

Introduction

From a single camera and monitor to complex video surveillance systems with hundreds of cameras, multiple operators, and digital recorders, closed circuit television (CCTV) systems can provide security for a wide range of businesses.

A good video surveillance system can make your business safer, more efficient, and less prone to theft and accidents. Specifically, video surveillance can provide many benefits:

- reduce shrinkage by catching shoplifters
- deter potential thieves
- monitor cash registers
- record evidence to prevent bogus accident claims
- identify visitors and employees
- monitor hazardous work areas
- increase security in and around business premises and parking lots



The most basic CCTV setup would be a single camera connected directly to a monitor and a recorder to store the video. While a setup like this could help security in some cases, it is unlikely to be enough for most businesses. Most situations call for multiple cameras. In some cases, you may even want a moveable camera to cover a large area. This **BuyerZone Video Surveillance Buyer's Guide** will help you understand what goes into a video surveillance system, how to compare CCTV vendors, and how to make a successful purchase.

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Pricing guidelines

Costs will vary quite a bit. We'll go into more detail on page 9, but here's a rough guide to costs for commercial-quality video security components:

- **Cameras: \$100 to \$250**
- **Hidden cameras: \$150 to \$400**
- **PTZ cameras: \$1,200 to \$5,000**
- **Fixed lenses: \$100 to \$300**
- **Auto-zoom lenses: \$800 to \$2,000**
- **DVRs: \$500 to \$1,000**
- **Housings: \$25 to \$200**

Evaluating your CCTV needs

Before starting to compare systems or choose potential vendors, sit down and consider your CCTV needs carefully.

First, consider what you want to monitor: General comings and goings? Vehicles? Do you want to see faces, merchandise, crowds? Once you decide what you want to see, choosing CCTV components becomes easier.

Next, decide what picture quality you need. Quality can refer to both how **detailed** the image is and how fast the



frame rate is. Frame rate is simply a measure of how many individual pictures make up the video. "Full motion," what you see on television and on VHS tapes, is 30 frames per second, or fps. Most often, CCTV systems record at slower rates, which result in more jerky-looking images but saves tape or hard drive space, allowing longer periods of time to be recorded.

Think about how your CCTV system will be monitored. Will you simply record at all times, and only review the tape when a problem occurs? Or will you have a dedicated employee watching for trouble? Also, with multiple cameras, you have the option of connecting each to its own monitor, or combining multiple images onto one monitor.

You should also decide whether your priority is to **deter** potential crimes or to **catch** perpetrators. Both can be important, but your priority will influence your purchasing decisions. If you are more interested in deterring certain activities, large, visible cameras are your best bet. Trying to catch criminals on tape without them being aware of it requires hidden cameras, which cost more both for hardware and for installation. If your monitoring target is internal, you run the added cost of having to hide and secure the recorder and monitor as well.

Surveillance cameras

There are many technical terms and specifications that dealers will refer to when discussing surveillance cameras as part of a CCTV system.

The basic technology behind most surveillance cameras is the Charge Coupled Device (CCD). CCDs convert the images that come through the camera's lens into electronic impulses. CCDs provide a good combination of low price and quality picture for security applications.

Camera formats are measured in inches: most surveillance cameras fall between 1/4" and 1". This refers to the usable image size created inside the camera. For most security use, a small size is fine – 1/4" or 1/3" cameras dominate CCTV sales. Larger formats do not necessarily result in better images, but can be advantageous in dimly lit situations since they are able to gather more light.

Many newer surveillance cameras use digital signal processing (DSP) to convert the analog video stream to digital information, improving picture quality and to adding functionality. The DSP circuit in a camera can have a very large effect on the quality of the images.

Color vs. black and white

Since prices have dropped significantly, many businesses today opt for color cameras over their black and white models. For security and evidence purposes, color cameras are better—sending security guards after "the man in the blue coat," for example, is difficult when you can't tell what color the coat is.

While black and white cameras can operate better than color cameras in extremely low light situations, most small to medium sized businesses use CCTV in well-lit indoor environments. In addition, many high-quality color cameras

today can switch to black and white mode when necessary. Some vendors don't even sell black and white cameras any more.

Resolution

Resolution refers to how detailed a picture the camera can see. The measurement to look for is horizontal TV lines (TVL). A normal surveillance camera picture is around 350 to 400 TVL, with high resolution getting up to 480 or 500. Upgrading a camera's resolution can cost as little as \$50.

You need to make sure your entire system is capable of supporting that resolution. If your VCR records 350 lines and your monitor displays 400, the money you spent to upgrade to a camera with 500 lines is completely wasted. In the end, the small cost to upgrade your camera may be multiplied by the costs to upgrade other equipment.

Note: do not be impressed by pixel measurements in the hundreds of thousands. TVL is a more consistent measurement.

Other specs

Signal to noise ratio (s/n) indicates how much "signal," or actual picture information, the camera transmits, as opposed to "noise," which comes across as static. An s/n ratio of 40db indicates that the signal is 100 times the noise, which results in an acceptable picture with some fine grain or snow. 30db results in a poor picture, and 60db produces an excellent picture with no static visible. Keep in mind that noise can be introduced by other components in addition to the camera.

Sensitivity to light is measured in **lux**. A sensitivity of 2 lux means the camera can see fairly well by the light of a 40W fluorescent bulb; 0.5 lux surveillance cameras can make out images outside on a dim night. Your needs will depend on the lighting in the area being filmed, but lux ratings should not be the most important aspect of your camera decision.

Peripherals

Along with your surveillance camera, you need several peripherals to get your system working.

Lenses

As with regular cameras, the lens on a surveillance camera determines how wide an image is created and how much light is let in. Lenses are generally sold separately from cameras.

The lenses you purchase should match the format of your camera: 1/4" lenses work best with 1/4" cameras. It is possible to use a larger format lens than the camera calls for, but it is not recommended.

You also need to decide what type of lens you need. **Fixed focal length** lenses offer only one set field of view and are the least costly. To change the resulting image, you need to switch lenses. **Variable focal length** lenses and **zoom** lenses offer greater flexibility, allowing you to adjust your image's field of view. Motorized zoom lenses, the most costly type available, give you the ability to control your surveillance cameras remotely. If you want to zoom out for general surveillance and in for detail when you spot suspicious activity, motorized zooms are the way to go.

If you will be using the surveillance camera outdoors, look for a lens with an **automatic iris**. As in the human eye, the iris of a lens is what controls the amount of light coming in to the camera. Automatic irises can significantly improve performance for outdoor cameras, where light levels vary considerably. However, you can save money and use a **manual iris** lens when the scene illumination never changes, for example in an illuminated store or office.

Pan, Tilt, Zoom

For advanced security applications, you may want a pan, tilt, and zoom (PTZ) camera. With the right equipment, a camera operator can pan (scan left and right), tilt (look up and down), and zoom in and out. The significant catch is the cost: PTZ systems are considerably more expensive than fixed cameras.

Housings

Cameras may need to be protected from potential vandalism or from the elements. Housings can range from simple coverings, to impact-resistant protection, to outdoor housings that include heaters and blowers for cooling. A more specialized type of housing is the dome: tinted Plexiglas hemispheres that prevent subjects from seeing which direction a camera is pointing. Choose the right housing based on the placement of the surveillance camera and its expected usage.



Monitors

Selecting a monitor for your surveillance system is a relatively minor decision, but there are a couple of important points to keep in mind.

First, make sure to purchase a monitor specially to handle the type of use it will receive. Televisions are not good monitors, since TVs are built to be on for a few hours per day, not the 8 to 24 hours per day they will endure. In some cases, computer monitors do make acceptable substitutes. Flat-panel LCD screens make great surveillance system monitors because they take up little space, have excellent resolution, and generate less heat than regular monitors.

As discussed earlier, make sure your monitor resolution matches your cameras. Buy a monitor with lower resolution and your camera's capabilities will not come through; buy one with higher resolution and you are throwing money away. And of course, make sure you buy color monitors if you opt for color cameras as part of your surveillance system.

Also consider the size: a 9" monitor may be sufficient if the operator is sitting directly in front of it, but a 15" monitor is the smallest you should choose if you plan to combine images from multiple cameras onto one monitor. Merging multiple images onto one screen can be an effective way to save space, and appropriate if there is a dedicated employee who has the ability to zoom in on suspicious activity.

Recording systems

Recording is essential to the effectiveness of any video security system. Without recording, you need to have an employee watching a monitor at all times – hardly a cost-effective solution. And even if you spot suspicious activity, without a recording, you have nothing to use in court.

Almost all video security systems include some sort of recorder to store the images the cameras capture. Only a few years ago, the universal solution was the familiar VCR. However, the introduction of digital video recorders (DVRs), which record onto hard drives instead of tape, has dramatically changed the situation.

DVRs offer so many advantages over VCRs that they have rapidly taken over as the CCTV recording solution of choice:

- **Ease of locating events** – Instead of fast-forwarding through hours of tape, DVRs can instantly retrieve images from any specific time or date, or automatically skip to the point on a recording when something changed.
- **Storage quality** – Like all tapes, video cassettes start deteriorating almost immediately once you record on them – and the problem gets worse every time you reuse them. DVR recordings have no degradation at all.

since they are stored onto a hard drive.

- **Multitasking** – While analog VCRs can either record or play, most DVRs can do both at the same time, letting you review images while still recording.
- **Smart monitoring** – The DVR can be set to take one picture per second or less – just enough to create a running record. However when it detects motion, it can automatically bump the recording speed up to full (30 frames per second), getting every detail of the unauthorized activity.

For businesses that do not want to constantly change tapes, DVRs are definitely the way to go. While security VCRs usually offer a time-lapse mode that lets them record for long periods of time, the resulting images are not a good record of events – they record only one snapshot every eight seconds. To get higher quality, you need to change tapes every day or more often. DVRs, on the other hand, can record for weeks or even months.

DVRs are considerably more expensive than VCRs, which is their only major drawback. However, the DVR prices have fallen considerably over the last few years and will continue to do so. Already, low-end DVRs and high-end VCRs have similar price ranges, and most manufacturers have stopped introducing new VCR models. Despite the increased cost, we recommend video security system buyers purchase a DVR whenever possible.

Choosing a DVR

As part of your CCTV shopping preparations, decide how much quality you need out of your recorder. There is no magic number or spec here: you need to decide how “good” the recorded picture needs to be, either for your own use later or possibly to use in court.

Once you decide this, you will be able to look at samples of the DVRs you are evaluating and see if they meet your standard. Vendors may be eager to throw compression settings, pixel counts, and other statistics at you – but those numbers are irrelevant if the picture itself does not offer the detail you need for legal or investigatory purposes.

The size of the hard drive will dictate how much you can record. On the low end, an 80-gigabyte (GB) hard drive will store about five to eight days of full-motion video from one camera. Most of the time you will not be recording full motion, so this is much more than it might seem. For most businesses, spending a little extra to get 120 or 240 GB is a worthwhile investment. Units expand up to 1.2 terabytes (1,200 GB), which can store many cameras’ worth of data for long periods of time.

Replaceable hard drives are a cheap way to boost storage capacity. With some DVRs, you can buy additional hard drives for as little as \$150 and swap them in and out as you need. This gives you the advantage of being able to store your data separately from the main video security system.

You will also need to consider how many cameras you want to connect to the DVR. Keep your future expansion needs in mind – buying a higher-grade model to get more inputs and more storage space can save you considerable money in the future. The DVR will also function as a multiplexer, putting up to 16 cameras on one display and allowing operators to call up any one image for closer inspection.

Also, if you ever have to use your security images – in court or in other ways – you will need to be able to export the video. This is an important consideration: some systems let you create industry-standard .avi files, which can be played on any PC, and burn them to CD. Others only allow you to export proprietary formats that can only play on the same brand player. Most DVRs do offer the option to connect a standard VCR – this allows you to simply tape the digital recording onto a standard VHS cassette.

Choosing a VCR

If you decide to save money by going with a VCR, make sure you purchase a model built for video security system usage, not a consumer VCR. Purpose-built security VCRs offer far more reliable operation than home models, so they can stand up to constant operation.

The main feature to look for in a VCR is how many hours it can record: models range up to 960 hours on a standard tape. Remember, though, that these extended recording times result in fewer frames per second.

Be aware of the hidden and ongoing costs of VCRs. Buying, rotating, and replacing VCR tapes can be expensive and time consuming. Constant usage creates quite a bit of tape debris inside the machine, requiring expensive regular maintenance. And in addition, if you have multiple cameras, you will need a multiplexer – a separate piece of hardware that combines multiple video images into one – to avoid purchasing a separate VCR for each camera.

Connecting your surveillance cameras

There are several ways to connect surveillance cameras to the rest of your system.

The most common is standard coaxial cable, the same cable used to connect video equipment in your home. Some installers use unshielded twisted pair (UTP) cables, like the CAT5 cable used in many computer networks, because they can reduce interference caused by electrical currents. A simple switching device called a balun can be used to connect coaxial lines to UTP, so you can combine both in a single system. UTP is cheaper than coaxial cable, so for very long runs, this may be an advantage.

Casinos or banks with complex systems consisting of many CCTV surveillance cameras may want to upgrade to fiber optic connections. With this setup, bandwidth is considerably greater, allowing many signals to be carried on the same wire. In addition, security is improved because tapping a fiber optic line is very difficult to do without disrupting the signal.

Wireless

In most cases, wireless connections are not recommended for video surveillance systems. While wireless technology has taken off in recent years, it simply has not reached the level of reliability that CCTV users demand. The frequencies they use are subject to interference from cordless telephones, air conditioning, fluorescent lighting, and almost anything with an electric motor. Users will have to expect interference, usually resulting in a snowy picture. In addition, CCTV surveillance cameras need electrical power – so you will have to run one wire to the camera even if the video connection is wireless.

There are situations where wireless is the way to go: connecting across a public street, for example, where digging a trench is not a practical solution. Wireless systems are also better suited for rural areas, where there are fewer potential sources of interference. In these cases, wireless transmitters can make expensive or potentially impossible installations feasible.

Installation of wireless systems requires specific expertise to diagnose problems and fine-tune the setup, so make sure your CCTV surveillance camera vendor is experienced with wireless setups if you choose to go this route.

Choosing a dealer

The overall success of your CCTV system can hinge on the expertise of the installers who set it up. There are many important factors to take into consideration that require an expert understanding of lighting, optics, wiring, security, and more. In other words, your experience connecting your home TV to the DVD player does not mean you should set up your business security system!

In the CCTV industry, businesses typically buy from integrators or dealers. These vendors usually work with multiple manufacturers to offer a range of products, as well as installation and support. As with most business purchases, there are several key factors to look for when choosing a CCTV vendor.

Experience

A vendor's experience in the industry is a significant indicator of the firm's reliability and long-term stability. You will

want to be able to work with your chosen vendor on an ongoing basis as you expand or upgrade your system, so choosing someone who will be around next year is important. Specific experience with businesses of your size and in your industry is also desirable: large warehouses may present problems that a vendor who specializes in small retail shops may not be prepared to address.

Installation

The quality of a CCTV installation can have lasting effects on your business. Qualified installers will not take a standardized approach to installation: they will analyze your needs and make sure you get a system that is customized to your location and business needs. They will also provide enough training and documentation to make sure your staff fully understands the operation and maintenance of your system.

Facilities

Visiting vendors' facilities can be a great way to get a sense of their operations. You will be able to check out their repair shop and get a sense of how busy they are. You may want to ask for an organizational chart or a tour of their help desk. Depending on your support needs, proximity may or may not be important to you – if you plan to rely on telephone support and shipping components back for repair, it will not matter, but if you expect field technicians to come to you, distance from the vendor can be a factor.

Demonstrations

Nothing will give you a better sense of how well a CCTV system achieves your goals than seeing it in action. Some vendors conduct on-site demos, which gives you the added advantage of being able to see how the hardware looks in your location. Others will invite you to try the system in their office, which gives you that facilities tour we discussed, or will set up an online demo, which is helpful if you plan to view images remotely.

References

Another familiar way to investigate CCTV systems integrators for your business is to ask for references to other customers – make sure to ask for references that are in businesses similar to yours. Of course, you will be referred to the vendor's most satisfied customers, but you can still learn quite a bit from them. Here are some sample questions to ask the references:

- How has the CCTV system accomplished the goals you set for it?
- Are you happy with the overall quality of the images, both live and recorded?
- Was the initial installation sufficient for your needs? Or did you have to add components or upgrade?
- What do you wish you had done differently?
- Have you needed any support or repairs? How did the vendor respond?
- Do you know of any one else who uses this system? (This can get you additional references to speak to, some of whom might be more candid.)
- If you had to say one negative thing about the system/dealer, what would it be?

Pricing

There are many components to video security systems: cameras, monitors, recorders, and cabling to connect the system. Add in the need for a quality installation, and it should be apparent that shopping by price alone is not a good approach. Some dealers will put together low-end packages to try to lure price-conscious shoppers – these

systems suffer from lower quality, shaky reliability, and will not last for years and years the way higher quality systems will.

On the Internet, you can find complete video security systems of 4 to 16 cameras, including a monitor and VCR. Often they look like great deals – and most of the time, they are too good to be true. Low-quality components and a lack of support combine to create an offer that can do more harm than good to your business.

A very rough rule of thumb to use for pricing a complete, installed video security system is \$500 to \$1,000 per camera, plus the cost of your recording device. This depends quite a bit on the types of hardware you choose and how you set it up – read on for a more thorough breakdown.

Cameras and lenses

Basic CCTV cameras are not very expensive. Because the hardware cost is fairly low, it is worth spending a little extra money to get better system performance. Brand name cameras can be found for **\$120 to \$250**, and are often a better investment than a no-name camera. Prices vary according to features as well -- larger formats, higher resolution, and better sensitivity all drive prices up.

Hidden cameras, concealed in everyday objects like clocks, smoke detectors, and calculators, run **\$175 to \$400**. PTZ cameras are far more expensive, running **\$1,200 to \$5,000** for one camera and the controller. If you do not have an operator to run a PTZ camera, it is rarely worth the expense.

Remember that in most cases you are purchasing a camera without a lens, so there is more to spend before you get a workable system. Lens prices vary widely. Fixed focal length lenses can go for **\$100 to \$300** depending on size and whether they have a manual or auto iris; automatic zoom lenses can be between **\$800 and \$2,000**.

Recording devices and peripherals

This is another area where your needs will determine how much you spend. Quality DVRs generally start at **\$500 to \$1,000+** for a single channel device, and get more expensive the more memory and inputs you add. If you are on a tight budget and willing to invest in fading technology, good time-lapse VCRs designed for security use start at **\$200 to \$400** and go up to **\$600** or more.

Housings can cost from **\$25 to \$200**, depending on the degree of protection they provide.

CRT monitors can go for **\$150 to \$500** and flat panels range from **\$200 to over \$3,000**. Both are heavily dependent on screen size.

Warranties

As with most modern electronics, CCTV components are generally very reliable, especially if you are purchasing industry-recognized names. If they are going to fail, they will almost always do so within the first 90 days, while covered by the manufacturer's warranty. In most cases, it is not worth purchasing the extended warranty coverage that vendors will offer you.

However, you may want to consider a maintenance plan for your video security system. Having your vendor regularly come in to clean and test your system can improve the overall performance and ensure that any problems that do occur are caught quickly.

Buying tips

Know what you want to see. Knowing exactly what you want to see in the monitor and on recordings – both the scene and the quality – is the single best way you can prepare for a purchase.

Avoid dummy cameras. While they may deter some problems, they also can create a legal liability by creating an

expectation of safety when none exists.

Put up signs. Highly visible signage that lets customers and employees know that they are being filmed can greatly increase the deterrent effect.

Do not record audio. Most CCTV systems do not include audio monitoring for the simple reason that it is generally illegal. People in public places can be videotaped without their consent, but their voices can not.

Buy for the right reasons. Using a high-tech solution to solve a low-tech problem can result in wasted money and effort. If you have vandalism problems in a parking lot, adding lights can be a far cheaper and more effective solution than installing cameras.