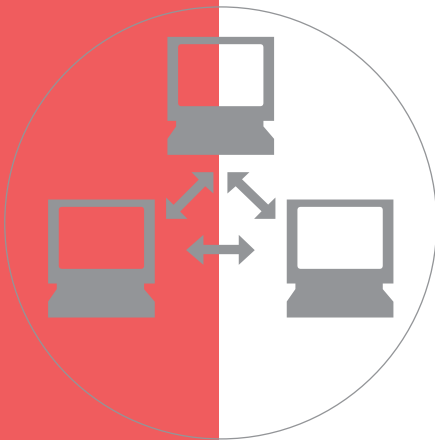




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**The Conversion Technology Experts**

# Media Conversion in Video Security and Surveillance Systems



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Video security and surveillance has become increasingly important the last few years, not only as a topic of conversation, but also as a corporate and government strategy reality. Whether retailers are monitoring for shoplifting or employee theft, corporations identifying visitors and employees or monitoring hazardous work areas, governments and municipalities combating street crime and terrorism, casinos preventing cheating and fraud or even homeowner's protecting their families and assets, one cannot deny the benefits of an effective video security system.

In recent years, demand for these applications has increased and technology has advanced so rapidly that there are now a myriad of choices among components. In fact, when one looks only at cameras, we can find many models, each with a specific use for time of day, fixed or pan, tilt and zoom (PTZ) capability, resolution quality, analog or IP-based video, etc. Unfortunately, one common component that is often overlooked in video systems is the quality of the cabling infrastructure used to transport these video images from camera to monitor or from camera to storage device. Designing your video network around coaxial, un-shielded twisted pair (UTP) or fiber-optics will have tremendous impact on the quality, bandwidth and distance capabilities of your video security and surveillance system.

## Typical Video Security System

Whether the video surveillance is analog-based or IP-based, there are a number of common components to most video systems including cameras, cabling infrastructure, monitors and a means of recording the video for future use and playback. Let's take a quick look at two of the most common video systems in use today.

### Analog Video Systems

Closed-circuit television (CCTV) systems have been in use for more than twenty years and comprise the vast majority of video security systems in use today. In a typical CCTV system analog cameras are connected via coaxial cabling back to a central management room where the coax is connected to a monitor(s) and a video cassette recorder (VCR) or digital video recorder (DVR). An additional component called a controller is used if the cameras have PTZ capability and is generally centrally located. All components are dedicated to this CCTV system and the system is "closed" to external access.

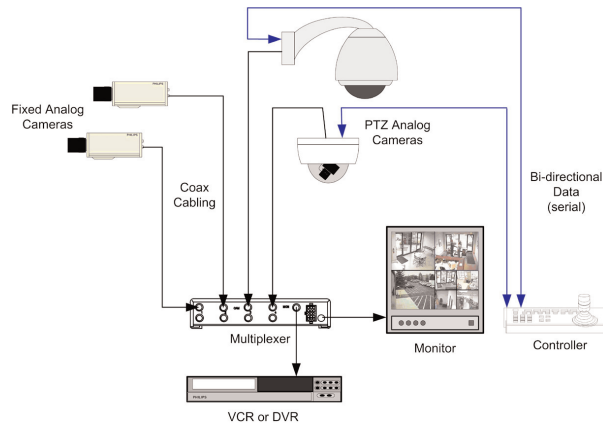


Fig. 1: Analog Video Security System with fixed and PTZ cameras

## IP Video Systems

IP-Surveillance systems are relatively new to the market. In a typical IP-based video surveillance system, network (IP) cameras are connected directly to the Local Area Network (LAN) and transport digital video across the IP network via UTP cabling and switches, recording video to any PC or server on the network. Since the cameras are IP addressable, they are able to be accessed from anywhere in the world, provided the user has the sufficient network access and security privileges.

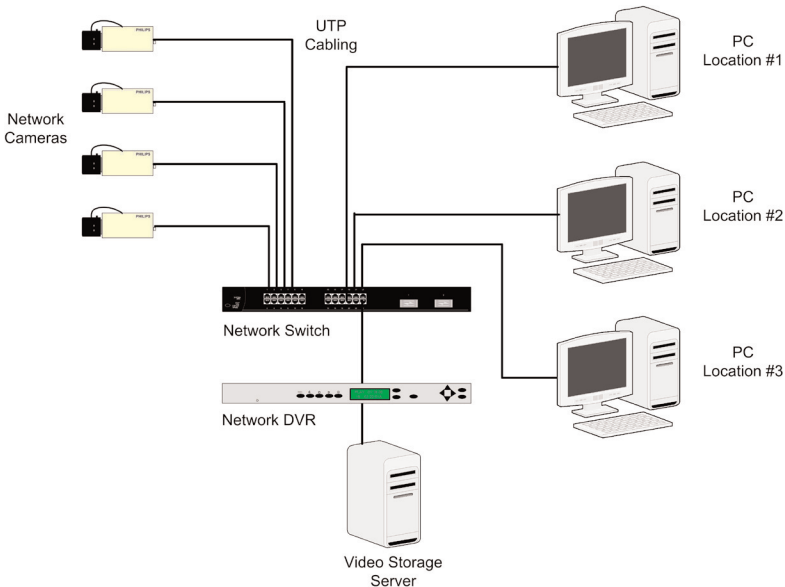


Fig. 2: IP Video Security System

## Benefits of Using Fiber Optics in Video Security and Surveillance

In the ever increasing reach of today's video security and surveillance systems, many security professionals are finding that the quality, bandwidth and distance needed to perform even the most basic surveillance is beyond the reach of coaxial and UTP cabling. In fact, even though IP-based video security systems are gaining popularity, they face a serious distance limitation of 100 meters (328 feet) or less over UTP cabling infrastructure. This poses an insurmountable hurdle when trying to monitor the many outreach locations of a typical surveillance installation. While fairing slightly better in copper distance limitations, most analog-based CCTV systems prove effective and economical only if the coaxial cabling runs are held to less than 750ft (228m). Utilizing coax beyond that distance, however, poses a number of problems, some of which are not immediately obvious.

For instance, let's say your monitor is located 1,000 ft (304 m) from the camera. In that scenario, without any active signal conditioning, approximately 37-percent of the high frequency information will be lost in transmission, providing a seriously degraded image. In fact, since you cannot see information that is not there, you may not even realize that information has been deleted. To accommodate lengths greater than 750

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feet (228 m) on a coax infrastructure, you must make certain that some provision has been made to guarantee the video signal's transmission strength such as the use of signal amplification, ground fault correction and surge protection. Installing these items will inevitably increase the cost of the system considerably, making alternative cabling methods more attractive.

In fact, the use of fiber optic cable will allow for cable runs of over 1500 meters (5,000 feet) on multimode and distances of over 10km (6.2 miles) on single mode cable. In addition to distance extension, fiber optics also presents a number of other unique benefits not present in either coax or UTP cabling:

- Smaller size and better tensile strength making it easier to install when pulling through conduit or in overhead cable trays
- High degree of security as fiber is inherently difficult to tap into or interfere with
- Immunity to electrical interference such as:
  - o Electromagnetic interference (EMI)
  - o Radio frequency interference (RFI)
  - o High voltages found in fluorescent lights, card access door strikes and outdoor lighting systems
  - o Induced voltages (ground loops) which causes picture distortion and audio interference
- Higher bandwidth
- Improved reliability and overall transmission performance

Local area networks (LANs) very commonly deploy fiber optics as the network backbone between buildings or in vertical risers of multi-story buildings. Utilizing this infrastructure already in place would be an attractive transmission alternative to risking the distance and quality issues common to coax and UTP video systems. Accessing this fiber optic cabling can be a challenge for most video security professionals as the majority of new cameras and monitors on the market today are not available with fiber optic ports on them. In addition, most existing video security and surveillance systems were designed and installed with coax or UTP cabling. To improve the quality, bandwidth and distance of these existing systems by transporting the video on fiber optic cabling, a method is required to convert the electrical video signal over to an optical format.

## **How Media Conversion Can Ease the Transition to Fiber**

For those not familiar with the technology, media conversion products transparently connect one type of media, or cabling, to another – typically copper to fiber. Bridging the gap between legacy copper infrastructures and fiber growth, media conversion products provide an economical path towards extending the distance of an existing network, extending the life of non-fiber based equipment, or extending the distance between two like devices.

Whether distance extension or simply utilizing existing fiber optic infrastructure, media conversion can be a cost-effective way to integrate fiber optic cabling into an existing copper-based video security system. In addition, the video media converters can be designed to actually perform many other functions in addition to transporting the video signal over fiber optics such as transporting the serial information necessary for control of PTZ cameras or even providing a means to transport the video over the Ethernet-based LAN. Below is a list of commonly found media conversion products listed from the most basic features to more complex products:

#### **Analog video conversion**

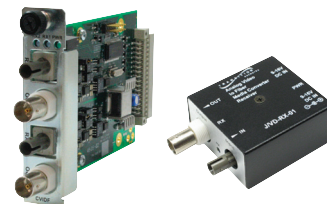
- Video baluns (passive) – un-powered devices that convert the video signal on coaxial cabling over to UTP cabling
- Video baluns (active) – powered devices that convert the video signal on coaxial cabling over to UTP cabling plus provide signal amplification and equalization
- Analog Video Media Converters – powered devices that convert an analog video signal on coax over to a fiber optic medium
- Analog Video + Data Media Converters – powered devices that convert an analog video signal on coax over to a fiber optic medium plus provide transport of serial data for remote control of PTZ cameras
- Video Encoders/Decoders (Codec) – powered devices that convert an analog video signal on coax over to an IP formatted signal that can be transmitted onto an Ethernet compliant fiber optic medium

#### **IP video conversion**

- Ethernet Media Converters – powered devices that convert an IP-based video signal on UTP over to a fiber optic medium
- Power over Ethernet (PoE) Media Converters – powered devices that convert an IP-based video signal UTP over to a fiber optic medium, as well as inject the power onto the UTP necessary to power remote IP cameras

Media converters come in a variety of form factors and sizes ranging from miniature, stand-alone devices that attach directly to a camera to managed, chassis-based devices allowing for full SNMP monitoring and management of the media converters.

In addition to providing a means for transparently connecting one type of media to another, media conversion can provide a cost-effective method for integrating a hybrid video security and surveillance system into one, seamless and manageable entity. Imagine the cost savings that can be realized by utilizing an existing, analog-based CCTV infrastructure, while implementing the latest technology of IP-based cameras for specialized video capture, storage or analysis as well as additional surveillance locations.



*Fig 3: Video to Fiber Media Converters*

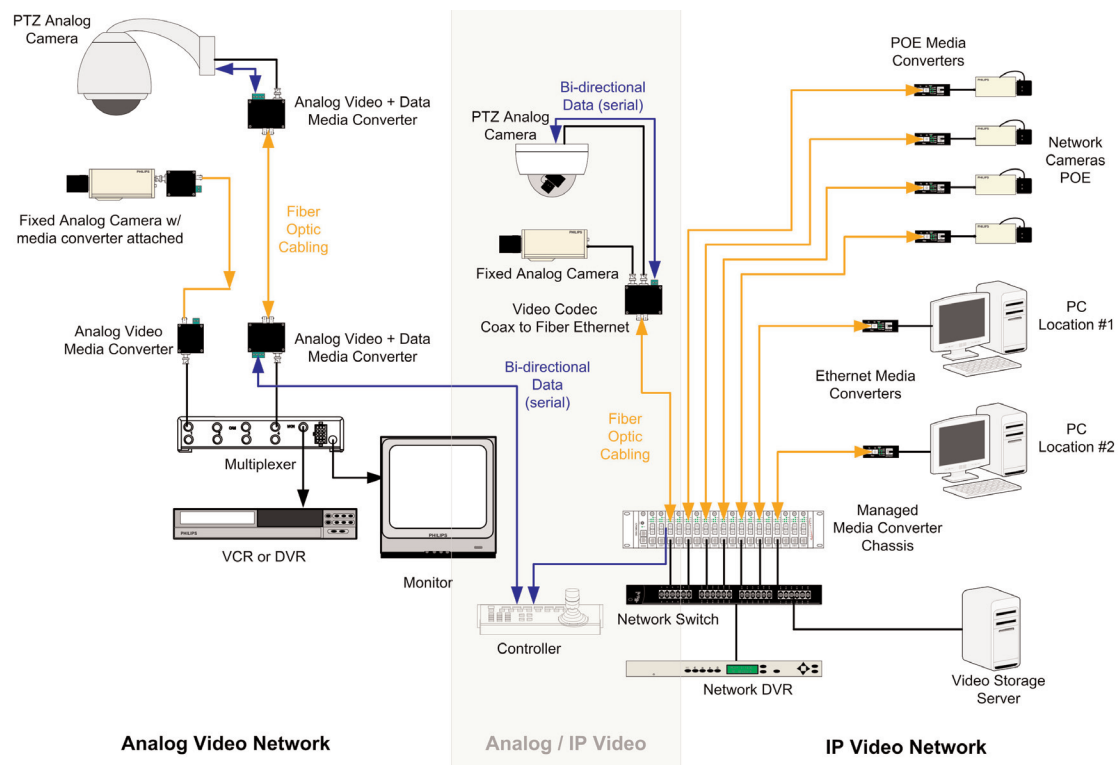


Fig. 4: Hybrid Video Security System with Media Conversion

The scope of this white paper is not to debate the merits of analog vs. IP-based video security systems or even to make claim that a hybrid solution is best, but rather to draw your attention to what often times can be the weakest link in many video applications – cabling infrastructure. While coaxial, UTP and fiber-optic cabling each have definite benefits making them the optimum choice for a given installation, designing the cabling infrastructure does not need to be limited to the connector available on the output of a camera or input to a monitor or storage device. Media conversion can provide an economical and effective means to convert to the cabling medium of choice for the best performance, highest bandwidth or greatest transmission distance needed to provide for an optimal video security and surveillance system.

Below is a listing of Transition Networks product that can used in the applications outlined in this White Paper. To view our complete product portfolio, please visit [www.transition.com](http://www.transition.com).

## Analog Video Products



JVD-TX-01 (xx)  
Transmitter



JVD-RX-01 (xx)  
Receiver



CVIDF20xx-15x  
Receiver



SVIDF201x-100  
Transmitter



CVIDF201x-110  
Receiver



SVIDF201x-110  
Receiver

Analog Video CCTV Media Converters

Analog Video CCTV Media Converters  
with Pan-Tilt-Zoom (PTZ) Data

## IP Video Products



E-100BTX-FX-05 (xxxx)  
Stand-Alone



CFETF10xx-105  
Chassis Card



Mx/E-PSW-FX-01 (xx)  
Mini Stand-Alone



MIL-SM24004TG



MIL-SM2401MAF

Ethernet, Fast Ethernet, and Gigabit Ethernet  
Copper to Fiber Media Converters

Multi-Layer Gigabit Ethernet  
Managed Switch  
24-port 10/100/1000TX  
+ 4 ports for Combo  
SFP/1000BASE-T

POE Remotely Managed Switch  
24-port POE 10/100BASE-TX  
+ 2 ports for Combo  
SFP/1000BASE-T



SPOEB10(xx)-1(xx)

Ethernet/Fast Ethernet  
Power-over-Ethernet  
Copper to Fiber  
Media Converters

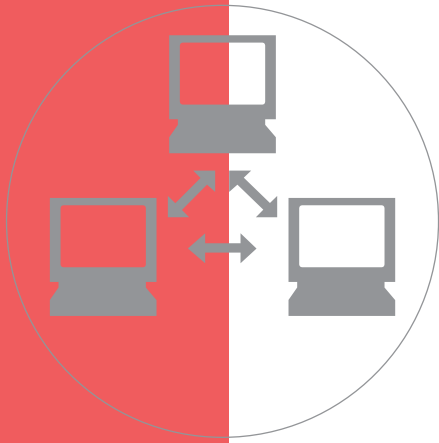


MIL-L100i • MIL-L800i • MIL-L100s

Power-over-Ethernet Injection  
and Splitting Solutions



Point System™ Managed Chassis



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