



## DVR General Info

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## 1.0 Recording Time

### 1.1 General Intent- Recording time

The Digital Video Recorder (DVR) as a natural evolution of the CCTV industry, is sometimes misapplied and misused by the industry and its consumers.

Historically the time lapse VCR was used to record (poor) video and archive it for long periods of time. The problem with them was that the tapes would degrade, even if only recorded on once (although most were not).

Although the images stored on a DVR will not degrade, they will not last forever as they will be purged from the DVR when the hard disk(s) are full. The DVR will record over the oldest video continuously. This is the reason that the DVR has a meter on the front screen showing how much of the disk's volumes are used. The owner or user of the system can watch and see the meter getting full and then know that they have "X" amount of time to address an issue that has been captured by the DVR before it will purge.

This require a more proactive approach to management of security on a site, by an owner. If you have a customer who claims they want to record a years worth of video, you need them to understand what that means.

Video, to us, is full motion video. That means 30 frames or pictures per second, per camera. If you have a 16 channel DVR with all channels occupied that means 480 photographs per second are being captured. Multiply 480 frames per second X 60 seconds (1 Min.) that is 28,800 images per minute –or- 1,728,000 pictures per hour –or- 41,472,000 pictures per day.

That 41 Million pictures in one day. If a customer really wants to save recorded Video for one year, and the average picture file size is 2KB. That would be approximately 15.1billion pictures. That is one big Hard Disk...approximately 146 terabytes. We can build you one, it will be the size of a small car and cost as much as a big house.

Obviously were using some humor and large numbers to illustrate the point that it is somewhat unfeasible, and maybe there is a better way...

### 1.2 Record When Needed

We suggest setting all cameras to record at full motion video, but only when there is motion, not all them time.

Now do the same math, but instead of recording all them time, you only record when there is activity. If your cameras are installed in a location where they see constant movement such as wind blown trees, birds or a river, but these areas are not the target

for viewing you can setup the motion detection to not be triggered by those areas, or decrease the sensitivity of the motion sensing till the DVR does not see slight motion. It is easy to calibrate.

Now you take that same 16 channel DVR, fully loaded with cameras and have only a 500 GB hard disk and you will likely have a month or so of stored video in an average commercial application with 8-12 hours per day of activity. There really is no formula to calculate how long you can record except predictive analysis and historical experienced. Basically that means it's a best guess, but we're good at it, so call.

## **2.0 Power Supplies**

### **2.1 CCTV Power Supply Methods**

Numerous methods exist for providing operational power to field devices in CCTV systems. The following methods of interconnecting devices to power supplies are brief examples. Obviously numerous variables exist and you should always consult local code, the authority having jurisdiction (AHJ), and national electrical code (NEC) on such matter.

*The methods discussed here are only power cabling and not for signal. Please see Topic #3 for signal connection methods*

Cameras of all types require power to operate, with the exception of the newer and evolving network only cameras that will run on power over Ethernet (POE). The standards for how power supplies work, are all the same, but the "packaging" of the power supplies is the variable.

### **2.2 Enclosure Power**

A very few industrial application cameras have a housing that incorporates its own power supply. These cameras generally are in an outdoor, weatherproof housing with a heater and a blower, as well as Pan Tilt and Zoom capabilities, and often a on board Fiber optic transmitter. This "All inclusive" package is geared toward campus type applications where cameras will be mounted in remote areas. These types of cameras are uncommon, but available. They will need a dedicated supply to power all of its componants.

### **2.3 Plug in Transformers**

The typical plug in transformer is a good option where cable runs are not too long, or where a 120VAC receptacle is available near the camera. Plug in transformers are stable and will last years when placed in dry, cool locations and they are not overloaded. Generally cameras operate on either 12 VDC or 16.5-24VAC. Most

standard application cameras without additional accessories such as infrared illuminators will operate on a standard 24VAC transformer. The other benefit to them, is at distributor cost, they are generally less than \$10.00.

A downside of them, is that they are not fused, unless you install a fuse at installation, and if one fails, you have to access it and, depending on where it is, can add hassle to service calls.



Some type have screw terminals....



some have wires.



When a 12VDC camera is used, they frequently use a pin type connector and most transformers for DC applications can be sourced with this connector in place.

## 2.4 Open Frame Transformers

Open frame transformers are generally *not* used, unless the power supply has been provided by an electrical contractor, as these types of transformers are hard wired to the source (generally 120VAC) and require installation into an electrical box or enclosure of some type for safety. Open frame transformers are generally used in more industrial applications, and are frequently “ganged” together, where many are installed in the same enclosure.



## 2.5 Distributed Power Supplies

From an installation point of view, the distributed power supply is the simplest. It will require that the power wire be pulled all the way back to the head end along with the video cable but provides an added simplicity in management of cabling, troubleshooting problems and cleanliness of the install.

Distributed power supplies come in a few shapes, and sizes with many options.

Options such as AC or DC power, Voltage ranges from 5-24VAC/VDC, current limited to be below 40VA keeping them “low voltage” by code, battery charging and internal batteries for backup, and fuse blocks are all standard.

Here are some examples:



Wall Mounted unit, including transformer, distribution fuse blocks and battery charger.



Rack mounted units are becoming more popular, and also look very nice and yield easy cable management.

This unit can be set atop the DVR, or mounted in a telecom rack etc. The front pulls out like a drawer.

Most distributed power supplies come in 8 channel increments, up to 32. This is convenient if you have say 8 outdoor cameras and need power for the heated housings and separate power for the cameras, in some cases they have multiple voltages on board the same unit for powering IR Illuminators and housings etc.

## 2.6 Power Supply Check List

Whatever your choice of power supply, be sure of the following items:

1. It will yield enough power for the item you are connecting to it.
2. You do not connect multiple items to single transformers thus overloading them.(they'll melt)
3. You will not be running enough cabling that you will suffer voltage drop from long runs
4. You are in compliance with Local or National Electrical Code
5. You are safe, and don't assume that just because it's low voltage it cannot cause a problem.

## 3.0 CCTV Wiring

### 3.1 CCTV Wiring methods

Numerous methods exist for moving information from one environment to another. The following methods of interconnecting devices to move live image captured video from point to point are brief examples. Obviously numerous variables exist and you should always consult local code, the authority having jurisdiction (AHJ), and national electrical code (NEC) on such matter.

*The methods discussed here are only signal cabling and not for power. Please see Topic #2 for power connection methods*

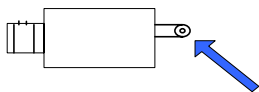
### 3.2 Coaxial Cable

The old standard of Coax cable. Video is susceptible to interference from other items generating Electromagnetic Interference (EMI) and Radio Frequency Interference (RFI). Because of this, coaxial cabling has been adopted as the standard method of carrying video. Coax has a inner solid conductor, specifically floating in a insulating sleeve inside of a weave of copper braiding. There are many types of coax cable and most general installations will use one the following.

**RG 59** Coax cable having at least a 75% copper shield and a 75 Ohm center to shield impedance is good to carry typical camera output of 1 volt approximately 750 feet.

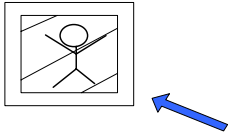
**RG 6, or 6U** Coax cable having at least a 75% copper shield and a 75 Ohm center to shield impedance is good to carry typical camera output of 1 volt approximately 1300 feet.

**RG174** Used for small local jumpers, but is not generally recommended for long runs. It is very small and has severe limitations in length, and uses hard to find connectors.



Coax on CCTV cameras is generally connected with a BNC connector.

They come in many types including compression fit, crimp fit and screw on. The compression and crimp type are preferred, The screw type are a high failure probability.



Coax on composite monitors sometimes referred to as spot monitors may either be via BNC or by typical RCA connectors. As a habit, always use BNC ends with adapters to fit the end device.

For most all applications that will be discussed further on in this document, the cable may be converted, but is generally converted back to Coaxial Cable both at the camera and at the receiving device. (DVR, Switcher etc.)

When installing Coaxial cable connectors on the cable, great care must be taken. The problems that can arise from a bad connector are underestimated. Odd shadowing or ghosting images can occur from a single ground strand being shorted into the center conductor, video loss can occur over long runs and many other hard to find problems can be introduced into a system by a poor connector.

Be well equipped with proper sized connectors for your cable, and the proper crimping tools, as well as good wire strippers for coax, the job will go much easier with less return service calls.

### 3.3 Converting to Unshielded Twisted Pair Cabling (UTP)

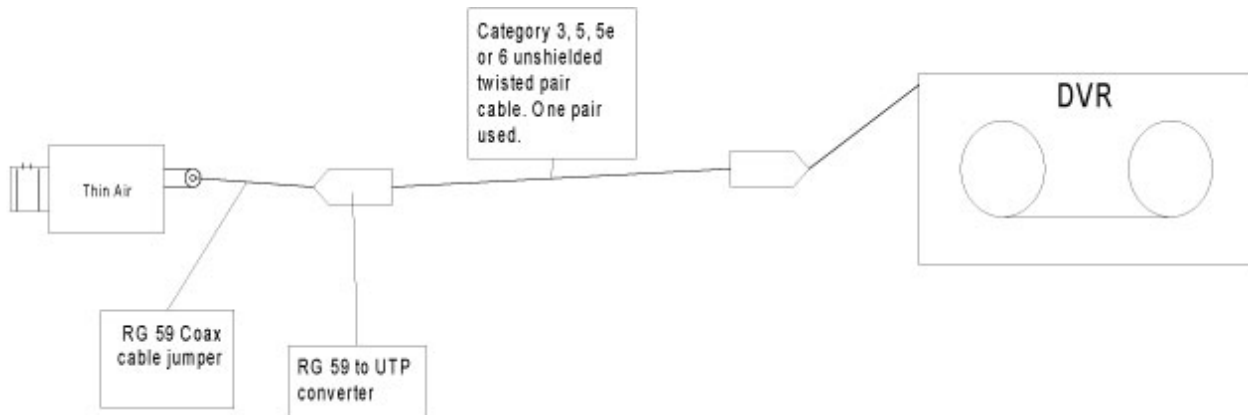
Several manufacturers make devices called baluns (bayluns) that convert composite 75 ohm video signals to a format that will run across typical twisted pair wiring, like that used in telephone cabling applications, or data/computer cabling. The variations that exist in the cabling types affect how far the video will run on the cable.

The phrase “Cat3” refers to unshielded twisted pair cabling that is of a certain size and dimension and has a certain number of twists per foot. This is what gives it the properties of volume and speed of data. Cat 3 cabling is the typical standard in Voice telephone cabling systems, including those in your home. Cat 5, 5e, 6 and 7 refer to the type of cabling that is used in computer data applications. These cables have a much higher volume of information that can travel over them.

Referring to the manufacturer specific recommendations, a cat 5 cable will generally more than double the length over a cat 3. Cat 5 however starts (with most balun manufacturers) at about 1800 feet.

The baluns vary as well depending on how far you want to run. At shorter distances over certain cable types the balun may only be a converter, while at longer runs, it may have a power transformer plugged into it to amplify the signal.

The cost of baluns can go from a pair price of about 100.00 up to about 500.00 depending on what type of distances your trying to cover.



This diagram shows how it works. This is the extent of a Coax to UTP conversion.

#### Notes:

- You cannot run power to the cameras over twisted pair cabling. It will work, up to certain distances, and in certain scenarios, but will interfere with other items connected to the buildings pre-existing wiring. The cable is between 22 and 24 gauge and will not carry the current required to run the camera.
- At shorter runs (generally under 750 feet) the baluns will not usually require power, as the runs increase, the receive end will usually require a power supply, then ultimately (upwards of 3000 feet) both ends will require a plug in transformer, similar to the cameras.
- Most buildings have category 3 cabling installed as a back bone for the voice communications system. The telephones (although many are changing to a Voice over IP system) are connected to this network of raw cabling and termination blocks in the various telecommunication and electrical rooms and ultimately to the main switch. Within the telecom rooms there is generally "punchdown" blocks that allow for cross connecting of lines to accommodate for moves and changes in the system. Frequently the cable that runs between the rooms and around the building is a high pair count cable like a 25 pair, or 50 pair or higher depending on the building size. This type of cabling may also connect buildings to other buildings for voice systems in counts as high as 600 pairs. These cables are all applicable for use in transmitting video, as the converters will generally tolerate upwards of 12 splices without loss.
- When utilizing category 5 or better cable that is pre-existing there are some issues to observe. With UTP converters you are only using the wire and not any function of any network hardware such as hubs, switches or routers. The signal generated by the UTP converter will NOT go through any of these electronics. You can use the cabling, but in each telecom room, you must cross connect the cables so as to not attempt to run through this hardware. Interface with the facilities IT manager or systems owner is crucial here.

### 3.4 Fiber Optic Cable

Fiber optic cable is a method of network distribution that allows for very long runs with minimal and measurable loss. Video will transmit across fiber optics, but with special hardware. Generally called part of the “backbone” fiber optic cable will connect the telecommunications provider (Qwest, Verizon, SBC etc) with the buildings main telecom room. From there, fiber will generally connect each of the intermediate telecom rooms as typical copper data cabling will only run 90 meters.

Generally CCTV over fiber is a planned function of the install of the fiber cable and not a retrofit using existing fiber. The cost is much higher than the other methods of cabling because of the hardware.

Similar to the Baluns over twisted pair method, Fiber optics use a video-to-fiber transceiver at each end to convert the video signal to a light pulse for transmission through the optical cable. These transceivers cost anywhere from 300-600.00 each. The transceivers are not a stand alone unit either, they install into a “shelf” or powered rack in the telecom rooms that the cards all mate into.

If a large campus type install is to occur, fiber may be the method by which non building cameras are connected and the products as well as design will be specified by an engineering firm or consultant.

### 3.5 Networked Video or Video Servers

Today, many facility owners are looking for options to not install more cabling than their building already has.

Using the pre-existing LAN to run video is feasible, but still represents some challenges.

A video server either single or multiple channels is connected to the LAN and given an IP address. This box will accept the composite video output from the cameras via coax cable and convert it internet protocol and send across the LAN or Web as set up.

Although the technology is getting better, video requires bandwidth and that is valuable real estate to an IT manager. The units have also been know to produce “noise” on the infrastructure, causing slow downs of other network functions such as email and web access.

In our opinion, Networked Video is great for remote viewing of one camera where a standard CCTV install is not warranted.

### 3.6 Wireless Video Transmission

It's all going wireless these days and CCTV is no exception.

Much like the diagram of UTP converters a wireless transmitter and receiver are paired. The coaxial cable is connected to the camera and the transmitter and the receiver is connected to the monitor source or DVR.

Many sizes and shapes exist, and many manufacturers supply them, but they generally all work the same. They all operate on the "family frequencies" as defined by the FCC. This means they are subject to interference by other users such as Police, Fire and Emergency services, Military and Cellular Carriers. These frequencies are from 1.95 Gigahertz and up. All work well in situations where running wire is impractical, but have very specific criteria under which they will work. Some wireless devices will run multiple channels, and some will do audio as well. Some require a line of site, or directional RF connection which may lower cost over higher powered omni directional units.

If connected to a DVR, a wireless transmitter / receiver may cause the DVR to record all the time if it is set to record motion only. This occurs because of the slight changes that occur in the RF connection between the units and slight picture changes that are not actually moving items but the DVR construes them as such and begins recording.

Wireless works when it is needed, but is not recommended where wiring can be used.

## 4.0 Application Notes

### 4.1 Auto Dealer

#### Product Set:

Thin Air Technology, Inc. manufactures CCTV products with added features for unique business applications. The equipment included in the product set is Cameras, interior and exterior in a variety of sizes and applications, Digital Video Recorders and Management Software and ancillary equipment such as power supplies, monitors and cabling and installation support equipment.

#### Standard Applications:

CCTV is generally installed to mitigate risk against vandalism, theft and other criminal acts. Historically the threat of CCTV, due to camera visibility is a strong deterrent. Many sites do not have personnel actively monitoring the system and looking for inappropriate activities due to the cost, but rather evaluate video based on events that occur and look for methods to prosecute, repair to assure that it does not happen again.

In the event that a criminal activity occurs, the video is exported to a secondary medium, such as CD and given to authorities.

#### Enhanced Applications of Thin Air Technologies products for Automotive Marketplace:

##### ***Vehicle Inventory:***

New or used vehicles are generally considered to be in the best possible or new condition by the buyer. Any vehicle suffering damage from parts theft, general vandalism, scratches or theft or transport damage will need to be repaired. This is time spent off the lot, or in an un-sellable condition. It also requires administration and handling costs from the dealer. For the dealer with a customer who is ready to purchase, not being able to deliver the right vehicle may result in a delay or possible loss of opportunity.

The addition of real time recording cameras to a lot or storage area will absolutely reduce the intentional damage done to vehicles, thus reducing costs associated with repairs. The high visibility cameras tell the opportunists that you're watching. Additional signages letting everyone know that through active surveillance of our operation, we're keeping our awareness up and our costs down.

##### ***Parts and Accessories:***

The OEM and Dealership supplied aftermarket parts and accessories market has exploded in the last few years. Many Larger dealerships have entire sections of the parts department or showroom allocated to the display and sale of higher margin items such as AV equipment, interior and exterior trim, performance parts, chrome and accessories. These are high liability demonstration items that many people want, but will not afford, making them a theft target.

Adding cameras to the entrance and exit of these areas as well as display cabinets lets shoppers know that the area is monitored.

### ***Cash Register / Point of Sale***

Needless to say, any location where monetary transactions are being conducted presents a point of liability to the organization. Often times, multiple persons have access to the same register also creating a liability for the honest employee.

Adding a camera to the area and connecting the cash registers serial data output to our Digital Video Recorder would allow the activities on the till to be indexed on the video and easily searched by management. The video screen would have the transactional data overlaid on it indicating type of sale, items, method of payment, change given etc. If, for example, a register comes up continuously short the video could be quickly searched by activity of the till being opened or a sale processed. The video clip from the transaction would be viewable in a small, exportable video clip file to be played on any PC.

### ***Vehicle Service***

In most dealerships, the "in for service" vehicles are dropped off at a drive up type location directly in front of the service bays. Service writers will administrate the service and a driver will take the vehicle into the shop, to store on the lot or be taken off site for additional services.

Once in the shop, the mechanic provides the services required and the vehicle is turned back over to the handlers for clean up and preparation of delivery.

When a customer brings a vehicle in for service at a dealership, there is an expectation of care and expertise that may not always be standard at an independent shop. The customer assumes the vehicle will come back in better condition than when it was dropped off. Obviously this is not always the case, due in part to abuse, neglect, vandalism, theft or attempted customer fraud. Service rates are high because liability is high. Placement of cameras anywhere that a customer's vehicle is driven, worked on or handled is imperative. A customer's fraudulent claim of dented fender or inappropriate use or service will be quickly addressed with a video history of the vehicles visit to the dealer. In some areas a reduction in garage keepers' liability insurance may even be available. This cue has been taken by most of the national oil change chains placement of cameras on each bay, assuring the vehicle leaves as it came in.

### ***Customer Service***

As a manager of a customer service centric operation, you really have very little first hand knowledge of how the employees uphold company standards or policies. The ability to watch customer body language or even listen in live from your office or home is possible with Thin Air's DVR's. The placement of high pressure microphones over cash registers,

and in customer handling areas will give management an interface tool to watch and listen to how their customers are being serviced.

### ***Sales Activities***

Every sales manager has the same problems. The goal is to keep people flowing from lot to finance to delivery and it's his/her job to see to it that the sales people are attentive and motivated. The interactive nature of our systems will allow sales management to watch customer volume over time, see how particular persons react relative to the policies and procedures of the lot, and most importantly, assure that the sales force is effective.

Generally speaking, the auto dealer has a distinct but different liability in each aspect of the operation. CCTV is much more flexible for coverage and mitigation of liability than any other system available.