapse will be determined by application.

24 hour / 72 hour high density (HD) recorders

These units were developed to work in specific applications with multiplexing switchers. By changing the method of sweeping or placing the video information on the videotape, three times the normal amount of information can be recorded per inch of videotape. In this way, video multiplexers were made more effective. I.e; in the 24 hour mode, a time-lapse recorder records 5 images per second. Using an eight camera multiplexer, the time-lapse recorder stores an average of .625 images per camera per second. A 24 hr. HD recorder stores 15 images in the same space. Therefore, using an eight camera multiplexing system the recorder stores 1.87 images per camera per second.

Digital Video Recorder (DVR)

These systems range in size from stand-alone units that use event based or time-lapse recording on floppy disks or hard drives to huge system units that record continuously. Digital storage systems have the advantage of being able quickly search through large amounts of video, based on an event, time of day, or camera. In addition, the amount of storage may be optimized with the ability to program the record rate for each camera, the most critical cameras having the most recorded video.

Video Switching Systems

If a CCTV system has more than one camera, there must be a way to control each video signal going to the recording device and the monitor. As do the applications and designs of CCTV systems, video switching units come in a wide variety of styles.

Sequential Switchers

Unit that provide full screen images, one camera after another, typically for 3 to 5 seconds each. When one camera is on the screen the other cameras are not being recorded. The major drawback is the time loss factor between camera images recorded (i.e. In an eight camera system, at 5 seconds of delay between images, there is 35 seconds of time loss from the point that the system switches from camera #1 to the point that the system returns to camera #1. Video sequential switchers also have severe limitations in controlling multiple PTZ devices).

Quads

Units that were originally designed to promote visual verification of up to four video images on a signal screen. Designed to display four images of 150 horizontal lines of resolution at a time, these units were not designed to be used for recording of the images in higher resolution applications.

Multiplexers

These units are high-speed switchers that provide full-screen images from up to 16 cameras. Multiplexers can playback everything that happened on any one camera without interference from the other cameras on the system.

Matrix Switchers

These units are designed to 'manage' large numbers of cameras and monitors. Usually used in systems of minimum 12 cameras, they are able to expand into the thousands of camera inputs and hundreds of monitor outputs. Each camera input and monitor outputs are completely independently programmable. I.e.; Monitor #1 will display all of the odd camera #s in a sequential mode. Monitor #2 will display all video alarms from the odd numbered cameras only. Monitor #3 will display camera image number 4 only. Matrix switching units have many other programmable features such interfacing to access control systems, user log-ins, and PTZ control.

Video Transmission

How the video signal is transmitted from the camera to the control point is usually determined by the most effective means available. Not all applications can use or should use the same method for transmitting the video image.

Coaxial cable

Coax is the most common method of transmitting the signal. It provides very high bandwidth and assures the transmission of high quality video within its distance parameters. It is restricted, primarily by distance and the quality of the cable used.

Twisted pair

This method requires the use of a pair of twisted wires to carry the video image. Since the redevelopment and upgrade of twisted pair technology in the early 1990s, twisted pair transmission technology is fast outpacing coaxial cable.

Fiber Optics

Fiber is clearly the best method for transmitting video over longer distances. When using fiber, the video signal is electronically changed into pulsed light. This light is then injected to a fiber. At the other end of the fiber, the pulsed light is changed back into an electronic signal. The advantages of fiber are that the video signal can be sent over long distances without significant degradation.

Microwave

This is the use of microwave radio waves to transmit the video signal across areas ranging from 200 meters (short range) to ten miles (long range). In the US, microwave systems over 100 milliwatts must be licensed by the FCC in advance of installation. Microwave systems must have an open line-of-sight between the transmitter and the receiver.

WAN Digital transmission

The introduction of the internet in the mid 1990's opened the door for wide area control and monitoring systems within the CCTV industry. Used by large corporate entities, a single control point is now able to monitor activities at multiple points around the world. Wide area networks can be built using private network communications paths, or use the Internet as the communications medium. Major disadvantages of intranet transmission include bandwidth restrictions and potential interference or security breaches from hackers.

Camera Housings and Accessories

Housings

Followings are the dimensions of economically developed Outdoor Housing Cases for the [CCTV](#) Cameras;

Small size: 80(W) x 70(H) x 260(D) mm



Medium size: 103(W) x 98(H) x 370(D) mm

Large size: 142(W) x 115(H) x 392(D) mm

Professional Cameras should be mounted in medium or large size housing cases and Web Cameras in large size ones. A heater and/or blower can be built into medium or large size housing case. When a heater and/or blower is built-in, the available inside depth length is reduced by about 40 to 50mm. A heater and/or blower housing is usually required to be powered separately by 110VAC or 24VAC.

Other special housing cases such as dome camera housings, triangular ceiling or corner mount housings, elevator-cab housings, explosion-proof housings are usually expensive.

Illumination

To see properly, a video surveillance camera requires a certain amount of lights produced by natural or artificial illumination. B/W cameras work with any type of light sources, but color cameras need lights that contain all the colors in the visible spectrum.

The amount of lights is defined by LUX (Lumens per Square Meter). One LUX is a candle light volume at one meter distance. Followings are some examples of natural lights expressed in LUX.

Full daylight: 10,000 LUX

Very dark day: 100 LUX

Twilight: 10 LUX

Deep twilight: 1 LUX

Full moon: 0.1 LUX

Quarter moon: 0.01LUX

A good B/W camera can see in full moon condition. But, a color camera will need an additional artificial light in full moon.