Television Recording
Systems and Technology

3 MAJOR RECORDING SYSTEMS

- VCR
- VIDEO DISC
- LASER DISC (Including DVD)
- DVR?

VCR

stands for VIDEO CASSETTE RECORDER. It is the same type of recording system found in some homes. In a CCTV system used in fluoroscopy, the recorded image comes directly from the TV Control Unit which receives the video signal from the VIDICON TUBE.
The principle of operation of a VCR is ELECTROMAGNETIC INDUCTION. This means that electricity and magnetism play a part in recording and viewing of images.

ELECTROMAGNETIC INDUCTION

In the early part of the 19th century, Danish physicist Hans Oersted discovered that an electric current passing through a conductor produced a magnetic field. The experiment consisted of a battery, some wire, a switch and a compass.
Several years later, British experimenter Michael Faraday showed that an oscillating magnetic field could induce current in a conductor. The magnitude of the effect depends on...

Faraday’s Law
- The strength of the magnetic field
- The velocity of the magnetic field as it crosses a conductor
- The angle of the conductor to the magnetic field
- The number of turns (loops) in the conductor

Electricity is induced in a conductor (such as a wire) when a magnetic field passes through the conductor, or the conductor is made to pass through a magnetic field.
HISTORICAL MILESTONE
Nicola Tesla invents and patents the alternating current (AC) motor and generator in 1888. The Westinghouse Electric Company backed his concepts for the transformation of American industry and the electrification of cities.

MAJOR PARTS OF A VCR
- Read/Write Heads (Head Drum)
- Magnetic Tape
- Tape Transport System

READ/WRITE HEAD
This is the part of the VCR that records or plays back the video signal. It is a specialized ELECTROMAGNET. This electromagnet consists of a iron-nickel alloy wrapped by two coils of wire.
HEAD DRUM

The read/write heads are contained in a cylindrical container called the HEAD DRUM. This is the part of the recording device that comes into contact with the RECORDING TAPE during recording and playback.

MAGNETIC RECORDING TAPE

is the medium used to record and playback images. It consists of a polyester base. A film of magnetic oxides coats the tape. The molecules of the oxides act as tiny magnets, called DIPOLES. The dipoles of fresh recording tape are arranged randomly.

TAPE TRANSPORT SYSTEM

This part of the VCR is motorized to move the recording tape from the supply reel to the take-up reel. It also permits rewinding of the tape. The motor has several speeds which affect the quality of the recording (e.g., SP, LP, EP)
RECORDING IMAGES

During the recording, the video signal is converted into an electrical signal which alters (oscillates) the magnetic field in the read/write heads.

RECORDING IMAGES

The tape transport system moves the recording tape against the head drum containing the read/write heads. The oscillating magnetic fields rearrange the magnetic oxides of the recording tape as it moves by.

PLAYING BACK IMAGES

After rewinding the recording tape, the VCR is switched to playback mode. As the tape passes by the read/write heads, the magnetic fields in the tape induce electric current in the heads which vary according to the strength of the magnetic field of the oxides as they go by.
PLAYING BACK IMAGES

The INDUCED electric current is then amplified and sent to the television monitor as a video signal for viewing.

VCR IMAGE QUALITY

- SPEED SETTING OF RECORDER
- NUMBER OF READ/WRITE HEADS
- POSITION OF HEAD DRUM TO RECORDING TAPE

SPEED SETTINGS

The speed settings determine how many frames/tracks can be recorded per unit time. Recordings on SP (standard play) produce the best recordings (most frames/track, but at a cost of lost recording time.)
SPEED SETTINGS

The LP setting provides intermediate video quality and twice the recording time as standard play (SP).

SPEED SETTINGS

The EP (extended play) setting will produce the poorest quality images, but permit three times the recording time of the SP setting.

SPEED SETTINGS

Although not under the control of the operator, the speed of recording is increased by having the read/write heads moving at the same time as the tape is moving. Both move in opposite directions, however.
NUMBER OF HEADS

A good VCR will have 4 read/write heads. This will permit recording twice the number of frames/tracks per unit time as a 2-head system. Another advantage of a 4-head system is the ability to FREEZE-FRAME an image without excessive loss of image details.

HEAD DRUM

All VCR systems position the head drum (the cylinder containing the read/write heads) at an angle to the recording tape. Therefore, the tape passes over the head drum at a slight angle rather than straight across. This permits the entire tape to be utilized for recording tracks.
HEAD DRUM POSITION

VIDEO TAPE RECORDER STANDARD

VHS is the accepted recording standard within the VCR industry. It won out over the BETA standard over 30 years ago.

VIDEO DISC RECORDERS

Video disc recorders operate on the same principle as video cassette recorders. They both use electromagnetic induction to record and playback images. Both use magnetic oxides as the recording medium.
VIDEO DISC RECORDERS

Video disc recorders are different in that disc recorders use a platter rather than polyester tape to support the magnetic oxides. These have pre-set grooves (tracks) which are used to record each image frame.

VIDEO DISC RECORDERS

Video disc recorders were limited in that they could only record still (static) images. Later versions recorded dynamic (moving) images. Either type could be used to make “hard copy” images on film using a multi-format camera system.

ADVANTAGES OF VIDEO DISC OVER VCR

- MORE DURABLE MEDIUM
- BETTER QUALITY IMAGES
- ANALOG AND DIGITAL COMPATIBILITY
LASER DISC SYSTEMS

Laser disc uses technology found in video and audio compact disk systems. Rather than using electromagnetic induction, these devices use optics and lasers to record and play back images.

The recording medium consists of a reflective material embedded in a clear plastic disk. A laser beam alters the reflective material during the recording phase.

Playback is achieved by passing a laser light over the laser-etched tracks. The reflected light is captured by a sensor which converts the light into electrical pulses which are amplified and converted into a video signal for viewing on the TV monitor.
LASER DISC SYSTEMS

Because of their superior recording capabilities, laser disc systems have replaced VCR and video disc systems. Current industry standardization is making compatibility possible over many playback systems, including those used in digital imaging.

TYPES OF CD MEDIA

- CD – Pre-recorded media cannot be overwritten
- CD-R - Recordable media which cannot be overwritten (W.O.R.M.)
- CD-RW - Recordable media which can be overwritten
- DVD – Digital Video (records dynamic as well as static images and data)

CURRENT STANDARDS

- HD-DVD
- BLU-RAY DVD
WHAT WAS TIVO?

Simply stated, the technology underlying TIVO® is the same as that used in computer hard drives. The generic name of this device is DIGITAL VIDEO RECORDER (DVR). This technology is similar to video disc except that there are no pre-set tracks on which to record data and images.