

# WHAT IS TELEVISION?

We know that electrical impulses can be fixed on magnetic tape for later playback. But exactly what impulses or "information" actually get onto the tape in the equipment we shall be using?

When we see a television program, whether live or pre-recorded (the two are indistinguishable), the receiver is handling three different kinds of information. These are: 1) the picture; 2) the sound, 3) the synchronization. If we are recording a videotape of this program we shall have to fix all three kinds of information on the tape. Let's take them in order.

The picture we see, of course. It is a moving picture; but just as with movies, the motion is apparent, an optical illusion and not real. This motion is produced by the rapid succession of slightly different still frames. In television, according to a standard observed throughout the USA, these frames succeed each other at the rate of 30 per second. In other words, in 1 second 30 individual pictures pass before the eyes. At this rate we are left with the impression of continuous motion.

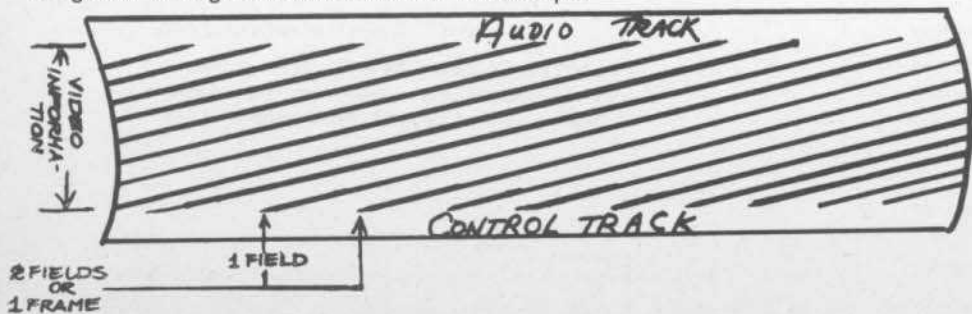
Television finds it convenient to take a further step and to divide each frame in half. This isn't difficult to visualize. If you go up close to a television screen you'll notice that the picture seems to be made up of a great many horizontal lines. Such a picture can be divided by showing at one instant every other line and the next, all the lines not included the first time. Lines 1, 3, 5, 7, 9, etc., would be shown first, then lines 2, 4, 6, 8, 10, etc.

Another U.S. standard specifies that each individual frame be composed of exactly 525 of these horizontal lines. 262.5 lines would appear during the first half of the frame and the same number during the second, totaling the requisite 525. (Just reduce for 250 line images.) A half picture or half frame is called a "field" as it appears on tape. This is due to the fact that it is "drawn" there by a magnetic "field".

During any given second of a television (program) we "see" 30 frames, each composed of 525 horizontal lines or that each second we "see" 60 fields, each composed of 262.5 horizontal lines.

On tape, the fixed pulses which represent fields are recorded.

Diagram: A Segment of Recorded Videotape



**Audio Track:** We hear the sound; and it is easier to record than the picture. It is merely striped across the top of the tape longitudinally, with some room separating it from the video tracks.

**Synchronization** is something we can't strictly see and which we usually don't hear. It's essential to the correct retranslation of the picture, however, and it has to do with the lines we noticed earlier on the screen. Have you ever pulled a loose thread only to find it began to unravel the fabric, left to right and top to bottom. If so, you won't have trouble visualizing how synchronization helps to draw the picture on the television screen.

The television picture is drawn by a beam of electrons directed at a phosphorus screen. The screen glows wherever it is hit and with a brightness proportional to the beam's strength.

Remember that a field comprises 262 or so lines. The beam, to accomplish this, must traverse the screen 262 times horizontally. A clocking mechanism is built into the various components of a television system to trigger these horizontal crossings. In figure 3, they are indicated by solid lines.

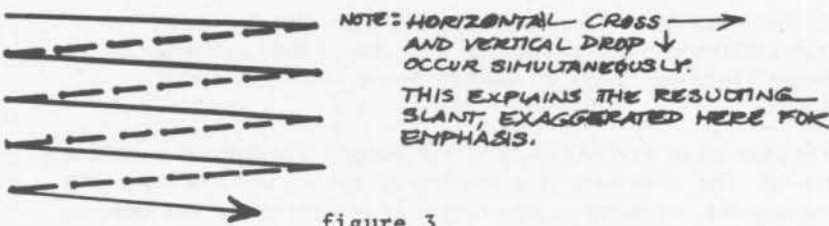
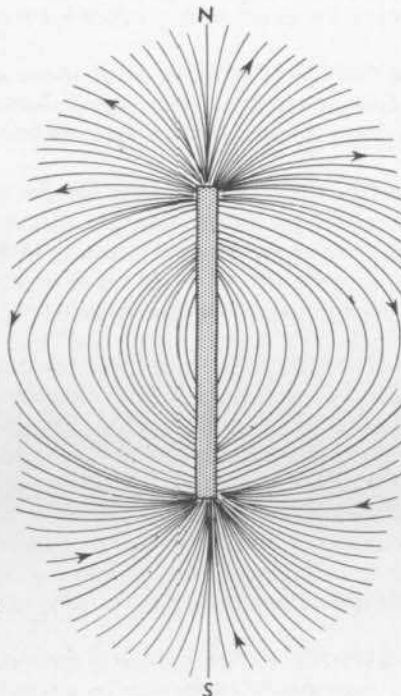


figure 3

In order to keep line 1 from being overlapped by 3, 5, 7, etc., the beam must also drop a small distance vertically as it crosses the screen horizontally. Another clocking mechanism takes care of this. The simultaneous crossing and dropping causes the resulting lines to be slanted very slightly.

During its sweep from left to right across the screen, the beam is "on"—going in the opposite direction it is "off". This is noted in figure 3 by solid ("on") and dashed ("off") lines.



**Control Track:** Horizontal and vertical synchronization signals are included among the video information which we already know is recorded diagonally across the tape. But because of the peculiar manner in which these diagonal stripes are made, additional information must be recorded along the bottom of the tape. This is also a longitudinal stripe.

Synchronization may be somewhat more difficult to understand than video or audio; but some knowledge of its importance is useful in operating a recording system effectively and in troubleshooting, should the need arise.

Synchronization is often given a practical definition: A part of the television system which insures that the television receiver will create the picture in the exact vertical and horizontal relationship as originally translated by the camera. All this means is that since the camera also used a beam to pick up the picture, synchronization keeps both camera and receiver beams pointing the same place on the screen at the same time. Any other relation would be chaotic.

Died. Mayo Buckner, 75, Inmate since age eight of Iowa's Glenwood State School for the mentally retarded, who received worldwide publicity in 1957 when it was befuddledly discovered that he was of superior intelligence and a gifted performer on eight musical instruments, but was by then so disoriented that he was considered incapable of ever adjusting to a normal life. Spent the remaining years as a patient with special privileges, teaching music and working in the print shop; of a stroke; in Glenwood, Iowa.



**Correlated Points:**

- The three types of information recorded on videotape:
  - video (pictures)
  - audio (sound)
  - sync (synchronization)
 are fixed there by electromagnetic "heads". These heads actually contact the dull, or oxide coated, side of the tape as it passes. As a result, the heads can become fouled with oxide, necessitating their cleaning with a solution such as freon.
- The same heads tend to build up a residual magnetism from repeated recording and playback. (An electromagnet ideally is supposed to have no inherent magnetism, only that created by the flow of current through it, but this is not achieved in practice.) This residual buildup reduces a head's ability to record or read back electrical signals faithfully. A simple demagnetizing process corrects this problem.
- Aside from the two items of "preventive maintenance" above, none is required except the occasional cleaning of the camera lenses.

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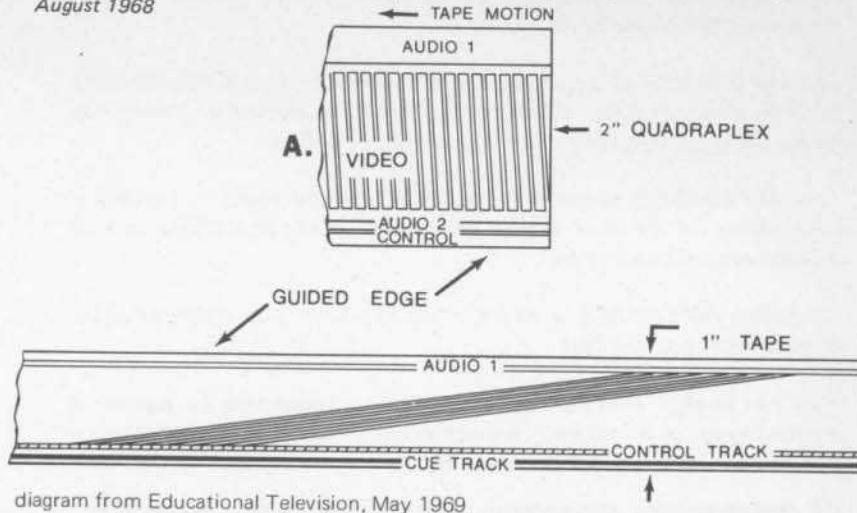


diagram from Educational Television, May 1969

## GLOSSARY

- AMPLIFIER**—An electronic device used to boost a weak signal without undue distortion.
- AUDIO-VIDEO MIXER (MODULATOR)**—An electronic component of an RF transmission system that combines the separate audio and video signals into one. The combined signal is then fed to the antenna terminals of an ordinary television receiver. Sometimes called an RF CONVERTER.
- CHANNEL**—The segment of the RF spectrum to which a television station is assigned or to which a television camera is tuned when transmitting via radio frequencies.
- CLOSED CIRCUIT**—A system of transmitting TV signals to receiving equipment directly linked to the originating equipment by coaxial cable, microwave relay or telephone lines.
- CONTRAST**—The range of light and dark values in a picture, or the ratio between the maximum and minimum brightness values. For example, in a high-contrast picture there would be intense blacks and whites, whereas a low-contrast picture would contain only various shades of grey.
- COAXIAL CABLE**—A special cable designed to carry one or more channels of television signals simultaneously.
- CRT**—Abbreviation for Cathode Ray Tube, the type of tube used to display television signals.
- DEGAUSS**—To demagnetize or erase, a Degausser being the device which does this.
- DISTORTION**—The departure, during transmission or amplification, of the received signal waveform from that of the original transmitted waveform.
- DROP OUT**—A black and white horizontal "blip" on the picture tube during playback of a videotape. Caused by missing video information. Common physical cause: missing iron oxide coating on videotape.
- FIELD**—One-half of a complete picture (or frame) interval containing all of the odd or even scanning lines of the picture.
- FIELD FREQUENCY**—The rate at which a complete field is scanned, nominally 60 times a second.
- FILM CHAIN**—One or more motion picture or slide projectors fed through an optical system to the pickup tube of a television camera. Multiplexer is a type of film chain where many projectors combine to supply the image to a single TV camera. Uniplexer is a type where only one projector is used.
- FRAME**—One complete picture consisting of two fields of interlaced scan lines.
- FRAME FREQUENCY**—The rate at which a complete frame is scanned, nominally 30 frames a second.
- FRAME ROLL**—A momentary vertical roll on the picture tube.
- GHOST**—A shadowy or weak image in the received picture, offset either to the right or left of the primary image. This is the result of transmission conditions which create secondary signals that are received earlier or later than the main primary signal.
- GRAY SCALE**—White-through grey-to black shade values on the TV screen.
- HELICAL SCAN**—The type of videotape recorder which records video information along slanted tracks on the tape. For this reason it is alternately called slant-track recording.
- INTERCHANGEABILITY**—The ability to exchange tapes between different videotape recorders with no appreciable degradation of playback image. Available at the present time only between machines of the same make and model.
- INTERFERENCE**—In a signal transmission path, extraneous energy which tends to interfere with the reception of the desired signals.
- INTERLACED SCANNING (INTERLACE)**—A scanning process in which each adjacent line belongs to the alternate field.
- KINESCOPE RECORDING**—A film recording made by a motion picture camera designed to photograph a television program directly off the front of a television tube. Sound is recorded simultaneously. Often called a "KINE".
- LINE FREQUENCY**—The number of horizontal scans per second, nominally 15,750 a second. (The number of frames (30) times the number of lines per frame (525).)
- MASTER**—The prime or original recording.

- NOISE**—The word "noise" is a carryover from audio practice. Refers to random spurts of electrical energy or interference. May produce a "salt-and-pepper" pattern over the picture. Heavy noise sometimes is called "snow".
- PICKUP TUBE**—An electron beam tube used in a television camera where an electron current or a charge-density image is formed from an optical image and scanned in a predetermined sequence to provide an electrical signal.
- PICTURE TUBE**—A cathode ray tube used to produce an image by variation of the intensity of a scanning beam.
- RECEIVER**—A television set, designed for tuned (RF) channel reception of sound and picture. A receiver/monitor is a combination instrument capable of receiving RF or video and sending out video signals.
- RECORDING HEAD (AUDIO)**—A stationary assembly used to record or playback electrical impulses at audio frequencies.
- RECORDING HEAD (VIDEO)**—Mechanical rotary assembly, usually a rotary motor driven device, for impressing video information onto videotape.
- RESOLUTION (HORIZONTAL)**—The amount of resolvable detail in the horizontal direction of a picture. A picture which is sharp and clear shows small details has a good, or high, resolution. If the picture is soft and blurred of horizontal scanning lines per frame.
- RF**—An abbreviation for Radio Frequency, a system of transmission utilizing tuned bandwidths of the radio spectrum to carry both audio and video signals—as in commercial TV broadcasting.
- SCANNING**—A single continuous narrow strip of the picture area containing highlights, shadows and halftones, determined by the process of scanning.
- SECOND GENERATION**—A copy of the master recording.
- SIGNAL**—An electrical pulse. In particular for our work, the electrical pulse which expresses the translation of light into electrical energy. Signals are noted in terms of strength (voltage) and frequency (cycles per second). Audio signal frequencies range from 20-20,000 cycles per second; video, from 20 on up into the millions of cycles per second.
- SPECIAL EFFECTS GENERATOR**—A device permitting selection of several special combinations of images, supplied by one or more video inputs.
- SWITCHER**—A control which permits the selection of one image from any of several cameras to be fed into the television display or recording system.
- SWITCHER-FADER**—A device permitting gradual, overlapping transition from the image of one camera to another. Sometimes incorporated as part of a special effects generator.
- SYNC GENERATOR**—A device used to supply a common or master sync signal to a system of several cameras. This insures that their scanning pulses will all be in phase. Scanning pulses out of phase produce distortion or rolling. This is sometimes noted as sync "loss".
- SYNCHRONIZATION**—The maintenance of one operation in step or "phase" with another. Abbreviated "sync".
- TAPE RECORDER**—A device, partly electrical—partly mechanical, for impressing electrical signals into magnetic tape. It usually operates by feeding tape off one reel and onto another (generally from left to right).
- TRANSFER**—To go from videotape to film, or the other way around.
- VIDEO**—The visual components of a television signal.
- VIDEO TRANSMISSION**—The picture signal applied directly to the viewing tube without use of an RF carrier frequency. As no conversion-reconversion stages are required, there is no picture deterioration. The result is a higher quality image.
- VIDICON**—The type of camera pickup tube used most frequently in closed circuit television. Uses Antimony TriSulfide as a photo sensitive surface.
- VIEWFINDER**—A small monitor built into the TV camera, enabling the cameraman to see exactly what his camera "sees".
- VTR**—Abbreviation for Videotape Recorder.

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- ... New way to get quick "hard" copies from a TV receiver: a desk-top terminal contains a second TV tube and a camera to take "stills" of the duplicate image. The picture (5 inches square) is put on paper via an electrostatic process and developed with liquid toner. Cost of each copy is less than 1¢ each. Problem: cost of the terminal will be approximately \$8,000 when it is introduced next spring.
- ... New Kind of "subscriber TV"—a prediction coming out of Varian Associates. TV over the air (not cable). The subscriber would receive only the signals he purchased. A "talk back" circuit would be available. In addition to offering special color TV programs, other services could include newspapers delivered by air and shopping by TV. A Varian marketing director calls the system "a closed-circuit point-to-point omnidirectional common carrier service"—and "unique." Product of a new ruling by the FCC. Will create a new industry.
- ... New way to turn a TV monitor into a burglar alarm: 2 light sensors are attached to suction cups to the screen of a closed-circuit TV monitor. When the sensors detect motion, they can trigger an alarm or a videotape recorder, etc. "Video Sensor" via GBC (Ikegami), Japan. \$495.
- ... By the year 2000 the distinction between broadcast and closed-circuit television will disappear and, in effect, all television will be "closed-circuit." The emergence of CATV as a force in televised communications has started to bridge the gap between broadcast and closed-circuit, inasmuch as all members of a particular community system fulfill the definition of CCTV: they are a controlled viewing segment.
- ... The end of the use of tape and film in TV is now clearly in view: Solid state memory banks are presently capable of storing sufficient information to reconstruct the TV processing research. There are people right now who are working on a means of building a cigarette-pack sized inert memory block that will contain within it total information necessary to "play" a one-hour TV program. This will be immune to all shortcomings of today's TV recordings, give instant random access, and, weighing but a few ounces, will make custom TV truly a reality. With millions of plug-in programs.

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## MAILING A VIDEOTAPE

Customs Duty on videotape is .55¢ per foot. The N.Y.C. brokers fee for clearing through Customs and delivery is \$15.00, or you can clear the tapes yourselves by going to the airport, signing forms and paying the Duty.