

Keeping An Eye Out

Security and
Surveillance
Cabling
Simplified
via UTP

by Jeffrey Herman



STRUCTURED
CABLING
SYSTEMS

Closed-Circuit TV (CCTV) is a major element in security and surveillance systems. With more and more CCTV cameras being installed, the associated cabling has become a significant part of the overall cost of a security system. This article will attempt to show how, by applying a structured cabling approach, a company can save time and money by effectively managing its security and surveillance system.

CCTV Security System

A typical CCTV security system consists of a number of strategically placed cameras that are connected to either a video switcher or multiplexer. A video switcher causes the images from each camera to be sequentially displayed on a monitor. A video multiplexer takes the signals from multiple cameras and simultaneously transmits and displays them on a monitor. As an integral part of the security system, a time-lapse VCR is used to record an extended time span of activity from the cameras. If a security breach is suspected in a location, the video tape can be played back to identify

the cause of the breach. Figure 1 illustrates a typical system.

Problem

CCTV systems traditionally use 75-ohm coaxial cable. Each time a new camera is moved or added, a cable must be pulled. For large installations, managing the cabling of a large number of cameras can be costly and slow to respond to changing security needs. For example, if a company has fewer cameras than monitoring locations, either new cameras must be added or existing cameras must be moved to the new locations. Either way, new cables must be pulled and costly delays will be incurred.

As the number of cameras in a CCTV surveillance system grows, a second problem arises: keeping track of the cabling connections. Without an organized method to manage the connections, there will eventually be a loss of cabling visibility and the company will lose track of where CCTV equipment is connected.

Solution

The solution is to apply a struc-

tured cabling approach to CCTV systems similar to that used for voice and data cabling and assuring the use of standard voice and data outlets, patch panels and connector blocks. (See Figure 2.) In a structured security cabling system, one should anticipate where CCTV monitoring will be needed and install CCTV wall outlets before the equipment is installed. For example, when the voice and data wiring is being installed, a number of strategically placed CCTV wall outlets should be planned. CCTV wall outlets should be near the camera and out of harm's reach. Plans should also provide for 24 VAC (voice activity compression) power to all potential camera locations.

In order to be able to apply a structured approach to security cabling, CCTV video baluns are needed to convert the coax-based CCTV equipment to UTP. (See Figure 3.) The balun is the essential link. Baluns works in pairs and provide a connection path between the CCTV camera and the video multiplexer or switcher at the other end. Once the conversion is made

from coax to UTP, the wiring can be concentrated at the telecommunications closet along with other voice and data services. Centralization permits moves, adds and changes to be controlled more easily. Cameras, video switches, multiplexers, monitors and VCRs may then be placed in different locations and managed from the same telecommunications closet. Figure 4 illustrates how improved control over the CCTV system may be achieved. In this figure, the drop side patch panels are designated for the camera outlets. A host-side patch panel is used for the video I/O ports, and patch cords make the connections between them. If a camera is moved, the corresponding patch cord moves the connection. Traceability is maintained with identity labels at each connection point.

From a wiring standpoint, one pair of UTP wires is required to transmit a single CCTV video signal. Another pair of wires is required to bring 24 VAC power to each camera, with the power supply usually located not far from each group of cameras.

What to Look for in the CCTV Balun—The Essential Link

VIDEO QUALITY AT MAXIMUM DISTANCE. The quality of picture is the litmus test for the quality of the video balun. Look for a balun that gives the best video

Figure 1

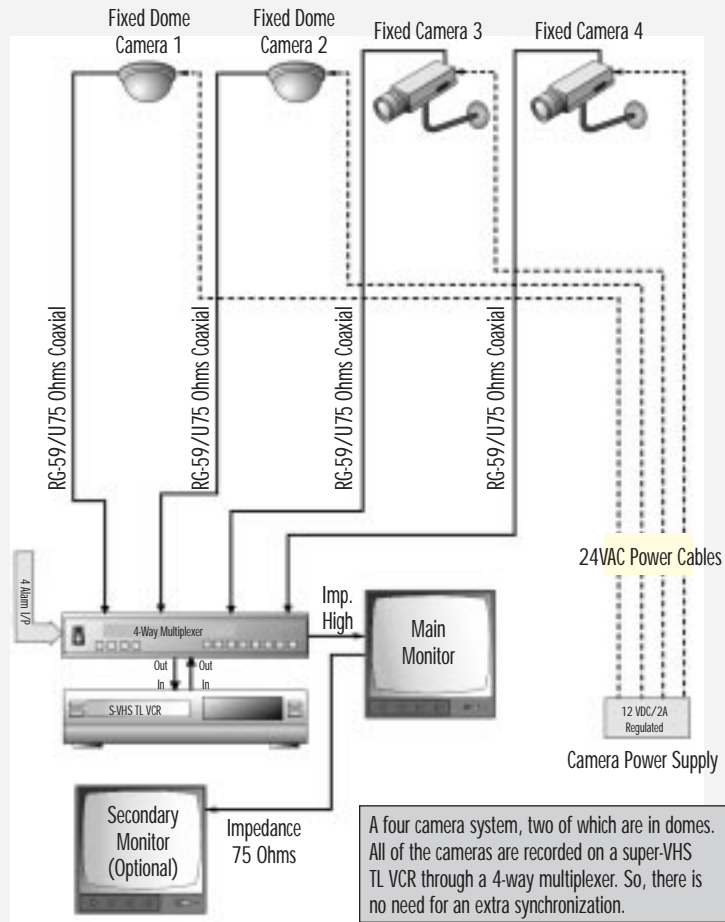


Figure 2 Structured Cabling for Security & Surveillance

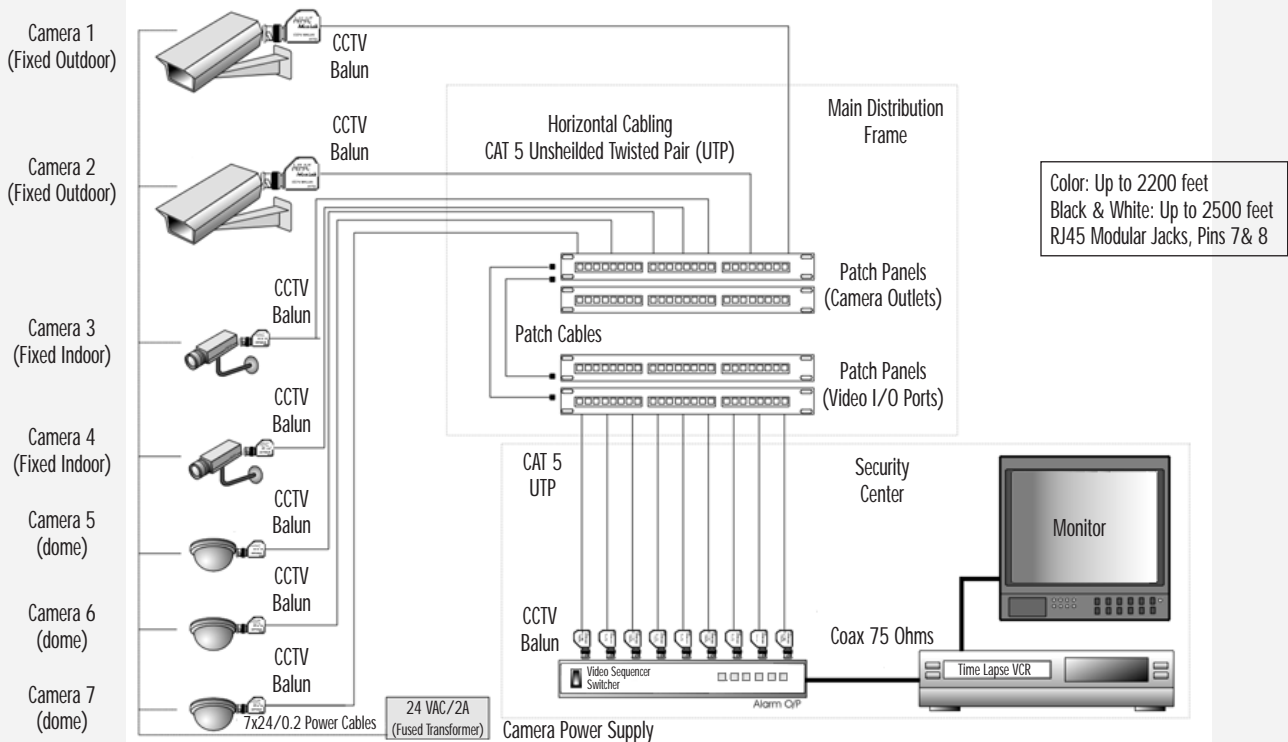


Figure 3

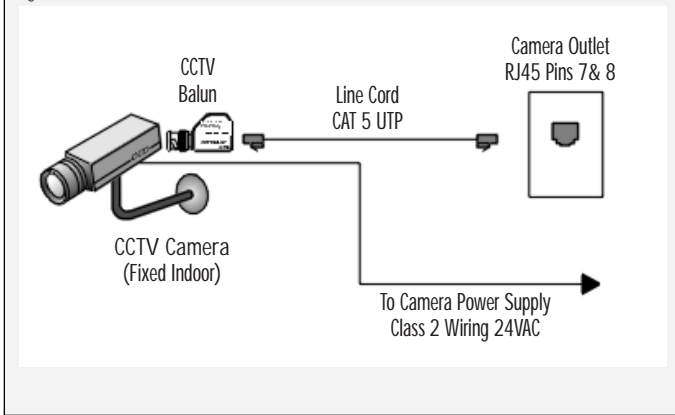


Figure 4

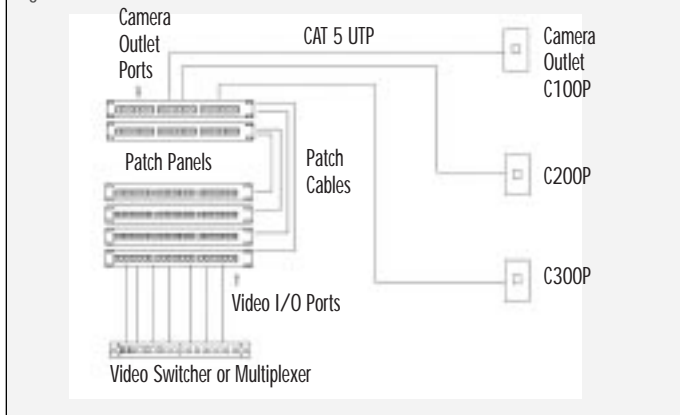


image at the maximum distance. The baluns should be able to support distances of at least 2,200 feet for color, and up to 2,500 feet for black and white signals. For extended distances, use video repeaters or fiber optic links.

CROSSTALK. Crosstalk is a measure of how much interference there is from one video pair to the adjacent pairs inside a cable sheath. The number of video pairs that can be placed within the same cable jacket will depend on how much crosstalk there is. The amount of crosstalk is determined by such factors as the qual-

ity of cable jacket, the capability of the cable to minimize the crosstalk from one pair to another, and the common mode rejection ratio (CMMR) of the video balun.

In order to minimize the interference of one video signal to another, try to limit the number of video pairs inside one cable jacket.

SIZE. Look for a balun that is compact enough to be placed behind the CCTV cameras, switchers and multiplexers. A balun with a BNC-Male connection is the preferred option if space permits. A balun

of this type can be expected to have dimensions of 1.0 by 1.25 by 0.5 inches. Figure 5 shows a typical CCTV video balun.

MACHINE WOUND COILS. Baluns contain transformers that are specially tuned to match a cable's impedance and convert an unbalanced signal to a balanced signal. Look for baluns that use machine-wound, sealed coils versus exposed hand-wound coils. The former provides more consistent performance and resists environmental effects such as temperature, moisture and dust. Video baluns differ from data

baluns in that if a data balun is slightly off-specification, the data may still get from one point to another, transparent to the user. However, if a video balun is slightly off-specification, the effect will be noticeable on the monitor.

CONNECTOR. In order to ease connections, use video baluns with RJ45 modular jacks. This allows camera equipment to be deployed in a new location by simply

Figure 5



unplugging a line and moving the camera. In order to achieve the best electrical contact, look for video baluns with modular jacks (RJ45) that have gold-plated contacts.

Cabling Guidelines

When planning and installing a CCTV system using UTP, the following guidelines are suggested:

1. Keep cabling away from sources of electromagnetic interference such as fluorescent lights, transformers, radio transmitters and power cables.
2. In order to minimize crosstalk, keep the number of twisted pairs in a bundle to a minimum.
3. Keep distances within the video balun's manufacturer specifications.
4. Adjust video monitors to compensate for any decrease in color or brightness due to cable length.
5. For extended distances, use video signal repeaters.
6. Use a twisted pair to transmit a signal. Do not split the twisted pairs.
7. Before installing equipment, test the quality of the video image from the longest cable run.
8. Verify that there are no ground loop problems.

UTP Awareness

There is a large installed base of security and surveillance systems that would benefit from structured cabling techniques. One of the main reasons that UTP has not been used extensively in the CCTV industry is the lack of awareness that baseband video may be transmitted

over UTP with clear picture resolution. This concern has been alleviated by improvements in technology. High-grade UTP and video baluns with superior design have dramatically improved the transmission quality of video over UTP. If one was in doubt as to whether structured cabling techniques could be applied to CCTV security and surveillance, it might be worth taking a second look.

Video baluns are available through the following vendors:

- Energy Transformation Systems (ETS)
- Intelix
- Lucent Technologies
- NHC Communications Inc.
- Network Video Technologies (NVT)
- VIDA Networking Consultants
- Vision Television Technologies Inc. (VTTI)

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Glossary

BALANCED SIGNAL. In CCTV this refers to a type of video signal transmitted through a twisted pair cable. It is called balanced because the signal travels through both wires, thus being equally exposed to external interference. So, by the time the signal gets to the receiving end, the noise will be canceled out at the input of a balun.

BALUN. Stands for balanced/unbalanced. Converts an unbalanced signal into a balanced one to allow data and video transmission over UTP.

CCTV (CLOSED-CIRCUIT TELEVISION). A television system intended for only a limited number of viewers and with a dedicated purpose, as opposed to broadcast TV.

CCTV CAMERA. A unit containing an imaging device which produces a video signal in the basic bandwidth.

CCTV INSTALLATION. A CCTV system, or an associated group of systems, together with all the needed hardware, auxiliary lighting, etc. Also refers to the act of installing such a system.

CCTV SYSTEM. An arrangement comprised of a camera and lens with ancillary equipment required for the surveillance of a specific area.

COAXIAL CABLE. The most common type of cable used for the transmission of video signals. It has a coaxial cross-section, where the center core is the signal

conductor, while the outer shield protects it from external electromagnetic interference.

COIL. The transformer inside a video balun which converts an unbalanced video signal into a balanced signal.

CROSSTALK. The interference caused by a signal transmission over one cable pair induced onto a signal on an adjacent cable pair.

GROUND LOOP. Unwanted interference in the copper electrical signal transmissions with shielded cable which is a result of ground currents when the system has more than one ground. For example, in CCTV, when we have a different ground resistance at the camera versus the switcher or monitor end, and the induced electrical noise generated by the surrounding electrical equipment (including mains) does not discharge equally through the two grounds (since they are different), the induced noise shows up on the monitors as interference.

PTZ (PAN, TILT, ZOOM). Some cameras allow control signals to be transmitted over the same video cable from a remote controller. Pan is left/right. Tilt is up/down. Zoom brings the image closer.

TIME LAPSE VCR (TL VCR). A video recorder, most often in VHS format, that can prolong the video recording on a single tape up to 960 hours (this refers to a 180-minute tape). This type of VCR is often used in CCTV systems. Instead of having the video tape traveling at a constant speed of 2.275 cm/s as in the case of full-motion VCRs, it moves with controlled discrete steps. Time lapse VCRs have other functions such as external alarm triggers, time/date stamp and alarm search.

UNBALANCED SIGNAL. In CCTV, this refers to a type of video signal transmission through a coaxial cable. It is called unbalanced because the signal travels through the center core only, while the cable shield is used for ground.

VIDEO MULTIPLEXER. A device that combines a number of signals into one. Often used in CCTV to describe a device that is primarily used to multiplex several video signals into one for the purpose of recording or microwave transmission. It can also refer to a fiber optic multiplexer which combines a number of video signals into one in order to transmit all of them over a single fiber cable.

VIDEO SWITCHER. A device for switching more than one camera to one or more monitors manually, automatically or when an alarm condition occurs. **CBM**