

Digital Video Recorders (DVR)

Digital video recorders (DVRs) record images to hard disk drives or other digital media. DVRs have several advantages over VHS recorders. Digital video recording are higher quality than VHS. Even in the lowest quality mode, most DVRs meet or exceed the performance of VHS recorders. Digital images do not degrade with time or use, no matter how many times it is viewed or copied. DVRs allow faster retrieval of images. The search feature of most DVRs allows the time, date, and camera selected to be viewed almost instantly. Some DVRs even offer built in remote viewing capability of telephone lines or the Internet.

Digital Recording

Unlike a VCR, DVRs process images before storing them. The translation from live analog video images to stored digital images involves several steps. Video signals from the camera run into the DVR and are captured by the DVR. Each individual frame of video (up to 30 images per second) from each camera is captured and processed individually. Individual images captured from the camera digitally processed into digital images. Images are converted into pixels (picture elements). The size of the image is now expressed in vertical and horizontal pixels. A typical 320x240 pixel image would require 360KB of storage space. In order to make maximum use of the system storage capacity the image is reduced in size (compressed). Smaller images allow more images to be stored in the same amount of space. A compressed image

is tagged with identification information (time, date, camera) and sent to the storage device. Each camera's images are stored in an image file. The file will store images up to a maximum length of time or size of image file.

Average Image Size

The average image size is the average size of each individual image being captured and recorded by the DVR to the image file. The actual image size will vary from frame to frame, so the average image size is used for calculation and comparisons. The average image size is usually expressed in kilobytes (KB), and the storage capacity is usually expressed in gigabytes (GB). Larger average image sizes mean less recording time.

Byte Comparison

1 byte is a single piece of information

1KB (kilobyte) is 1024 bytes

1MB (megabyte) is 1024KB

1GB (gigabyte) is 1024MB

1TB (terabyte) is 1024MB

Storage Capacity – Average Image Size

The size of the average image being recorded to the DVR depends upon four factors: compression, quality, picture size, and activity. Compression is how much and using what method the images are compressed. JPEG, MPEG M-JPEG, and Wavelet are a few of the most common types

of compression. Manufacturers do their best to claim their compression scheme is the best, but with no industry standards for comparison, it is impossible to say which is the most effective. Some DVR manufacturers offer different levels of compression. At the higher levels of compression, image sizes are smaller, but quality is lower. At the lower levels of compression, image sizes are larger, but quality is higher.

Quality

Most DVR manufacturers offer a selectable quality setting for the recorded images. Again, this is a trade-off of image size vs. quality. Lower quality settings may be acceptable for less critical cameras, or cameras viewing large target areas. Higher quality settings are preferred for more critical cameras, or for cameras viewing smaller target areas used for identification.

Picture Size

Many DVRs have selectable image size for the recorded images. The image sizes are usually expressed in horizontal and vertical pixels. Typical image sizes range from 180x120 to 720x480 pixels. The larger the picture size, the more pixels there are. Larger pixel size pictures will display larger on the monitor and will yield better results when they are enlarged. The trade off is that larger picture sizes produce larger average image sizes.

Activity

Most DVRs use conditional refresh. Conditional refresh allows the DVR to record only the changes to an image after the initial image is recorded. If a picture changes little from recorded image to recorded image the image file size will be smaller. If the picture changes a lot from recorded image to recorded image the image file size will be larger.

Storage Time – Number of Images

The number of images we can store on a DVR is a factor of average image size and the size of the storage device.

Storage Comparison

If we recorded images to a 20GB hard drive, how many images could we record using...

360KB images?

10KB images?

The answer:

58,245 of the 360KB images would fit onto 20GB

2,097,152 of the 10KB images would fit onto 20GB

Images Per Second

The above example shows how many actual images can be recorded. But most customers are not interested in how many images can be recorded; they want to know how much recording time they will get. The record time will depend upon the size of the images and how often they are recorded. Let's look at the above system using the 10KB average image size:

Recording Time Comparison

If we recorded 10KB images to a 20GB hard drive, how much recording time would we get recording at...

- 1 image per second?
- 5 images per second?
- 30 images per second?

The answers:

24 days recording 1 image per second

4.8 days recording 5 images per second

16 hours recording 30 images per second

Images Per Second and Cameras

The above example used a single camera. What if the system had 4, 8, or 16 cameras? If each camera is recording at the same rate as the single camera example you would have to divide the record time by the number of cameras. Watch what happens to our record time!

Recording Time Comparison With 16 Cameras

If we recorded 10KB images from 16 cameras to a 20GB hard drive, how much recording time would we get recording at...

- 1 image per second per camera?
- 5 images per second per camera?
- 30 images per second per camera?

The answers:

- 1.5 days recording 1 image per second per camera
- 7.2 hours recording 5 images per second per camera
- 1 hours recording 30 images per second per camera

This document is part of a complete book entitled:
CCTV System Design & Installation

By Charles Aulner and Bryan McLane

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